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A Macroeconomic Plan for a Green Recovery

Dimitri Zenghelis¹

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Executive summary

A unique green opportunity has arisen for policy-makers to create viable new markets, boost private investment and innovation, and stimulate the economy without requiring large public expenditure. By sending a credible market signal in the form of clearly identified market-based policy instruments — involving long-term carbon pricing, standards and regulations, together with carefully designed technology support — the government has the potential to unlock private investment in renewable energy, energy efficiency and low-carbon vehicles. It would do so by utilising the historically vast pool of available private saving. Macroeconomic theory and evidence tells us that in the current economic environment, this could unleash sizeable economic benefits by boosting private spending, creating jobs and generating tax revenues. It would also allow the monetary authorities greater leeway to stimulate demand. Moreover, this private investment need not be expected to crowd out alternative capital expenditure or boost public borrowing.

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1. The 'glut' in saving

Despite billions of dollars of public borrowing to fund ballooning public sector deficits in many rich countries over recent years, real risk-free short- and long-term interest rates remain close to or below zero. The reason is that public demand for funds is more than amply matched by a growing pool of private savings.

There are two key sources of the glut in global savings over recent years. The first is continued large capital outflows from, in particular, Asian countries running current account surpluses. Historically, slow-growing advanced economies have been exporters of capital as investors take advantage of greater opportunities and higher returns in less developed states, so helping raise their level of economic development². More recently, this norm has been reversed in some large developed economies such as the United States and United Kingdom (though Japan and Germany, for example, continue to be high net-saving countries and sizeable exporters of capital).

Since the crisis of 1997-98, many Asian countries — foremost among them China — have sought to defend their economies from future speculative attack by building vast reserves of assets denominated in foreign currencies, mostly the U.S. dollar. In selling their own currencies to purchase foreign exchange assets, they also put downward pressure on domestic exchange rates, providing a boost to the domestic tradeable sector by making exports more competitive and imports more expensive. This has met with mercantilist support from domestic business lobbies and those seeking to nurture export-based industries seen as vital to economic development. The foreign exchange proceeds from these net exports are then recycled as capital outflows in the form of foreign currency domestic saving.

Over the past decade or so, these financial flows have helped raise the price of a range of developed country assets, putting downward pressure on interest rates and playing an important part in generating the recent housing boom which underlay the financial crisis. This process was recognised as far back as 2005 when Ben Bernanke, as Governor of the U.S. Federal Reserve Board, outlined the impact that the savings glut was having on housing³:

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.

Since 2008, these flows have been joined by another wave of surplus saving, this time from private households and companies in the developed world. After the financial

² According to James (2002), Britain exported more capital as a percentage of GDP, over much of the mid- to late-19th century (reaching 7% immediately prior to the First World War), than any other large creditor nation since. As faster growing new world economies with large commodity reserves, the United States and Australia benefited from net capital imports over the 18th and 19th century, yet, even so, from 1880 until the late 1970s, the United States predominantly ran trade surpluses for goods and services, with systematic trade deficits only emerging since around 1980. See US Census Bureau: <http://www2.census.gov/prod2/statcomp/documents/CT1970p2-08.pdf>.

³ Bernanke (2005).

crisis, businesses and households across the world found the paper value of their assets diminished. They responded by spending less while saving more of their income in order to pay down outstanding debt. The combined effect has been a surge in global liquidity⁴. This money, in many cases, has had nowhere productive to go as investors and banks remain insufficiently confident in future markets to extend lending⁵. Speculative appetite to purchase risk-free bonds is also limited as expected real bond yields have fallen close to zero⁶. To the extent that investors are committing funds at all, capital has tended to shift from high-yielding venture capital projects to less risky investments. Consequently, short-term nominal interest rates have fallen to near zero (Table 1 shows latest U.S. Treasury yields across a spectrum of maturities – averaging close to zero for the next couple of years). The world is awash with liquidity and in some cases this money makes better returns under the mattress.

Table 1: Daily U.S. Treasury yield curve rates
June 2011

Date	1 mo	3 mo	6 mo	1 yr	2 yr	3 yr	5 yr	7 yr	10 yr	20 yr	30 yr
23/06/11	0.01	0.01	0.07	0.15	0.35	0.62	1.48	2.19	2.93	3.84	4.17

Source: U.S. Treasury

2. Limits to conventional monetary policy

This flood of liquidity creates a policy problem. Normally when recession threatens, central banks respond by cutting short-term policy rates. Short- and long-term rates determined in the market tend to fall in sympathy as liquidity pushes up the price of a portfolio of assets and lowers their yield. The private sector then responds by borrowing and spending more. But when rates are close to zero, this vital policy mechanism is no longer available because no one will lend at negative rates. A vital source of monetary stimulus is cut off.

To gauge the degree of monetary policy impotence, one can look at a common monetary policy ‘rule of the thumb’ called the Taylor rule. This acts as a proxy for the appropriate policy stance and sets interest rates as a simple function of inflation and the output gap⁷. Applying a standard Taylor rule to the United States would mean

⁴ The term ‘liquidity’ here is used to refer to cash or assets that can be converted into cash quickly and without any price discount, which is available to fund investment.

⁵ With public authorities retrenching, corporations shaking out labour and cutting operating expenditure, and consumers consolidating, investors understandably fear a protracted slow recovery or possibly a “double dip” recession, and are nervous about committing funds to all but the safest investments.

⁶ A pure ‘Keynesian’ might describe this as a ‘liquidity trap’ where monetary policy is unable to stimulate an economy, either through lower interest rates or an increase in the money supply. The extent to which this is true is open to debate and depends on the degree to which real money balances directly influence aggregate demand via the so-called ‘Pigou effect’ and, if so, how quickly. This is because the Pigou effect will not work if deflation is expected to get worse, providing an incentive to hold money in anticipation of further asset appreciation through holding real money balances.

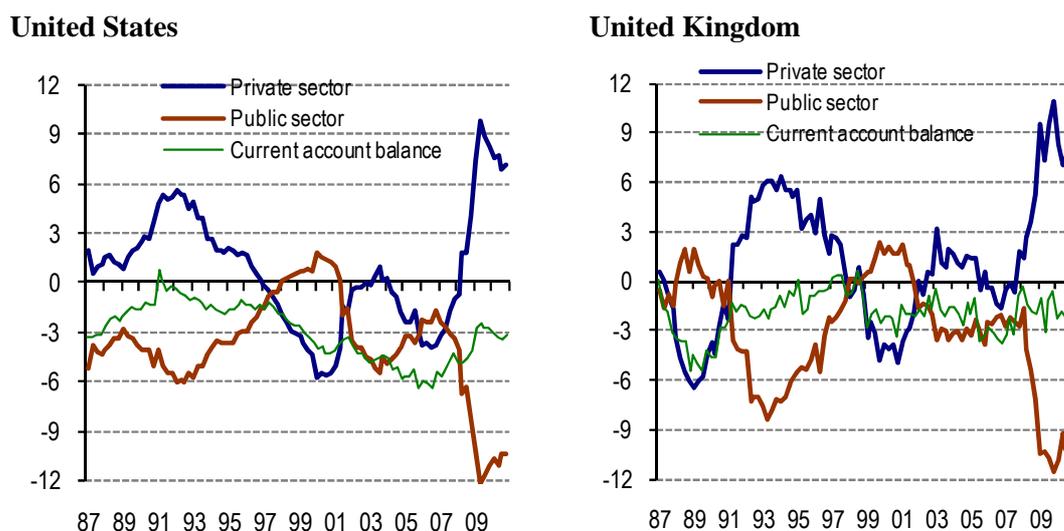
⁷ The Taylor rule computes the amount by which interest rates should be raised above (reduced below) their long-run equilibrium level if either inflation rises above (falls below) its target or the output gap turns positive (negative) in order to maintain an appropriate policy stance. $R = r^* + \pi^* + \alpha(\pi - \pi^*) +$

that the Federal Reserve’s main policy rate would likely need to be anywhere between *minus 2* and *minus 6* per cent (rates would be slightly less negative in the UK reflecting the persistence of inflation here)⁸. With monetary policy facing the zero lower bound on interest rates, monetary authorities have resorted to unconventional methods to raise liquidity⁹. The limitations of monetary policy in a liquidity-flush environment shifted the focus of policy to the fiscal side, and for good reason.

3. An enhanced role for fiscal policy

When assessing the importance of counter-cyclical fiscal policy, it is highly instructive to look at the net borrowing positions of the private and public sectors. Figure 1 shows net borrowing (the balance between investment and saving or, equivalently, income and expenditure) for each sector, private and public. The current account aggregates both balances and measures the excess of saving over investment (income over spending) at the whole economy level¹⁰.

Figure 1: Sector financial balances, % of GDP



Source: BEA/ONS

β (YGAP). The weights attached to inflation and the gap are commonly $\alpha = 1.5$ and $\beta = 1.5$, respectively.

⁸ Krugman and Wells (2010) used a Taylor rule to estimate U.S. policy rates in October 2010 and found that they “should currently be minus 5 or 6 percent”.

⁹ For example, both the Bank of England and the U.S. Federal Reserve have undertaken so-called “quantitative” and “qualitative” easing, directly buying increasingly long-term government debt and private debt. For perhaps the most concise and authoritative explanation of these policy options, see Buiter (2008).

¹⁰ Any (relatively small) statistical errors are captured in the “balancing item” which ensures that the current and capital accounts sum to zero.

The private sector in the United States alone generated a surplus of \$1.1 trillion in 2010, while in the United Kingdom, the private sector surplus was £110 billion.¹¹ By comparison investment in clean energy by both the public and private sectors was just £21 billion in the US and £2 billion in the UK, according to a report by Pew Charitable Trusts.¹² Institutional investors, such as pension funds, are sitting on huge surplus savings belonging to all of us, most of which are making negligible, or even negative, real returns.¹³ The issue is confidence to invest rather than liquidity.

The symmetry between the private and public sector positions is immediately obvious and is no coincidence; it reflects the mutual causal links between net borrowing in the two sectors. For example, in normal circumstances if — all else being equal — the government were to decide to borrow more to fund additional expenditure, this would trigger a number of mechanisms that would prompt a countervailing rise in private net saving. First, by raising the supply of public sector bonds — all else being equal — the government would reduce their price and long-term interest rates would rise. Second, short-term interest rates would also rise as the monetary authorities responded to the additional inflationary consequences of increased public sector net borrowing. Finally, rational individuals might curtail spending and build up savings in anticipation of higher future tax demands to fund increased public sector debt. All these factors would serve to reduce private sector investment and boost saving concurrently.

The causality can also run the other way. The trends in Figure 1 are ‘ex-post’ and do not show underlying causality. However, the evidence suggests that this is indeed the case and that the *recent* swings in financial balances are likely to have been driven, at least initially, by the private, not the public, sector. The reasons are easy to identify. Having seen their wealth eroded by asset price falls over the recent financial crisis, the private sector understandably postponed investment and began to repay debt to rebuild net worth. As spending, income and profit growth fell, so too did tax revenues, while welfare-related spending accelerated. Combined eventually with discretionary borrowing to stimulate the economy, this swelled global public deficits¹⁴.

The fiscal deterioration has therefore been driven by the extended economic slowdown, which is itself a function of the private sector saving more at a time when there are not enough perceived opportunities for profitable risk-adjusted investment to attract borrowers. Had the public sector not borrowed to offset this reduction in private spending out of income, demand in the economy would have fallen further with dire consequences for output and jobs. When the private sector is aggressively paying down debt, the best way to avoid a deep recession is for the government to

¹¹ Private surplus refers to the National Accounts definition of total private income minus total private spending (consumption and investment). It is the private sector counterpart to the public sector (fiscal) deficit, the difference between the two comprises net borrowing from abroad.

¹² Pew Charitable Trusts, *Who’s Winning the Clean Energy Race* (2011, <http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Report/G-20Report-LOWRes-FINAL.pdf>, Page 45)

¹³ For example with UK inflation pushing 4%, real yields on short dated UK Treasury paper remain negative, see: <http://markets.ft.com/research/Markets/Bonds>.

¹⁴ Krugman and Wells (2010) estimate that most of the fiscal deterioration in the United States has been automatic or ‘cyclical’: of the two-year federal deficit over 2009–10 of around \$2.5 trillion, the Obama stimulus plan accounts for less than a quarter.

move in the opposite direction and dis-save. The cost of capital is low and there is very little fear of the public sector 'crowding out' private investment. Richard Koo, the chief economist of the Nomura Research Institute, draws on his experience of Japan's lost decade in the 1990s and argues that the world is awash with savings with nowhere to go. There is little scope for crowding out when: "financial institutions are happy to lend the \$100 to the last borrower standing"¹⁵. With the public sector acting as 'borrower of last resort' as the private sector pulls back, the ballooning budget deficits of recent years were essential in avoiding a global depression.

However, public borrowing is reaching its limits. Savings in the United States have to go somewhere, yet many believe public borrowing cannot stretch much further. John Taylor recently summed up concerns: "We have had a large government stimulus, and we have the (public) debt problem, which is huge and growing ...a real concern and we need to address it"¹⁶. Taylor differs from Koo on the issue of crowding out. He and other economists believe that discretionary, rather than 'automatic', public sector borrowing is misallocating capital in a way that will hinder real wealth creation, and crowd out private investment when the recovery begins. This is because distortionary taxes and interest rates will have to rise further and faster than would otherwise have been the case¹⁷. As the scope for effective counter-cyclical fiscal policy becomes limited by such concerns about the sustainability of debt, the political economy returns to alternative policy mechanisms designed to leverage private investment increase.

4. Emerging limits to fiscal policy

The recent sharp accumulation of public debt has raised questions about the ability and willingness of future taxpayers to pay off the debt without prompting the government to default, reschedule or 'monetise' the debt through allowing inflation to increase. The cost of such uncertainty manifests itself in an early loss in investor confidence and higher bond rates for vulnerable countries. This is notably evident in the recent experience of Greece, Ireland and Portugal (though the inability of these countries to devalue their currencies within the euro-zone has heightened their vulnerability).

Concerns that too much borrowing might compromise a government's long-run fiscal sustainability can lead to sharp increases in borrowing costs. When debt levels are high, such increases can have a dramatic impact on debt-servicing costs and further strain fiscal deficits. For example, a two percentage point premium on current U.K. public sector debt of £952 billion could eventually lead to annual debt interest payments rising by £19 billion, more than 1.25 per cent of GDP, though the speed with which it does so will depend on the maturity structure of the debt. The scope for further sizeable unfunded increases in public spending to pay for the provision of environmental or other public goods therefore becomes increasingly limited.

¹⁵ Koo (2010).

¹⁶ Taylor (2010a).

¹⁷ Taylor (2010b), Taylor (2010c) and Taylor (2009). See also Baxter and King (1993) and Bowen and Stern (2010).

5. Credibility, reduced uncertainty and the green opportunity

Private sector financial balances (net borrowing or saving minus investment) have recently reached record (or near-record) post-war surpluses. With all this private liquidity available for investment, a better approach might be for governments to create profitable private sector opportunities. But this is not easy when, as already identified, business confidence is low and the private sector — especially banks and financial intermediaries — are nervous about investing¹⁸. Yet there is a unique green opportunity to create viable new markets. Many market risks, such as fickle consumer behaviour, construction and operation risks, as well commodity price uncertainty, are mostly outside governments' control.

In addition, private insurance and hedging schemes are in many cases available to diversify such risks without the need for public intervention. But this is notably not true of many green markets. Numerous market failures, for example under-pricing of the social cost of pollution from greenhouse gas emissions and a lack of incentives for energy efficiency or investment which generates large knowledge spillovers, prevent investment from which businesses and consumers could profit collectively (but do not)¹⁹. Because of this, and because the private sector does not take into account these and other positive “externalities” resulting from innovation in green technologies (such as reduced congestion and greater energy security), it will consistently under-invest in green technologies and in green research and development, knowledge generation, and knowledge sharing²⁰.

Of course governments could promote growth and create jobs through policies to promote fossil fuel extraction or mandate kitchen refurbishment for everyone, but this would unnecessarily distort the efficiency of the market and interfere with individual liberties. Moreover, such policies would not seem credible to investors as the long term rationale for the policy intervention would be unclear. The same is not true in the presence of market failures whereby the uncoordinated actions of individuals pursuing their own self-interest collectively deliver a worse outcome for society as a whole.

In such sectors, investors rely on policy-makers to define the size, profitability and scope of the market. If a government can shoulder some policy and regulatory risk by sending a clear market signal in the form of long-term standards, regulations or pricing, the private sector is likely to invest in the expectation of reliable risk-adjusted revenue streams²¹. This sector is, after all, uniquely well-placed to benefit from a

¹⁸ At the time of writing, most of the key business confidence measures show a recovery from the trough of late 2008/early 2009, with the strongest growth in the tradeable sector. However, many service sector confidence indicators remain subdued, with surveys of small business optimism and expected credit barely recovering from the recessionary trough (for example see National Federation of Independent Business, January 2011).

¹⁹ For example, private landlords have no incentive to insulate their housing stock as it is the tenant, not the landlord, who pays for the resulting higher energy bills. An owner occupier also faces similar disincentives if s/he plans to sell the property. Home owners and businesses also face high upfront capital costs, transaction costs and the “hassle factor” when it comes to investing in energy efficiency.

²⁰ Grantham Research Institute (2009)

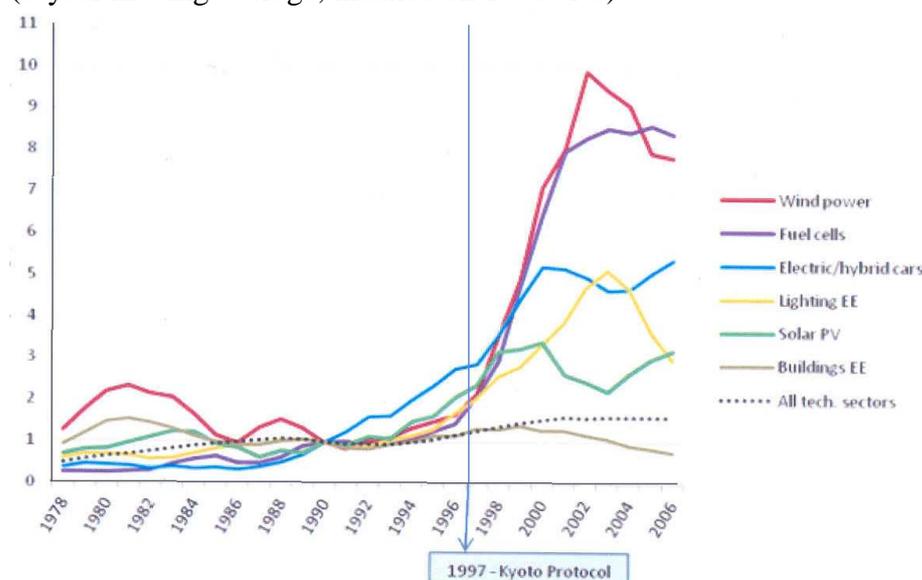
²¹ Risk can be hedged directly through the issuance of government bonds to raise capital for low-carbon investment directly, or the issuance of bonds linked to an index that is related to climate mitigation policy, such as achievement of a carbon target, the carbon price, or fossil fuel energy price. The

viable long-term future with growing market opportunities for decades. The scientific assessment is clear and responding to it will require a near zero-carbon world by the second half of this century, even if the early effort has been sporadic and uncoordinated.

Once the private sector is confident there is a market in which it can generate sustained risk-adjusted returns, it will start to invest. The role of environmental policies and policy instruments in setting expectations and providing the right incentives for the development and diffusion of ‘environmental’ technologies cannot be overestimated. Figure 2 shows patent activity for a range of green technologies such as wind, solar photovoltaics, fuel cells and electric vehicles. The importance of policy signals in setting expectations is illustrated by the fact that innovations in these key sectors underwent a marked up-turn in the period immediately following the signing of the Kyoto Protocol in 1997.

Figure 2: Innovation in climate change mitigation technologies

Patenting activity in Annex-I countries²²
(3-year moving average, indexed on 1990=1.0)



Source: OECD (2010)..

Even in the present more uncertain global green policy environment, without as much of an ambitious and coordinated a global policy response as might have been hoped, private investment in new energy generation and energy efficiency has quadrupled since 2004 according to Bloomberg New Energy Finance (NEF). New investment in clean energy is expected to surpass investment in conventional energy generation in 2010, rising to between US\$180 and US\$200 billion, 30 per cent up on the previous year and compares with \$46 billion invested in 2004.

investor would receive a higher return if the climate target were missed. See Grantham Research Institute (2009). Risk can be taken on indirectly through policy frameworks, institutions and implementation mechanisms as with the establishment of the United Kingdom’s five-year statutory carbon budgets and independent U.K. Committee on Climate Change.

²² Based on ‘claimed priorities’ (CP) deposited at any patent office worldwide, classified by technological field, based on identification developed by the EPO/OECD World Patent Statistics database (PATSTAT). OECD (2010).

This increase partly reflects the stimulus provided by discretionary fiscal packages in 2008 and 2009, some of which included support for renewable energy in many countries, as well as the fact that investment in 2009 was temporarily depressed by tighter credit conditions at the peak of the financial crisis. The United States, South Korea and China in particular included sizeable renewable energy investments as part of their stimulus spending programmes²³. The delay between policy announcements and investment implementation reflects lags in the administrative and planning processes, especially for large infrastructural projects²⁴. According to the UNEP SEFI Sustainable Energy Investment Trends Report 2010, US\$188 billion in green stimulus funding had been allocated to renewable energy and energy efficiency globally, of which only 9 per cent had actually been spent by the end of 2009. The majority of the funds were expected to be spent in 2010 and 2011.

The growth of this sector has been particularly marked in developing countries. NEF estimates that investments in renewable energy assets grew by more than 200 per cent from 2005 to 2008 in OECD countries, and by more than 500 per cent in non-OECD countries. By the first quarter of 2010, China was the largest destination for investments in renewable energy.

Of course, some crowding out of investment is to be expected to result from green policies, even in the short run. For example, a clear price signal in favour of renewables will — all else being equal — be expected to reduce the viability of investing in fossil fuels, but the two effects are very unlikely to be offsetting. The current environment of long-run uncertainty over the viability of fossil fuel investment, both in terms of diminishing access to cheap supplies and the increasing likelihood of policy to reduce the energy- and carbon-intensity of economic activity, is already impeding investment. However, it is matched by continued short-run uncertainty over the viability of renewables and energy efficiency, which only perpetuates general investor caution. In addition, the multiplier effects of supporting new technologies such as renewables are likely to be larger than in mature sectors. Partly, this is because these new technologies will, to begin with, be less productive and more labour-intensive than conventional technologies. In the short run, this helps create jobs and boost demand. The Green Jobs Report estimated that, with strong policy support, up to 2.1 million people worldwide could be employed in wind energy, 6.3 million in solar photovoltaics and around 12 million people in biofuels-related sectors by 2030²⁵. Even in the long run, the additional resource cost of investment in low-carbon energy is likely to fall as sectors like wind and solar undergo faster declines in investment and production costs, as a result of learning by doing, while generating more substantial knowledge spillovers to other sectors, than mature conventional energy technologies²⁶.

²³ See IEA (2009) and HSBC (2009a).

²⁴ See HSBC (2009b).

²⁵ Green Jobs Report, ILO/UNEP/IOE/ITUC (2008).

²⁶ For a review of the learning curves literature, see McDonald and Schratzenholzer (2002), Junginger *et al.* (2008) and Lako (2010).

6. Managing expectations and limiting policy failures

Expectations clearly play a crucial role in influencing investor behaviour. In order for climate policy to generate investment, the process must be credible, clearly communicated and transparent with well-defined policy instruments and objectives. Inaction breeds uncertainty in an environment where the climate and resource challenges are widely known, but the precise design of the inevitable policy response has yet to be determined. Establishing credibility takes time. Political consensus will be needed to underpin the long-term consistency of the policy objective, and building credibility and consistency requires establishing robust institutions and processes.

Policies must be carefully designed to be cost-effective, noting that the scope for policy failure can be as large, in some cases, as the market failures that a policy seeks to address. Yet there is little cause to delay the introduction of effective policy signals to address market failures and induce investment and innovation. Market instruments remain the most efficient means to ensure investment. Price signals to internalise environmental externalities provide immediate incentives to change behaviour without discriminating between technologies and processes. Consequently they are both more efficient and less susceptible to rent-seeking activities. Rent-seeking occurs where vested interests seek to influence policy-makers in order to maximise the income benefits from policies (or minimise the loss). Such groups tend to be more politically influential and focused (industries with a market stake in proposed legislation) than the more diffuse potential gainers from public policy (consumers and citizens), spurring a costly process dubbed ‘capture’.²⁷

Pricing can take the form of carbon taxes or emissions trading. Despite reduced scope for technology capture, both taxes and trading will be subject to rent-seeking and lobbying (in the case of taxes, lobbying will centre on the level and base of the tax and the need for compensatory subsidies, while in an emissions trading scheme, the focus will be on the size of the emissions cap and the distribution and monetary value of any allowances). Consequently, the levels and breadth at which such signals should be set requires careful analysis and should change over the business cycle in a clear and predictable manner²⁸. It is also worth noting that, in principle, the revenues raised from environmental taxes or auctioned permits can be used to reduce distortionary taxes elsewhere in the economy. In sectors where price sensitivity is low (such as curbing energy inefficiency and waste) policy signals may take the form of standards and regulations, provided they are clearly articulated in scope and aim. To limit rent-seeking and enhance efficiency, these standards should be stipulated in terms of expected outcomes (such as a quantified improvement in buildings or vehicle engine efficiency) rather than technological inputs or processes.

Market failures in technology will require some research development and deployment (RD&D) support, especially for early technological innovation and investment in untried markets. This means that so-called “winners” will need to be

²⁷ For a comprehensive, if not entirely unbiased, discussion of the scope for policy failure and capture by vested interests see Helm (2010).

²⁸ See Bowen and Stern (2010).

picked²⁹. This will also be the case when a government decides on allocating large procurement orders and contracts. The scope for vested interests to lobby government will consequently be enhanced in such circumstances and policy must be carefully designed to minimise the scope for a “technology pork barrel”³⁰. In addition, dispensing financial support for RD&D is likely to be far more effective when combined with “demand-pull” policy frameworks designed to create new markets in which private innovators can expect a secure future revenue stream, as discussed above. As Houser *et al.* (2009) point out, measures designed to tackle market failures in the provision of RD&D will “only make a meaningful dent in U.S. emissions if they complement comprehensive climate policy.”³¹

More generally, economic slowdowns are drivers of creative destruction in innovative sectors. Microsoft, Nokia and Research in Motion were all born, or reborn, during a downturn. Indeed, over half of the companies on the 2009 Fortune 500 list began during market downturns³². Economic crises breed innovation and entrepreneurship, which in turn provides the spark for a subsequent resurgence in productivity and growth. Enabling this is the key to long-term growth, but it is also essential for short-term recovery. Countries that harness innovation as drivers for growth will be most likely to pull out of recession. This means governments should have an incentive to sustain an environment that nurtures these engines of innovation, at precisely the time when risk aversion and a scarcity of finance threaten to limit the capacity of the innovators to deliver. With the public sector retrenching, policy would best be targeted at strengthening the impact of public spending, and the temptation to take the axe to public investment in education, research and infrastructure should be resisted³³.

To be efficient, all the appropriate tools in the policy-maker’s tool-box must be used, with each instrument targeting a particular market failure, while taking account of its consequences for the rest of the economy. Policy must be sufficiently stringent to change behaviour, predictable in order to contain risk, yet simple and flexible in evolving to changing circumstances while limiting compliance costs³⁴. Simple policy regimes with fewer overlapping instruments are harder to ‘capture’ and more likely to improve the transparency and effectiveness of policy³⁵. Appropriately designed policy has the potential to increase private investment in this large and growing market, stimulating demand, boosting jobs and laying the foundation for long-term sustainability at relatively little cost to treasuries and without crowding out private investment. Indeed, in generating activity, it is also likely to boost public sector

²⁹ Even here, there are non-discriminatory options available such as making RD&D support explicitly a declining function of the technology’s maturity, though applying non-discriminatory policies to universal subsidies has the potential to be extremely costly.

³⁰ See Cohen and Noll (1991).

³¹ See Houser *et al.* (2009).

³² See Pilat and Wyckoff (2010).

³³ Bowen and Stern (2010) note that the economic cycle reduces the short-run co-benefits of active climate policy, for example because lower economic activity may reduce the damage from local pollutants and reduce congestion. However, in the long run, the benefits of climate policy remain little changed during downturns while their costs can be greatly reduced.

³⁴ See Bowen (2011).

³⁵ See Fankhauser and Hepburn (2010).

revenues and hasten efforts to contain public sector deficits and limit public sector debt³⁶.

Conclusion

There is no lack of private money in the current market. However, there is a perceived lack of opportunity. As a result of reduced spending and investment, private sector financial balances (net borrowing or saving minus investment) have reached record (or near-record) post-war surpluses in the United Kingdom (£137 billion in 2009) and United States (\$1.2 trillion in 2009). This provides a bountiful source of available funds for investment in green technologies and addressing market failures. Private sector investments across the world in clean energy by both the public and private sectors was \$162 billion in 2009. Because the market for green investment requires a clear policy signal to become viable, governments have the potential to unleash huge private investment opportunities with little threat of crowding out private investment or displacing alternative jobs. In so doing, they can improve the long-run allocation of resources, support resource-efficient growth and reduce the threat of irreversible environmental damages.

If governments can shoulder some policy and regulatory risk through a commitment to clearly identified market-based policy instruments, involving long-term carbon pricing, standards and regulations, together with carefully-designed technology support, the private sector can invest with confidence, while incentives for wasteful rent capture are limited. This would generate profitable new markets and drive private investment without further aggravating public sector deficits or compromising public sector consolidation plans. It is also likely to unleash sizeable macroeconomic benefits by boosting private spending, creating jobs and allowing the monetary authorities greater leeway to stimulate demand at a time of fiscal consolidation. All that is required is that politicians, officials, and economists grasp the opportunity. If instead governments fail to act, then not only do they risk missing an opportunity to lock in new low-carbon infrastructure, they also risk unnecessarily extending the present economic crisis.

³⁶ However, to be effective, limited public funds for risk-sharing are likely to get first of a kind projects and business models under way (carbon capture and storage being perhaps the pre-eminent example). Even where technologies have been developed, scaling up deployment and establishing a track record often represents a major investment barrier — the so-called ‘valley of death’ — and here too public support may be required. In the United Kingdom, these issues are all being explicitly addressed in the establishment of a Green Investment Bank – see for example Aldersgate Group (2010) and also Ernst and Young (2010).

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