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Broken models? Economics and ecosystem services

A collaborative research project between

Alliance Trust Investments, Newton Investment Management and Schroders



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Executive Summary

As the visibility of changes to ecosystem services continues to increase on a global level, from the drought in the USA to the smog of Beijing, there is increasing recognition that the outcomes of these changes are having material economic impacts. The evidence may emerge quickly through visible indicators, such as rising crop prices, or gradually through less immediately tangible indicators, such as declining health. This short report (a follow-up to Schroders' 2011 report "Ecosystem Services: Where's the discussion?") summarises the findings of a project which set out to explore how the chief economists of some of the world's largest investment banks are integrating changes to ecosystem services into their economic forecasts.

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Introduction

Human society is dependant on the effective functioning of the ecological systems and processes which provide us with food, generate nutrients, regulate the climate and absorb our waste. As the global population and economic wealth has continued to expand, noticeable changes in ecosystem services have resulted; such that many of these services, which underpin our global economy, are being changed in ways that will have serious economic impacts. Despite this, a 2011 review of the Chief Economists at several investment banks, conducted by Schrodgers, showed that there was very little appetite for integrating these changes into economic forecasts. This report builds on that initial research to explore once again the views of Chief Economists on questions such as whether changes to ecosystem services are a relevant consideration in economic models and how, if at all, these changes can be modelled.

What are ecosystem services?

‘Ecosystem’ is not a new term. A definition from the 1930s describes the “whole system including not only the organism-complex, but also the whole complex of physical factors forming what we call the environment”¹. More recently, the University of Cambridge talked about “a natural unit that consists of living and non-living parts which interact to form a stable system”².

‘Ecosystem services’ is a more recently defined concept. It is anthropocentric, placing humans at the centre and defining those functions of ecosystems which provide humans with utility. The Millennium Ecosystem Assessment categorises different benefits that society obtains from ecosystems, as shown in Figure 1.

Figure 1 – The Millennium Ecosystem Assessment’s four categories of ecosystem services

Supporting/habitat services	Provisioning services
Nutrient dispersal and cycling	Food, crops, wild foods, and spices
Seed dispersal	Water
Primary production	Minerals
	Pharmaceuticals, biochemicals, and industrial products
	Energy
Regulating services	Cultural services
Carbon sequestration and climate regulation	Cultural, intellectual and spiritual inspiration
Waste decomposition and detoxification	Recreational experiences
Purification of water and air	Scientific discovery
Prop pollination	
Pest and disease control	

¹ Tansley, A. (1935). “The use and abuse of vegetational terms and concepts.” Ecology 16: 284–307.

² Sedgwick Museum website

Market failure and the decline of ecosystem services

Free markets have allowed many ecosystem services to be overexploited. Profit-maximisation, coupled with inadequate regulation, have led to humanity using the earth's provision of physical goods, the 'source side', and its ability to absorb the environmental effects of industrial activity, the 'sink side', at rates that are beyond the earth's ability to replenish itself. Now this over-use is, in many instances, a break on economic activity and can therefore be described as a market failure.

Source side market failures

A number of services provided by ecosystems have been degraded by human activities, particularly during the past 250 years of industrialisation, and no longer function at their full, historic capacity. Such causal effects can be seen as a form of market failure. An oft-cited example is the depletion of localised fisheries, including the North Atlantic where some species, such as cod, were overfished to the point where populations collapsed. This overexploitation led to the degradation of a natural resource, and to the collapse of the industry.

Sink side market failures

Natural processes are able to absorb many potentially damaging anthropogenic outputs. However, the scale of human activity is such that the absorptive capacity of many ecosystem services has been surpassed, meaning that outputs remain in the environment as pollution. The most commonly referenced example of a market failure degrading the environment's capacity to function as a sink for human industrial activity is carbon dioxide emissions and the resultant global warming.

The erosion or removal of ecosystem services will mean a loss of utility, whilst restoring an ecosystem may increase utility, such as by limiting carbon dioxide emissions. However, doing so will usually bring economic costs. Similarly, replacing ecosystem service utility functions with artificial replacements to achieve the same services, for instance through carbon capture and storage, is also very expensive. As economic activity increases, driven by the demands and activities of a growing world population, ecosystem services will come under greater pressure, on both source and sink sides. Restoration and replacement costs for degraded ecosystem services can then be expected to increase, thereby strengthening the arguments that conservation may be a more cost effective long-term strategy.

Ecosystem degradation is affecting economic performance at the regional, national and international levels and is likely to do so in the future. However, the investment decisions of long-term asset owners and asset managers are frequently made based on economic forecasts that are yet to integrate changes to ecosystem services into their models. This raises questions about the accuracy of corporate and sovereign growth assumptions, about the validity of asset allocation decisions and ultimately about the protection of client and beneficiary interests.

The economic risks of ecosystem decline

The responsible investment industry has long been aware of the risks of changes to ecosystem services, manifested through a focus on the risks to companies of this decline or, indeed, on the contribution of those companies to the changes; as well as identifying products and services that would benefit from efforts to adapt to, or mitigate, the impacts of these changes. This is demonstrated by the growing amount of work linking the value of ecosystem services to financial value. Examples of this include analyses of water scarcity risk to Chinese utilities and of the cost of carbon impacts to the global aviation sector. It is also demonstrated by industry initiatives established to focus on specific ecosystem service elements.

The "*Stern Review on the Economics of Climate Change*" in 2006 was one of the most high profile reports which attempted to focus attention on the economic ramifications of climate change. Since then there have been several studies that have highlighted the economic value of ecosystem services, including the multi-government sponsored 2008 report "*The Economics of Ecosystems and Biodiversity*", the UK Government's 2011 report "*National Ecosystem Assessment*", and the chapter entitled "*Seizing the opportunity of green development in China*" in a 2012 World Bank report³ which reported that "*environmental degradation and resource depletion in China is valued at approximately 9% of GNI*" around eighteen times higher than corresponding figures in Japan or Germany.

³ "*China 2030: Building a Modern, Harmonious, and Creative High Income Society*" World Bank, 2012

These various initiatives and separate research reports demonstrate expert recognition that changes to ecosystem services can have a material impact on financial performance. They also suggest a collective desire to address this impact. These studies are isolated examples and there is a noticeable absence within economic forecasts (at both the corporate and macro level) of the consequences of changes to ecosystem services (such as climate change, water scarcity, fishery decline, soil erosion, pollinator fall off) on these forecasts. This study asks why this was the case.

Findings of the 2011 survey of economists

Despite the missing data sets in long-term economic models, these models are used to guide and inform investors, whether this is at the company modelling level (e.g. growth assumptions or levels of risk applied) or in the long-term strategic asset allocation decisions made by companies, asset managers, advisors and trustees. In 2011 the recognition of this absence of discussion led to Schrodgers undertaking the inaugural analysis of the degree of integration of changes to ecosystem services into economic forecasts by economists. This consisted of sending a short questionnaire to the Chief Economists of 14 separate investment banks. The following three responses were received:

- The subject is too big to meaningfully contemplate
- Economic growth in the emerging markets would be inflationary on commodity prices but externalities are typically underweighted
- Ecosystem services are already incorporated in our report (this incorporation was limited to the following sentence in the final paragraph of the report *“One of the most significant variables we are not capturing is the natural resources with which an economy is endowed and how this drives its relative terms of trade and its bargaining power in the global economy”*. Whilst this may indeed demonstrate “incorporation” we do not believe it demonstrates “integration”)

Findings of the 2012 survey of economists

In 2012, Schrodgers collaborated with Alliance Trust Investments and Newton Investment Management to pose a similar set of questions to the Chief Economists of the following investment banks: UBS, HSBC, Goldman Sachs, Bank of America Merrill Lynch, Citigroup and Societe Generale. Three of the six banks approached with the 2012 survey agreed to a meeting to discuss the questions posed⁴. The questions asked are in Figure 2, below.

Figure 2 – Questions posed to Chief Economists on integrating ecosystem service change into economic models

1. How do you incorporate a consideration of ecosystem services into your economic models?
2. What impact do you estimate the current change in these ecosystem services is having on global economic performance, in terms of output, inflation and other metrics?
3. If you incorporate ecosystem services into your models, what is the valuation methodology you use where there is currently no market value for specific environmental goods or services?
4. If you have incorporated a consideration of the change in ecosystem services into your models, what are the results for your short and long-term (40 year) models?
5. What are your expectations of the economic response to ecosystem services changes in terms of market volatility, policy shifts and technological innovation?
6. If you have not addressed these factors in your models, please could you explain why not?

⁴ Two economists confirmed that the focus of their predictive work on short term issues meant they did not consider these long term issues in their forecasts at all and one cited time constraints as a reason not to focus on these macro issues.

From these questions, we have summarised the results of the discussions, below.

Integration

Each interviewee acknowledged shortcomings in the ability of existing economic models to readily incorporate ecosystem service impacts, though opinions varied as to whether this constitutes a material weakness in the quality of their economic modelling. Each interviewee also conceded that investors may not receive an accurate picture about all potential inputs to, and outputs from, economic growth, with existing models. A clear consensus was expressed that changes to ecosystem services would, over the longer term, impact industries and economies. However there was little or no consensus on how to integrate changes to ecosystem services into existing models.

Short-termism

One of the most common reasons cited for a lack of integration was the different time horizons over which these impacts would be felt (e.g. 5–10 years) and the differing but invariably far shorter focus of their clients. This clear mismatch may be resolvable only through clients adopting longer time horizons, a change in the mix of clients themselves, or accepting that long-term analysis is best conducted by different economic research institutions.

Pricing

Existing models struggle in particular to integrate factors which are not currently commoditised or securitised. There is reluctance, with some justification, to place a value on services for which there is no existing market or for which significant uncertainty around current or future pricing remains. Accounting theory can bring ecosystem services into macroeconomic balance sheets, via recognition of the values of all capital types, including financial, human, manufactured and natural, provided they have an estimative price or value.

Adaptation or mitigation

There was most discussion around lines of analysis that side-stepped contentious issues around what might be causing climate change or ecosystem service change and instead focused on adapting to these changes where they are self evident. Whilst adapting to the planet warming by more than two degrees might seem terrifying from an environmental perspective, it highlights the preferential short-term economic focus on business as usual for interviewee's clients. It also avoids the difficulty of selling a mitigation story to much of their client base.

Freedom of opinions

There was broad agreement that all issues could be addressed in published research without significant risk of negative opinion from the parent company, peers or clients, provided the appropriate tools could be developed.

Improved models?

The value of ecosystem services is invisible within GDP and this led to widespread acknowledgement that GDP has its limits. Interestingly, no one proposed a wholesale reform or abandonment of GDP but, instead, proposed either:

- a. A better understanding of its uses and dangers or
- b. Better modelling of the inputs within it.

GDP was defended in a manner which was confident, particularly given recent and widespread debates around the weakness and inappropriateness of GDP as a useful metric for economic and sustainable advancement.

Economists expressed hope that there would be an improvement in data collection and processing power that would enable far more complex modelling of the inputs into GDP. In summary, the consensus view of economists was that *we don't need new models we just need more data and for modelling to be able to more accurately forecast, price and incorporate the impacts of ecosystem service change.*

Conclusion: Investing wisely despite broken models

In terms of acknowledgment of the topic and willingness to discuss it, there was a significant improvement between the 2011 and 2012 surveys with a much greater level of informed discussion being had. There were also commitments to publish work on this topic. One clear challenge for the economists is the demand for very short-term focussed work, constraining their ability to produce long-term investment perspectives. These are constraints that are unlikely to be imposed in other long-term asset allocation areas, which draw private investment finance such as city planning, transport and infrastructure projects.

Many long-term investors, however, do not depend on long-term economic modelling, given the frequency with which the outcomes from models are wrong. Instead, investors look for well run companies in attractive sectors which offer a relatively higher chance of strong returns. This does not mean that incorporating ecosystem services into investment decision making does not occur. Instead, investors look at company-level implications of changes to ecosystem services and engage with companies to make sure they are integrating upside and downside catalysts into their business. This has the advantage of allowing investors to understand a localised risk (for instance water scarcity for a brewer manufacturing in specific geographies) and to understand how a company is ensuring its long-term productive capacity. At a micro-economic level, such risks can be understood, possibly quantified and hedges or mitigation strategies designed.

All companies contribute to, and are affected by, the variability of the global economy; however whilst the consequence of changes to ecosystem services are increasingly recognised at the micro-economic (company) level this same recognition has not been extrapolated to the macro-economic level. This absence must therefore be acknowledged as, at least, a weakness of economic forecasting and, at most, a gross failure.

Investors who can incorporate ecosystem services and commoditised natural capital into their economic models will be able to invest with more comprehensive tools. This should mean that, where outputs from models are cogently interpreted, investors will have the opportunity to outperform over the long term through more accurate allocation of capital.

Following on from this project, it would be interesting to explore the relevance placed on changes to ecosystem services within the models employed by NGOs, government agencies, international finance organisations and companies making long-term strategy announcements and capital expenditure commitments as well as revisiting the thoughts, and models, of the economists we have engaged with over the course of this project.