Circular economy

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CIRCULAR ECONOMY

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1. Introduction and Background

Currently world population is just over 7 billion and expected to reach 9 billion before 2050 (US Census Bureau, 2013). Increasing affluence in developing and transition countries where population is growing most, is now resulting in a wave of ''new consumers''[1].   This is an important development as in the industrialised world the main drivers for the level and growth of environmental pressures are said to be final consumption and affluence ((Hamilton and Turton (1999, 2002), Lenzen and Smith (2000), Melanie, Phillips and Tormey (1994), Parikh and Painuly (1994), Wier, Lenzen, Munksgaard and Smed (2001), Wolven (1991) as seen in Lenzen et al (2007)). It should however be realised that in a developing country context, development and greater affluence can sometimes lead to reductions in some environmental impacts with the affordance of better technology and avoidance of environmentally damaging behaviours (linked to poverty). However, for others such as climate change and green house gas (GHG) production, it can substantially increase environmental pressures (see Vennemo et al, 2009).

There are a number of globally important environmental pressures for which key threshold limits for control variables have been identified as important not to pass due to societal risks; this is the concept of 'planetary boundaries' (Rockström et al., 2009). Climate change induced by greenhouse gases is one of the key global environmental pressures, that if ignored, will harm economic growth and cause social disruption (Stern, 2006). In the case of climate change, key threshold values for green house gases have already been passed, which is also the case for four of the ten environmental pressures listed in Rockström et al., (2009). There is now an urgent need for action to mitigate GHGs worldwide. Land use[2] is also important, as it affects the level of greenhouse gases and climate change, as well as other important environmental pressures, such as biodiversity, the nitrogen the phosphorous cycles and fresh water use.

Beyond environmental impacts, consumption and affluence are also substantially contributing to current and future resource scarcity, as some key resources are finite and for a number of key commodities, much of the accessible 'lower hanging fruit' (in terms of discovery and extraction) have already been picked, additionally, there are physical limits in regaining materials at the end of life of products. In the case of renewable resources, these are often being extracted at a faster rate than they can replenish, over exploitation (OECD 2012). In the 20th century, world economic output grew 22 fold and fossil fuel consumption by 14 fold. Material extracted or harvested worldwide reached nearly 60 billion metric tons in 2007 (per annum), a 65% increase from 1980 and an 8 fold increase over the last century (OECD, 2012). Resource scarcity is a key contributor to recent ongoing commodity price pressures (PwC 2011). Rising commodity prices limit economic growth and prosperity (Economist, 2011, and Gang et al., 2006). Figure 1 shows historic changes in the GMO commodity price index.

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[1] Myers and Kent 2004.

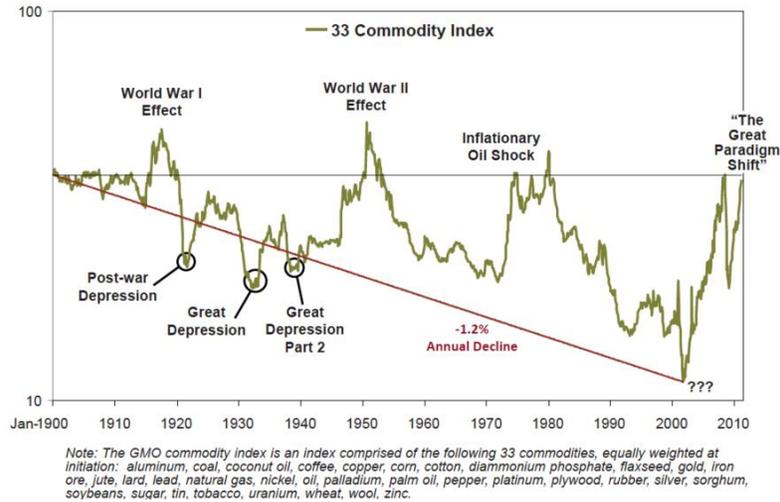[2] In terms of percentage of global land cover converted to cropland.

Figure 1: GMO Commodity Index (GMO as of 2/28/11).

Helbling (2008) from an analysis of the last 50 years suggests that the 21st century boom (seen towards the right hand side of Figure 1) is unusual in three respects: 1. It lasted much longer than earlier booms; 2. Price increases in real terms were much larger than earlier booms; 3. A broader base of commodities were involved in the boom (at least 4 and sometimes all 5 of the major commodity groups - oil, metals, food, beverages, agricultural raw materials). The boom was largely unexpected. A review by UNDP and ODS (2008) identify that robust demand (driven primarily by emerging economies, India and China[3]) as well as supply constraints appears to be driving the price increases and that financial speculation (in case of metals) seems also to be playing a role. In the past, higher prices have been successful in driving technical innovation in both discovery and capture of resources and consequently lowering prices. Grantham (2011) and others in the risk industry such as Stahel (2013) however, advocate that the old trends in commodity prices have changed and that we are moving into a new paradigm. Whether this is actually so, remains to be seen as seen (see below recent figure for 2011 onwards), but there is now consensus that current rates of global consumption of materials and energy cannot be maintained due to environmental reasons (Allwood et al 2011, Green et al 2012, Allwood and Cullen 2012, Ellen MacArthur Foundation 2012).
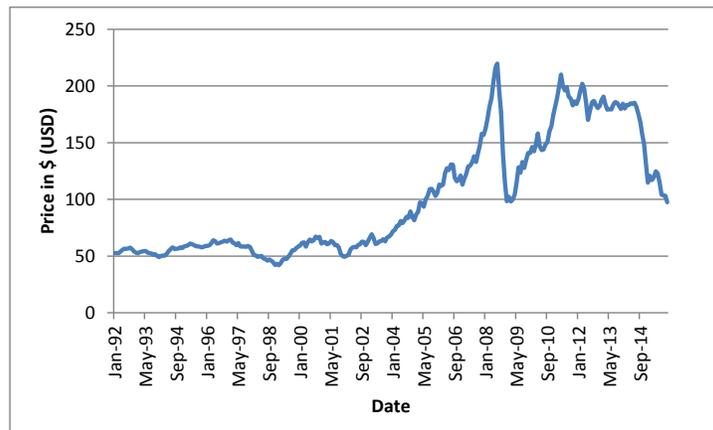

Figure 1: GMO Commodity index 1992 – 2015 (Index Mundi 2016)

High levels of demand and consumption are related to (and environmental impacts compounded by) the current economic system that we apply. Such systems rely on high material throughputs and have a poor ability to take account of natural capital and its depletion (Wackernagel and Rees 1997). Stahel (2010) and the Ellen MacArthur foundation identify the 20th century's linear industrial economy, as one where more economic growth generally means more material throughput and where there is low usage of materials before disposal. Some advocate that technology and resource efficiency will be the

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[3]UNDP 2008 state that (p.21): *"for oil, China, India and the Middle East accounted for 56 percent of growth in oil consumption from 2001 to 2007. China alone has accounted for 90 percent of the increase in world consumption of copper from 2000 to 2006. In general, when the post-2001 years are compared with the 1980s and 1990s, the contribution of China, India and emerging economies to global consumption of commodities has increased dramatically"* Grantham (2011) goes further, he suggest that growth in demand from China is the primary driver of the current boom in commodity prices. New productions of fossil fuels such as shale have resulted in some easing of supply for fuels such as gas, but the impact of this production is predicted to diminish after 2025 (International Energy Agency 2012). Such new gas supplies can help as a substitution for energy, but not for many of the other valuable uses of oil.

'saviour'(Neumayer 2000), there is however now mounting evidence that technology and resource efficiency alone is unlikely to be sufficient in reducing the pressures on both the environment and resource scarcity (OECD 2012, Jackson et al 2009, Clift and Allwood 2011). It is now becoming increasingly clear that changes in the management and policy of economic systems (OECD 2012, Stiglitz et al 2009,Victor 2008, Jackson 2009, Foxon 2010, Cambridge econometrics and SERI 2010 and Stahel 2013) is required to ensure that society stays within threshold values for key planetary boundaries, and in avoiding increasing resource scarcity. To continue to apply the standard assumptions that that (1) higher prices will drive enough supply side innovation to meet future demand and (2) technology and end of pipe environmental policy will be enough to reduce and resolve environmental pressures is a high risk strategy. There is now a need for a more precautionary, but also a more intelligent approach to managing resources. As Clift and Allwood (2011) identify, if an economy reduces material flows of certain materials, this does not necessarily mean having fewer goods in use. To enable a more intelligent approach, there is a need to firstly understand the ways in which current economic management and policy affect flows of important resources where scarcity is a key issue and for which CO_2 production and land use are important. Analysis of the effects of economic management and policy on physical flows and land use is limited[4], but this is an important research agenda given recent strong evidence that key threshold values for environmental pressures such as climate change have been reached and of a potential new paradigm in relation to commodity prices (UNEP 2008, Grantham 2011 and Stahel 2013).

Stahel (2010) has been one of the first to consider how to make substantial improvements to the performance of the economy from a physical perspective. Stahel's innovative work advocates a move from what he calls a linear industrial economy (take, make and dispose) towards a circular economy (via creating loops in resource use). Such an economy focuses on utilisation and performance in use, optimising existing stock and in selling goods as services, where businesses may retain ownership of physical goods and reuse these to maintain supply of services. From a physical perspective there is strong evidence that such an economy is robust and can substantially improve performance. Stahel (2010), the Ellen MacArthur Foundation (2013, 2015), and WRAP (2015) advocate that economic performance – including employment rates - would also improve with a transition to a circular economy. Though some evidence exists, economy wide analysis has not been conducted; this is also the case with respect to employment effects (WRAP 2015a) and outcomes for prosperity , indirect effects have not been investigated and remain important research gaps (as seen in the Ellen MacArthur Foundation 2015).

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[4] For CO_2 a key threshold parameter for climate change, work has been started by Alvarez-Diaz (2011). Work to look at exactly how specific aspects of economic management and policy effect key resources is however limited and at an early stage, Stahel (2010), Jackson (2009) and Victor (2008) are some of the few researchers who are starting to looking at this.

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