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**Exiting the crisis in the right direction:
A sustainable and shared prosperity plan
for Europe**

Spencer, Thomas and Lucas, Chancel and Emmanuel, Guerin

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Exiting the crisis in the right direction: A sustainable and shared prosperity plan for Europe

Thomas Spencer, Lucas Chancel,
Emmanuel Guérin (IDDRI)

ORIGINS OF THE CURRENT CRISES

Europe is in the midst of a series of interlinked crises. These have their roots in the build up of structural divergences and macroeconomic imbalances between in particular Eurozone states. Important steps have been taken to strengthen economic and fiscal governance, in order to put the European economy on a more sustainable basis in the longer term. However, short-term economic stimulus is needed; otherwise the burden of austerity and structural adjustment will not be socially sustainable. At the same time, reforms need to consider long-term challenges, in particular resource pressures and climate change.

BRIDGING SHORT- AND LONG-TERM CHALLENGES

The shift towards a green economy can bridge these two timeframes. Long-term challenges are already emerging. Resource prices have reached record levels, unseen since 1900. Price correlations between and within resource groups are stronger than ever, and create systemic risks for the global economy. The dramatic pre-crisis rise in commodity prices, particularly oil, played a role in fuelling and triggering the crises. Resource and environmental constraints are thus already a challenge and an opportunity.

GREEN INVESTMENTS TOWARDS RESILIENCE AND PROSPERITY

The shift to a green economy is vital to guarantee long-term resilience and resource security in Europe. It will reduce Member States' vulnerability to future oil prices, alleviating the oil price drag on the EU economy by 0.7% of GDP by 2020 already. By 2030, investments in resource efficiency can save the EU 3% of its GDP per annum. In the short-term, measures such as environmental fiscal reform and green investments can create investment in jobs and growth, particularly in troubled Peripheral countries. European coordination on these measures is vital.

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For more information about this document,
please contact the authors:

Thomas Spencer – thomas.spencer@iddri.org

Lucas Chancel – lucas.chancel@iddri.org

Emmanuel Guérin – emmanuel.guerin@iddri.org

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Table 1. Synergies and conditions between the green economy and the crisis response

In the table below, we outline the policy priorities in the current crisis context, and the potential synergies and conditions between them and green economy reforms.

	Environmental Tax reform	Investing in the green economy	Supporting Innovation
Fiscal consolidation	<p>Outcome: can yield additional state revenues.</p> <p>Condition: depends on the recycling option chosen^a</p>	<p>Outcome: Will likely require some short run budgetary outlay, but private sector can contribute significantly. Demand stimulation and job creation create additional revenues in the medium run.</p> <p>Condition: depends on capacity to mutualise sustainable investments (i.e. green bonds). Depends on the policy design and size of the multiplier effect^b</p>	<p>Outcome: will likely require some budget outlay, but policy design can attract the private sector</p>
Job creation	<p>Outcome: can create jobs via payroll tax reduction</p> <p>Condition: depends on reductions in payroll taxes and labour market characteristics^a</p>	<p>Outcome: can stimulate high and low skilled employment in currently labour intensive sectors.</p> <p>Condition: see above^b</p>	<p>Outcome: no positive effect in the short term.</p>
Reducing inequalities	<p>Outcome: can reduce inequalities via increased employment, potentially in low skill, low wage sectors. Can increase progressivity.</p> <p>Condition: progressivity depends on incorporation within broader tax reform</p>	<p>Outcome: green investment programs can target job creation among and social improvements in vulnerable population segments, such as reduction in energy bills and creation of public transport.</p> <p>Condition: depends on the skill profile of employment created, and the ability to generate social benefits, such as energy security.</p>	<p>Outcome: depends on the white/blue content of green jobs and trade regulatory framework</p>
Reducing intra-EU-Eurozone imbalances	<p>Outcome: Could form part of a coordinated strategy to increase relative cost competitiveness in Peripheral countries, by reducing labour taxation. Revenues could contribute to transfers to Peripheral countries.</p> <p>Condition: depends on integration within a broader strategy to address European imbalances</p>	<p>Outcome: potential for inward investment and the creation of new export sectors (e.g. clean energy) in Peripheral countries.</p> <p>Condition: depends on the design, content, target of investment programs</p>	<p>Outcome: technological catch up and increased collaboration on and diffusion of frontier innovation could reduce economic imbalances.</p> <p>Condition: depends on the design, content, target of innovation programs.</p>
Competitiveness	<p>Outcome: Can increase innovation and competitiveness of green sectors. Can reduce exposure to fossil fuel price fluctuations. Can reduce the competitiveness of a small number of industries.</p> <p>Condition: ETR alone is insufficient. A positive outcome depends on a broader policy package and industrial strategy to promote green sectors and facilitate the adaptation of exposed sectors.</p>	<p>Outcome: potential for increased competitiveness via increased resource productivity and lesser exposure to resource price shocks</p>	<p>Outcome: large potential for increased non-price competitiveness, particularly in green sectors. Lower exposure to resource price shocks.</p> <p>Condition: depends on a broader policy package and industrial strategy to promote green sectors and facilitate the adaptation of exposed sectors.</p>
Increased economic resilience	<p>Outcome: can reduce exposure to resource price volatility and increases, by price variance and inducing structural and behavioural changes.</p> <p>Condition: depends on level of the tax rate and its evolution over time, and complementary policies to induce efficiency and innovation.</p>	<p>Outcome: can contribute to large-scale development of sustainable infrastructures and reduced exposure to resource price shocks</p> <p>Outcome: depends on actual level of green investment</p>	<p>Outcome: innovation enables faster rate of transition. Lower exposure to resource price shocks, and increased productivity of clean technologies.</p> <p>Conditions: depends on ability to direct technical change</p>

EXECUTIVE SUMMARY

Some Peripheral countries of the Eurozone - Greece, Ireland, Portugal, and Spain - are in the midst of unprecedented crises. Given the level of integration within the EU, this is now a European crisis. It still threatens the existence of the Eurozone and the European project. A shift towards a green economy can contribute to setting the European economy on the right path.

The current situation has a number of causes. Massive private debt booms built up in a number of Peripheral countries. When these countries joined the Eurozone they experience a “positive confidence shock”, based on the perceived removal of sovereign debt risks and strong future growth perspectives. The “positive confidence shock” is evident in the negative real interest rates experienced by some Peripheral countries since 2000. It encouraged excessive borrowing, inward capital flows and the build up of asset bubbles. When the global financial crisis hit, external capital was withdrawn, bubbles burst, and government fiscal positions worsened dramatically. In the case of Greece, government indebtedness was also excessive before the crisis.

The crisis revealed that the growth model for Peripheral countries was to a large extent unsustainable. Financial and asset bubbles, and public indebtedness in the case of Greece, hid growing structural divergences between Eurozone countries. These are evident in the current account imbalance of more than 10% of GDP between the Peripheral countries and Germany. The crisis also revealed the incompleteness of the Eurozone. Peripheral countries cannot devalue their currencies to reduce the debt burden and increase external competitiveness. Fiscal transfers or labour market mobility are also more limited than in other currency zones, such as the USA.

So far the EU and the Eurozone have, at least temporarily, managed to contain the crisis. Steps

have been taken to improve fiscal discipline, economic coordination and surveillance. Structural reforms are being undertaken to rebalance economic growth in Peripheral countries. But these will take time to bear fruit, and are missing two key elements:

Firstly, short-term measures to stimulate investment in jobs and growth across Europe, in particular in Peripheral countries. Without stimulus measures, the structural adjustments in Peripheral countries threatens to be socially unsustainable. A stimulus program should be focused on increasing the structural resilience of Peripheral economies, while also creating short-term jobs and growth.

However, the crisis response must also address the defining challenges of tomorrow. Among these, two interlinked challenges stand out as especially important: the growing pressure on natural resources, and climate change.

These long-term challenges are already emerging. Real resource prices have reached record levels, unseen since 1900 (McKinsey, 2011). Price correlations between and within resource groups are stronger than ever, and create systemic risks for the global economy. These trends will continue. Highly productive resources have been tapped: increasing production is growing more costly in monetary, resource and environmental terms. Yet by 2030 the world will have to find 45% more energy than today, 50% more food, 40% more water, 80% more steel, as the developing world grows at a rate and scale without historic precedent.

The dramatic pre-crisis rise in commodity prices, particularly oil, played a role in fuelling and triggering the crisis. In Europe, Member States' vulnerability to the oil price rise was unequal. This exacerbated the structural divergences and macroeconomic imbalances that destabilized the Eurozone. In the USA, an explosion in global “petrodollars” contributed to the glut of cheap credit that fuelled the subprime boom, becoming the largest global source of capital outflows in 2006. When

oil prices continued to increase, interest rates rose fivefold in response; average household expenditures on mortgage repayments rose 33% between 2004 and 2007. Likewise, average household gasoline expenditure rose 120% between 2002-2008. Household budgets were cut, increasing the rate of mortgage defaults, and reducing aggregate demand. The US slid into a mutually aggravating cycle of recession and mortgage defaults, until the bubble burst in August 2008.

Resource and environmental constraints are thus already a challenge and an opportunity. Europe has the world's highest per capita imports of resources, and is now faced with a crisis demanding profound and long-term reforms. This chance should be seized to exit the crisis in the right direction, towards a sustainable and shared prosperity. Green economy reforms can have clear synergies with the crisis response.

The crisis weakened fiscal position of Member States. Many European Countries have pursued discretionary fiscal reforms, by increasing taxes and reducing government expenditures. These measures hamper growth in the short-term; they do not address long-term challenges, and they can have negative social consequences. Environmental fiscal reform (ETR) can contribute to a sustainable and fairer fiscal consolidation. Carbon and energy taxation can be a growth-friendlier way of raising net revenues than taxes on other production factors or economic rents (Vivid Economics, forthcoming).

Environmental taxes also offer the possibility to transfer taxation from desirable activities like employment towards environmentally damaging activities. Combined with broader tax reforms, environmental taxes have the potential to reduce EU unemployment by 2.2 percentage points by 2020 (Ekins, 2012), induce innovation and resource efficiency, and enhance the progressivity of the tax system. In Peripheral countries, where the black market labour share is high, such a taxation shift can create incentives to join the official workforce. For example, a labour-carbon tax shift could improve employment by 3.3% in Spain (Markandya, 2012). In addition, reduction in labour taxes could contribute to lowering unit labour costs while preserving net wages, and hence to a recovery of relative competitiveness in certain Eurozone countries. Environmental taxation can therefore be a logical part of fiscal consolidation, job creation and economic rebalancing in the Eurozone.

Europe also needs cross border investments to smooth the necessary structural reforms and de-leveraging in Peripheral countries. Investments in European sustainable energy and resource-efficient infrastructures can create employment and stimulate demand in the short-term. Green sectors are particularly attractive as they create more jobs than brown sectors, in the short-term. In a situation of high, non-equilibrium unemployment, public investments can create additional net jobs and economic activity (Rendahl, 2012). But they also enable long-term macroeconomic gains thanks to a reduction in the energy bill, to which Peripheral countries are particularly exposed, and induced improvements in long-term productivity. A joint strategy to reinvest in Europe's productive assets, particularly in Peripheral countries, should focus on the green sector, and leverage European funds. Such green investments are a necessary complement to Eurozone structural reforms, as in the current environment they can create jobs and growth, and longer-term productivity gains.

European countries cannot compete on price with emerging countries without threatening social cohesion. Innovation in green technologies and ideas offers the opportunity to enhance competitiveness by focusing on potentially high-productivity, emerging technologies. This is even more important as Europe's trade partners are increasingly investing and innovating in green products and services. The experience of some EU Member States shows that environmental regulation and innovation can increase export competitiveness in green sectors, and potentially more broadly across the economy in the longer term. A recent econometric study of export performance in the EU by Costantinia and Mazzanti finds (2012), for example, that "...[o]verall, the effect of environmental taxes does not conflict with export performances, while in some cases they give a large impulse to export dynamics".

The shift towards a green economy is vital to guarantee long-term resilience and resource security in Europe. It can reduce Member States' vulnerability to future oil prices, alleviating the oil price drag on the EU economy by 0.7% of GDP by 2020 already. By 2030, investments in resource efficiency can save the EU costs equivalent to 3% of its GDP per annum. The reduction in exposure to price rises and volatility can reduce investment uncertainty and improve the EU's current account. Reduction of fossil fuel use and GHG emissions are also necessary to limit risks associated to climate change, such as extreme events.

INTRODUCTION

“What is the way forward?” This paper tackles a question posed by many European leaders and citizens. Tensions in sovereign bond markets have eased somewhat since early 2012 and the risk of a breakup of the Eurozone has receded. But the crises are not over. Bond markets remain tense; the public and private sectors have a long way to go with deleveraging, and the way out of the crises will be long for the real economy.

However, compared to January 2012, the current situation allows us to step back somewhat from short-term concerns and pose elements for a longer-term reflection. This is precisely the objective of our study, whose aim is to bridge the gap between two time horizons, which have regrettably been considered separately up to now.

We argue that short- and long-term concerns can be combined through a shift towards a sustainable European economy. In order to do so, we first retrace the interlinkages between resource prices and the subprime crisis (the external shock which revealed systemic weaknesses in the Eurozone). Secondly, we examine the contribution of resource prices in these structural divergences and macro-economic imbalances in the Eurozone. By doing so we show that resource issues contributed and amplified the extent of the economic crises, without being the ultimate cause. We then present the rationale for a shift towards a sustainable and fair European macro-economy. This shift can be initiated through three types of instruments: investments, taxation and innovation policy. We address these instruments in the final section.

1. UNDERSTANDING THE CRISES: ASSESSING THEIR ROOT CAUSES

1.1. Main causes of the crises

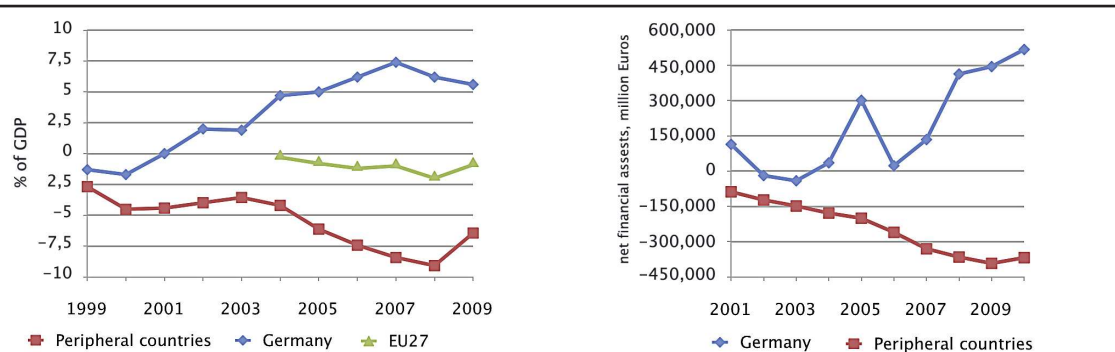
In this section we briefly outline the causes and evolution of the current European crises. In the subsequent Section 1.2., we assess the potential role of resource constraints in contributing to the crises, firstly the US subprime mortgage crisis, and secondly the European crises. **The intention of Section 1.2. is to “zoom in” on this particular sub-cause under-discussed in the literature - not to posit that resource constraints alone led to the crises.**

The 2008/2009 global financial crisis began with an economic downturn emerging in 2007/2008 in the USA, leading to an accelerating meltdown in the US subprime mortgage market. The collapse of Lehman Brothers in September 2008 froze global credit markets and plunged much of the world into recession. As a result of the credit crunch and ensuing economic downturn, European countries saw a drop in fiscal revenues and an increase in expenditures, undertaken in order to strengthen social safety nets and stimulate growth. Particularly in the Peripheral countries,¹ public sector debt increased dramatically.

However, attributing the current EU debt crises solely to the “external” shock of the 2008/2009 financial crisis would miss the expansionary fiscal

1. i.e. Ireland, Greece, Portugal, Spain, Italy.

Figure 1. Current account deficit (left) and net financial assets (right) in selected European regions



Source: Eurostat

policy that some Peripheral countries, Greece in particular, undertook in the boom years. In a number of Peripheral countries windfall revenues from private, debt-funded asset bubbles masked expansionary fiscal policy, as cyclical budget positions were interpreted as structural (Hauptmeier et al, 2010). When these bubbles burst on the back of the global financial crisis, growth slumped, private sector deleveraging set in, and governments' fiscal positions worsened.

Pre-crisis private debt and asset booms in Peripheral countries can be attributed to both structural and institutional factors. The competitiveness of Peripheral countries had decreased compared to the Northern Eurozone countries, due in part to rapid growth in unit labour costs in Peripheral countries and the stagnation of real median income in Germany. But thanks to large capital inflows, including a large share of external debt, Peripheral countries were able to grow during the boom years, despite this loss of competitiveness. Based on expectations of future high economic growth, external investors sought higher rates of return on capital in Peripheral countries, while the private sector took on high levels of debt. Enormous amounts of capital flowed “downhill” to regions where growth prospects appeared strong, allowing domestic consumers to increase credit-based consumption.

However, the introduction of the Euro also contributed to these imbalances (Berger and Nitsch, 2010). When the Peripheral countries joined the Euro they experienced a “positive confidence shock”, as investors believed that European institutions such as the Stability and Growth Pact would ensure macro-prudential governance, and the risk of currency devaluation was removed. Interest rates fell from their pre-Euro levels, and even converged to those of core countries such as Germany.

The Euro also eliminated nominal exchange rate rebalancing. Real exchange rate divergence was therefore fully reflected in inflation differentials between Eurozone countries.² In the context of a single monetary policy, this led to pro-cyclical distortions of short-term real interest rates. That is, lower income Peripheral countries experienced strong growth; real wages and inflation rose, and real interest rates fell,³ providing further incentives for borrowing and investment. The perceived removal of risk and monetary policy distortions that came with Eurozone membership steepened the “downhill” flow of capital into Peripheral countries. Huge asymmetric current account and private debt positions are evidence of these structural divergences and macroeconomic imbalances in the Eurozone (figure 1). **Thus growth in Peripheral countries was largely based on unsustainable capital inflows, which masked increasing losses of competitiveness and growing systemic risks.**

The perspectives for growth in the Peripheral countries, and in the wider EU are now low. The IMF projects growth for the Peripherals to average 1.1% over the next 3 years, and 1.6% over the next 5; for the rest of the EMU it's 2.3% and 2.3% respectively. Growth perspectives are in part so poor because of the reduced flexibility associated with Eurozone membership: nominal depreciation is not an option to increase external competitiveness. Nor is, currently, debt mutualisation to reduce interest rates and sovereign debt burdens in Peripheral countries. There are also supply-side factors, as households, business and governments still have a long way to go with deleveraging (McKinsey, 2012). Banks are not lending, and businesses

2. Cumulated CPI inflation differentials relative to Germany were as high as 21% for Greece, 16% for Spain, 14% for Ireland, 12% for Portugal, and 8% for Italy.

3. Real interest rate = nominal interest rate – inflation

and households are not investing or consuming. Most European governments have little or no room for fiscal manoeuvre to offset the slump in private demand, and austerity measures will depress growth in the short-term (Guajardo et al, 2011). Yet growth is seen as essential to assist with deleveraging, support the European social model, and attract future investments (Darvas and Pisani-Ferry, 2011).

In response, European policy makers are following a three-pronged strategy. Firstly, fiscal austerity and structural reforms aim, in the longer-term, to restore sustainability to public finances, and competitiveness to national economies. Secondly, improvements to European economic and fiscal governance aim to assure markets that fiscal profligacy; extreme structural divergences, and private debt bubbles will be avoided in the future. Lastly, policy makers are extending liquidity to troubled sovereigns, and to the banking sector through the ECB's Long-Term Refinancing Operation. **However, this strategy overlooks short-term measures to stimulate employment, investment and demand, and long-term measures to ensure the sustainability and prosperity of the European economy in a resource constrained world. We argue below that green economy reforms can potentially bridge these time frames.**

In sum, the European crises can be attributed to a series of failures in European fiscal and economic governance:

- The failure of the Stability and Growth Pact to control fiscal excess, particularly in certain Peripheral countries such as Greece. Peripheral countries failed to profit from the boom years to shore up their budget position, and in the case of Greece it actually deteriorated.
- The absence of surveillance and governance mechanisms to control structural divergences and macro-economic imbalances between European countries, and private debt bubbles.
- In crisis countries the outlook is worsened by the absence of the macro-economic adjustment mechanisms present in other currency zones, such as nominal adjustment, labour market mobility, fiscal transfers or debt mutualisation.
- The absence of a credible strategy to break the mutually reinforcing spiral of massive fiscal and structural adjustments and poor growth prospects in troubled countries.

1.2. Resource constraints

The section above offered a brief diagnosis of the European crises. This section explores the evidence for links between resource constraints – in particular energy prices – and the 2008/2009

global financial crisis, and the subsequent European crises.

1.2.1. Theoretical basis for considering energy price-macroeconomic interactions

Energy price-macroeconomic interactions have interested policy makers and analysts since the oil price shocks of the 1970s and 1980s. The academic literature generally agrees that the energy price-macroeconomic relation has weakened subsequently, due among other factors to decreased oil intensity in the economy; increased flexibility in labour markets, and greater monetary policy credibility.

However, the latest research has recently re-evaluated the oil price-macroeconomic relation (Hamilton, 2012; Peersman and Van Robays, 2011; Kilian, 2009). In particular, recent literature highlights the importance of disentangling the source of the oil shock and the characteristics of the importer (Kilian, 2009). For oil importers, increased trade and the recycling of oil revenues into global capital markets can (temporarily) offset oil price shocks arising from global economic booms, i.e. **demand side oil shocks**. Below we explore this in the case of the US subprime mortgage crisis and the European current account imbalances. On the other hand, oil price shocks arising from **supply side constraints** do not entail such offsetting effects, and can lead directly to reductions in GDP and increased inflation.

There are a number of channels for the transmission of oil prices into inflation:

- *First round direct effects* depend on the weight of energy products in the Harmonized Consumer Price Index (HCPI): HCPI inflation increases due to higher oil prices.
- *First round indirect effects* depend on the energy intensity of production: industries increase their prices to match new energy costs and hence inflation rises.
- Through *second round effects* wages are reset to catch up with inflation: costs and hence inflation increase.
- Through *demand effects* reductions in aggregate demand eventually reduce inflation.
- Through *monetary policy*: monetary policy will react by raising interest rates to dampen the inflationary impact.

Thus different macroeconomic impacts from an oil price shock depend on the nature of the shock, and the characteristics of the importing nation. In particular, this concerns the different energy weights in the HCPI basket; energy intensities and energy market structure and regulations; labour market characteristics such as indexation and

bargaining power of unions; monetary policy, and finally the current account position.

1.2.2. The US: global imbalances, energy prices and the subprime crisis

This section traces the potential contribution of oil prices to the build up and collapse of the US subprime mortgage bubble, which triggered the global financial crisis. We do not argue that oil prices were the only causal factor; indeed, others such as financial deregulation and deliberately expansionary monetary policy played a central role. **The focus here is on separating out the role of oil prices, i.e. the various channels by which it interacted with the subprime crisis.**

1.2.2.1. Building the bubble: petro-dollars in the global savings glut

A global savings/consumption imbalance leading up to the crisis has been identified as an important contributing factor. Surplus savings countries such as China and oil producers recycled capital back into global markets, leading to a liquidity glut, pushing down interest rates, and facilitating borrowing. “Petro-dollars” were a significant part of this global savings/consumption imbalance. In 2006, oil-exporting countries became the largest source of global net capital flows, increasing 348% between 2002 and 2006 (McKinsey, 2007). These petro-dollars were recycled into, among other things, US bonds, which lowered interest rates, and also into booming real estate markets, in particular in developed countries (McKinsey, 2007). Thus part of the US subprime mortgage bubble can be attributed to the global liquidity glut, of which petro-dollars were a significant part. This process was recognized as far back as 2005, with Chairman of the Federal Reserve Ben Bernanke stating:

“During the past few years, the key asset-price effects of the global saving glut appear to have occurred in the market for residential investment, as low mortgage rates have supported record levels of home construction and strong gains in housing prices...” (Bernanke, 2005).⁴

It is important to note that petro-dollars were not the only source of the global savings glut. Rapid economic growth and high savings in Asia also played a role, as did the surplus savings of rich Americans. The stagnation of the real median wage in the US since roughly 1990 also contributed to growing indebtedness. As the median real wage stagnated, rather than aiming at reducing income inequalities, policies to stimulate household consumption were based significantly on encouraging

borrowing, including loose monetary policy and mortgage incentives (Rajan, 2011). Some authors have argued that growing income inequalities were thus an important aspect of the US subprime mortgage crisis (Kumhof and Rancière, 2010). In addition, financial sector deregulation permitted the aggressive sale of subprime mortgages and elaborate securitization products, which hid growing systemic risks. **Thus the subprime mortgage bubble was created by a combination of factors. These included a global liquidity glut, of which petrodollars were a significant part; expansionary monetary policies to stimulate debt-based consumption in a context of rising inequalities, and financial sector deregulation.**

1.2.2.2. Bursting the bubble: interest rates, energy prices and aggregate demand

Oil prices also seem to have contributed to the bursting of the US subprime bubble. The interactions are multiple, and should be delineated carefully. It is difficult i) to separate out the factors leading to increasing mortgage delinquency/defaults before the crisis, and ii) to identify the threshold of mortgage delinquency/defaults, which then resulted in the full-blown subprime mortgage crisis and the 2008 meltdown of the US, then global, financial system.

However, there are a number of channels by which oil prices contributed to increasing the mortgage delinquency/default rate, by reducing household revenues and increasing the household debt burden.

- *Direct energy price channel:* between September 2003 and August 2008 the nominal oil price rose from \$28.3/barrel to \$133.4. In 2003, the average suburban household spent \$1,422 a year on gasoline, which rose to \$3,196 in 2008 (Freilich et al, 2010). Apart from negative effects on aggregate demand (see below), increased energy expenditures reduced household liquidity and negatively impacted on mortgage delinquencies/defaults. Kaufman et al. (2010) show econometrically that rising household energy prices constrained household budgets and increased mortgage delinquency rates, once other factors are controlled for. Although they caution that identifying the trigger point for the collapse of the subprime bubble is difficult, if not impossible, they conclude that “...this analysis indicates that increasing energy expenditures are among the most important drivers of the post 2005 increase in mortgage delinquency rates” (Kaufman et al, 2010: 194).
- *Indirect interest rate channel:* Some authors (cf. Carr and Beese, 2008) argue that the Federal Reserve increased its rates in part because of the

4. We are indebted to Dimitri Zenghelis for pointing out this quote.

sharp oil price rise from 2004 to 2008. The federal fund rate rose from 1% in May 2005 to 5.26% in March 2007. This increased the interest payments on existing variable interest home loans. It also decreased home values, as homebuyers factored in the cost of higher interest rates. The consequence was a reduction in asset values and an increase in liabilities, contributing to the increase in mortgage delinquencies/defaults. Monetary tightening also impacted negatively on aggregate demand (see below).

A number of contextual factors also interacted with the oil price increase to potentially worsen vulnerabilities:

- *Labour market interactions:* Peersman and Van Robays (2009) show that the inflationary impact of the oil price shock from 2004-2008 was reduced in the US due to the structure of the labour market. Producers used a strong bargaining position to pass the cost burden onto consumers through a reduction in real wages. Thus while second-round inflationary impacts were mitigated, this was at the expense of a decline in real wages. In short, energy costs increased and real wages stagnated. This had negative impacts on aggregate demand (see below), and constrained household budgets.
- *Distributional impact of energy prices:* Gusdorf et al (2008) highlight the fact that energy price shocks have strong distributional effects, mostly impacting energy expenses of households at the outskirts of a town, and low-income households who spend a greater income share on energy. Subprime mortgage loans were also concentrated on poorer households, leading to a confluence of risk factors.
- *Mal-adapted urban planning:* According to Karlenzig (2011) urbanization patterns in the USA were not adapted to natural resource constraints, with a high level of urban sprawl. Between 1970 and 2000-7, the distance driven per month by the average household increased 50%, from 1500 to 2200 miles/month (Ramey and Vine, 2010). Car dependent urban planning increased household exposure to oil prices.
- *Fuel inefficiency of the vehicle fleet:* Sivak and Tsimhoni (2009) show that the fuel efficiency of the US vehicle fleet barely improved from 1991 to 2006, increasing from 16.9 to 17.2 miles per gallon (mpg). Improvements in the car fleet were likewise limited, increasing from 21.2 to 22.4 mpg 1991-2006.
- *Depressed consumer spending and aggregate demand:* rising oil prices also led to a downturn in consumer spending and aggregate demand. This operates via a number of channels:

reduced discretionary income; increased precautionary savings; operating cost effects, whereby consumers are deterred from purchasing energy intensive goods; and reallocation effects, whereby the inter and intra-sectoral shift of demand from more to less energy intensive goods involves frictions in the reallocation of capital and labour. A number of recent studies have showed that the oil price spike of the 2000s had a negative impact on consumer US spending and aggregate demand (Hamilton, 2009; Edelstein and Kilian, 2009; Ramey and Vine, 2010).

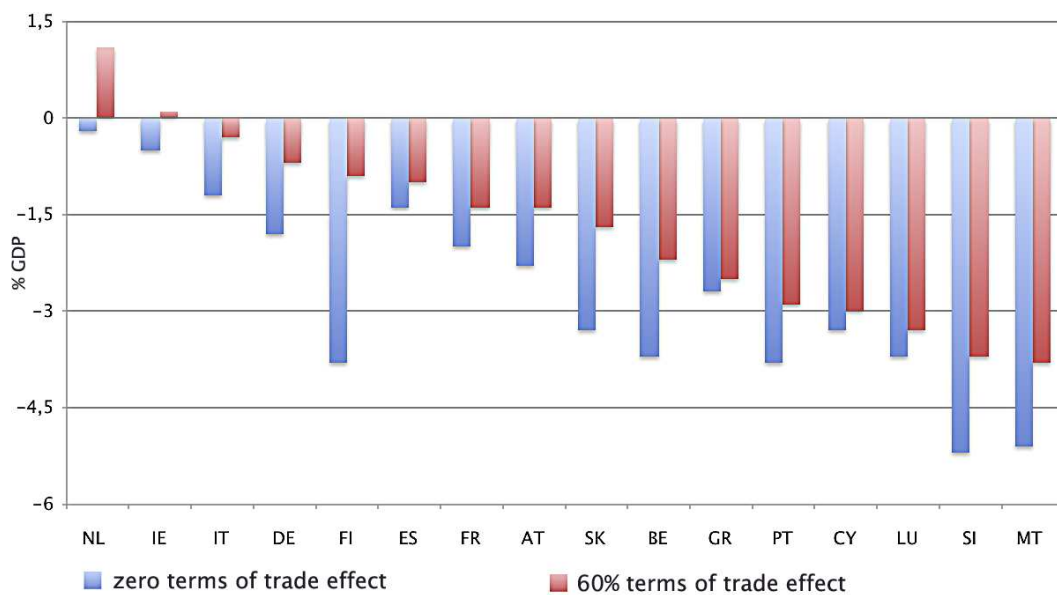
- *In particular, the automobile sector plays a key role* in transmitting the oil price shock to a reduction in aggregate demand. Consumers cut down on auto purchases, and a frictional shift from more to less energy intensive models took place (Ramey and Vine, 2010). There also seems to have been a shift from energy intensive domestic vehicles to less energy intensive imported vehicles (Edelstein and Kilian, 2009), although separating out energy price/exchange rate effects may be difficult. Hamilton (2009) estimates econometrically that the decline of the US auto-sector shaved 0.7% of GDP over 2007:Q4 – 2008:Q4, while seasonally adjusted employment in the auto-sector fell by 125 000 between July 2007 and August 2008. **The decline of the US auto sector was an important contributing factor in tipping the US into recession in Q4 2007, although there was clearly a mutually reinforcing interaction between the recessionary slide and the decline of the autosector.** As jobs were lost and wages fell, the mild recession exacerbated the subprime crisis, which burst in Q3 2008 throwing the financial sector and the real economy into meltdown.

In sum, there seems to be a solid evidence basis for considering oil prices and mal-adaptation in the US housing and auto sectors as important contributing factors to the US subprime crisis. This is by no means to suggest that oil prices were the only factor; numerous other factors increased and eventually exposed the systemic risk in the US housing and financial sectors.

1.2.4. Europe: impact of energy prices on the macroeconomy, current account, and monetary policy

This section investigates the impact of energy prices on Europe's macroeconomy, current account and monetary policy. In comparison with the US, the literature on the energy price-macroeconomic interaction in Europe is more limited. **The aim is to assess whether asymmetric reactions to**

Figure 2. Energy current account impact of 100% rise in oil price under two scenarios of terms of trade interactions



Source: ECB 2010

energy price increases could have contributed to the destabilisation of the Eurozone.

1.2.4.1. Macroeconomic impacts: historical analysis and prospective studies

There are a number of ex post studies investigating the impact of energy price increases on the macro-economy in Europe (Hahn and Mestre, 2011; Carstensen et al, 2011; Peersman and Van Robays, 2009; Gómez-Loscós et al, 2011). Hahn and Mestre (2011) provides a historical perspective, using a VAR model to analyse energy price-macroeconomic interactions from 1970-2009. The study shows that oil prices have had a substantial impact on GDP and inflation across the period, including during the recent 2008/9 recession. This result is consistent with Carstensen et al (2011) for Germany and Gómez-Loscós et al (2011) for Spain, both of which show a negative GDP impact of oil price increases contributing to the 2008/9 recession.

In addition to the ECB’s retrospective econometric analysis, ECB (2010) provides a model-based analysis of the interaction between energy prices, inflation and GDP. Their results show that a moderate, permanent 10% rise in oil prices would reduce Eurozone GDP by 0.24%, with quite heterogeneous results across countries. Among the worst impacted are Belgium, Germany, Greece, Italy, and Spain, due to the importance of energy costs in production and consumption in these countries. Employment impacts are particularly

severe for Spain, Italy and Greece. The study further shows that negative impacts in Germany may have been offset by recycling of petrodollars in the German export sector.

1.2.4.2. Current account balance

In fact, the above quoted modelling results from ECB (2010) do not take into account the nature of the oil shock, i.e. a supply versus demand shock; terms of trade effects, nor the recycling of oil revenues into the EU economy. Peersman and Van Robays (2009), for example, speculate that for Germany the negative price impact of the 2004-2008 oil price boom was mitigated by increased exports, a point confirmed empirically by Carstensen et al (2011).

Modelling by ECB (2010) shows that considering terms of trade effects can change the picture presented above. Figure 2 below shows firstly the energy current account position of Eurozone countries in percent of GDP under an oil price increase from \$52 to \$100/bbl, assuming firstly that zero percent of the increased revenues accrued to oil exporters is spent on foreign goods (zero terms of trade effect). Secondly, it shows the energy current account under the same conditions, this time assuming that 60% of oil revenues are spent on foreign goods (60% terms of trade effect). This is roughly in line with historical estimates of terms of trade effects; the movement of oil price from \$52 to \$100 is consistent with what occurred from 2004-2008.

The analysis confirms the results of Carstensen's et al (2011) analysis of the oil price impact on Germany leading up to the crises. It suggests that in some countries the macroeconomic reaction to oil prices is buffered by terms of trade effects, assuming that the price shock results from increased global demand and hence was associated with increased trade and foreign capital inflows. This effect would not be present in the case of a supply side shock. **The asymmetric reactions of current accounts to oil price increases (compare Germany with Portugal and Spain) suggests that energy prices played a role in divergent current accounts leading up to the crises.** This operated by both the direct channel, i.e. asymmetric import dependency and oil intensity of GDP; and an indirect channel, by which some countries were able to improve their current account position from increased global trade during the demand boom.

1.2.4.3. Monetary policy

Asymmetric inflationary reactions to energy prices could distort monetary policy in a single currency zone. Indeed, as noted above in Section 1.1., pro-cyclical distortions in Eurozone monetary policy was one of the factors behind the crises. In investigating this factor, the literature has largely focused on real wage differentials. However, asymmetric reactions to energy prices may also be of potential concern (EC, 2011a). A number of studies have looked at the transmission of energy price shocks into Eurozone inflation (Peersman and Van Robays, 2009; ECB, 2010; Carstensen, 2009, Álvarez et al, 2011; Gómez-Loscos et al, 2011).

As noted in Section 1.2.1. above, there are several channels for the transmission of energy prices into inflation. Direct effects depend on the energy intensity of the economy; the weight of energy in the HICP, and the nature and regulation of the energy market, among other factors. Indirect effects depend on the structure and regulation of the product and labour markets, particularly on the degree of wage indexation.

The literature suggests that there are asymmetric direct inflation effects between Eurozone Member States. These are related to structural factors such as the energy intensity of production and consumption, and energy market structure and regulation (ECB, 2010). This suggests that closer coordination of energy policy – energy efficiency, market regulation and integration, and diversification/decarbonization policy – may be necessary in order to minimize direct energy inflation divergences between Eurozone Member States (EC, 2011a). Nonetheless, the literature is fairly clear that indirect effects, particularly wage

indexation in the long-run, are a more important cause of energy price driven inflation divergences than structurally caused direct effects (Peersman and Van Robays, 2009).

Peersman and Van Robays (2009) show econometrically that energy inflation, particularly through the wage indexation channel, distorted European monetary policy, with pro-cyclical effects, leading up to the crises. In some countries, energy price increases were followed by wage increases, increasing inflation further. High inflation reduced real interest rates, facilitating borrowing, consumption and economic activity.

A comparison with the US is instructive. As shown in Section 1.2.2. above, US labour market flexibility mitigated the second round inflationary impacts of the 2004-8 oil price shock, at the expense of reduced real wages. In Europe by contrast, in particular in some Peripheral countries, real wages were relatively preserved at the expense of second round inflation. Thus the negative macroeconomic impact of the oil price boom was demand-led in the US, as consumers' and households' budgets were constrained. In Europe it was supply-led, as inflationary pressures reduced the competitiveness of certain Eurozone economies. Energy price inflation, and associated wage indexation, played a role therein. The example of the US warns, however, against assuming that labour market flexibility reduces macroeconomic vulnerabilities to oil price increases.

This discussion should be interpreted with care. Firstly, it shows that structural factors, such as energy intensity, were secondary to indirect wage effects in determining the transmission of energy price increases to inflation. Secondly, energy inflation and associated wage increases were only one, and likely secondary, factor behind the loss of competitiveness and pro-cyclical distortion of monetary policy that lay behind the crises in Peripheral countries. Nonetheless, this section **does provide an evidence base suggesting that asymmetric reaction to energy prices were one of the factors that contributed to widening the destabilisation of the Eurozone.** Energy policy should potentially be considered among the structural factors around which greater Eurozone coordination could be necessary in order to avoid structural divergences, monetary policy distortions, and macroeconomic imbalances.

2. THE NEED FOR SUSTAINABLE AND INCLUSIVE MACROECONOMICS

The concept of the green economy has recently entered into the work of numerous international

organizations (e.g. OECD, 2011). We define a green economy as one, which *creates welfare, while ensuring that natural assets continue to provide the resources and environmental services necessary for welfare in the future, and guaranteeing social cohesion today*. In this section we first review the structural drivers of the green economy, i.e. growing resource constraints and environmental damages. These factors make shifting towards a green economy vital for long-term prosperity. Then we describe the green economy, i.e. its characteristics and relation to traditional economic indicators such as GDP. Finally, we make the argument that the green economy should form a central pillar of the EU crises response.

2.1. Structural drivers of the green economy

After a century of decline, real prices for a broad range of commodities have increased dramatically between roughly 2000 and the present (figure 3). This price trend is being driven by demographic, economic, and environmental factors. The developing world, especially India and China, is currently experiencing economic growth at a rate and scale without historic precedent. By 2030, the world will see another 3 billion people enter the middle class (McKinsey, 2011). By 2050, global economic output is projected to quadruple and the global population to reach 9.2 billion (OECD, 2012). Unless economic growth can be decoupled from resource inputs, and resource inputs decoupled from environmental damages, the resulting environmental damages and resource scarcity could eventually threaten economic growth (Stern, 2007; OECD, 2012).

The boom in demand for resources is also posing a challenge to resource supply. To meet growing demand and offset declining production, the world will have to add 47 million barrels/day of gross oil production capacity by 2035, twice the current total oil production of all OPEC countries in the Middle East (IEA, 2011). The IEA projects oil prices to remain high, reaching 120 USD in real terms by 2035, 210 USD in nominal terms (IEA, 2011). Supply growth for water and land will have to accelerate by 140% and 179-248% respectively compared to supply growth over the last 20 years, in order to meet “business as usual” demand growth to 2030 (McKinsey, 2011). Global resource extraction is projected to increase from 65 billion tons currently to 82 billion tons in 2020, and 140 billion tons in 2050 (UNEP, 2011). These demand trends are likely to place severe pressures on supply chains, prices and the environment.

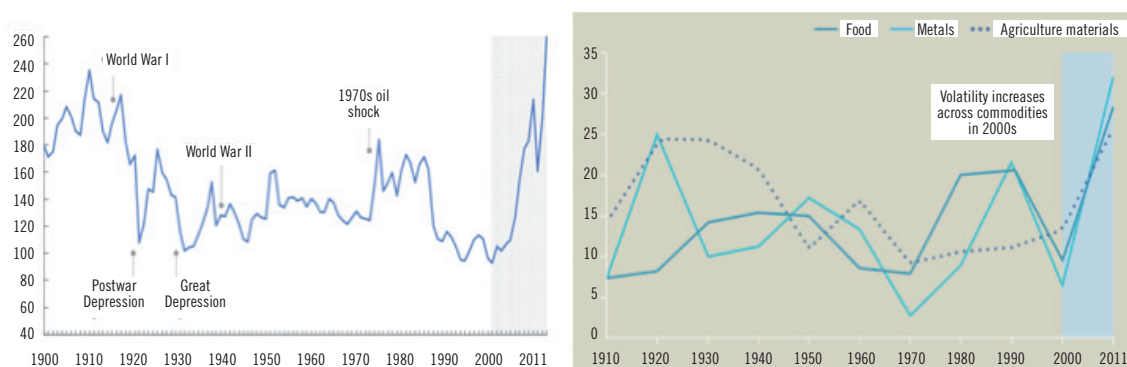
Technological improvements may open up new resources (e.g. shale gas). However, several factors

warn against technological complacency. Firstly, the marginal costs of resource extraction are increasing, both in monetary and resource terms. In other words, resource extraction is itself growing more resource intensive (McKinsey, 2011; UNEP, 2011). In the case of oil, for example, historical production increases have occurred through the exploitation of new, less productive fields (Hamilton, 2012). Shale gas production is associated with increased resource inputs, rapid declines in marginal returns and potentially significant local environmental damages. Thus while some resources, such as fossil fuels, may not be physically scarce, decreasing marginal returns create economic scarcity and limits to the rate at which production can increase.

Secondly, as outlined above, the scale of the supply challenge is enormous, creating risks of supply bottlenecks. In the case of some resources, such as rare earth metals, very rapid demand growth in coming decades and concentration of production in a few countries could create supply bottlenecks and geopolitical vulnerabilities (JRC, 2011).

Thirdly, environmental constraints to resource extraction will become increasingly biting. In this regard, the concept of “planetary boundaries” has recently been proposed, describing thresholds in global bio-physical systems, beyond which non-linear environmental degradation would have seriously deleterious consequences for human welfare (Rockström et al, 2009). Examples include the ability of the global carbon and nitrogen cycles to absorb carbon and nitrogen wastes from human activities without major, irreversible changes to global biophysical systems. **Thus limitations in the absorptive capacity of biophysical systems should be considered as part of actual physical resource scarcity. However, internalising such external costs will clearly require policy.**

At the same time, the price and volatility of different resources are increasingly correlated (World Bank, 2010). This is due to increasingly connected global markets, including global financial markets. In addition, growing substitutability between resources, such as energy, food crops, and land, promotes price correlations within and between resource groups. In addition, as noted above marginal resource extraction is itself growing more resource intensive. **As a result of market linkage, substitutability, and growing resource intensity of production, resource prices are now more volatile and correlated than at any other time in the last century**, as shown in figure 3 (McKinsey, 2011). Via these mechanisms, economic, geopolitical or environmental perturbations can spread throughout the

Figure 3. McKinsey global commodity price index (left); commodity price volatility (right)


Source: McKinsey, 2011 (left); Ellen MacArthur Foundation (2012)

global economic system, implying a high degree of systemic risk to economic and indeed geopolitical stability.⁵

These factors suggest that scarcity pressures will remain, and a high economic premium will be placed on improving resource efficiency, and decoupling resource use from environmental impacts (McKinsey, 2011). As summarized by the OECD, the current trajectory “...risks exceeding biophysical limits or tipping points, and causing non-linear large-scale (systemic) irreversible damages...” (OECD, 2012:49). **The imperative to change direction is clear.**

2.2. What is the green economy?

In this context, the green economy integrates environmental and resource constraints in economic development trajectories and policies. In this section, we summarize the characteristics of the green economy. This is not an exhaustive list, but seeks to refine our definition provided above.

- *Focus on other metrics than just GDP.* An economic transformation towards a green economy will require a shift in how we measure economic/social progress. It is becoming increasingly clear that GDP as a metric does not offer useful answers to current challenges (see Stiglitz et al., 2009; Helm, 2011). It is not a good metric for measuring wealth distribution, as the American example above has shown (see part 1.2.2). It says nothing about the maintenance of economic, physical and environmental assets. As the economic crisis showed in Greece, it cannot be assumed that future growth will compensate

for the depletion of assets or accumulation of liabilities. The threat that climate change poses to future growth reinforces this point from the environmental perspective (Stern, 2007).

- The location of such environmental thresholds is uncertain, as is the ability to decouple growth from physical inputs, or physical inputs from environmental damages. The latter will depend on the elasticity of substitution between “dirty” and “clean” modes of production and consumption, i.e. the rate of social and technological change. It is clear, however, that the rate of depreciation of natural assets and dirty/clean substitutability is not fully exogenous, but depends also on policy responses (Acemoglu, 2009; Hourcade et al, 2011; Helm, 2011). **In this uncertain context, it is not useful to focus on GDP growth rates as an indicator of either environmental sustainability or social progress.** What matters more than growth rate is the content of production. Does it maintain physical and environmental capital? Does it improve intellectual capital to facilitate decoupling of physical inputs and environmental damages? Does it create jobs and address inequalities? This is the approach we adopt in the paper.
- *High rate and scale of innovation in socio-technical systems.* The green economy envisages a large-scale transformation of the global economy over the coming decades. The transition will likely induce dramatic social, economic and technical innovations (Preston, 2012). Energy management companies help actors reduce their energy consumption and are paid by their energy savings. Other types of structures focus on increased sharing of production factors. Product-service systems, like bike or car sharing, potentially enable more efficient use of assets through a redefinition of conventional property

5. For example, it is fairly clear that energy and in particular food price inflation was an important trigger of social unrest that exploded into the Arab Spring.

rights. Energy cooperatives, in which decision-making is shared between producers, workers, consumers and local authorities may enable better information sharing among actors, and more socially desirable economic choices. Resource recycling offers whole new supply chain options.

- *Large aggregate opportunities but distributional consequences within and between sectors.* This shift from “brown” to “green” modes of production and consumption entails large distributional consequences. Nonetheless, the aggregate opportunities appear significant. For example, McKinsey (2011) modelled a resource productivity scenario to meet the resource supply challenge to 2030. They assessed 130 measures to increase resource productivity across all sectors, 70% of which would have an internal rate of return above 10% at current prices. They valued the potential resource productivity gains at 2.9 trillion USD p.a. in 2030. McKinsey estimates that the shift towards the green economy in the EU could save companies USD 340 to 380 billion p.a. in material costs, or 3% of EU GDP in 2010, under the moderate scenario (Ellen MacArthur Foundation, 2012). This indicates the scale of the economic shift possible, and the potential aggregate opportunities.

This combination of a high rate and scale of socio-technical innovation, and the distributional aspects of the transition, imply that policy makers and business actors need to anticipate and respond strategically to emerging trends. Policies such as labour market or industrial policies will be necessary to accompany this shift.

- *Strong role for policy to correct market failures and create new markets.* Price and resource scarcity will not be sufficient to induce the necessary transition. A number of market failures, in particular pollution externalities such as climate change and innovation spillovers, mean that governments will have to intervene to optimise and create new markets. This can also have positive economic consequences by inducing a more efficient use of economic resources (Hallegatte et al, 2011).

2.3. Towards an integration of green macroeconomics in the European crises response

Europe’s crises require multiple responses, amounting to a wide reaching reform of Europe’s economy and governance. This context is both a challenge and an opportunity for shifting towards

a green economy. There are voices arguing that environmental issues should be delayed until after the recovery. This is ill advised for three reasons.

Firstly, delay in shifting towards a sustainable economy will entail higher costs and greater risks, due to infrastructure lock-in; delayed innovation, and higher environmental damages (Hallegatte et al, 2011; IEA, 2011). In the long term, resource intensive growth will not be sustainable, as high resource prices and environmental damages will constrain it (Stern, 2007; OECD, 2012).

Secondly, the “delay argument” misses the fact that there are large political opportunity costs to delaying the transition. The crises are giving the urgency and political feasibility to implement difficult reforms. These are perceived by policy-makers, particularly in Germany, as necessary to lay sustainable foundations for long-term European economic prosperity. However, this strategy overlooks short-term measures to reduce inequalities, stimulate employment and investment and long-term measures to ensure the sustainability and prosperity of the European economy in a resource-constrained world. A shift towards a sustainable economy can potentially bridge these time frames, and the crises context can give political urgency to implement them.

Thirdly, reforms for a transition towards a green economy, such as environmental taxation, investment policies, and innovation can potentially complement the current crises response. In order to assess potential synergies between green economy policy reforms and the current crises response, we construct a matrix of short and long-term objectives for European economic policy (See Table 2). This is not intended to be an exhaustive list or to justify the objectives. Rather we aim to cluster relevant objectives for the purpose of gathering assessment criteria. In part 3 below, we assess three green economy instruments against these objectives, namely environmental fiscal reform, green investment and green innovation policies.

3. TOWARDS AN INTEGRATION OF THE GREEN ECONOMY: SYNERGIES AND INSTRUMENTS

3.1. Environmental tax reform

3.1.1. The rationale for and principles of fiscal reform in the current context

A consideration of Environmental Tax Reform (ETR) should be embedded within the current context. Eurozone Member States are faced with multiple conflicting challenges, including fiscal

Table 2. Matrix of short and long-term objectives for European economic policy in the current crises response.

	Objective	Rationale
Short-to mid-term	Fiscal consolidation	Markets do not perceive the fiscal positions of some Peripheral countries as sustainable. Therefore, fiscal consolidation is necessary to reduce interest rates and induce investment within troubled countries.
	Job creation	Unemployment is at record high levels in the Eurozone, risking social tension and long-term alienation from the labour market.
	Reducing inequalities	The crises have led to a sharp spike in economic inequalities within countries. Apart from the human cost thereof, this risks the social sustainability of the reform measures undertaken.
Mid-to long-term	Reducing intra-EU/intra-Eurozone imbalances	These crises were clearly the product of structural divergences and macroeconomic imbalances between Eurozone countries. As currently devised, measures to reduce imbalances will likely take 5-10 years to bear fruit.
	Competitiveness	Maintaining competitiveness is crucial to maintaining desirable, globally contested economic activities in Europe, and hence employment and prosperity.
	Increased economic resilience	Resource constraints and supply risks pose systemic risks to prosperity in the long term.

consolidation, high unemployment and structural reforms to increase competitiveness of certain sectors. In response, fiscal reforms have focused on several issues:

- **Increasing revenues:** around one third of Member States implemented revenue-increasing measures in 2011. The EU average for the total tax burden (including social security contributions) increased from 39.8% in 2010 to 40.2% of GDP in 2011 (EC, 2011g), mostly due to discretionary measures.
- **Creating employment incentives:** the Commission's 2012 Annual Growth survey notes that a shift away from labour taxation can create employment (EC, 2011c). As EC (2011g) notes, in most countries fiscal reforms responding to the crises were integrated into broader tax reforms, including the shift of the tax burden from labour or capital to consumption (in Denmark, Finland, Germany, Hungary, Lithuania and Holland) or increased property taxation (in Czech Republic, Germany, Greece, France, Latvia and Portugal).
- **Addressing distributional concerns:** the crises have resulted in a sharp increase in unemployment and inequality, already at historically high levels before 2007. The EC also notes an "overall tendency towards a steeper progression in personal income tax" among member states in 2011. In Spain, Greece, Portugal, UK, Latvia, France and Luxembourg for instance, there were attempts to increase income tax progressivity via higher top marginal tax rates. But some authors have argued that tax systems remain highly regressive, given the importance of indirect taxation (VAT) in the overall tax burden. Piketty et al (2010), show that French median households spend 50% of their income in taxes, while the 0.1% richest households have a total tax burden of only 35%. Thus fiscal reforms should consider

the distributional consequences of both direct and indirect taxation.

- **Addressing competitiveness concerns:** there is the perception that high labour costs in some Peripheral countries were one of the reasons behind the crises in the Eurozone. In this context, there has been increased interest in the possibility of a tax shift away from labour towards consumption. This is seen as one means to lower labour costs, while reducing *direct* impacts on net wages. For example, modeling by de Mooij and Keen (2012) suggests that such a labour-consumption taxation shift would increase export competitiveness in the Eurozone, and may be a means to address structural divergences and macroeconomic imbalances between Member States.
- However, there are a number of reasons to be skeptical. Firstly, cost-competitiveness is only one dimension of price-competitiveness, itself only one dimension of external competitiveness. Secondly, as noted above, increasing consumption taxes such as VAT has regressive distributional consequences, i.e. hitting hardest the disposable income of the poorest, pensioners and unemployed. Thirdly, in the Eurozone context, lowering labour costs via a labour-consumption tax shift is a non-cooperative approach. Nonetheless, acting on labour taxes can be one tool to address cost competitiveness concerns.

3.1.2. The opportunity for and potential of environmental fiscal reform

In this context, ETR could offer a number of attractions. It offers the opportunity to recycle revenues through either a reduction of the tax burden on socially desirable activities such as labour or investment; increases government investment, or fiscal consolidation. In the current crises context, it may offer a means to meet multiple policy

objectives, including creating employment and addressing environmental goals. Differential tax rates between countries, fuels and sectors also create distortions in the internal market, inefficiencies in environmental policy, and foregone revenues. But these impacts are complex and must be thought from the angle of broader tax reforms within a context of increased European coordination on fiscal policy.

3.1.2.1. Fiscal consolidation

Environmental tax reform could create significant revenues. Over the past decade, environmental taxation has been falling as a percentage of GDP in the Eurozone,⁶ and there are large differences between Member States (EC, 2011d). Environmental taxation ranges from 4.8% and 4.0% of GDP in Denmark and the Netherlands, to 1.6% of GDP in Spain with the EU27 average at 2.4%. Energy taxation ranged from 3.0% of GDP in Slovenia to 1.2% in Greece, with the EU27 average at 1.8%. The Commission estimates that direct revenue losses from environmentally harmful subsidies may reach 0.5% of GDP (EC, 2011c). A higher auctioning price in the ETS would create another ~0.2% p.a.⁷ of GDP. Implementing the Commission's proposed energy taxation directive would create up to 0.33% of GDP p.a. **It should be noted that revenue positive ETR may reduce or offset the economic benefits of recycling revenues via a reduction in employment taxation.**

3.1.2.2. Employment creation

By contrast, if revenues are recycled via reductions in social security contributions or income tax, ETR can potentially deliver a "double dividend":

- Firstly, pricing the external costs of environmentally damaging activities can bring about welfare improvements through reduced environmental damages (first dividend).
- Secondly, revenues can be used to reduce distortionary taxation on labour and investment. The imposition of new taxes in the resource sector will induce a deadweight loss. At the same time, the reduction of taxes on labour or investment will induce a welfare gain. Under certain conditions, the net welfare result from the recycling of revenues can be positive, i.e. the creation of employment and potentially economic growth (second dividend).

The literature on the potential of labour-resource tax substitution to create an employment double dividend is large and complex. Most authors see the labour market situation as a crucial factor, in order to preserve the reduction in labour costs and maintain the employment effect (Carraro and Siniscalco eds, 1996; Kratena, 2002). The current Eurozone context of macroeconomic disequilibrium and significant unemployment would likely reduce possibilities of upwards renegotiation of real wages.

Secondly, the type and magnitude of existing tax distortions will influence the outcome of ETR. If the tax burden is shifted from the relatively over-taxed production factor (labour) to the under-taxed production factor (energy/carbon), a net gain of employment could accrue. In this regard, the Commission calculates that one third of Eurozone MS could increase employment by reducing labour taxation, which varies widely between MS (EC, 2011e).

Many European Member States such as Denmark, Sweden, Finland, Germany or the UK already have significant experience with ETR. The literature on the macroeconomic impacts of ETR is large and still open for further research. However, general points of consensus in academic analysis and ex post assessment have been reached (Hourcade et al, 2010):

- ETR with revenue recycling always provides superior welfare outcomes compared to ETR without recycling.
- **Net employment gains can be attained if revenues are recycled via a reduction in social contributions or income taxes.** A meta-analysis of European studies shows that a majority find that ETR brings about net positive employment gains, if labour costs are reduced via reductions in employers' social security contributions (Hoerner and Bosquet, 2001). The assumption of non-equilibrium labour markets with involuntary unemployment is an important condition for this result (Kratena, 2002). The elasticity of substitution between labour and energy is also vital in determining the employment outcome. In the short-term, this may be restricted by the lock-in of energy intensive capital stock; in the longer-term, as the capital stock evolves, the elasticity of substitution may increase. Thus it is important to consider ETR from a dynamic perspective.
- Very small impacts on GDP levels ($\pm 0.5\%$), with a majority of studies showing a net GDP gain. For example, countries that implemented carbon tax ETR show small GDP impacts, with the balance on the positive side (Andersen, 2010; Agnolucci, 2009).

6. 2.3-2.6% of GDP in 2009, down from 2.6-2.7% of GDP in 2000,

7. Under a carbon price of €30/ton by 2020. Based on Cooper et al (2011)

Thus, while a double dividend is by no means assured, ETR does seem to offer the potential to deliver both environmental and employment benefits, if the tax burden on labour can be effectively reduced.

3.1.2.3. Reducing inequalities

Regarding distributional issues, the extensive literature on ETR points to some generally applicable conclusions. Household fuel/energy taxes tend to be socially regressive, as poor households spend a greater portion of income on fuel consumption. Motor fuel taxes can impact the lower and middle class disproportionately, as well as rural households. Rural households, the unemployed and retired tend to be the most vulnerable groups, and these would not necessarily benefit from labour tax reform.

However, the distributional impact of ETR is, firstly, dwarfed by the distributional impact of other indirect taxes, e.g. VAT. Secondly, combining ETR with a broader tax reform can improve distributional outcomes. Comprehensive reform could include payroll tax measures targeting the lowest income deciles (which can also improve the employment outcomes), plus targeted transfers to particularly vulnerable groups such as pensioners, low income workers and the unemployed. These should be designed so as to preserve the price signal arising from the change in relative prices but without hampering economically fragile households.

In short, there is no mechanical connection between ETR and distribution outcomes. Distribution outcomes depend on the recycling method and politically acceptable compromises can be found, i.e. integration of ETR within broader tax reforms.

3.1.2.4. Increasing competitiveness

In addition to distributional concerns, there are concerns around potential competitiveness effects of ETR. The Pollution Haven Hypothesis (PHH), i.e. that environmental regulation leads to the off-shoring of environmentally damaging production, has been subject to much study. The large literature is not unequivocal, and suggests that PHH effects may be limited a very small number of specific industries, and that production factor endowments (human capital, physical capital, natural capital) far outweigh any significance of environmental regulation. For example, Quirion and Hourcade (2004) show that an EU carbon tax in energy intensive sectors, without any recycling, would have lower impact on firms' marginal costs than inter-annual exchange rate variations. Econometric analysis from the UK, using a natural

random experiment with a control and trial group of firms, show that the Climate Change Levy had a positive impact on energy intensity but fail to see any negative effect on firm performance (Martin et al. 2011). In Section 3.3.2.1. below we discuss the potential positive competitiveness impacts of environmental regulation.

In sum, negative competitiveness impacts of ETR are likely to be limited to a small handful of industries. Politically acceptable approaches to cushion these impacts are possible.

3.1.3 Conclusions and way forward

ETR could form part of a broader fiscal reform in European Member States and at the EU level. It offers the opportunity to shift taxes from labour to resource consumption, creating employment and reducing environmental bads. This goes in the direction of existing fiscal reforms to address the crises, but has the added benefit of not targeting consumption in general. Distributional issues are key, but smart policy design can address these.

There is a need for further, detailed research on the potential of environmental fiscal reform in individual Member States, i.e. identifying Member States with an attractive combination of high unemployment, high labour taxation particularly at the lowest marginal rates, and lower environmental taxation. In addition, further research could address the aspect of European coordination, identifying the objectives and contribution of ETR to address European challenges such as reducing structural divergences and macroeconomic imbalances.

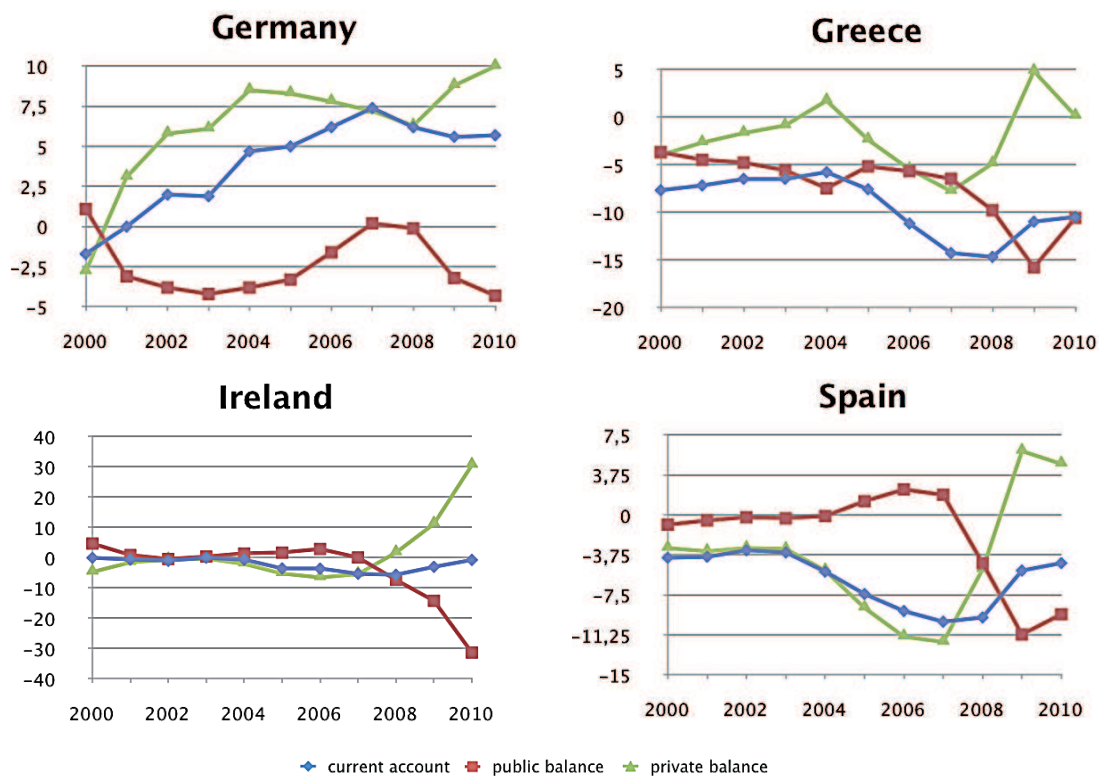
3.2. Green investment

3.2.1. The rationale for and principles of investment in the current context

Current high sovereign bond spreads in Peripheral countries and tightened bank credit standards highlight the need for public and private deleveraging. However, they are also a symptom of weak growth prospects. Progress with deleveraging will be slow if GDP growth remains weak. And GDP growth prospects are weak precisely because the private and public sectors are deleveraging. In this section we survey contextual elements for the argument for an investment program within the crises response.

Figure 4 below shows the financial balances of the public, private and external sector in Germany, Spain, Ireland, and Greece. The public balance is the public deficit or surplus; private balance is private net borrowing or saving, and the external sector is the current account deficit or surplus. Thus these variables represent flows, not stocks.

Figure 4. Sectoral financial balances in % GDP



Source: Own calculations based on Eurostat

Several points are worthy of note. Firstly, with the exception of Greece, the debt crises began in the private sector, as Peripheral governments ran surpluses during the boom years. The private sector is now engaged in strong deleveraging, as evidenced by the jump in private balances, i.e. the shift to net private saving. Secondly, this has been accompanied by significant growth in public sector deficit. Thirdly, there has been a large imbalance in the current account and private balance between Germany and the Peripheral countries.

Figure 5 below shows quarterly real interest rates⁸ in Germany and the Peripheral countries since 2000. Two observations stand out. Firstly, Peripheral countries experienced periods of near zero or even negative real interest rates during the boom years. This distortion in European monetary policy created significant incentives for the cross-boarder capital flows and domestic private borrowing that led to the crises, as noted above. Secondly, subsequent to the crises, real interest rates have exploded in Peripheral countries, reflecting uncertainty over the fiscal and

macroeconomic situation. As a corollary of this, real interest rates have gone negative in Germany and the UK.⁹ This reflects simple supply and demand, as significant private savings search for scarce “safe haven” investment options (Zenghelis, 2011).

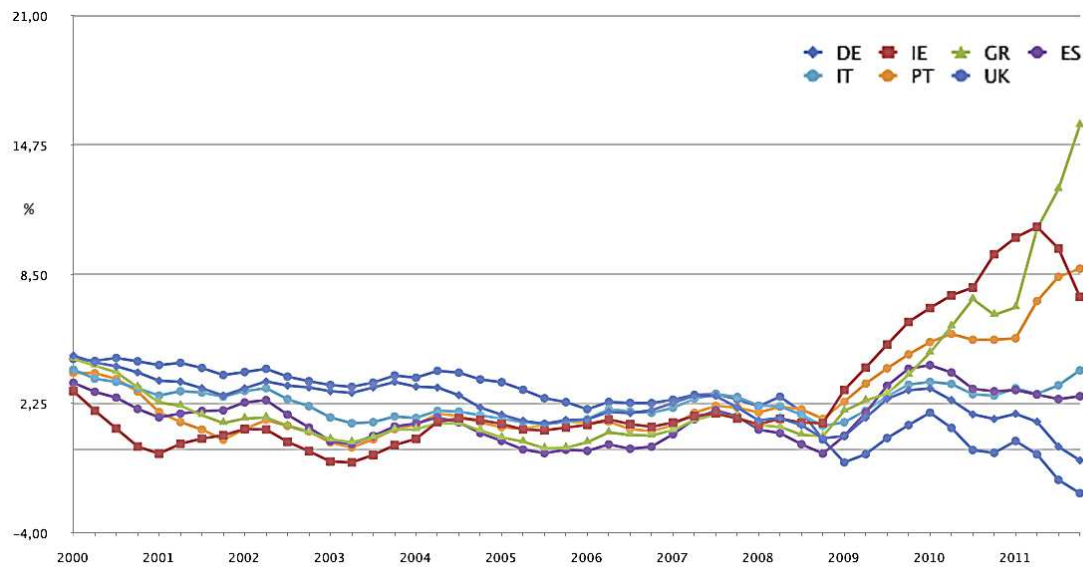
Figure 6 below shows investment in gross fixed capital formation as a percent of GDP since 1970. It highlights the progressive decline in infrastructure investment, infrastructure broadly defined as fixed assets. Some authors (Helm, 2011) have argued that GDP growth in recent decades has been overly based on the depreciation of existing assets and indeed the accumulation of financial debt. Maintaining prosperity will require maintaining the quality of assets, which may not have been the case over preceding decades. In this context, significant investments in Europe’s productive assets (i.e. renewable energy infrastructures) will likely be required over the coming decades.

From this contextual discussion several conclusions can be drawn to inform the following sections on green investment:

9. Relatively high inflation rates in the UK also played a role in depressing real interest rates. In 2011, they averaged 3.9%, compared to 1.9% in Germany.

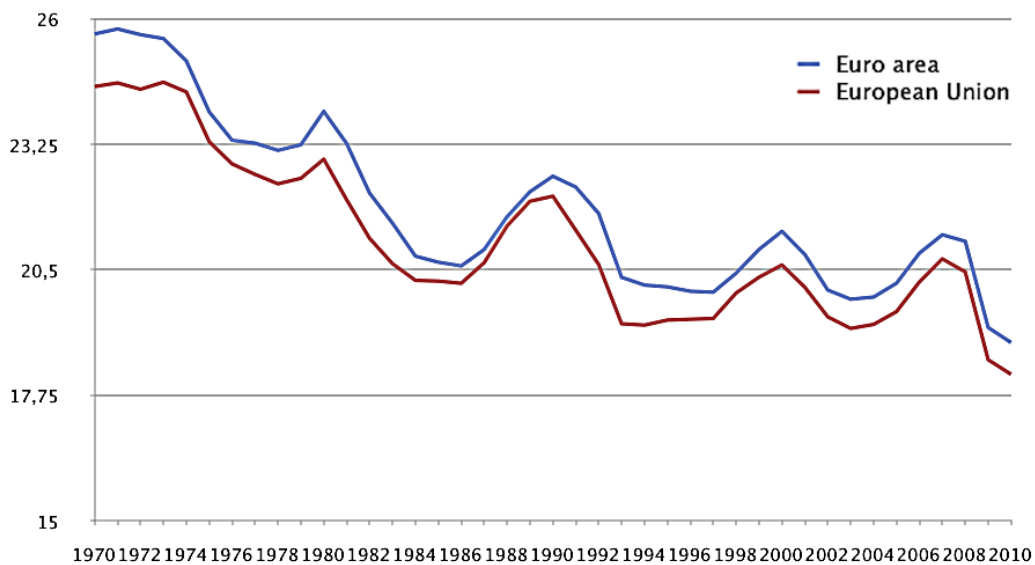
8. Real interest rates = nominal interest rate – inflation.

Figure 5. Quarterly real interest rates



Source: Own calculation based on Eurostat

Figure 6. Gross fixed capital formation as % of GDP



Source: World Bank data

- Peripheral countries are now caught in a vicious circle of recession, austerity and private sector deleveraging. The current disincentive to investment is evident in real interest rates shown above. Yet unless there is some macroeconomic stimulus, the fiscal and social burden of adjustment may not be sustainable.
- Providing macroeconomic stimulus is a European public good (Dullien and Schwarzer, 2011).

Capital is available and there is a dearth of perceived safe investments, as shown by negative real interest rates in Germany and the UK. But surplus capital and safe investment opportunities are not shared equally around Europe, as evidenced in the spread of real interest rates above. A European approach is needed to provide European macroeconomic stimulus, and inward investment in Peripheral countries.

- In coming decades, Europe likely stands before significant investment needs to renew its productive infrastructure. **This provides an opportunity to coordinate the large-scale investments needed; the need to provide inward investment and macro-economic stimulus in Peripheral countries, and the current surplus capital available to some Member States.** The green sector is arguably a clear candidate for such an investment program.

3.2.2. The opportunity for and potential of green investment

A macroeconomic stimulus plan would need to adopt a number of approaches. Arguably, it should include measures to reduce interest rates in Peripheral countries, potentially through some form of debt mutualisation (EC, 2011f). Others have called for significant European reinvestment programs in Peripheral countries (Schwarzer, 2012; Marzitto, 2011). For a number of reasons, we argue that green investments, particularly in energy-producing and consuming infrastructure, should be an important part of a macroeconomic stimulus plan for Europe, and troubled Member States.

Firstly, it is of large scale. The Commission estimates that delivering a low-carbon economy by 2050 will require an increase in investment of 1.5% of GDP, roughly returning investment to its average over the 1985-2005 period (see figure 6 above). Secondly, it could offer long-term productivity and economic resilience gains, if exposure to fossil fuels can be reduced and the productivity of green technologies improved. Thirdly, some form of debt sharing is likely to be more politically acceptable if it responds to the current logic of creating the long-term conditions for sustainable growth in troubled countries, and Europe more broadly, i.e. by leveraging investments in long-term productive assets.

3.2.2.1. Stimulating activity and restoring confidence in a large scale, high learning sector

The green sector is characterised by significant market failures and public good aspects. Investment is therefore below socially desirable levels, and government intervention can crowd-in, rather than out, private investment into new, efficient productive capital.¹⁰ This is especially so currently, with the EU economy well below equilibrium. In addition, green investments in Europe's productive infrastructure are also likely to be suboptimal without intervention, due to their public good

nature. Thus investments in the green sector could provide significant leverage effects and positive European spillovers. Investment in long-term productive infrastructures will create long-term sources of revenue attractive to private investors, provided that market failures and political risks can be adequately managed. These characteristics mean that investments could be leveraged with a minimum direct draw on public budgets.

One should not be uncritical of the growth potential of green investments. There will be a trade off between short- and long-term objectives. The current capital stock is designed for high carbon and resource consumption, and measures to reduce carbon and resource consumption could result in a less productive usage of this existing capital stock. Secondly, green technologies are currently not as productive as brown technologies, i.e. they are more capital and labour intensive than brown alternatives.

This line of argument can be addressed in several ways. Firstly, not all green policies would display inter-temporal trade-offs; some, such as energy efficiency, can involve significant win-wins also in the short-term (Gillingham et al, 2011). Secondly, the EU economy is currently far from equilibrium in any case.¹¹ This means lower opportunity cost of investing now in green infrastructures and technologies (Stern and Bowen, 2010). Thirdly, the "brown" pathway of economic development is not without inter-temporal trade offs either, as it could engender risks of lock-in into long-term unproductive capital stocks and lock-out from future growth markets. Policy risks are therefore similarly pertinent to brown investments, resulting in investment delay (IEA, 2007). Fourthly, arbitrage between green and brown is not static and can be modified by policies to raise the relative productivity of green technologies. Fifth, other proposed structural reforms will also take years to boost activity in weaker Peripheral countries, and there are few other credible candidates for large-scale investment programs that also bring long-term productivity gains. Finally, any strategy to shift investment forward temporarily should be designed to create the long-term productive capital and skills to enable the repayment of that investment.

Thus while green investment can create employment and stimulate activity in the short term (see below), the main rationale may be the need to reinvest in European productive infrastructures, in order to increase productivity and resilience in the long-term (see below).

10. See e.g. Leiter et al. (2010) for an investigation of environmental regulation and investment into productive assets

11. As implied by the current high output gap of 1.6% of GDP.

3.2.2.2. *Employment*

The green sector may be characterised by a high initial labour intensity and a high share of domestic value added within the whole value added chain (Voituriez and Balmer, 2012). They may also be less tradable than in other industries. In the short-term, these characteristics can help create much needed employment, while in the longer-term improving the productivity of green technologies through learning effects. Experience with green stimulus shows that it can provide significant employment benefits, especially if complementary policies such as emissions pricing or RD&D is in place. For example, analysis of the green stimulus package in the US estimates that it created 720 000 jobs over the period 2009-2012, 10% of the overall Recovery Act's employment creation (Aldy, 2012). The impact would have likely been larger if complementary policies had been in place (Aldy, 2012).

3.2.2.3. *Economic resilience*

Green investments can create the conditions for long-term prosperity. This will depend on a high degree of resource productivity. Indeed, we argued above that energy prices played a role in the current crises, and are now dragging on the recovery. In general, Peripheral countries are among the most exposed in the Eurozone to fossil fuel prices, due *inter alia* to their energy/oil intensity and import dependency (ECB, 2010). Exposure to fossil fuel prices has a negative impact on growth, price stability and hence Eurozone monetary policy, and current account balance. A long-term strategy to put the European economy back on a sustainable footing should also consider energy and resource scarcity.

A number of studies have attempted to quantify the hedge that climate/environmental policy provides against resource constraints, particularly oil. Peersman and Van Robays (2011) show econometrically that countries that reduced their oil and energy dependency by improving efficiency and diversifying the energy mix have reduced their exposure to oil shocks over the period 1970-2010. Rozenberg et al (2010) show that global climate policy is a valuable hedge against the negative macroeconomic impacts of uncertain oil scarcity. Prospective modelling studies, such as JRC (2012) and Ecofys et al (2009), estimate that the EU's 2020 climate policies will improve energy security and reduce exposure to oil price shocks.

Green investments have the potential to stimulate innovation and advance the productivity frontier, as well as adapt the economy to systemic resource constraints, which are

necessary to maintain prosperity on the long run by strengthening resilience.

3.2.3. *Conclusions and way forward*

Green investment could be a means to provide a short-term macroeconomic stimulus and inward investment in Peripheral countries, while creating the conditions for long-term economic resilience. There is a clear need for policy coordination, given the imbalance in capital availability between European countries. The political feasibility of this coordination may be higher in the case of green investment, since it lays foundations for sustainable economic prosperity rather than solely relaunching short-term demand.

There are a number of policy proposals for leveraging green investment (e.g. green bonds). Further research could address the questions of modalities for designing such instruments (conditionalities, issuance, project design and selection) and assessing their potential to stimulate productive employment and activity in troubled regions.

3.3. *Stimulating green innovation*

3.3.1. *The rationale for and principles of innovation in the current context*

Historically, innovation and technical progress have been associated with the high growth rates seen during the eighteenth century and nineteenth century industrial revolutions. During its nineteenth century industrial revolution, the UK focused its innovation, scientific experimentation and technology diffusion on a few high tech sectors (Landes, 1969). Thanks to technical progress, labour productivity grew at rate exceeding population growth and capital deterioration, thus allowing economic activity to bypass the law of decreasing marginal returns and Malthusian limits to growth (Solow, 1957).

In that same period, the global balance of economic power was reshaped. In 1820, Asia accounted for 55% of world GDP, a hundred years later only 20% (Maddison, 2002). Several political, military and economic factors explain this trend. These included the adoption of technical progress as a motor of growth by western countries. **The ability to drive and harness innovation has therefore been crucial in determining economic progress and geopolitical power relations since the first industrial revolution.**

For economies near the productivity frontier, innovation may be the main source of wealth creation. This is in line with endogenous growth theory, which states that long-term growth is a

result of internal forces in the economy (Romer, 1990). Among these forces, innovation ranks first. Aghion et al (2009) stresses that innovation tomorrow depends on the portfolio of choices open today. Hence, policy choices made today will define our future technological boundaries.

After the destruction of the Second World War, Western Europe had caught up with the world technology frontier in terms of per capita GDP and labour-capital ratio by the 1980s. As a result, it exhausted capital accumulation and imitation as the main sources of growth (Aghion, 2006). However, since then Europe has not been significantly pushing forward the productivity frontier: since 1995, European productivity has declined relative to that of the US (World Bank, 2012).

In order to reverse this trend, EU leaders placed innovation policy at the core of the 2000 Lisbon Strategy, whose goal was for Europe to “become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion”. By 2010, academics and EU officials generally agreed that the strategy had failed to make Europe the most innovative region of the world.

The inability of the EU to meet its Lisbon targets sheds light on the need to review its innovation policy framework. The World Bank (2012) offers a recent analysis of deficiencies therein. Europe’s innovation gap is due to a complex array of causes, notably barriers to entry, capital market failures, fragmentation of the internal market, etc. Innovation in the EU too compartmentalized among countries and disciplines. The Innovation Union report shows that 85% of public research is programmed, financed, monitored and evaluated at the national level (EC, 2011h). Less than 6 % of total public R&D investment is done in a collaborative, transnational approach. Just 11% of energy-related R&D investment, public and private, is invested at the European level (JRC, 2009). In terms of interdisciplinary integration and achieving EU economies of scale, the EU still has substantial efforts to make.

Diffusion of research and innovation is also a weak link for the EU. While Europe is among top players in terms of knowledge production (29% of world production of peer-reviewed publications versus 22% for the USA and 17% for China), it is losing ground as regards to exploitation of their results: the rate of growth in the number of PCT¹² patent applications over recent years in Japan and South Korea is double that of the EU (EC, 2011h).

12. Patent corporation treaty.

These deficiencies will not be addressed solely by a focus on the green sector: policy effort is clearly necessary to address Europe’s overall innovation system. Nonetheless, there may be reasons for placing a special focus on the green sector, as we argue below.

3.3.2. The opportunity for and potential of green innovation

Firstly, a range of *barriers to entry*, *public good* effects and *market failures* characterize this sector. These include environmental damage externalities; knowledge spillovers; information asymmetries and coordination externalities. Significant economies of scale and initial productivity advantages mean that *laissez faire* innovation may be biased towards incumbent (dirty) technologies, leading to a socially suboptimal development of new (clean) technologies (Acemoglu et al, 2009; Unruh, 2002). Finally, clean technology innovations may provide significant public good contributions, such as climate change mitigation and resource security. These factors suggest that social returns to clean technology innovation could be high, particularly in the long-term.

3.3.2.1. Competitiveness

Secondly, it is posited that clean technology innovation could provide a source of *competitive advantage*; firstly, as it enables more efficient production with increasingly scarce resources; and secondly, as a sector itself with large growth prospects internationally (Bleischwitz, 2010). A large body of research has investigated a posited connection between environmental regulation, innovation and competitiveness (Porter Hypothesis, PH). The PH is generally divided into strong and weak variants:

- environmental regulation can increase environmental innovation (*weak PH*);
- and in turn increase the competitiveness of firms or countries in the green sector (*strong sectoral PH*).
- sector specific innovation can spill over into other sectors of the economy, increasing the overall economic competitiveness of the economy (*strong economy-wide PH*).

Well-designed policy mechanisms can indeed contribute to increased sectoral innovation (EEA, 2011). The nature of the environmental problem, the sector involved, and the regulatory tools chosen are important contextual conditions, but well-designed policy, combining push-pull interventions, does seem to be able to stimulate environmental innovation. This finding appears particularly robust for the energy sector (Costantini and Crespi, 2008; Johnstone et al, 2010).

The strong PH is more complex. It likely involves a trade off between dirty and clean sectors, and interactions with existing factors of comparative advantage. Above, in Section 3.1.3.3., we addressed the question of negative competitiveness impacts of environmental regulation. Here we survey the literature on the strong PH.

There have been a small number of econometric studies of the relationship between environmental regulation and EU export performance, either in green technologies or more broadly (see Huberty and Zachmann, 2011; Costantini and Crespi, 2008; and Costantini and Mazzantini, 2012). These find, firstly, that environmental regulation can increase export competitiveness in the green sector. Existing innovative and technological capabilities are a key co-determinant of export competitiveness in the green sector. Countries/firms already specializing in similar sectors will perform better in terms of green exports. Recently, Costantini and Mazzantini (2012) find that environmental regulation is associated with increased general export competitiveness, specifically in the high-tech and medium/low-technology sectors.

3.3.2.2. *Economic resilience*

We argued above that the world was entering into a period of resource scarcity, driven by booming demand and the growing marginal cost of resource extraction (McKinsey, 2011). In this context, firms and industries producing resource efficient goods may gain a competitive advantage. For example, Hamilton (2009) and Edelstein and Kilian (2009) argue that the decline of the US auto-sector during the 2007/8 oil price boom was in part due to the fuel inefficiency of its products relative to those of international competitors. In addition, innovation is essential for decoupling economic prosperity from resource inputs and environmental impacts.

This line of argument is developed in the theoretical framework of Acemoglu et al (2009). Under resource constraints, the long-term prosperity of an economy is shaped by:

- The exhaustibility of dirty production factors.
- The (dynamic) elasticity of substitution between dirty/clean production methods.
- The ability of environmental innovation to enhance 2) in order to avoid productivity constraints arising from 1).

In a context of low short-term substitutability of production methods and resource limitations to dirty production (e.g. exhaustible fossil fuels, significant environmental damages), directed environmental innovation is essential to maintain long-term prosperity. Hourcade et al (2011) show that with more pessimistic (realistic) parameters

for the substitutability of clean/dirty production and the stringency of environmental constraints, innovation and pricing policies become even more central to maintaining prosperity in the mid- to long-term.

Thus environmental innovation should be seen as a key part of a long-term strategy to maintain prosperity and competitiveness in an increasingly resource-scarce world (Quitow, 2011; Bleischwitz, 2010). However, inertia and path-dependency in the development of clean technologies necessitates immediate policy intervention.

3.3.2.3. *Reducing inequalities*

According to Blanchard and Cohen (2009), the relative and absolute decrease of low skilled workers' wages over the past 25 years in the US is due to innovation, regulation and trade dynamics. This argument is further detailed in Brauer and Hickok (1994) who show that productivity gains and trade induced structural changes weighed more on less educated, low-skilled workers.

Interestingly, recent studies (Voituriez and Balmer, 2012) report that investments in green technologies have the prospect of being beneficial for both high and low skilled workers. Jobs created by green technologies are to a certain extent non-tradable and range in all types of activities: from technology design to production, to installation and maintenance. Green innovation itself cannot address wage and employment inequalities, but its integration within an intelligent regulatory framework can.

The economic transformation envisaged by the green economy must thus be accompanied by a larger set of policies. The shift to a green economy will require professionals capable of moving at the interface of different disciplines and utilizing cross-disciplinary innovation. In that respect, pan-European, multidisciplinary educational programmes are short of funding, teachers and infrastructure. Projected demand for skilled workers in green economy sectors exceeds BAU supply (EC, 2011h).

3.3.3 *Conclusions and way forward*

Fostering environmental innovation should be part of a long-term macroeconomic strategy for Europe. First, it is a necessary (though not sufficient) step to achieve the ecological transition: by lowering its cost it will facilitate the shift towards a resilient economy. Second, by developing new products and services, environmental innovation can be a source of non-price competitiveness, particularly in the longer-term. EU trade partners are growingly investing in green technologies,

making it even more essential to develop innovative green industries in the EU.

Getting the right EU wide policy framework to develop and diffuse innovation is crucial. Currently at the European level, resources are too low and too fragmented. Policy instruments to support innovation can be improved in three ways: by directing environmental innovation (reorganization the institutional framework, subsidizing), facilitating access to markets (feed in tariffs) and modifying existing markets (via implicit/explicit price mechanisms and market segmentation through information and labels). These three dimensions need further harmonization and funding at the European level.

CONCLUSION

Since January 2012, the tension in sovereign bond markets has calmed somewhat, and progress has been made on reforms to fiscal and economic governance. This buys some breathing space for reflection on the longer-term economic strategy of the EU, and whether the short-term response to the crises can be brought in line with that strategy.

The EU crises are taking place within a context of rapid and profound global change. Two

megatrends in particular stand out: growing pressure on resources, and climate change.

In the long-term, the transition to a green economy is essential, in order to maintain the environmental conditions for prosperity, and a competitive economy within those constraints. Resource and environmental constraints are already a challenge and an opportunity. The dramatic pre-crises rise in commodity prices, particularly oil, played a contributing role in fuelling and triggering the crises.

In the long-term, therefore, the benefits of moving to a green economy will be increased economic resilience, innovation, and competitiveness, as well as the preservation of environmental assets. In the short-term, there can also be potential to create synergies between the crises response and the shift to the green economy. Two particularly promising opportunities are environmental fiscal reforms and green investments. If integrated within broader fiscal reform, the latter can contribute to a sustainable and fairer fiscal consolidation, while creating significant employment. Green investments have the potential to create employment and activity in the short-term, while pushing forward the technology frontier in key green sectors. This is consistent with the current focus of the crises response, namely placing the EU economy back on a sustainable path. ■

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Exiting the crisis in the right direction: A sustainable and shared prosperity plan for Europe

Thomas Spencer, Lucas Chancel,
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