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**Macroeconomics, Financial Crisis
and the Environment**

Strategies for a Sustainability Transition

Miklós Antal, Jeroen C.J.M. van den Bergh

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Macroeconomics, Financial Crisis and the Environment: Strategies for a Sustainability Transition¹

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Abstract

We raise fundamental questions about macroeconomics relevant to escaping the financial-economic crisis and shifting to a sustainable economy. First, the feasibility of decoupling environmental pressure from aggregate income is considered. Decoupling as a single environmental strategy is found to be very risky. Next, three main arguments for economic growth are examined: growth as progress, growth to avoid economic instability, and growth to offset unemployment due to labor productivity improvements. For each, we offer orthodox, heterodox and new responses. Attention is paid to progress indicators, feedback mechanisms affecting business cycles, and strategies to limit unemployment without the need for growth. Besides offering an economy-wide angle, we discuss the role of housing and mortgage markets in economic cyclicity. Finally, interactions between real economic and financial-monetary spheres are studied. This includes money creation, capital allocation and trade-offs between efficiency and operating costs of financial systems. Throughout, environmental and transition implications are outlined.

JEL-Code: E32, E44, O44, Q01, Q43, Q54

Keywords: financial-monetary system, GDP information, housing-mortgage markets, macroeconomics, positive and negative feedbacks, productivity trap.

Highlights:

- We study macroeconomic issues relevant to escaping the current crisis and making a transition to a sustainable economy.
- We consider existing mainstream as well as heterodox proposals and add our own proposals.
- Various arguments for growth and decoupling as an environmental strategy are analyzed and alternatives are formulated.
- Attention is paid to progress indicators, cyclicity due to positive feedbacks, and job creation without high growth.
- We study characteristics and reforms of financial-monetary systems that may impede or enable a sustainability transition.

1. Introduction

Reading the growing literature on sustainability transitions, one can notice the absence of any information or insights on macroeconomics. This is surprising as well as unfortunate: surprising, because the macro or landscape level is supposed to play a major role according to the influential multi-level perspective on transitions (Geels, 2011); unfortunate, as many of the dynamic processes that make up a transition are macroeconomic in nature and have been studied extensively in macroeconomics. Transferring knowledge from this field to transition studies is likely to increase our understanding of how to respond to barriers and opportunities for transitions. A lack of understanding of macroeconomic complexities easily results in the design of policies that are ineffective.

In particular, the study of transitions has paid little attention to conflicts between core environmental and macroeconomic objectives, even though these can slow down or obstruct sustainability transitions. As such conflicts have occupied a central place in ecological economics (Daly and Townsend, 1993; Harris and Goodwin, 2003; Victor, 2008; Harris, 2009; Jackson, 2009; Hueting, 2010; Kallis, 2011; van den Bergh, 2011), insights obtained here can benefit the study of sustainability transitions.

Without denying the importance of micro level analysis of small-scale experiments and niche innovations, it has to be acknowledged that the macroeconomic landscape has a tremendous impact on the behavior of consumers, producers and investors. This landscape may have to change to enable a quick transition, which is needed to respond to urgent environmental problems, especially at a global scale. But things are more complex, as the landscape is not independent of the underlying levels. In fact, we have both top-down and bottom-up causation (van den Bergh and Gowdy, 2003), creating a system of many feedbacks which is impossible to be completely grasped intuitively. This means that the 'microfoundations project' in macroeconomics (Weintraub, 1977; Janssen, 1993) is too simple, as it only focuses on bottom-up causation. Without understanding well the complete two-way interactions, unrealistic expectations about the feasibility, direction and speed of a transition may result.

One might think that macroeconomics does not offer clear insights, as it is a collection of different schools, which represent often inconsistent, even opposed, views on how the macroeconomy functions. However, the internal heterogeneity of macroeconomics makes sense – it is a clear response to the economic complexity and lack of experimentation with which macroeconomics struggles. This is made evident again in the fierce debates within macroeconomics on the causes of, and the solutions to, the current financial-economic crisis. But this disagreement does not mean that no useful insights are available. Diversity of insights is worth more than no insights, and from current and past debates between representatives of different schools one can learn a lot. Not considering macroeconomics seriously runs the risk of overlooking existing ideas that may be essential to transitions thinking, or at best reinventing the wheel. Of course, a critical eye is needed to select and interpret theories and insights from macroeconomics for the purpose of enriching transition thinking. In our view, combining mainstream views with openness to heterodox criticisms and perspectives has to be an integral part of the learning process.

Few studies have addressed this interface of sustainability, transitions and macroeconomics. Although the tension between economic growth and environmental quality was recognized decades

ago and an “environmental macroeconomics” was called for (Daly, 1991), the synthesis of macroeconomics and sustainability thinking still stands as a major challenge (Harris and Goodwin, 2003).

In this article we touch upon several fundamental macroeconomic issues that are relevant to the aims of escaping from the current crisis and making a transition to a sustainable economy. Since most mainstream macroeconomists believe that environmental problems have to be addressed by decoupling environmental pressures from economic growth (‘green growth’), we first look in Section 2 at the opportunities this strategy offers. Next, Section 3 enters into the wider growth debate by studying arguments for continued economic growth and strategies that may help to reduce the dependence of economic stability on growth. This involves considering the connections between labor productivity, economic stability, GDP, welfare indicators and sustainability transitions. Besides economy-wide phenomena, we study sectoral issues that strongly influence economic dynamics and, thus environmental impacts, such as the connection between housing and mortgage markets. In Section 4 we proceed by investigating selected mechanisms of the financial system. This subsystem of the economy is particularly important, because it is to a large extent responsible for the gravity of the current crisis. In addition, it can significantly affect the likelihood of a sustainability transition. Money creation, capital allocation for transition projects and systemic properties of financial markets are three topics considered here. Section 5 concludes.

2. The feasibility of decoupling

According to mainstream macroeconomics (e.g., Mankiw, 2004; Krugman, 2012), the solution to environmental problems is the decoupling of environmental pressures from aggregate income (or economic growth), that is, the strategy of sustainable or green growth. This perspective is often kept implicit, but assuming growth as a binding condition leaves no other option. In this view, there is no conflict between indefinite labor productivity³ growth and resulting income growth on the one hand and full employment and decreasing total environmental pressure on the other. The first question posed in this article is whether such a strategy of decoupling is feasible or not.

Due to the magnitude of contemporary environmental problems, very large changes are needed to address these issues. Under different income and population scenarios and a policy target of 450 ppm for atmospheric CO₂ in 2050, carbon intensity – the average amount of carbon emitted to produce a unit of economic output – has to be reduced by 82-97% between 2010 and 2050. The lower-end value of 82% is calculated for 1.5% per capita economic growth. In view of historical trends of average energy efficiency improvements in most countries, the feasibility of such dramatic reductions over the course of 3 to 5 decades through efficiency improvements and structural change while preserving growth (i.e., decoupling) is highly uncertain. In fact, there is no historical evidence of anything that comes close to achieving this aim. Environmental Kuznets curve research (Stern, 2004), which is often referred to as providing a reason for optimism, has only found decoupling for mainly local and less important environmental problems, while it disregards relocation of dirty activities and associated changes in trade patterns as well as the shifting of environmental problems from one domain to another (Peters et al., 2011).

³ Economic output per worker per hour.

On the other hand, looking merely at history may easily lead one to underestimate the potential of decoupling as a means of reducing environmental pressures, because so far we have not seen any widespread implementation of stringent, effective environmental policies. In other words, historical decoupling was largely autonomous rather than induced by policy. Scaling up efforts to increase environmental efficiency is absolutely critical for sustainability transitions. Nevertheless, there are a number of reasons to be skeptical about decoupling opportunities, as indicated in Table 1.

Table 1. Barriers to decoupling of environmental pressures from economic output

Concern	Explanation	Example
Rebound	Efforts to solve an environmental problem can have indirect effects that cause the efforts to be ineffective (like energy rebound), or can aggravate other types of environmental problems ('environmental rebound').	Energy rebound: higher energy efficiency can stimulate more indirect energy use. Environmental rebound (shifting of problems): reduction of carbon emissions through expansion of bioenergy and nuclear power will (likely) cause biodiversity loss and radioactive waste.
Non-linear abatement costs	The cost of emission or material use reduction rapidly increases at higher abatement levels, as one runs out of cheap (cost-effective) options.	The cost of greenhouse gas emission reduction grows progressively with more ambitious targets as it is difficult to move away from fossil fuels.
Possible correlation between pollution and growth at the sectoral level	The contribution of highly pollutive sectors to growth may be substantial (growth depends on factor productivity increases which may be easier in capital-intensive – often 'dirty' – industries).	Heavy industries and the construction sector are expected to grow rapidly in developing countries and emerging economies in the coming decades, with an inevitable increase in associated environmental pressures.
Geographical shift of production and consumption	If the share of highly energy- or material-intensive economies in the world economy grows, global average efficiencies are likely to decrease.	Recent energy efficiency improvements in many countries were offset through this channel. For instance, China exports energy-intensive products to western countries.
Social-political feasibility of environmental agreements and policies	Strong opposition from vested interest groups can block the establishment of international agreements and national policies.	Lobby groups, corrupt administrations and uncooperative countries can resist or weaken proposals. Misinformation, e.g., about climate change, can reduce public support for action.
Low effectiveness of established policies	Compliance with policies can be low because enforcement is difficult due to bad policy design, imperfect monitoring and control, or corruption.	Policies are often not translated into actions or loopholes for polluters remain, especially in developing/emerging economies with weak or corrupt governments.

Given the considerations in the table, it is unlikely that we will achieve sufficient efficiency gains to tackle the major environmental problems and compensate the rise of material throughput that accompanies economic growth. Recent trends of relevant indicators are alarming. For example, after improving by approximately 25% between 1980 and 2000, global energy intensity has stagnated between 2000 and 2010 (Yoder, 2011) and in the last two years it has deteriorated (WEO, 2012). So global economic growth and rising energy intensity have both contributed to increased absolute energy use in 2010 and 2011. In view of the formidable environmental challenges and the concerns expressed in Table 1, decoupling as a main or single strategy can be judged as taking an irresponsibly large risk with our common future. Even a minimal consideration of the precautionary principle

requires being open to strict environmental policies that may slow down growth or even result in reductions of GDP. Therefore, strategies are needed to make periods of low or negative growth socially and politically acceptable.

3. Macroeconomic arguments for growth and potential responses

Mainstream economics and politics are very much concerned with economic or (per capita) GDP growth. In the current crisis context, they tend to assume that recovering or stabilizing growth is the only way – that is, a necessary or even sufficient condition – to reduce unemployment and more generally to realize social aims or well-being. We will examine why economists and politicians prioritize economic growth so much and stick to decoupling as an environmental strategy if achieving environmental targets in this way is so uncertain. We argue that there are three main reasons for this. First, aggregate income growth is understood as progress. Second, the economic system is self-amplifying, so in the absence of growth economic instability leading to a recession is likely. Third, improvements in labor productivity through technical and organizational innovations make economic growth necessary to preserve jobs. The following subsections will elaborate these viewpoints and suggest alternative strategies that may tackle related problems.

3.1 First argument: aggregate income growth is progress

Mainstream economic textbooks equate per capita GDP with the standard of living. The argument is that the total expenditure on the economy's output of goods and services (GDP) equals the total income in the economy, so higher output translates into higher aggregate income for individuals as well as the public sector. Therefore, growth is seen as creating a higher standard of living and better public services (Mankiw, 2004). This is suggested to contribute to progress in the sense of increased well-being⁴.

In countries where most economic activities take place in the formal economy, but the average income is low, economic growth can increase people's well-being. However, the GDP functions more like a market cost than a social benefit indicator (Mishan, 1967; Daly and Cobb, 1989). It can also be seen as summing expenditures on 'good' and 'bad' items. Moreover, it neglects informal activities, distributional inequity, resource depletion and environmental deterioration (Stiglitz et al., 2009; van den Bergh, 2009). In addition, there is clear evidence that beyond a certain income threshold growth in average income does not improve subjective well-being or happiness (Easterlin et al., 2010), which has been explained through adaptation to higher income and zero-sum status games (Clark et al., 2008). Consequently, in most rich countries using individual income growth as a proxy of progress lacks convincing theoretical and empirical support. Nevertheless, people do not seem to realize this in view of the continued striving for income growth.

⁴ For our discussion here it is not essential to make a sharp distinction between well-being and welfare as some authors do.

At the same time, governments enjoy increasing tax revenues under a regime of economic growth, which allows for higher public spending and a buffer to accommodate economic shocks⁵. Furthermore, countries with a higher per capita GDP can tolerate more debt per capita, since economic stability depends on debt levels relative to GDP. If GDP grows by 3%, debt can also increase by 3% without affecting stability. The opportunity of issuing more bonds further increases spending power. For politicians, the benefits of growth are usually direct and tangible (e.g., extra tax revenues that make public projects with visible results possible) while costs are indirect and rarely attributed to them (e.g., air pollution). Connections between politicians and businesses that benefit from economic expansion – including legal and illegal relations such as through lobbying and corruption – further strengthen the public sector's commitment to growth. In addition, growth serves as a lubricant to accept and prolong existing income inequalities. Without being exhaustive, one more argument is that economic and military power struggles at various levels motivate political leaders to stimulate growth of their economies to surpass those of other nations (Rogoff, 2012). As a consequence of these various reasons, economic growth finds strong support among politicians.

Potential responses

Daly and Cobb (1989) have argued that the economic benefits of a larger output must be weighed against its costs to determine the optimal size of the economy. This idea is very difficult to operationalize as one ideally should know all the marginal costs and benefits in economic, social and environmental dimensions at any scale of the economy to decide where the cost-benefit trade-off is (approximately) optimal. To go a little way in this direction, they proposed the Index of Sustainable Economic Welfare (ISEW), which shows that in rich countries ISEW has not increased together with GDP since the 1980s.

As part of the strategy to reduce the dominance of the GDP indicator, such new aggregate indicators can be used or, alternatively, the current set of macro indicators can be improved by adding distributional and sustainability indicators to guide public decision making (Stiglitz et al., 2009). It is easy, however, to be skeptical about the political feasibility of these efforts. The basic idea is good, though, namely that by better informing citizens, politicians and business people about the real social (private plus external) costs and benefits of economic growth, decisions can be better in line with a development in the direction of a sustainable and equitable macroeconomy.

A related policy objective is to reduce the emphasis in society on materialistic values and income growth. Two 'information strategies' are: to weaken the role of commercial advertising that stimulates consumption growth (which strengthens aspirations for higher income); and to launch campaigns that decrease individual interest in material consumption by drawing attention to non-material dimensions of well-being, such as personal relationships, connections with nature, creative activities, continuous learning and generosity (Aked et al., 2008). Highlighting the negative consequences of status competition helps both strategies. This might also be discouraged by wealth taxation, more progressive income taxation, and perhaps even setting a maximum level to salaries (both in the public and private sectors). Possibly, stimulating the availability of relatively innocent

⁵ Very fast growth, however, can increase vulnerability to financial crises, especially if it is accompanied by quick credit growth (Aiginger, 2011).

games that provide an outlet for any innate feelings of competition and rivalry can be an additional element of the policy package.

This paper happens to be written immediately following the 2012 presidential elections in the USA. In the context of our discussion here on public information, it is noteworthy that in the presidential and vice-presidential debates no single reference was made to either environmental or climate change (despite 160,000 people petitioning the moderators to include these issues). Pushing for a greater representation of environmental problems at the political level or making efforts to decouple business interests from political decisions through novel campaign financing mechanisms (Lessig, 2011) are strategies that can facilitate the transition to a system where GDP growth is a less dominant social aim. This is a major challenge under current social and political conditions. As politicians have several strong reasons to pursue growth, more involvement of citizens and scientific and non-governmental organizations is essential to adequately prioritize social goals in public decision making. Possibly, internet petitions and crowd-funded campaigns can act as catalyzing factors here. This deserves attention in research.

3.2 Second argument: the system is self-amplifying – no growth implies a recession

The current economic system is self-amplifying, because most connections between the important system variables are positive feedbacks.⁶ Critical variables include output, expectations, investment levels, employment, real incomes and the ability of borrowers to meet their debt obligations. If there is growth and optimism, then new business investments create jobs, wages earned in these jobs increase aggregate spending, and the amount of money can grow in the economy through relatively easy credit. Optimism is reinforced and further growth can be expected. If growth is lacking, however, then the economy falls into a spiral of negative expectations, decreasing investment, increasing unemployment, falling real incomes and growing debt problems. As default risks soar, credit becomes more difficult to obtain and the amount of money in the economy can decrease, which can further reduce spending. As a consequence, expectations decline further.

There are few negative feedbacks that reduce the strength of spirals and thus dampen fluctuations. Such automatic stabilizers are the tax system that takes less money out of the economy⁷ when business slows down and government spending (unemployment insurance, welfare benefits, etc.) that pumps more money into the system during recessions. That is, unless the public budget is cut because of a deficit, as is currently the case in many European countries. These stabilizers are insufficiently powerful, however, to assure stability and cannot prevent negative spirals. As a result, inevitable recessions emerge from time to time.

⁶ Positive feedback means that (part of) an output of a system appears as an input to the same system which reinforces the actual trend in the output (whether an increase or decrease).

⁷ Of course, money “taken out of economy” does not disappear, because governments can put it back into circulation. Taxes, however, introduce inefficiencies in the form of so-called deadweight losses. The absolute amount of these losses is proportional to the level of economic activity. Further reasons for the stabilizing effect of taxes are the time lag between tax collection and the spending of revenues, the potential inefficiency of government spending as compared to private spending to stimulate the economy, and the fact that a part of tax revenues may be withheld or spent outside the national economy.

If recessions are bad, while maintaining steady economic output is difficult and risky (small changes can trigger a recession), it is not surprising that most economists prefer growth. If growth is too fast, however, the economy can ‘overheat’⁸ which can lead to inflation and a threat to economic stability. Thus, most economists favor moderate growth. However, even moderate growth translates into an exponential growth pattern which threatens environmental sustainability. In addressing this apparent contradiction, mainstream economic growth models extended with environmental and resource variables tend to support optimism about decoupling as they find that for certain initial conditions and parameter values infinite sustainable growth is feasible (Xepapadeas, 2005).

The Keynesian answer to the demand fluctuation problem and the ‘high price of recessions’ argument is to increase aggregate demand in recessions by public spending to preserve jobs in the short run, even if this means increasing the public debt. This strategy is intended to get the economy back on the upward spiral. The economic effectiveness of the strategy is, however, not certain, because government money can keep inefficient firms (“zombies”) alive while more debt can create fears of sovereign debt default (country-level bankruptcy), with further negative consequences.⁹ Moreover, growth may slow down if public debt becomes very high (Reinhart and Rogoff, 2010). Alternatively, one might stimulate private consumption through lower taxes. However, the effectiveness of this strategy might be limited due to the “paradox of thrift”; both individuals and firms may save more during a recession to safeguard themselves against uncertain futures. This would result in a decreased propensity to consume, which weakens the impact on aggregate demand. On the other hand, falling incomes can increase the average propensity to consume while credible policies that reduce uncertainties can boost confidence and economic activity, for instance, in greener sectors (Zenghelis, 2012). Regardless of the net effect, it is clear that this strategy offers no escape from the growth imperative and the associated instabilities.

Most new classical and monetarist economists, on the other hand, favor austerity and debt reduction as a short term solution to crises, which, after an initial period of hardship, is supposed to lead to renewed confidence and ultimately an upswing in the business cycle. As growth returns, the self-amplifying system can push the critical variables in the favored direction. The effectiveness of this strategy is not proven either, as its short- and medium-term effects involve a destruction of employment and social institutions, which in turn depress expectations. Moreover, this strategy represents – like the Keynesian one – just another call to get back onto the positive spiral.

In environmental terms the strategies are similar in their focus on decoupling. The traditional Keynesian strategy of investing heavily in physical infrastructure may have more severe direct environmental impacts (Yoder, 2011). On the other hand, it also offers opportunities for “green stimulus packages”, whereas the austerity strategy tends to reduce support for investment in renewable energy and other environmentally benign activities (Jänicke, 2012; Harris, 2013). So it is difficult to generalize about which strategy performs better in environmental terms in the long run.

⁸ Overheating refers to periods of high growth when investments increase, so it is easy to find jobs. As employees are strong in wage negotiations, their salaries grow. Increased costs of production typically raise consumer prices. In addition, the amount of money in the economy grows quickly through new loans. These effects result in inflation pressure (Mankiw, 2004).

⁹ Greek, Spanish and Italian sovereign default risks during the Eurozone crisis are illustrative of this.

Potential responses

A more fundamental solution that can help to avoid crises over a long period of time would be to reduce the instability of the system. This can be achieved by weakening positive and strengthening negative feedbacks. The structural modification of relationships between macroeconomic variables accompanied by changes in people's beliefs can serve these goals. Examples are listed below.

Demand for basic goods and services is, by definition, fairly predictable and insensitive to price changes and marketing efforts. If access to these would be radically improved for poor people in both developed and developing countries, they would make up a larger part of the total economy. As a result, economic fluctuations would be smaller. With 7 to 9 billion people on the planet, of which at least 20% being very poor, and increasing resource scarcities which may increase the prices of basic goods and services, the reduction of volatility in the economy as a whole could be substantial. Achieving this represents an enormous challenge, evidently. For example, it requires income redistribution to allow poor people to buy more (and more expensive) food.

Changing indicators is another strategy to reduce self-amplification. It is likely that information about GDP currently contributes to instability. Citizens, students of economics, politicians and the media are all indoctrinated with the belief that GDP growth is a good policy goal in itself. This affects expectations and the dynamics of markets through self-fulfilling prophecies and pro-cyclic behavior. The sensibility of economic agents to GDP information determines, for example, the strength of the positive feedback between growth and the level of investment.¹⁰ Stability even depends on what is regarded as a reasonable rate of growth. Theoretical and empirical macroeconomics has no unambiguous answer to this because of the complexity and unpredictability of the economy. Actually, the definition of a reasonable growth rate varies with country and historical context and is influenced by mass-psychology. Unrealistic growth aims – which are not uncommon, see for instance the 3% target of the EU for 2000-2010 (Lisbon strategy, 2000) – may even increase risks of economic instability. Several respected economists (e.g., Rogoff, 2009; Gordon, 2012; Witt, 2013) believe that pre-crisis growth levels will be difficult to recover. If this is true, then lower growth rates have to be accepted to mitigate risks of economic instability arising through the feedback from the gap between GDP expectations and realizations.

Self-amplification leading to instability can also be due to interactions of several markets. One of the most important examples is the combination of the housing market (including construction) and mortgage markets. When these sectors are booming, house prices rise swiftly. Sellers receive windfall profits; buyers get easy loans by using the new – potentially overvalued – house as collateral. Speculative investments soar and subprime mortgages can be offered. Too good credit ratings, until the bubble bursts, create a false feeling of security. When the bubble bursts and prices collapse, the balance between assets and liabilities is lost, default rates rise and foreclosures become common (Beachy, 2012).

The sector's boom-bust cycle affects several variables that have economy-wide relevance, most notably private debt levels and default rates. To keep debtors' assets and liabilities balanced, house prices cannot decrease (they should preferably increase), for which high turnover is usually necessary. A recession in the housing sector simultaneously increases private debt problems and

¹⁰ This is called the accelerator effect.

unemployment while also reducing total investments in the economy. A decline in the construction sector is largely responsible for this. Thus, the housing sector's cycles significantly contribute to the whole economy's cyclic behavior.

Part of the problem can be traced back to the field of credit rating, where certain regulatory functions have been delegated to private rating agencies. In the U.S. and other countries, many important investors are obliged by law to hold only securities that are rated as "investment grade" by "nationally recognized" rating agencies. As a consequence, major rating firms (i.e., Moody's, Standard & Poor's, and Fitch) possess considerable power and exert much influence on the system. However, these agencies cannot foresee nonlinear changes that would require modifying ratings of particular risky investments. Ratings of complex assets – like mortgage-related securities – are especially sensitive to analysts' model assumptions (Coval et al., 2009). Moreover, there may be conflicts of interest between raters and security issuers who pay for the rating service. Before the current financial crisis, for example, rating agencies became highly involved in the design of mortgage-related securities and ran a risk of losing large investment banks as customers if ratings were not in line with issuers' wishes. Public policy has intended to limit conflicts of interest, increase transparency, and allow entry into the rating business to stimulate competition. An alternative policy response would be to stop using the ratings of a few selected agencies as legal standards (White, 2010). Evaluating the various responses from the perspective of feedbacks in the economy would help to identify a solution that improves the system value of rating agencies.

To further reduce cyclicity, a land value tax in urban areas could be considered, as already proposed by Henry George in the 19th century (<http://www.henrygeorge.org>). This would come down to a "two-rate taxation system" that taxes site value and real estate improvements separately (Cohen and Coughlin, 2005). This discourages speculative investments and reduces windfall profits of sellers. The reason is that, unlike gains in property value due to productive investments, gains due to positive externalities (e.g., macroeconomic trends or local infrastructure developments) would be taxed away and given back to society instead of going to lucky individuals. This Georgian tax has been supported by progressive and conservative economists alike, including Nobel laureates like Joseph Stiglitz and Milton Friedman. Two-rate taxation systems have been applied successfully in hundreds of cities worldwide with Pittsburgh (Pennsylvania, USA) being the most famous example (Oates and Schwab, 1997). This approach has been shown to contribute to better building quality, higher employment, lower land prices and less speculation (Kunce and Shogren, 2008). Possibly, it may positively affect investments in energy efficiency of houses, as competition will be less dominated by sales prices in favor of housing quality and user costs. The introduction of such a tax is, however, difficult and would require a long transition period.

Besides weakening positive feedbacks, strengthening negative feedbacks can reduce the strength of the growth imperative. Strict environmental policies, for example, may serve as negative feedbacks that slow down growth when the economy would boom, but limit economic activities much less during downturns. An example is lower environmental tax payments, due to less resource use. Such policies would moderate growth of sectors that contribute much to growth since current high-growth sectors are often very pollutive (Hueting, 2010). Any negative employment effects of such policies could be compensated by recycling tax revenues to the reduction of income taxes and in this way stimulate labor-intensive, often cleaner activities (de Mooij, 1999; Ekins et al., 2012).

Obviously, the foregoing list of strategies to address the self-amplification problem and simultaneously reduce environmental pressure is incomplete. Additional strategies are listed in the discussion of the financial-monetary system. Further research on weakening positive feedbacks and strengthening negative feedbacks is very important, in our view.

3.3 Third argument: labor productivity growth requires output growth to preserve jobs

Labor costs are among the largest expenses of most employers, which creates a strong motivation to increase labor productivity in competitive sectors. With more output per worker per hour, a smaller workforce is needed to produce the same output. If the average number of annual working hours per employee does not change, labor productivity growth requires output growth – either through the expansion of existing businesses or the emergence of new ones – to prevent a structural loss of jobs. For net job creation, even faster growth is needed.

This is, however, a general theoretical argument. History shows that growth often (though not always) has been sufficiently high to compensate for labor productivity improvements. In addition, macroeconomic models show that productivity growth can translate in either positive or negative effects on employment (Pissarides and Vallanti, 2007). Therefore, macro- and labor economists have been much concerned with the necessary conditions and policies for combining productivity growth and full employment. Limited duration of unemployment benefits, incentives for and assistance with job searching, a high level of unionization as long as this is offset by high levels of coordination in wage bargaining particularly among employers, high wage flexibility and low overall taxes have been suggested as the main elements of an effective policy package (Nickell, 1997). Under these conditions, it is believed that the causes of labor productivity – including technological progress, education, good health, and availability of cheap energy – can translate into economic growth and full employment.

This is the traditional macroeconomic perspective. Things get more complicated if one adds environmental considerations. Environmental sustainability may not be consistent with a high or even positive rate of growth. Translating environmental goals into effective policies would likely limit the growth rate, or even reduce the size, of pollutive industries, in both cases resulting in a lower rate of overall economic growth. As a result, the growth engine producing employment to compensate for labor productivity improvements would slow down. In other words, the classic conflict between environment and growth appears in an altered form. Accordingly, new strategies are needed to reduce environmental pressures and to get out of the “productivity trap”, i.e., to keep unemployment low without the need for high or positive economic growth (Jackson and Victor, 2011).

Potential responses

Strategies with a potential to preserve or increase employment with low or no output growth have to change the conditions that make growth a necessity. Possible steps in this direction include the reduction of labor costs for employers, the expansion of sectors where labor productivity cannot

grow quickly, the reduction of competition in the economy, and the reduction of per capita working hours. Each of these strategies is discussed below.

The first strategy to escape from the productivity trap is the reduction of labor costs for employers. This can be achieved by replacing labor taxes with energy or environmental taxes. This will stimulate the search efforts of firms, through organizational and technical innovations, to be more directed at energy or material savings instead of labor saving. This will mean a stronger focus on energy and material productivity which can work out well for both the environment and employment (Ekins et al., 2012). We should acknowledge here the complex debate on the “double dividend”, which has concluded that we should not be too optimistic about a second, employment-related dividend (de Mooij, 1999). This insight is, however, strongly dependent on static analysis – substitution within given production functions – using general equilibrium models. When including dynamic innovation effects, a double dividend seems more likely, because production functions shift and new substitution options arise.

Nevertheless, the implementation of an environmental tax reform is difficult. Arguably, this is because it creates uncertainties about tax revenues, as the tax base can decrease through the regulatory effect of environmental taxes. Labor market responses are uncertain as well. In addition, business stakeholders often resist such reforms, due to a limited understanding of the purpose of these policies, a lack of trust, and their resistance against new taxes (Dresner et al., 2006).

It should be noted that an environmental tax (or more generally, environmental regulation) on its own could give rise to early dominance of currently cost-effective technologies and a focus on incremental innovations associated with these technologies. To avoid this problem, technology-specific policies (e.g., support of R&D and market applications through subsidies or feed-in tariffs) are needed as well. They will keep open and stimulate development pathways of still expensive, but in the long run environmentally better performing technologies (Azar and Sandén, 2011).

A second strategy is the expansion of sectors where labor productivity is low and cannot grow quickly. Jackson and Victor (2011) argue that a sector comprising “green services” could help to ease the dependence of the economic system on continuous growth. Examples of such services are repair, maintenance and refurbishment services, craft workshops, training, sports and gardening. Together with other labor-intensive occupations (e.g., nursing, teaching and eldercare) whose labor productivity does not improve easily, a shift towards these activities could increase well-being. How this shift could be stimulated and financed, however, is uncertain.¹¹ Expanding markets for these services requires changes in people’s attitudes and pricing of environmental and other externalities, and might benefit from certain industrial policies. At the same time, quick expansion of low (labor) productivity sectors would likely contribute to economic instability, which might even result in a recession. This is especially true in a still growth-dependent economic system. Further down the transition path, it may perhaps be easier for the system to undergo this structural, sectoral change.

The Baumol effect (or “disease”) might be mentioned here as it also deals with the problem that productivity growth can differ much between sectors. As a consequence, products in sectors with

¹¹ One option is to increase taxes on large companies by closing tax havens that currently allow these companies to pay very low (1-2%) corporate taxes. According to Stiglitz (2011) “advanced industrial countries could shut them down overnight”.

lower productivity growth (including green activities) become relatively expensive as the revenues have to cover salaries that often increase proportionally with those in sectors with high productivity increases (Baumol and Bowen, 1965; Baumol, 1967). Nordhaus (2008) observes that overall productivity growth has slowed down during the second half of the twentieth century in the United States as the share of “technologically stagnant” service sectors has risen. Jorgenson et al. (2007) report productivity resurgence after 1995 and technological development in the service sector after 2000. According to Oulton (1999), the distinction between intermediate deliveries and final consumption is relevant to the validity of the Baumol effect, because intermediate deliveries from low productivity growth sectors to other sectors can contribute to the overall productivity of the economy. A related question for transition research is to what extent green sectors contribute to the productivity of other production sectors.

A third strategy is to consider changes in the organizational structure of our economy. As a starting point one might take the principal forms of economic organization suggested by Polanyi (1957), namely market exchange, redistribution and reciprocity. With redistribution (a somewhat confusing term) he means a systematic movement of assets towards an administrative center and their reallocation by the authorities at the center. The extreme case of this is central planning in communist countries. At sectoral levels one still finds redistributive solutions in most rich countries, notably in health care, education, public utilities and public transport. We have seen many transitions in these to market exchange systems, with some successes, but also many failures. Reciprocity, on the other hand, refers to the exchange of assets between people who are having non-market, non-hierarchical relationships with one another. Examples are sharing in local tribal societies and exchange in long-term relationships of trust and confidence, such as in families and friendship networks. Compared to market exchange productivity growth is less important in the other two organizational forms.

In times of crisis, one could possibly create employment opportunities relatively quickly and serve equity and sustainability goals at the same time by applying the ‘redistribution mode’ to certain sectors. One possible redistributive strategy whenever unemployment reaches a pre-defined critical value (e.g., 8%) is to implement temporary ‘crisis taxes’, such as on very high incomes or wealth and on companies that make excessive absolute or per employee profits. The resulting tax revenues could be used by the government for job creation either directly through public work programs, or indirectly through training and skill building of unemployed. If the scope, magnitude and duration of the taxes are clear and fixed by law, then such unorthodox economic policies could have smaller negative market consequences than ad-hoc measures.¹² The disadvantage might be a reduced efficiency leading to lower average wages.

Reciprocity can also stand as a model for new organizational forms of production. For example, cooperative self-management can help to reorient production from profit seeking to the satisfaction of concrete needs, keep environmental impacts local – contributing to their visibility and manageability – and cut transport-related emissions (Exner and Lauk, 2012). This may further reduce the need for certain public services such as environmental remediation or even healthcare. Experience with cooperatives may trigger altruistic and cooperative behaviors that can benefit other

¹² Hungary currently applies ‘crisis taxes’ targeting banking, energy, telecommunications, and retail sectors. However, the ad-hoc nature of these (and other) economic policies has created market insecurity, which contributed to the temporary depreciation of the national currency and higher bond yields.

areas of economic reality. If, however, informal reciprocal networks reach a large scale in the economy this can severely depress tax revenues, which in turn will put the provision of many public goods at risk or require increasing taxes elsewhere.

A fourth strategy to get out from the productivity trap is a reduction of working hours per employee to allow for work sharing so as to create more employment (NEF, 2010). Here the main question is whether or not shorter working hours can increase employment. A widespread belief is that the same amount of work can be shared by a larger number of people working fewer hours per capita. The problem with this argument is that there is no fixed amount of work to be shared, because the scale and composition of demand are likely to alter as a result of changes in consumer prices and income distribution caused by work sharing (as explained below). In the long run, the main determinants of employment are supply-side parameters, namely productivity and labor costs (Kramarz et al., 2008). If workers produce more value than the cost of their employment, they will be hired. Reductions in working time increase employment (the number of people employed) only if the output/labor-cost ratio does not decrease too much. If an imposed cut in hours increases the wage pressure¹³, output will decrease (Nickell, 1997). As a consequence, the number of total working hours will go down so that there is less work to share. Depending on the relative magnitude of hours' reduction and output decline, the number of people employed may increase, stagnate, or decline.¹⁴ Macroeconomic model predictions and mainstream interpretations of historical data are usually pessimistic about opportunities to increase employment through work time reduction (Kramarz et al., 2008).

Nevertheless, historical data and modeling results cannot always predict the future (Lucas, 1976). Material and economic conditions have changed considerably (Beddoe et al., 2009) as most people in rich countries have relatively easy access to food, shelter and other basic amenities. Therefore, if explained and communicated well, an increasing number of people may accept lower salaries for less work.¹⁵ Furthermore, even if workers will not accept nominal salary reductions for fewer working hours, much less resistance can be expected if nominal wages are maintained while real wages get slowly eroded by inflation in a period when working hours are gradually reduced. To some extent, employees' preferences adjust to the trade-off levels of income and leisure time that the market delivers (they "want what they get" according to Schor, 2005). The opposition of employers to work time reduction is sometimes ideological, which can decrease after the implementation of public policies, like a general reduction of work time in all sectors (Hayden, 2006).

To make the strategy of work time reduction and sharing effective, both employees' and employers' concerns have to be considered. For employees, the main question is whether or not the reduced salary is still enough to make a living. This can work out differently in different countries and sectors. Reducing the strength of status competition may help to convince workers to accept a lower salary in proportion to the reduced work time. For employers, the main concern is a rise in employment-related fixed costs (hiring, training, insurance and pension payments) and possibly the lower quality

¹³ Work sharing also means "salary sharing", in other words, a proportional salary cut. People working fewer hours due to imposed work time reductions tend to demand and receive higher hourly wages (Hunt, 1999).

¹⁴ Hayden (2006) gives a positive account of work sharing policies in France. Kramarz et al. (2008) hold such policies responsible for the demise of a large number of companies. Hunt (1999) reports stagnant employment in Germany after the reduction of working hours.

¹⁵ Forced changes can significantly increase illegal employment, so acceptance of policies is very important.

or higher cost of additional workforce (Schor, 2005). In addition, sharing of management tasks can be difficult.

Particular advantages of work sharing policies during economic crises are that they allow businesses to retain skilled workers, reduce firing and hiring costs, and keep up staff morale during difficult times (Crimmann et al., 2010). On the other hand, during an economic crisis salaries are already reduced and immediate cost reduction tends to be a dominant concern for employers, which may cause workers and management to resist sharing.

4. The financial-monetary system and sustainability transitions

Next to the functioning of the 'real economy', structural features of financial and monetary systems can assist or hinder a transition to a sustainable economy. If, for example, the financial system is designed to facilitate the channeling of money into socially and environmentally benign sectors of production then it can accelerate a transition. Similarly, sustainable consumption might be supported by a money system that makes local products easier to purchase so that distances of freight transport are reduced. On the other hand, maintaining the current financial system can be very expensive and may proceed at the cost of funds that benefit a transition. Local money systems can also hamper a transition if they are unstable and collapse after a few years of operation.

To study the effects of monetary and financial systems on sustainability transitions, three topics are considered in more detail: the creation of money, the allocation of funds, and systemic features of different monetary and financial schemes. In each case, there are open questions and unsettled debates. We do not take sides in these, but merely point out the potential relevance of these topics for sustainability transitions.

4.1 The creation of money

In the current money system, more than 90% of the money in circulation is created in the form of loans by private banks. These banks do not need to own the money they lend out. Instead, they are allowed to lend more than what they actually possess.¹⁶ As a consequence, providing loans increases the total amount of money in the economy. When the loan is taken out to buy something, the buyer goes into debt and the seller receives the money. Accordingly, more than 90% of the money in circulation has a debt counterpart somewhere else in the system. To repay a debt, money is drained from the system, hence money disappears each time a loan is paid back.

Loan-based money creation is important for sustainability transitions for several reasons. First, loans are given out at interest, which makes money creation a lucrative business. More than 90% of the profits go to private actors, while less than 10% goes to the central bank, ending up in the treasury to

¹⁶ In countries where deposited money legally is the property of the bank (not the depositor), a more precise formulation is that the liabilities of banks (obligations to depositors) can exceed their reserves (i.e. money in their safes or accounts at the central bank). The ratio between the amount of reserves required and loans permitted varies between countries and sometimes also between banks in a country. Ratios under 10% are common. This system is known as fractional reserve banking.

potentially serve public goals like environmental protection. This contributes to the power of the financial industry and its weight in the economy.¹⁷ Second, lending institutions are major proponents of economic growth, because they stand to lose much money if default rates increase in the absence of growth. As these institutions are very powerful both economically and politically, they are able to reinforce the growth imperative; namely, through exerting pressure on politicians or influencing public opinion through the media. Third, debt-financed investments are dominant and play a crucial role in the economy. These investment decisions strongly influence not only capital allocation and job creation but also the total amount of money in the economy.

The latter effect on money supply is important from a cyclicity perspective. In upswings, expectations are usually positive and it is relatively easy to get credit, which increases the amount of money in the system. In recessions, however, fears of default are often strong so lending slows down. The resulting reduction of the amount of money in the economy can make recessions more severe. While most economists agree that credit booms and busts contribute to cyclicity in the real economy, they debate the importance of credit cycles in creating business cycles – not least because the frequency and amplitude of these cycles differ. Fisher (1933) noted that co-existing cycles can aggravate or neutralize each other. Aikman et al. (2010) argue that damaging effects of credit cycles on output are common: more than 50% of crisis years in their analysis are preceded by credit booms. An important reason for this is that in the absence of high level coordination among lenders it is rational for individual financial institutions to supply excessively risky loans during credit booms, which creates the conditions for subsequent credit crunches. A policy solution to this collective action problem is public regulation so as to increase coordination between lenders to curb credit cycles.

An associated question is whether or not central banks are able to control the amount of money that circulates in the economy. Mankiw (2004) says that vigilant central banks that frequently collect data on deposits and reserves can keep money supply close to whatever level they choose. Douthwaite (1999), on the other hand, argues that money supply is fundamentally unstable, creating risks of inflation and depression. Aikman et al. (2010) suggest that monetary policy cannot simultaneously dampen credit and business cycles. Apart from structural characteristics of the money system (e.g., commercial money creation which is a main culprit according to Douthwaite (1999)), the behavior of the actors in this system may also contribute to crises (e.g., excessive saving contributing to a liquidity trap¹⁸). Policy prescriptions vary according to the importance attributed to these factors. This is a reason for persistent debates about the money system and monetary policy.

A related issue is whether economic stability is consistent with positive interest rates in a system where money is created through loans. Assuming a constant velocity of money, some critics claim that since interest represents money that is not yet created (the debtor did not get it as part of the loan), output growth is needed to allow for the introduction of this new money (without inflation) so that everybody can pay back their loans. Without growth, bankruptcies are seen as inevitable. This argument, however, neglects at least two important facts. First, banks spend at least a part of their interest revenues (e.g., on salaries and buildings), so this money can enter the economy in addition

¹⁷ Before the crisis, the financial industry represented 25 percent of stock market capitalization in the United States (Soros, 2008).

¹⁸ A situation in which cash injections by central banks into the private banking system fail to sufficiently increase money supply, because cash is hoarded due to negative expectations (fears).

to loans (the other part increases the capital stocks of banks). On top of this, governments inject central bank money into the system. This money is essentially interest-free, because at a later point governments receive the interest revenues from central banks. Whether these extra sources of money are sufficient to prevent bankruptcies in a low or zero growth system or even make it possible to decrease the total amount of money is uncertain. The answer is likely to depend on the stage of the business cycle, which affects interest rates, lending patterns, and changes in the capital stocks of banks.

Potential responses

Some of the problems identified might be resolved by adapting the current financial system, adding new components to it, or even replacing it. We can merely offer some illustrative examples here.

A first option is to increase reserve requirements of private banks (Daly, 2012). This would alleviate the sectoral imbalance tilted towards the financial sector in the current system and increase the spending power of governments. If the reserve requirement is 100%, then private banks can no longer increase money supply by lending. Instead, the capacity to create money rests entirely with the central bank. This means better control over money supply which allows for anti-cyclic monetary policy, and has the main advantage that the profit made with money creation remains in the public sector. The price to be paid is a drastic reduction of private investments due to diminished credit availability.¹⁹ This would slow down change in the private sector with positive as well as negative consequences: speculation would be cut and the financial sector downsized, but private investment into 'sustainability projects' would also be reduced. The role of non-corporate actors in capital allocation and job creation would grow with uncertain consequences for environmental sustainability. In such a transition to monetary centralization, one could avoid a shock in the economy by gradually increasing reserve requirements. Stopping before 100% could shift the balance without the full nationalization of money creation. Implementing such changes is a collective action problem where coordination between countries is essential, because markets would very severely punish countries that would move in the direction of nationalizing money creation unilaterally. Very strong social pressure is likely to be necessary for any change to happen to counter the power of incumbents with vested interests.

Another option is to introduce new currencies created by citizens to reduce the dependence on the existing top-down money system. Local Exchange and Trading Systems (LETS) and complementary currencies can facilitate localization and contribute to the self-reliance of communities, according to some authors (Seyfang, 2006). If a community relies less on the conventional currency and economy for employment, the positive feedbacks between conventional economic variables and total employment might be reduced. The strength of harmful self-amplifying cycles is then likely to weaken. However, local money systems or the composition of several systems might also become growth-dependent. To avoid this and enhance sustainability transitions, local currencies have to be designed in such a way that they stimulate or contribute to the creation of markets for environmentally benign activities characterized by low growth of labor productivity. In addition,

¹⁹ With higher reserve requirements, credit money would constitute a smaller percentage of the total money supply than today.

these alternative currency systems must be reliable: they have to exist and operate with sufficient liquidity for extended periods of time. For this, enforceable agreements backed by collateral are needed, otherwise there is no pressure on members indebted in these local currencies to repay their debts, which is the most common reason for the collapse of such systems (Douthwaite, 1999). The Swiss WIR system shows that such enforcement and long-term reliable operation are feasible (Studer, 1998).

To further reduce growth dependence of currency systems, it may be possible to use interest-free currencies in certain cooperative communities. Just as people went into each other's debt for thousands of years without expecting interest payments (Graeber, 2011), it may be possible to do the same today in communities where trust is mutual, possibly with the help of interest free money. For example, time-based currencies can, through facilitating cooperation, serve as a means to extend reciprocity beyond families and very small groups to somewhat larger groups. If people get time credits for certain activities instead of 'normal money', then they use these credits to pay for the help of others – instead of spending money on 'normal' goods and services – which can be good for the environment. Challenges to such systems include operation costs, long-term reliability and potential tax-evasion problems associated with informal reciprocal networks.

A radical systemic change would be to replace the current monetary system with different currencies for different purposes, namely exchange, store of value, and unit of account. Douthwaite (1999) proposed a system in which national exchange currencies would be used to pay for consumption goods and services, national store-of-value currencies would be used exclusively for investments, and an international unit-of-account currency would be used to facilitate uniform accounting across borders (playing the role of the former gold standard). Currency exchange markets would exist to enable trading between these currencies within countries and between the store-of-value currencies of different countries to allow for international capital flows. It is argued that such a system would have several advantages. It would be easier to guarantee an appropriate supply of the exchange currency, because inflation would not be as problematic as in the current system where it erodes financial savings and purchasing power. The separate store-of-value currency would prevent or neutralize 'capital flight': capital outflows from a country would be automatically balanced by an equal amount of capital inflows. Even climate change mitigation could be organized through such a system if the international currency represented carbon emission rights. The idea that a new international reserve currency is needed is shared by Stiglitz and Greenwald (2010). They also mention that "global public goods" could be financed through the newly issued reserves. In light of the suggested benefits, carefully assessing the pros and cons of alternative monetary systems seems to be important. This includes attention for transaction and administrative costs.

4.2 The allocation of capital

According to Jackson and Victor (2011), the transition is, above all, a challenge about investment. Which projects receive funding is a major question which can strongly influence the direction of change. Can capital markets be configured around social and environmental sustainability?

Creditworthiness in the current financial system depends on one major factor: the debtor's expected ability to pay the money back together with interests in due time. As socially and environmentally

important investments often have long payback times or do not even generate positive financial returns, money is insufficiently allocated to these areas so as to maximize well-being. Moreover, the current system allocates a lot of money to very environmentally harmful activities (UNEP, 2011). In other words, the business sector's ability to finance societal goals is limited.

Potential responses

To address this problem, several alternative solutions can be considered. Correcting prices is one option that may contribute to increased business involvement in funding sustainability projects. The removal of perverse subsidies and pollution pricing are very important steps in this direction. The reason is that capital allocation is much driven by benefit/cost ratios, which are directly affected by pricing. In the case of economic activities with many different social and environmental ramifications, however, it may be difficult, if not impossible, to get the prices right. In addition, discounting by investors means that there is an under-investment in projects with favorable environmental impacts in the long run, and an over-investment in projects with short-term economic benefits and long term environmental damage. Consequently, price corrections may be insufficient – even though necessary – to stimulate ordinary business actors to provide sufficient funding for large transition projects.

One may try to stimulate more socially and environmentally responsible investments through ethical banks, public subsidies, education and campaigns. Associated is the role of NGOs, like nature conservation organizations using contributions from citizens to buy valuable natural areas that need permanent protection. Responsible investments can foster a process of relevant value changes in society at large, which will affect consumers, producers and investors alike. This might culminate in new norms and regulations associated with the use of natural resources and the environment. It is, however, difficult to predict the direction and speed of this process, and which particular instruments are most effective.

Another option is to rely much on investment by the government in expensive sustainability projects, including environmental R&D. For example, the Norwegian government pays one billion dollars to Indonesia for not cutting down rainforests. Other examples are large scale investments in renewable energy projects (Jacobsson and Jacobsson, 2012). Besides public finance, public-private cooperation can be essential, partly because private actors need to share the large risks of sustainability projects (Buchner et al., 2011). Stronger government involvement, however, requires higher taxes or a considerable shift in governmental spending. This may count on social-political resistance.

In addition, creative project funding opportunities are an option. An example is renewable energy investments financed by issuing vouchers that are backed by future energy production (Douthwaite, 2012). In effect, this means that lenders receive principal and interest payments in the form of clean energy after the renewable power station starts operation. Similarly, energy service companies can design and implement energy savings projects without down payments. Savings in energy costs over a longer period of time can be used to pay back the capital investment and to make the business profitable for the energy service company. Probably energy conservation in buildings and industries provides the best opportunities for such a type of solution.

4.3 Systemic properties of financial systems

The core function of financial systems may be defined as connecting buyers and sellers of scarce monetary funds in a way that helps prices to adjust to levels which maximize the well-being of the users of the system. In the real economy, this is supposed to lead to the optimal allocation of capital. How much a certain system achieves these purposes depends not only on the efficiency with which it operates, but also on the scope of the system's coverage, i.e., the range of entities that are relevant to well-being (stocks of companies, different types of risks, tradable emission permits, etc.) it can handle. An optimal financial system has broad coverage (values everything that matters), a high efficiency (correct prices in financial markets) and low operating costs.

These goals, however, often work against each other and striking a good balance is difficult. For example, broad coverage can reduce efficiency when prices do not signal all risks and externalities. Broader coverage can increase operating costs because markets for new entities have to be created and maintained, implying information collection for stock pricing, probability assessments for risk pricing, or monitoring and control for emissions trading. The other major goal, efficiency, can also go against operating costs. It may be enhanced by the introduction of derivatives and complex packages of fungible items, but these products can substantially increase volatilities and hide systemic risks. Reducing these costs can be very difficult, because a whole industry has been built around volatility and protection against risk, which is opposed to system reform with the aim of reducing volatility (Lietaer, 2001). Similarly, automated high frequency trading (HFT), which is supposed to contribute to efficiency by increasing liquidity, can have very significant costs both directly through excessive profits of HFT traders and indirectly by increasing volatility (CFTC&SEC, 2010).

Potential responses

For a sustainability transition to take place, these three conflicting performance criteria of the financial system (broad coverage, high efficiency and low operating costs) need attention. Whether or not effective allocation of investment capital to transition projects can be realized through financial markets depends on the coverage and efficiency of the financial system. In addition, it seems likely that the costs of transition projects somehow compete with the system's operating costs. Potential coverage, efficiency and operating costs are strongly influenced by the historically developed characteristics of financial markets and governance structures. In many poor countries financial systems are not yet fully appropriate for functions like emissions trading. Hence, if global carbon pricing is implemented in a cap-and-trade system, further improvement of financial infrastructures and policies is essential. In rich countries, however, broad coverage is already possible, but the frequent misallocation of capital²⁰ and the very high operating costs of the financial system call for an assessment of the benefits and costs of financial products, services and practices. Complexity reduction and downsizing may be considered in the light of the findings of such an assessment (Friedman, 2011).

One much debated way to decrease complexity, positive feedbacks and moral hazard is splitting up institutions. For example, separating savings and low risk investments from high risk investments can

²⁰ For example, thousands of buildings built during the housing boom are empty (unused) today.

reduce default risks in the low-risk subsector under unfavorable economic conditions. At the same time, defaults in the high-risk subsector – which could be very profitable under favorable economic conditions – would be allowed since their failure would not have systemic consequences. In this way, moral hazard would be reduced and excessively expensive bailouts could be spared. Arguably, badly functioning private financial institutions need to be able to go broke, just like manufacturing firms can do. This is part of the healthy competition and creative destruction which can contribute to progress. But the trend has been to protect banks, including through incentives for mergers.

An instrument to reduce volatility by limiting speculation is a Tobin-type financial transaction tax (FTT). This could reduce the volume of very short term investments (including HFT), which might moderate the pro-cyclical herd effect. If a tax on all transactions were to significantly reduce liquidity and compromise efficiency, then a modified version of the tax might be needed, which would take effect during periods of volatility when exchange rates leave their pre-defined, normal ranges (Spahn, 1995). How much exactly a Tobin-type tax would limit volatility and bubbles is still subject to debate (Eichengreen et al., 1995; Davidson 1997; Scheinkman and Xiong, 2003). Skeptics might be convinced by the fact that existing FTTs seem not to have damaged the jurisdictions where they were introduced (Fullerton, 2011). Further real-world experiments are needed to settle this issue. The recent open letter of financial industry professionals in favor of FTTs and the criticism it drew gives the impression that the sector is divided on this idea (Gongloff, 2012). This policy is gaining political support in the EU, although the rates considered (0.1% for stocks and bonds, 0.01% for derivatives) are much lower than the ones originally proposed by Tobin himself (about 0.5%).

Further options to arrive at a more stable financial system include more regulation, notably forbidding very dangerous activities and investments, limiting leverage and controlling the complexity and transparency of financial assets. However, adequately regulating the financial system is extremely difficult, because the sector is politically powerful, lobbies intensively, and regulatory competence cannot keep up with the dynamics of the industry (Solow, 2011). A potentially radical restructuring of the sector needs to give more explicit attention to well-being and (un)sustainability implications of capital allocation as well as to reducing operating costs of financial systems by reducing profit rates in the sector.

5. Conclusions

One motivation for this study was that a transition to a sustainable economy cannot be well understood without a serious analysis of macroeconomic constraints and implications. Another motivation was the present economic-financial crisis which is expected to last for quite some time, and may hamper, as well as offer opportunities for, a transition. As the issues are complex and it is impossible to fully overview the relevant literatures in mainstream and heterodox macroeconomics, and for reasons of space, we could only offer a limited set of insights and directions for thinking about solutions. Nevertheless, we have tried to give a broad account of the most important reasons for which the stability of the present world economy strongly depends on continued growth and an expensive as well as expansive financial system. While many issues discussed here have been studied before, our study has gone deeper into the macroeconomic arguments and complexities, pointing out the relevance of these for thinking about sustainability transitions. Furthermore, we have tried to

offer a balanced approach by identifying both advantages and shortcomings of solutions from orthodox and heterodox macroeconomics, which has rarely been done in earlier studies.

So far, a sustainable economy has not emerged. Decoupling of growth and environmental pressures is the main hope and focus of politics and a large part of economics – witness the recent popularity of the notion ‘green growth’. But decoupling is unlikely to be fast enough in all relevant environmental dimensions, if successful at all, which means that (high) growth may be at stake when we go for a serious sustainability policy. This conflicts with three established reasons to pursue growth: growth is seen as progress, it is seen as necessary to avoid economic instability that ends in a recession, and it is seen as inevitable to compensate for continuous improvements in labor productivity which otherwise would cause structural unemployment. These issues and their potential remedies, including new creative solutions, deserve to occupy a more central place in the research on sustainability and transitions.

We have considered a range of strategies. Regarding the first reason for growth, we argued that both individuals and governments have to understand and accept that GDP (per capita) does a bad service as a welfare indicator, especially in rich countries. Devoting more attention to non-material dimensions of well-being and discouraging status competition are important objectives related to this. Regarding the second, we pointed out that self-amplification in the economic system is at the core of crises and has to be controlled. For this purpose, various positive feedbacks need to be weakened and negative feedbacks need reinforcing. Shifting the focus of production towards basic goods and services, changing indicators and expectations, reducing sensitive connections between sectors or markets – for example, through urban land taxes in the housing sector and transaction taxes in finance – and strengthening environmental policies can help to achieve these goals. Regarding the third argument, we suggested that full employment, which is crucial for high social welfare, needs to be decoupled from economic growth. Opportunities for shifting taxes from labor to environment to stimulate energy and materials saving instead of labor saving were highlighted. A sectoral shift to low productivity growth activities and a shift from market-based economic organization towards redistribution and reciprocity were briefly discussed as well. In addition, opportunities for and difficulties of work sharing were reviewed.

The good news is that a number of strategies can help to address several of the above concerns simultaneously. Strict environmental regulation, environmental tax reforms, the introduction of sustainability and welfare indicators, skepticism about the GDP indicator as a relevant guide for public policy, the acceptance of lower material consumption levels without severe losses of happiness, the reduction of status competition in consumption, and more cooperation at the community level are such multi-purpose instruments. The bad news is that solutions for one of the three mentioned growth-related issues can translate into problems associated with another. For instance, a shift to sectors where labor productivity is low can create employment without growth, but the same shift can trigger a recession due to self-amplification in the system. Consequently, the timing of the application of different strategies is very important.

Moreover, as many of the discussed changes are fundamental and have many implications, they are unlikely to receive quick and enthusiastic social-political support. This is especially true for the potential modifications of the financial sector. Money creation, the allocation of funds, and the trade-off between the coverage, efficiency and operating costs of the financial system are all very

important aspects of the financial system where changes are necessary but their implementation seems impossible at present. Due to the global interconnectedness of financial systems, almost all problems have become multi-player collective action dilemmas. This makes the application of innovative policies even harder than in the real, national economy where global interconnectedness mainly involves international business and trade relations.

With the current crisis imposing hardship on voters and popular dissatisfaction growing, however, the chance of radical changes increases. It is important to be well-prepared for these, in the sense of being open-minded and tolerant to a wide range of potential solutions. This can help to give a transition to a more sustainable macroeconomic system more credibility – and push away the inclination to characterize it as a mere utopia.

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