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The final edition of Economic & Labour Market Review

Welcome to the last ever edition of ELMR. Since 2007 this has been the Office for National Statistics' flagship journal, each month providing the latest commentary, analysis, research and statistics on the UK economy and labour market. The decision to discontinue ELMR has been taken alongside ONS's plans to launch its new website at the end of August 2011. This will offer a new and improved way for ONS to deliver statistics and articles online.

Most of the suite of economics and labour market tables on the ELMR website will no longer be updated, but in each spreadsheet a note has been attached to say when the table was last updated and where the information can now be found. The only ELMR tables that will continue to be published each month are the Further labour market tables as these are not published elsewhere. Dates for these releases are on the National Statistics Publication Hub. Once the new website goes live these will become supplementary tables to the Labour Market statistical bulletin.

The monthly Economic Review article which provides the latest perspective on the UK economy from the point of view of ONS's statistics has also been discontinued. However, ONS remains committed to publishing relevant commentary on all its key economic statistics and intends to publish a note alongside each month's National Accounts release. The quarterly Regional Economic Indicators will continue to be published as usual and a link to this can be found from the Regional Trends part of the ONS website.

The ELMR mail box will also closedown towards the end of May 2011, and any requests for information or data after then should be made to ONS's customer contact centre on 0845 601 3034 or at info@statistics.gov.uk.

Further information
ONS's announcement regarding the postponement of the new website's launch and other details about the ONS's Web Development Project can be found at:
www.ons.gov.uk/about/what-we-do/programmes-projects/web-development/index.html

Contact
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Economic & Labour Market Review May 2011

Gross domestic product, real income and economic welfare

Graeme Chamberlin
Office for National Statistics

Summary

As a measure of economic activity, gross domestic product (GDP) is a useful indicator of output and suitable for using in estimates of productivity. However, as a measure of welfare, it has several limitations. This article follows Sefton and Weale (1996, 2005) in producing an estimate of real income – a corrected or adjusted version of GDP – that is linked to current and future consumption possibilities. This measure of real income differs from real (money) GDP by taking account of capital consumption, net income and transfers from overseas, and uses a consumption deflator rather than a general GDP deflator so that output is valued in terms of consumption units.

Introduction

Gross Domestic Product (GDP) is a measure of the total output produced in a particular country. Dividing by the population of that country gives GDP per capita, or the average amount of output for each person, and these figures have been typically used to detect changes in living standards both over time and across countries. However, as a measure of average welfare, GDP per capita is at best a materialistic measure and at worse a flawed measure. There are many aspects to welfare, living standards, quality of life, well–being and so on that are not captured by GDP, and in fairness GDP was never designed to actually measure these things anyway (Vanoli 2005). As Allin (2007) states, a discussion about welfare invariably involves a number of factors that lie outside of the simple production boundary that GDP/National Accounts aims to record.

GDP's difficulties in measuring welfare have been long recognised. For example, the Human Development Index[1] was an early attempt to consider a range of wider indicators and presently the Office for National Statistics (ONS) is engaged in developing new measures of national well–being for the UK that cover quality of life, environmental and sustainability issues as well as economic performance[2]. But despite its limitations, GDP and its variants still have value as a measure of progress and the resources available to society. In a recent article in *Economic & Labour Market Review*, Chiripanhura (2010) discusses real net national disposable income and household consumption among others as indicators of societal well–being across countries.

This article follows up on Chiripanhura (2010) by looking at real net national disposable income for the UK in greater detail and its implications for welfare. The main point of difference is, following the arguments laid out by Sefton and Weale (1996, 2005), real income is calculated using the consumption rather than the GDP deflator, as this gives a measure of income that is more closely related to current and future consumption possibilities and hence welfare.

GDP and real income

As part of the annual *Blue Book*[3] the ONS publishes a measure called net national disposable income. This is related to GDP in the following way:

Gross Domestic Product ('money' GDP)

+ Net income from the rest of the world (receipts less payments)

+ Subsidies less taxes from/to the rest of the world on products and production

= **Gross National Income**

+ Current transfers from the rest of the world (receipts less payments)

= **Gross National Disposable Income**

- Fixed capital consumption

= **Net National Disposable Income**

Therefore net national disposable income differs from GDP at market prices in two main ways. First, it is a net measure so excludes capital consumption. This is the value of capital stock that wears out in a given period (annual). Second, as a national rather than a domestic concept, it includes the net income, current transfer and tax payments between the UK and the rest of the world. Both of these adjustments are considered appropriate for moving GDP towards a measure of welfare.

Investment expenditure that simply replaces capital that wears out cannot be thought of as adding to the income/consumption possibilities of a nation. This can be an important consideration when comparing GDP across countries. Different rates of capital consumption would mean that net national disposable income could differ, even if gross measures are similar. Significant changes over time could also happen within a single country as the structure of industry and types of capital utilised by them shift. For example, at the turn of the new millennium there was substantial interest in the possible consequences of moving to IT assets with much shorter working lives than traditional plant and machinery.

For the purposes of calculating the income available to a population (to consume or invest) it should not matter whether this originates from home or overseas. Income generated by the ownership of foreign assets increases these resources whereas the income paid to foreign owners of domestic assets reduces it. Net income reflects the difference between the two. Added to this are current transfers between the UK and the rest of world – which includes, among others, net payments to supranational organisations like the European Union, international aid and insurance premiums and claims[4] – and net taxes and subsidies with the rest of the world.

Net national disposable income is commonly referred to as 'national income' for short.

To sensibly compare national income over time requires deflation into real measures, and it is here regarding the choice of appropriate deflator, that this article departs from the National Accounts approach and those measures discussed in Chiripanhura (2010). The System of National Accounts (SNA) uses the general GDP deflator, but as Sefton and Weale (1996, 2005) suggest, the consumption deflator is more appropriate if income measures are to be related to current and future consumption possibilities.

For output measures it does not really matter if goods are produced for consumption or for investment, hence both can be valued in their own units. However, when considering welfare, investment goods represent consumption that is forgone today in order to produce more consumption goods in the future. Therefore if income measures are to reflect current and future consumption possibilities it makes sense that all output is valued in consumption units. This follows a similar approach to Weitzman's net domestic product measure (see Oulton 2002). Real income is therefore defined as net national disposable income deflated by the consumption deflator.

Following Metz, Riley and Weale (2004) the difference between real GDP (at market prices) and real national income can be separated into these three effects – namely the capital consumption, net income and deflator effects such that:

GDP market prices / GDP deflator

=

Net national disposable income / consumption deflator

+ Capital consumption / consumption deflator

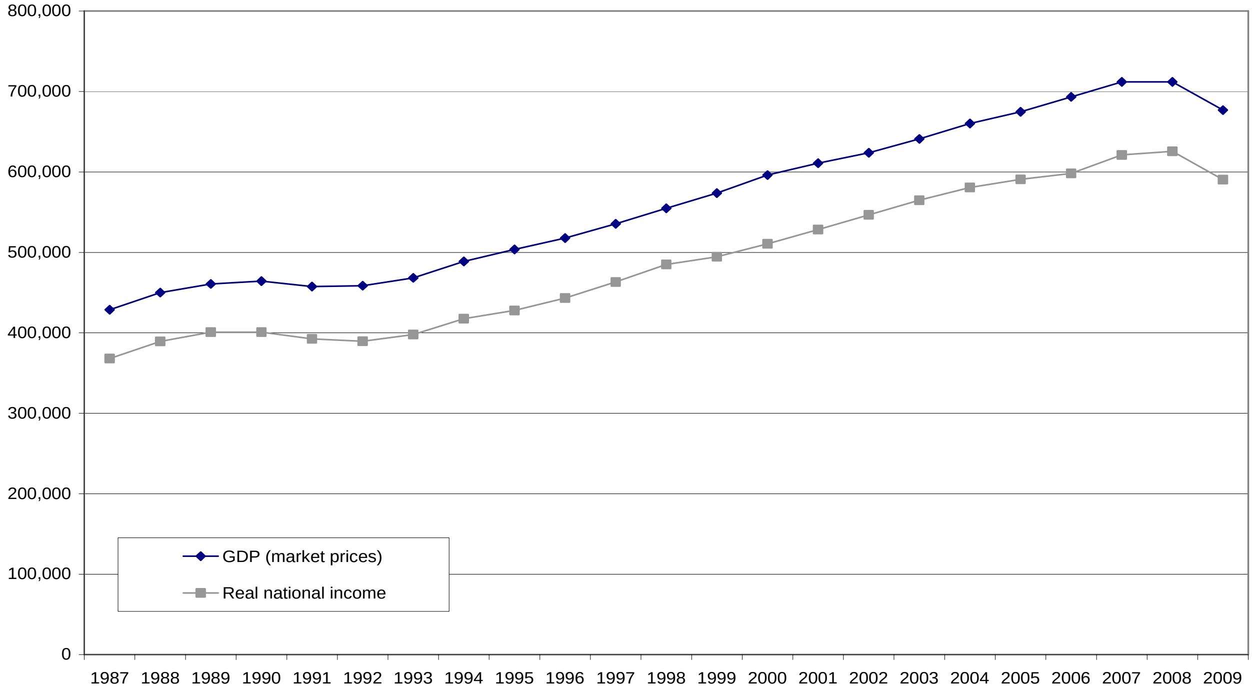
- Net factor and transfer income from overseas / consumption deflator

+ GDP market prices (1/GDP deflator - 1/consumption deflator)

The final term relating to the deflator effect is the adjustment required to move from output valued in terms of production to consumption and has no meaning except in relative terms (that is relative to the base year). Clearly, real GDP and real income can move in different ways if there are changes in the rates of capital consumption or the importance of net income from abroad or because the GDP deflator has moved differently to the consumption deflator.

Figure 1a GDP and real national income – levels

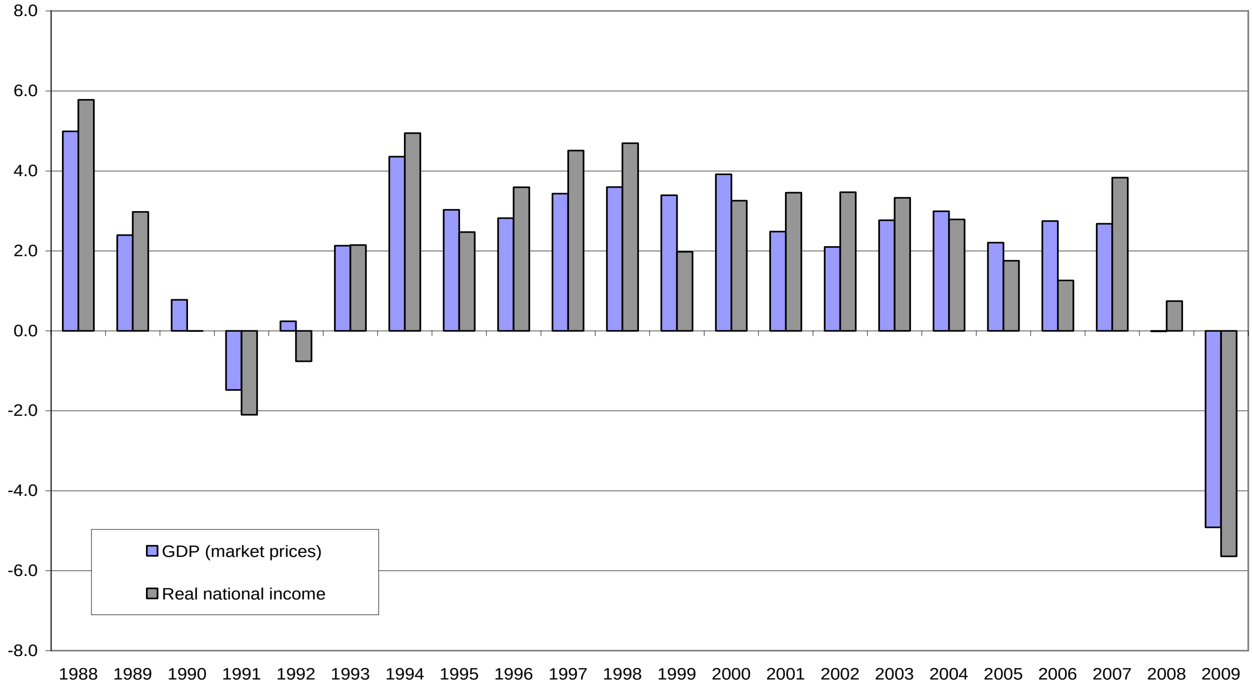
£ millions



Source: ONS Blue Book

Figure 1b GDP and real national income – growth rates

Per cent



Source: ONS Blue Book

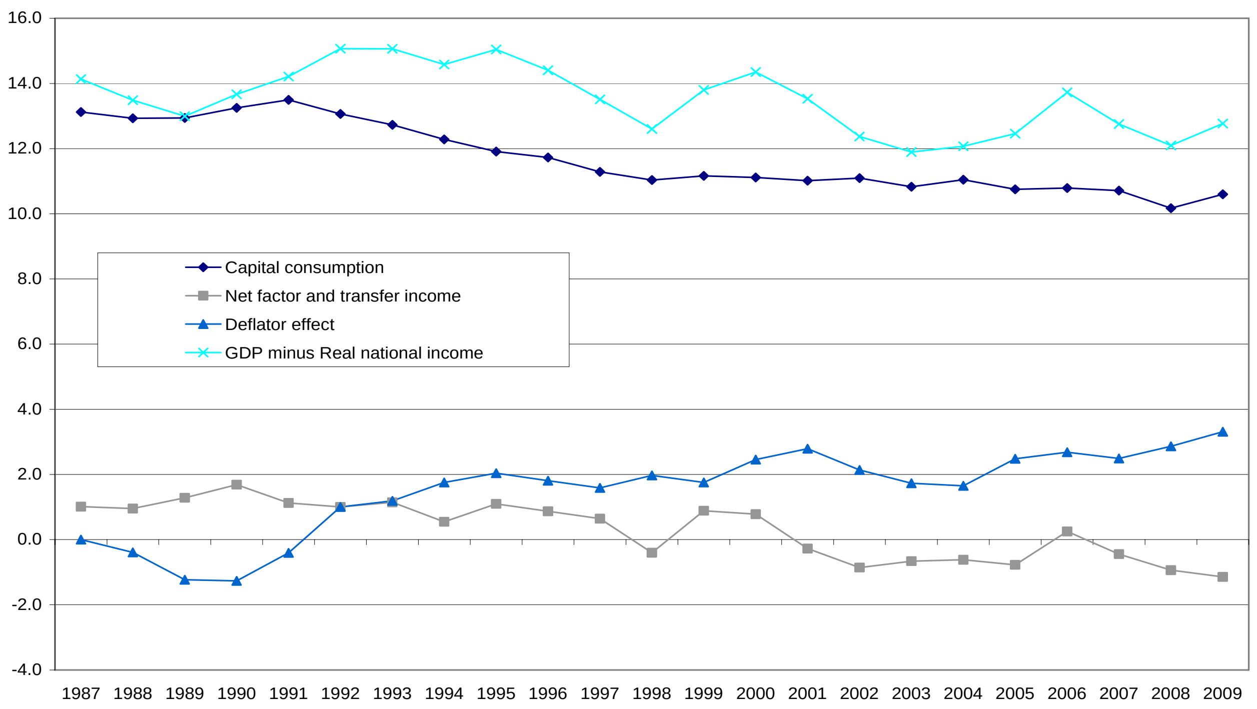
Figure 1a shows the levels of real GDP and real national income between 1987 and 2009, and **Figure 1b** the corresponding annual growth rates. The key points to note are:

- the level of real income lies below that of real GDP
- Growth rates over the period are fairly similar. Real GDP grew at an average rate of 2.1 per cent per year whilst real income grew at 2.2 per cent per year
- Figure 1b shows that real income growth tends to be more cyclical than real GDP growth – growing faster in times of expansion but weaker in times of slower growth or recession. This feature of the data will be discussed further in the course of the article

Figure 2 shows how each of the three effects – capital consumption, net income and transfers from overseas, and deflation – have impacted on national income relative to real GDP at market prices.

Figure 2 **GDP and real national income – differences**

Per cent GDP



Source: ONS Blue Book

The overall difference in levels between the two measures has varied between 12–15 per cent of GDP. Capital consumption has the largest impact in reducing real national income relative to GDP. It is interesting to note that since 1992 capital consumption has fallen as a proportion of GDP, although it edged upwards in the latest year (2009).

Net income and transfers tends to be volatile – a reflection of how this measure is impacted by financial market and exchange rate movements. Up until 2000, a deficit in net income flows reduced real national income relative to real GDP. But over the last decade, this position has reversed, with a surplus in net property income raising real national income relative to GDP.

The deflator effect captures the movement in consumption prices (private and public) relative to the overall GDP deflator. During the late 1980s, consumption prices fell relative to the broad GDP deflator, but since then have risen faster and as a result reduced the level of real national income relative to real GDP. The rest of the article will look at changes in these three elements over the last two decades in greater detail.

Capital consumption

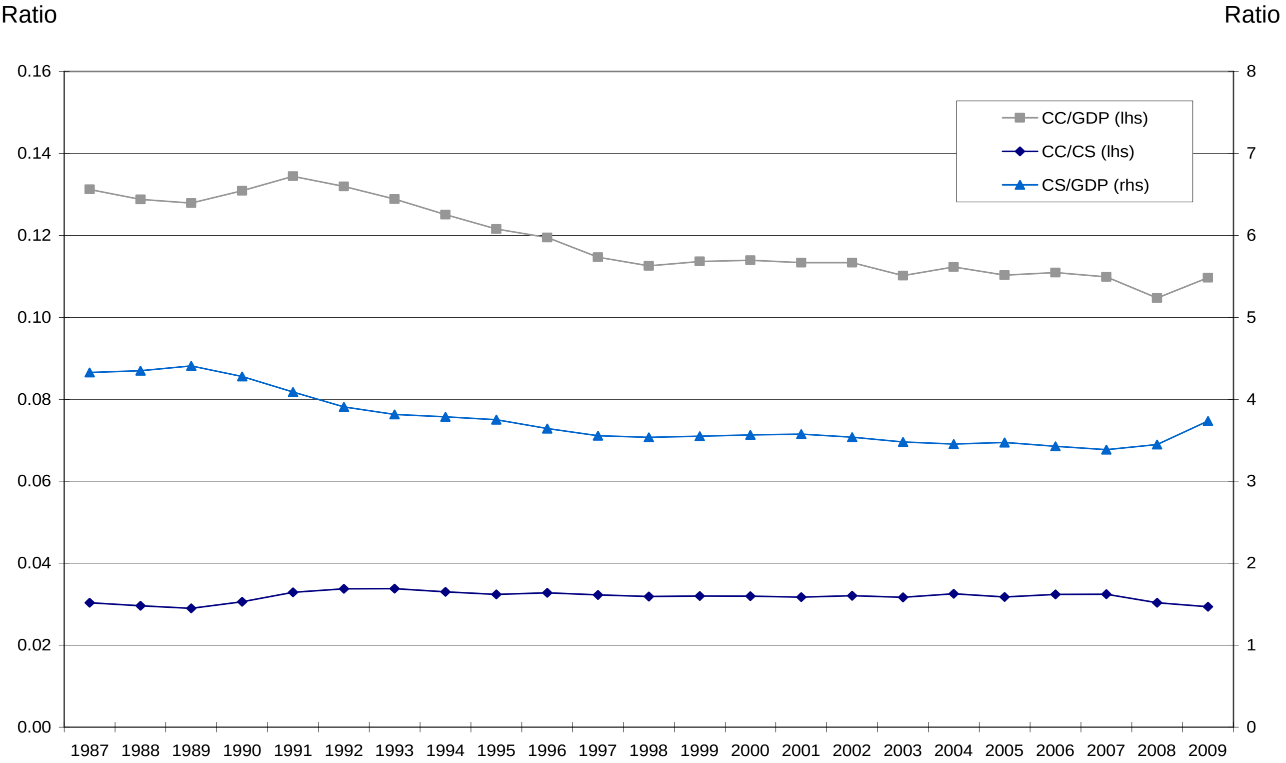
Figure 2 clearly shows that since the late 1980s capital consumption has trended downwards relative to GDP with the exception of the latest year in 2009. The UK now has one of the lowest ratios of capital consumption to GDP in the OECD. If this ratio can be split into two parts such that

Capital consumption / GDP = Capital consumption / Capital stock * Capital stock / GDP

then the fall is occurring because:

- capital consumption as a share of total capital stock is falling – that is the existing capital stock is wearing out less quickly
- the capital stock is declining relative to GDP; or
- a combination of the two

Figure 3 Capital consumption rates



Source: ONS Blue Book and Capital stocks, capital consumption and non–financial balance sheets

Figure 3 shows that the second of these explanations is the most consistent with the data. The ratio of capital consumption to the capital stock has been fairly constant since 1987 but capital stocks have tended to fall relative to GDP since the early 1990s recession. This suggests that UK output has been becoming gradually less capital intensive.

Figures 4a and **4b** provide a more detailed breakdown of capital consumption rates by asset and by sector respectively[5]. In terms of assets the main driver of the downward trend has been 'other machinery and equipment' which, as a ratio to GDP, fell from 0.06 in 1993 to around 0.03 in 2007. This ratio has picked up slightly in 2008 and 2009 due to

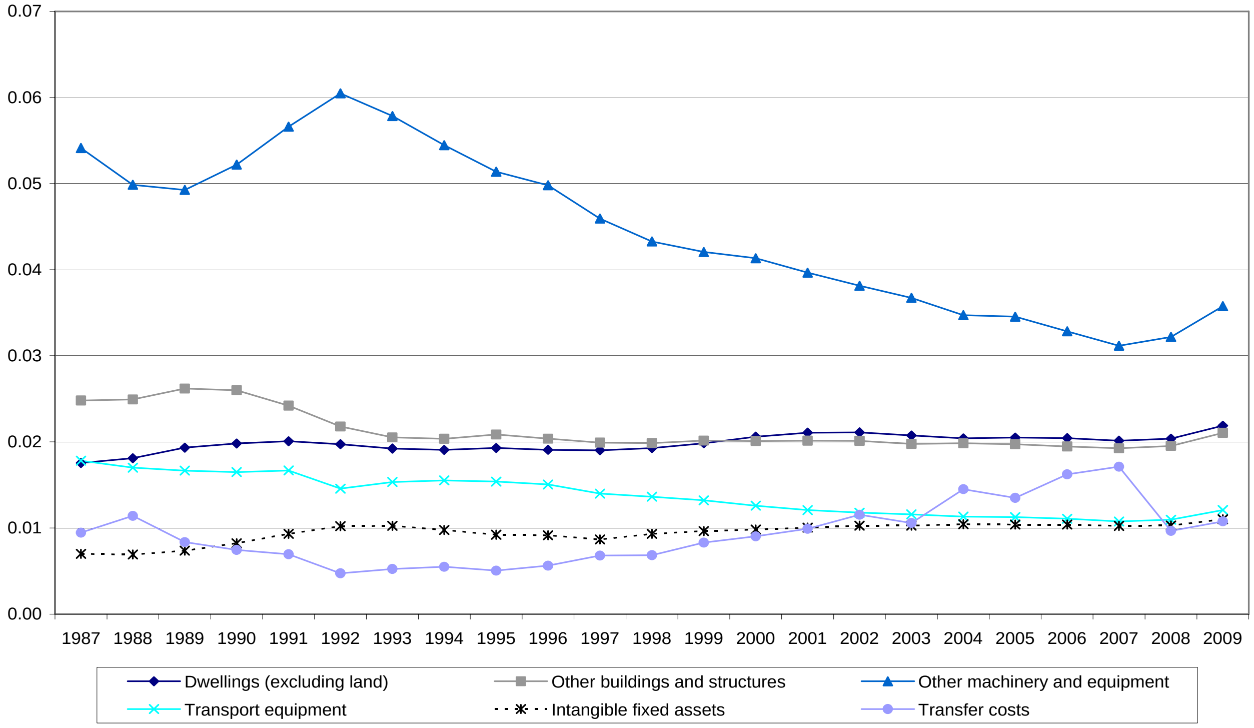
- premature capital scrapping by firms looking to reduce capacity in the recession and increased rates of company liquidations
- a large and sharp fall in GDP due to the financial crisis and recession

but this has not dramatically reversed the longer–term trend.

Most of the other components of capital consumption have broadly moved in line with GDP itself. An interesting exception is the component referred to as transfer costs which relates to the costs associated with the transfer of ownership of non–produced assets[6] (such as land and dwellings). Since 1992 this part of capital consumption has risen faster than GDP but fell back substantially since 2008 – clearly reflecting the general pattern in property prices and the number of property transactions over this period.

Figure 4a Capital consumption rates – by asset

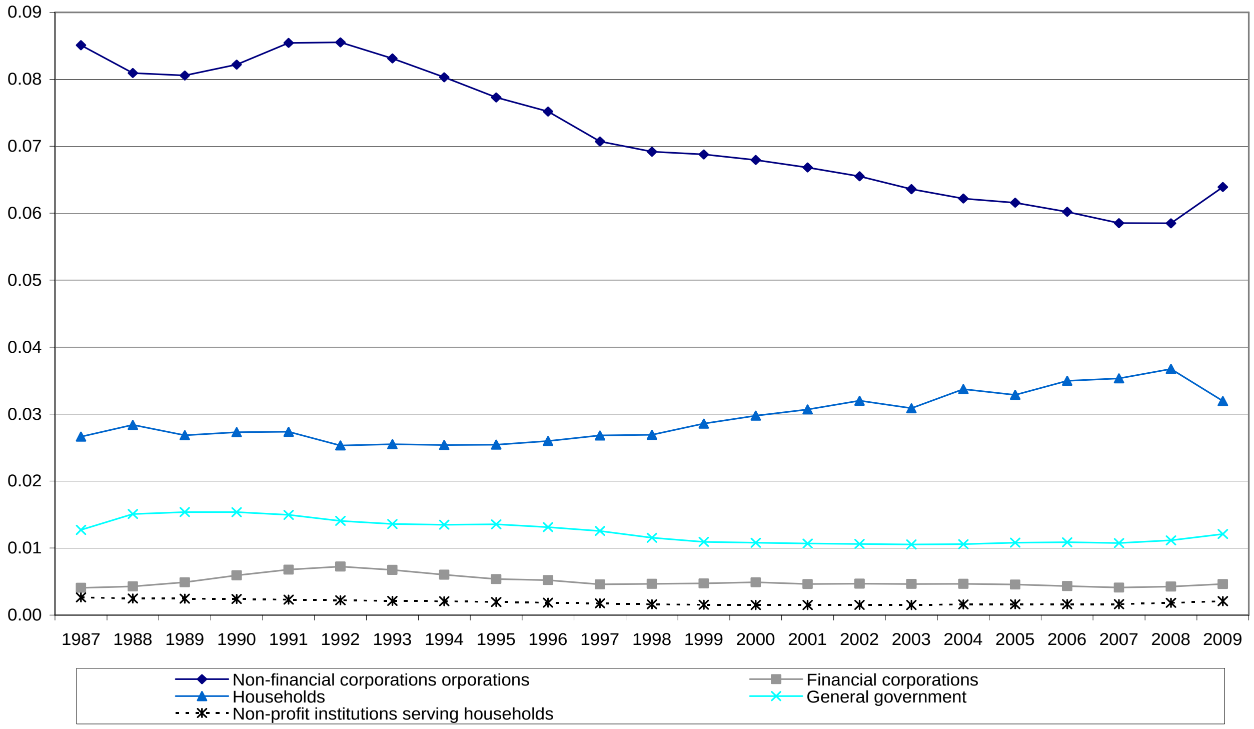
Ratio to GDP



Source: ONS Blue Book and Capital stocks, capital consumption and non–financial balance sheets

Figure 4b Capital consumption rates – by sector

Ratio to GDP



Source: ONS Blue Book and Capital stocks, capital consumption and non–financial balance sheets

These developments have also been reflected in the sector data. The falling capital consumption to GDP ratio in the other machinery and equipment segment is clearly concentrated in the non–financial corporations sector. And the corresponding movements in transfer costs have been strongly reflected in the capital consumption of the household sector.

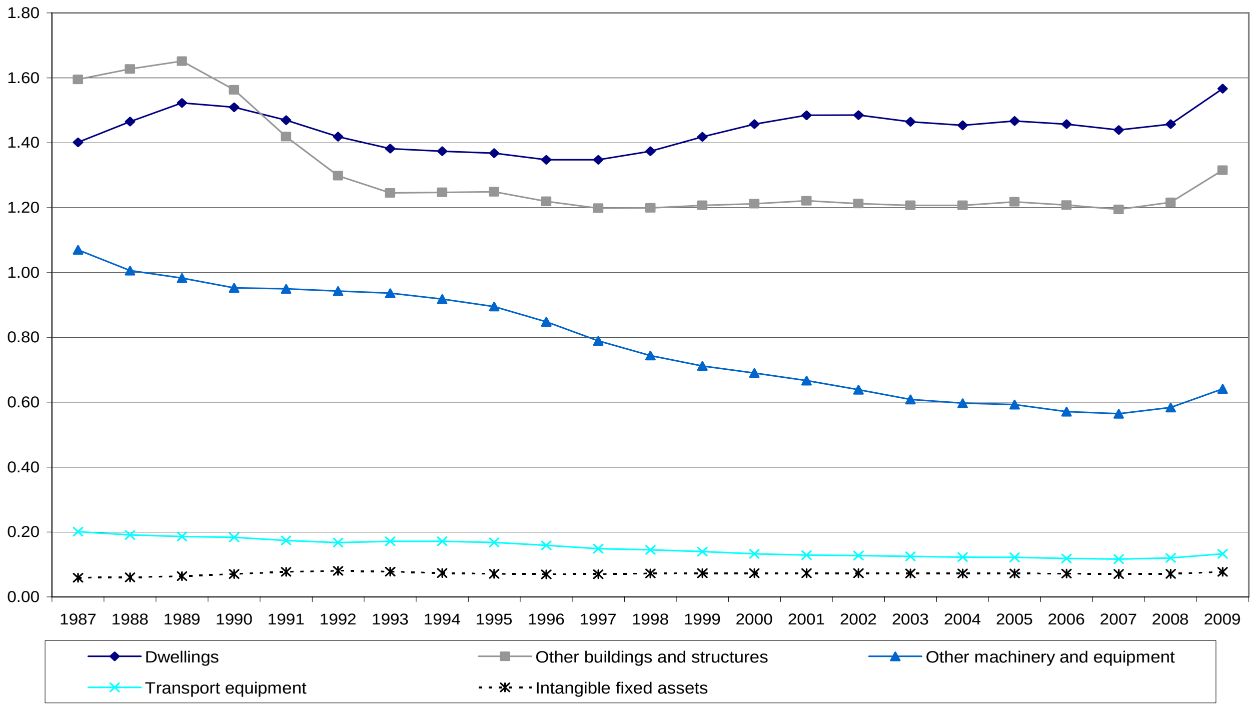
Figures 5a and **5b** show gross capital stocks and gross fixed capital formation (GFCF/investment) as a ratio to GDP for these broad asset types.

In terms of capital stocks, the largest components are dwellings and other buildings and structures. These are long–lived assets which depreciate slowly, so these large stocks reflect a build up in investment over many decades. As a result the stocks do not change much from year to year, which explains why following the sharp fall in GDP during the recent recession, the ratio of capital stock to GDP increased by a noticeable degree.

The strong decline in other machinery and equipment capital stock is also very evident in Figure 5a, from over 100 per cent of GDP to around 60 per cent of GDP over the last two decades. Such a long and protracted fall suggests important structural factors have been at play in the composition of UK investment and output.

Figure 5a **Gross capital stocks**

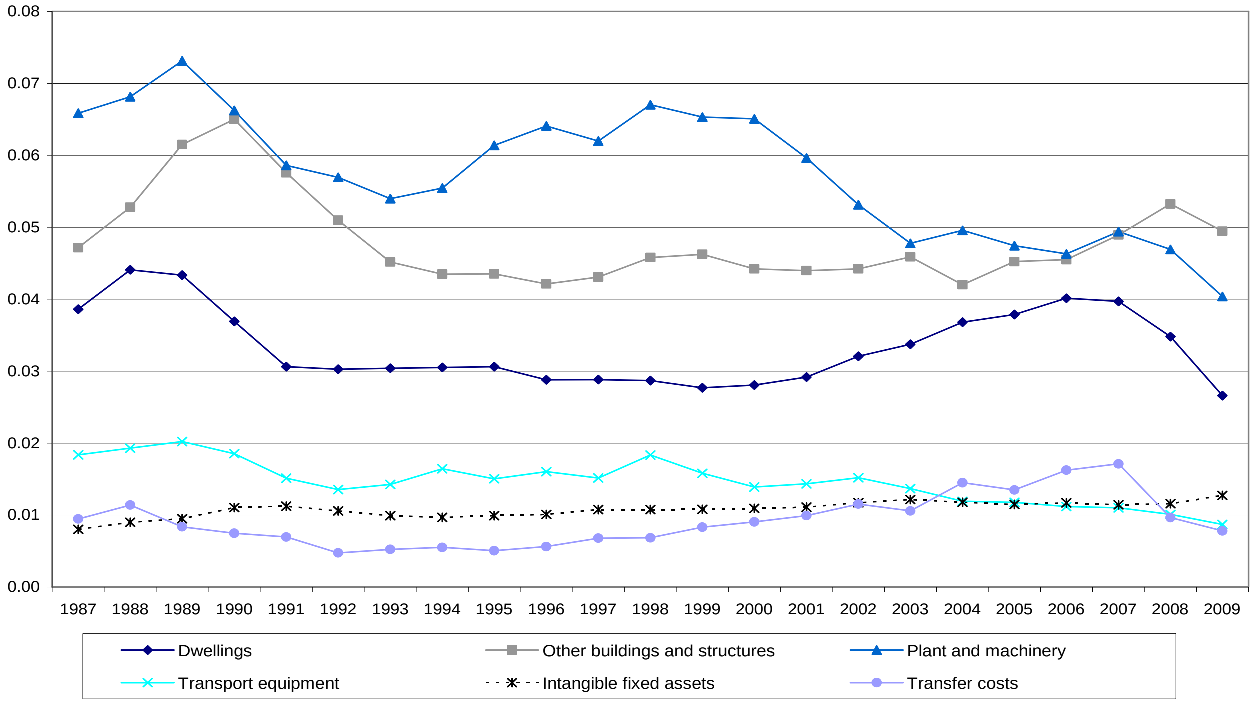
Ratio to GDP



Source: ONS Blue Book and Capital stocks, capital consumption and non–financial balance sheets

Figure 5b **Gross fixed capital formation**

Ratio to GDP



Source: ONS Blue Book and Capital stocks, capital consumption and non–financial balance sheets

Gross capital stocks reflect the accumulation of net investments in each asset (GFCF minus capital consumption). GFCF in each of the main asset types are shown in Figure 5b, these tend to be more volatile/cyclical than the corresponding stocks data. Dwellings, other buildings and structures and transfer costs have followed the same movements as UK commercial and residential property markets – particularly the sharp rise since 2000 and falls in 2008 and 2009. On the other hand, and in line with the corresponding movements in stocks, plant and machinery GFCF has exhibited a long decline as a share of GDP.

The evidence from Figures 3 to 5 suggests that capital consumption in the UK has fallen relative to GDP because of a long run fall in the stock of other machinery and equipment, which in turn has been driven by a protracted fall in plant and machinery investment in the non–financial corporations sector. As suggested already, the duration and the extent of this shift tends to point to structural factors in the makeup of UK investment and output over the last two decades.

This issue was highlighted in Chamberlin (2008a) which showed how a declining share of investment in GDP by the private non–financial corporations (PNFC) sector had gone hand–in–hand with an increase in cash holdings by the sector. That article pointed to two factors which may be accounting for this relative fall in investment spending.

The first was a longer–term fall in the price of investment goods relative to the overall GDP deflator. This means that the fall in the ratio of GFCF to GDP is more pronounced in nominal than in real terms. If investment goods were quality–adjusted, like many of the higher–technology parts of the consumer prices index (CPI), this fall would be even less apparent in real terms. Therefore, due to falling relative prices and quality improvements in capital goods it is plausible that firms require less nominal capital in order to produce their desired output levels. These issues will be discussed further in the section on deflator effects.

Second, UK output has strongly shifted to the less capital intensive services sector where traditional plant and machinery investment is relatively small. As a result, the falling share of investment in GDP is a natural outcome of structural changes in the UK economy away from production towards services. But this might in itself reflect issues in measuring the capital stocks of the services sector which consists of relatively more intangible and relatively less tangible assets than the production sector. The significance of intangible assets has grown in the UK economy, not just because of the move away from manufacturing towards services, but also due to the increasing incidence of new information and communication technologies (ICT) in many areas of economic activity.

Computer software and hardware has already been capitalised in the National Accounts, and the new SNA plans to introduce R&D as a capital item although provisionally as a satellite account. However, Giorgio Marrano and Haskell (2007) argue that the National Accounts definition of investment is still too narrow and ignores many types of firm spending that has asset properties. These include a wider definition of R&D to include design, and spending related to the development of brands, human capital of workforces and organisational structure and management. Taking these into account would, in 2007, double the share of GFCF in GDP, and much of this would be in the services sector.

The measurement of capital consumption is already a tricky issue for statisticians. Judgements must be made concerning the average life lengths of different assets and their rates of decay (for example straight line or exponential depreciation). It also requires an accurate measure of the capital stock which requires estimation, usually through a perpetual inventory model (PIM)[7]. These difficulties mean that gross measures are often preferred to net measures of output. Extending the scope of the capital stock from tangible to intangible assets would be even more challenging still, especially as many new ICT investments are relatively short–lived due to rapid technological advancements leading to an increased rate of obsolescence.

If though the current National Accounts figures on capital consumption are taken as they currently are then what do they say about UK welfare? Naturally, a decline in investment would lower gross measures of output such as GDP, but if this in turn feeds through to a lower capital stock and less capital consumption then it would be offset in net figures. As a result, net national income and other measures would appear relatively stronger compared to gross output measures. This is shown in Figure 2, where the level difference between real GDP and real national income accounted for by capital consumption has been seen to fall.

Figure 1b also shows that real national income tends to fall faster than real GDP in recessions (for example 1990–92 and 2009). This may be partly caused by increased rates of capital consumption in downturns due to company liquidations and premature capital scrapping – acting to lower net income compared to gross output measures.

Net income and transfers from abroad

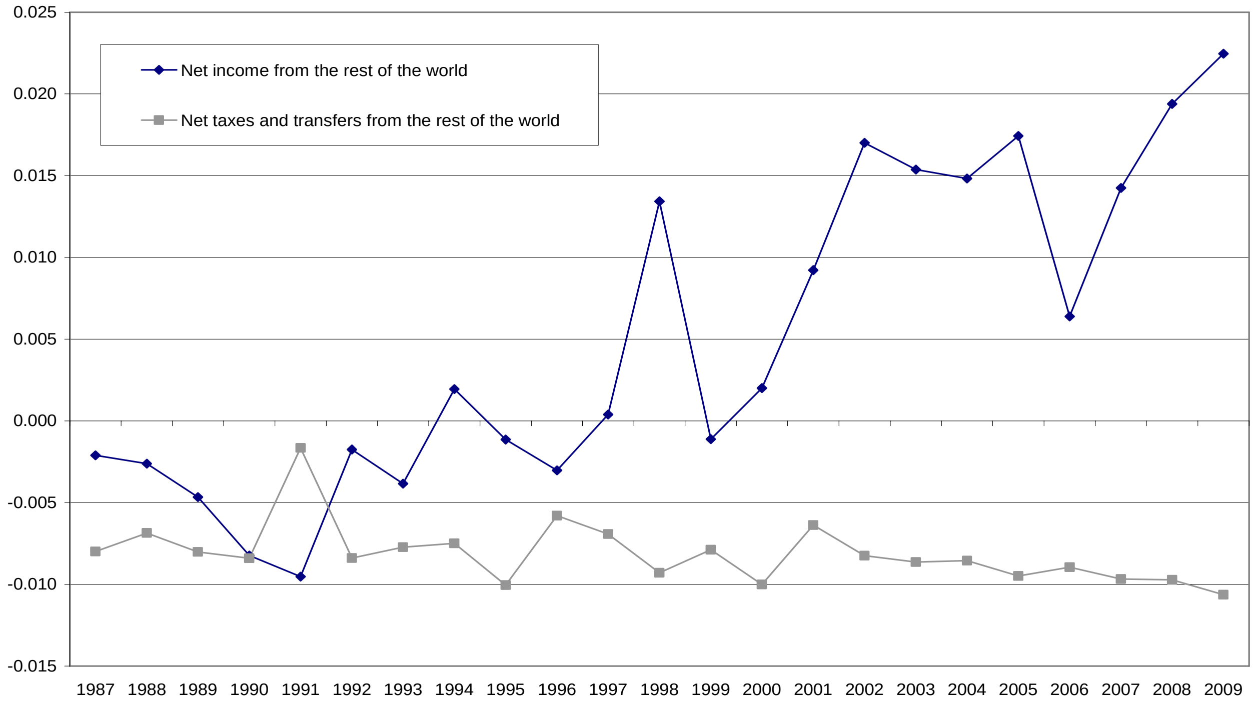
For income measures to have welfare significance it makes obvious sense to use national rather than domestic measures. For example, suppose a country were to borrow from overseas to invest in its own capital stock. The flow of goods and services generated by the larger capital stock would add to GDP but the interest payments on the overseas loans would not be deducted. Therefore it would be possible to increase GDP by simply borrowing from overseas. It could also be possible that the value of the extra goods and services produced by the newly installed capital is less than the cost of servicing the loan that funded it. National measures though would however offset the increase in domestic production against the costs of servicing the foreign loan and would hence provide a more realistic measure of income for welfare purposes. This section looks more closely at net income and transfers between the UK and the rest of the world as reported in the Balance of Payments.

As **Figure 6** shows, for the past decade net income flows have generally been positive, meaning that the UK is earning more income from its ownership of overseas assets than it is paying foreigners for their ownership of UK assets. In 2009 this positive net position raised national income by two per cent relative to GDP. Figure 6 also shows the UK's net position in transfers and taxes and here the deficit is seen to be both longstanding and fairly constant as a proportion of GDP. As a relatively rich nation the UK is a net–giver of foreign aid and more significantly makes positive net contributions to supranational organisations such as the European Union (EU) and

United Nations. Payments such as the foreign aid budget and EU contributions have historically been linked to the level of GDP.

Figure 6 Net factor and transfer income

Ratio to GDP



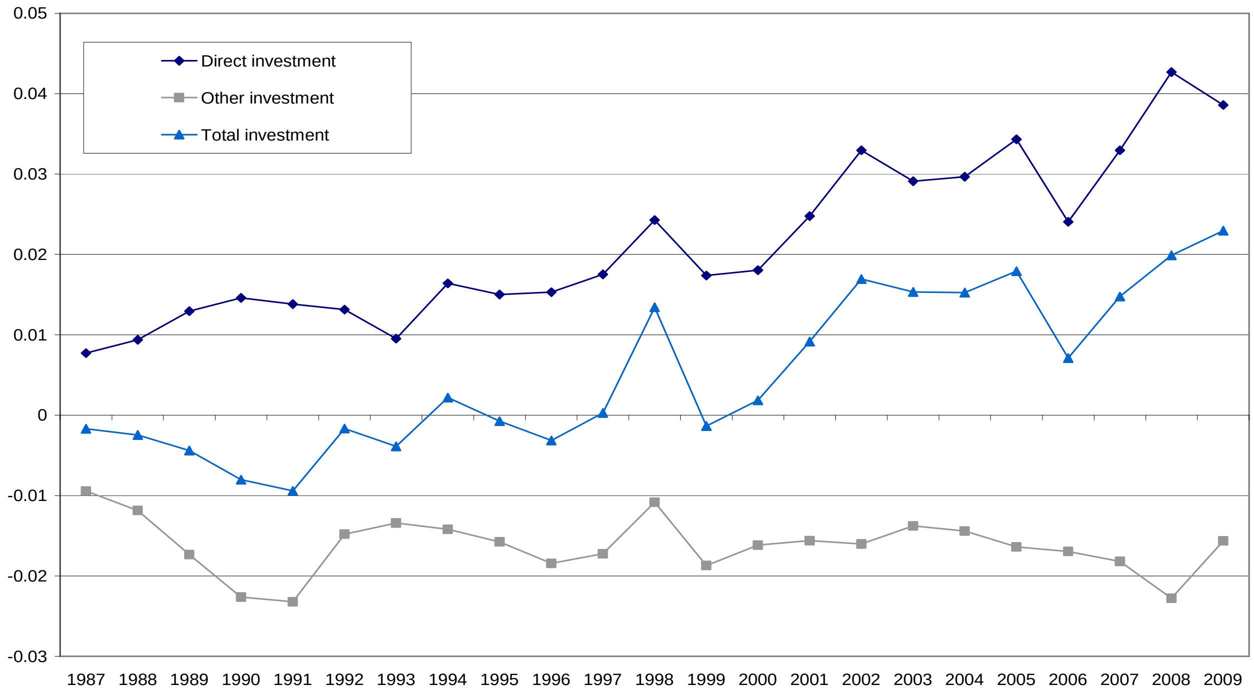
Source: ONS Blue Book and Pink Book

Figure 7a shows that whilst net income overall is positive for the UK, this is entirely as a result of income earned on foreign direct investment (FDI). This is offset by a net outflow of payments to foreign owners of UK portfolio assets such as equities and interest–bearing assets. The UK's positive net income position is all the more remarkable when looking at its International Investment Position (IIP) in **Figure 7b** – that is the difference between its stock of foreign assets and foreign liabilities (often refereed to as the net asset position). This shows that positive net income is being generated by a negative net asset position. Figure 7b though also shows that despite an overall negative IIP, the UK does crucially run a surplus in FDI assets.

Generating positive investment income from a negative IIP can only be feasible if the UK earns a higher rate of return on its stock of foreign assets that those overseas earn on their stocks of UK assets. This is confirmed in **Figure 8a**. Although the rates of return on UK assets and liabilities have both drifted downwards since the early 1990s in line with global interest rates there is clearly a wedge that opens up in and around 1999. **Figure 8b** gives further indication as to where this advantageous rate of return position is coming from. Whilst rates of return on non–FDI assets and liabilities are similar, the UK is managing to achieve a significantly higher rate of return on its FDI than overseas owners of UK direct investments. This rate of return gap widened in 2008 and 2009 – largely reflecting the lower profitability of overseas financial firms located in the City of London.

Figure 7a Investment income balances

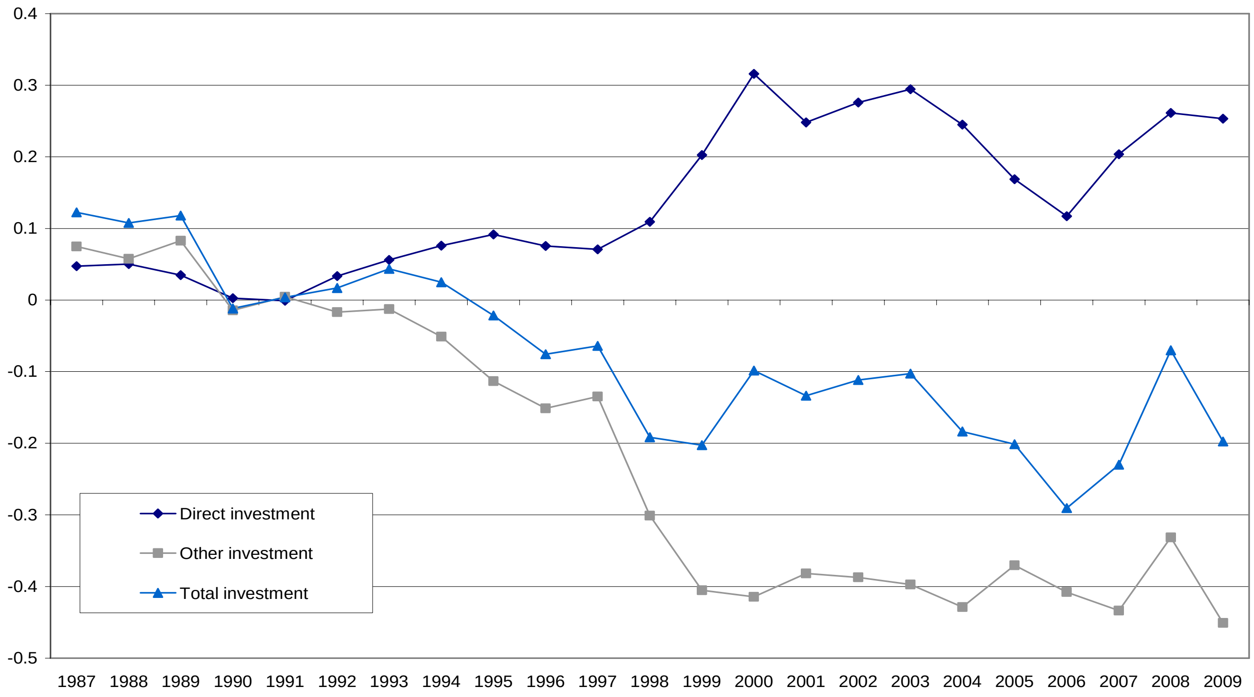
Ratio to GDP



Source: ONS Blue Book and Pink Book

Figure 7b Investment income position (IIP)

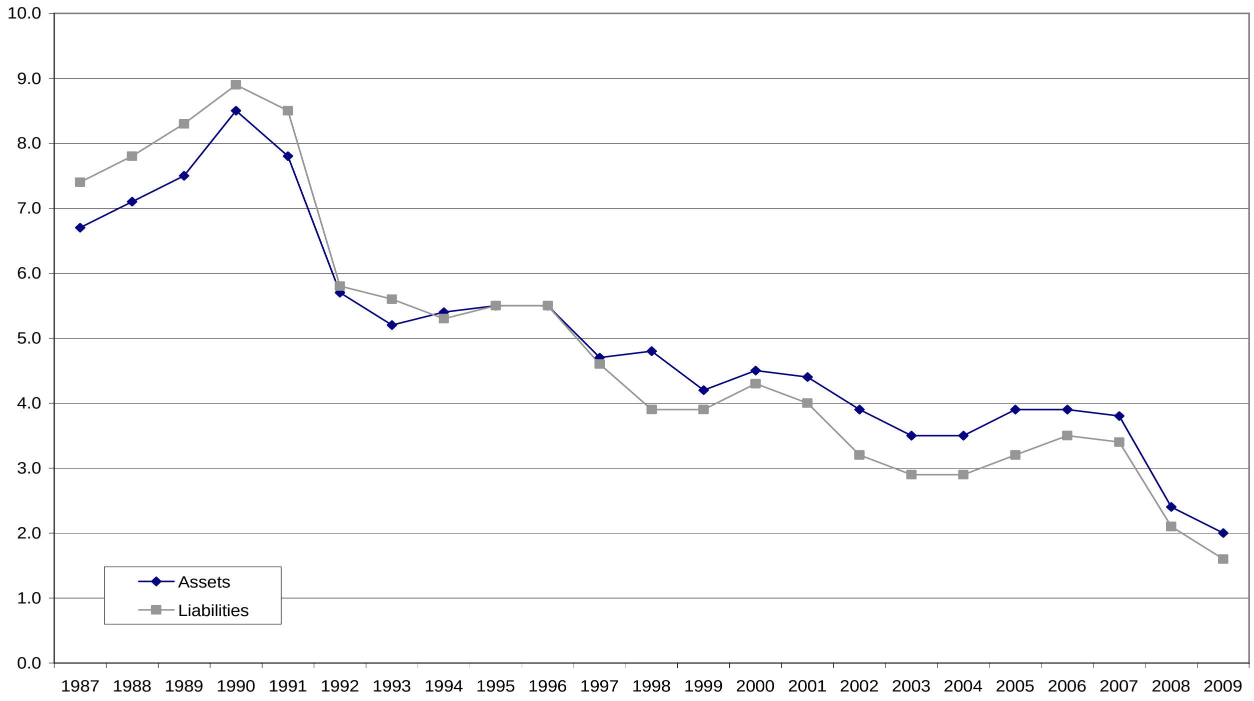
Ratio to GDP



Source: ONS Blue Book and Pink Book

Figure 8a Rate of return on total UK assets and liabilities

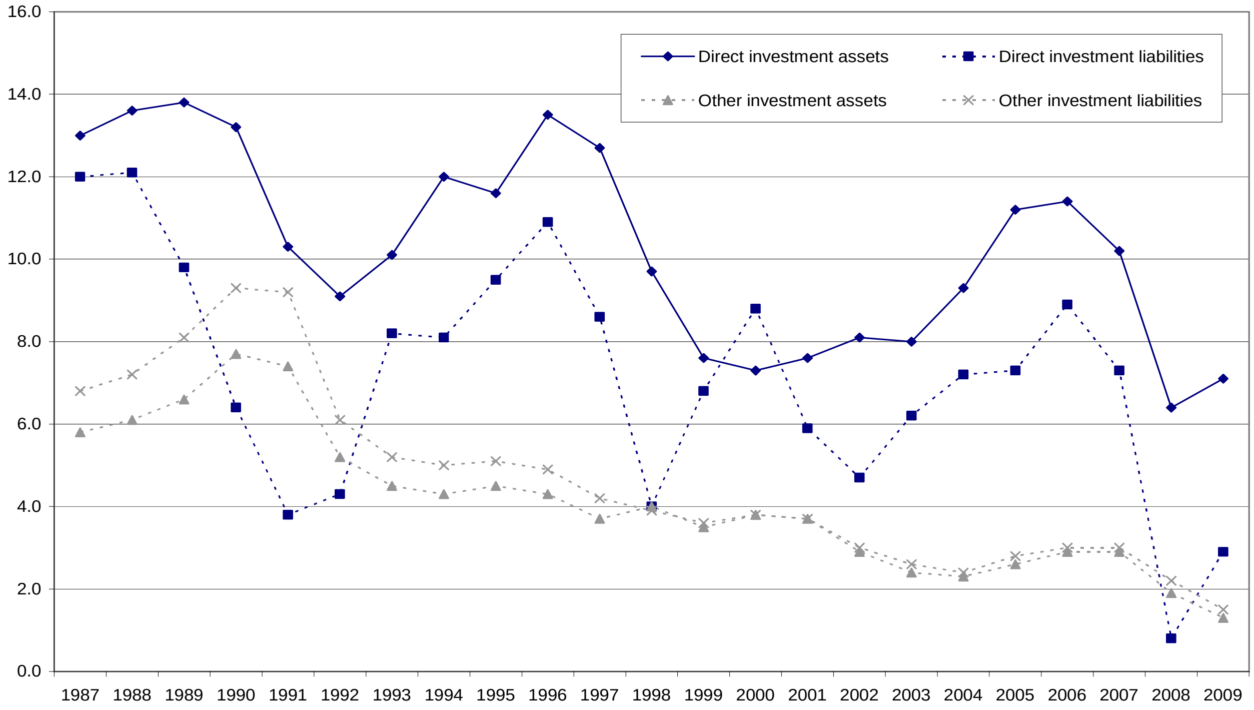
Per cent



Source: ONS Blue Book and Pink Book

Figure 8b Rate of return: by asset

Per cent



Source: ONS Blue Book and Pink Book

Although it is good news for real income measures, the UK's ability to simultaneously run positive net income and negative IIP balances is a curiosity. Nickell (2006) describes the UK as essentially behaving like a successful venture capitalist by borrowing cheaply in short–term interest–bearing assets and lending longer–term in riskier but higher yielding direct investments. Chamberlin (2009) has also commented on this issue. The US has also experienced a similar phenomenon and various explanations for it have been suggested (see Chamberlin 2008c) – some of which may or may not apply to the UK.

The US is in a fairly unique position in that the dollar is the world's foremost reserve currency. Therefore holding dollar–denominated assets, even if the rate of return is low, offers advantages of liquidity (easily convertible) and insurance (low risk premium). Sterling does not have the same status as the US dollar as a global reserve currency, but it is still an important international currency due to the UK’s strong trade links with Europe and the Commonwealth and also London as an important international financial centre.

It is also suggested that high rates of return on US direct investment overseas are achieved by intangibles that often accompany them. These relate to ideas, processes, management structures, ways of doing things and so on that make US investment intrinsically successful- an oft given example is that Disneyland Paris consists of a lot more than the capital structure of a theme park. These intangible flows have been described as 'Dark matter' in that their presence is not actually directly observed but only indirectly on the things they influence (profits). As already mentioned in the course of this article, the UK has a fairly strong presence in the services industries (financial and business) where intangibles are likely to be significant, so it may too be benefiting FDI profitability in this way.

Another reason for a US rate of return advantage in FDI is that direct investors into the US may be willing to accept a lower rate of return in order to gain access to a large market, that then allows them to achieve scale economies on their global production. The same reasoning could apply to FDI into the UK if it is aimed at achieving access to the European Union market.

Rates of return in individual countries may also be affected by national tax rates. As much of world trade and production is controlled by multinational companies in vertical production chains, internal pricing strategies can be used to shift profits to parts of the operation where taxes are lower. If the US and UK are relatively high tax countries, then multinationals may raise the internal prices at which UK subsidiaries buy downstream or lower the price they sell upstream in order to reduce profit margins accordingly.

Finally, it is the case that the UK's positive investment position in FDI has been built up over many decades and much of the UK's successful FDI has been in place for a long time. Evidence tends to suggest that mature FDI tends to earn higher rates of return than new FDI which often faces high start up costs and is more exposed to competition whilst it becomes established. In this respect, the UK's legacy in FDI is almost like an established trust fund.

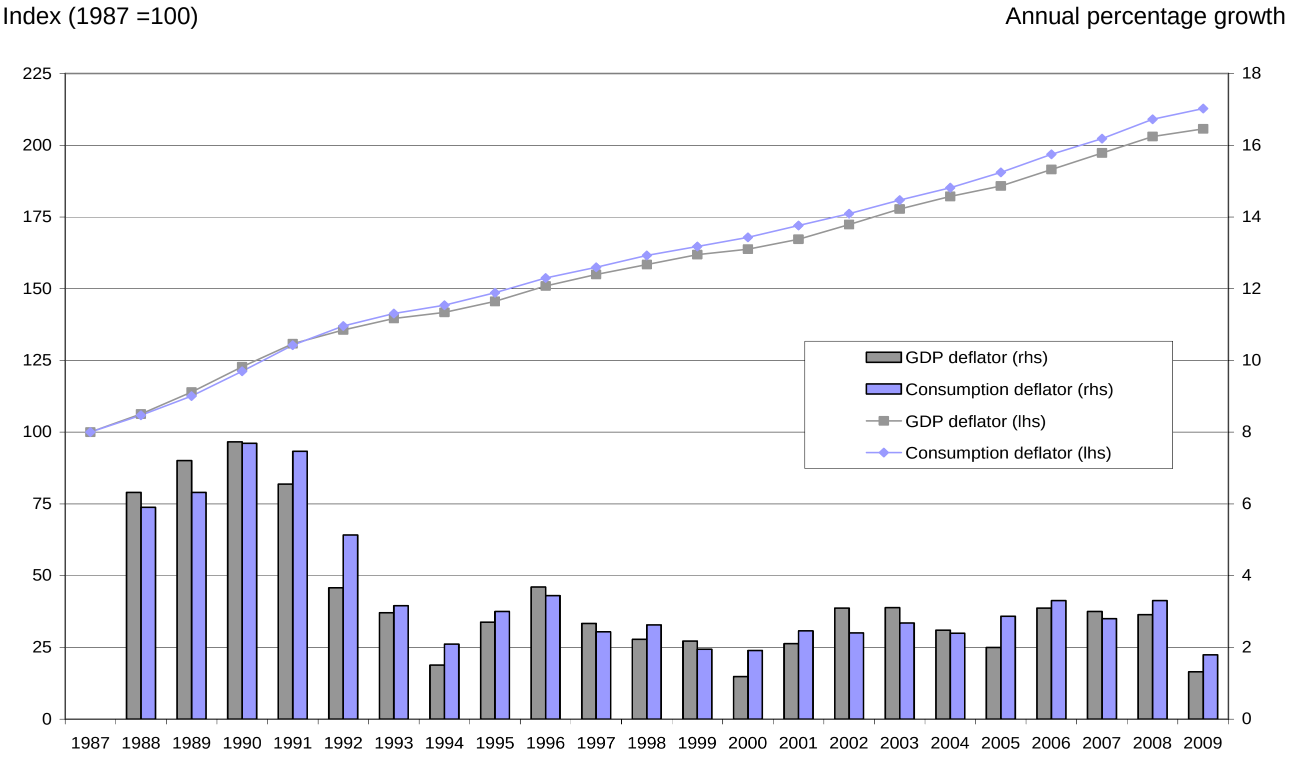
But how sustainable is this position? As Figure 8b shows FDI earnings are fairly cyclical, although FDI payments follow broadly the same pattern and are constantly lower. There are two main threats to the UK's positive income position. First, a rise in global interest rates would increase the rate of return on assets where the UK IIP is significantly negative. Second, the UK has been running a sustained current account deficit that has even persisted through the recession. Continuing to fund this in theory leads to a further deterioration in the IIP and hence an increase in liabilities relative to assets.

Deflator effects

The rationale for deflating with a general consumption deflator rather than the GDP deflator is to produce a real income measure that is related to current and future consumption possibilities. The consumption deflator reflects the prices of both household, non–profit and government consumption on goods and services. This broader measure of consumption deflator than just a personal of household deflator is considered appropriate because government and non–profit consumption is usually undertaken on behalf of the household sector in providing collective and social goods and services. Therefore, the overall level of consumption matters more for welfare than the actual sector that does it. The consumption deflator differs from the GDP deflator in that it does not reflect the prices of investment goods and exports and imports.

Figure 9 shows that the consumption deflator has increased faster than the overall GDP deflator relative to 1987, the impact of which is to reduce the growth of real income relative to real GDP as shown in Figure 2.

Figure 9 **Deflation**



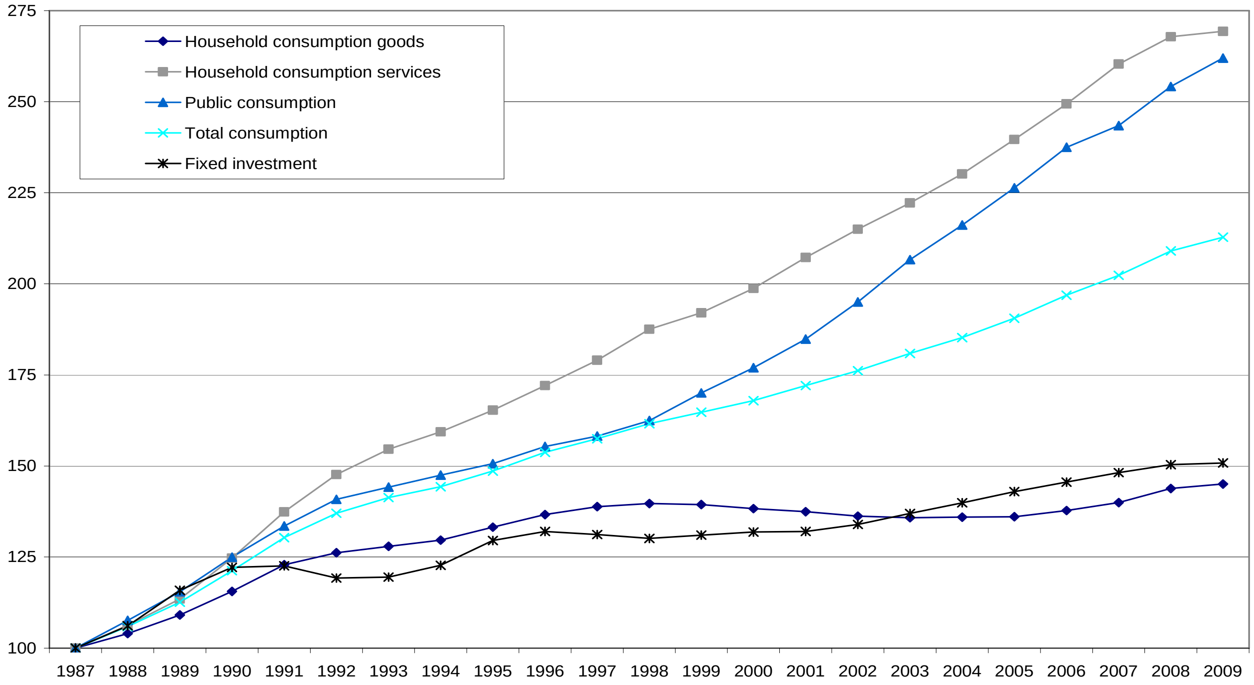
Source: ONS Blue Book

Consumption and investment deflators

Figure 10 shows the overall deflators for consumption and fixed investment and also the deflators for various components of consumption. It is clear that consumption prices since 1987 have risen faster than fixed investment goods prices. In terms of welfare, this would act to reduce real income relative to real GDP. The falling relative price of investment goods implicitly reflects their reduced ability to produce consumption goods and services in the future and thus points to lower growth in future consumption. Another way of thinking about the issue is that a falling relative price of fixed investment goods has the same effect on the user cost of capital as an increase in the depreciation rate. If investment goods are steadily becoming cheaper relative to consumption goods then part of the return to capital is best seen as compensation for the falling price of capital goods- in effect like depreciation and not available for net investment or consumption. Either way it reduces the real (in terms of consumption units) value of future consumption output.

Figure 10 **Consumption and investment deflators**

Index (1987 = 100)



Source: ONS Blue Book and Consumer Trends

Figure 10 shows that the faster increase in consumption prices has been driven by government consumption and by household consumption of services. On the other hand, household consumption goods prices have risen broadly in line with fixed investment goods – where the slower growth has been driven by falling durable goods prices since the mid 1990s reflecting a general fall in the price of global manufactures over the 1990s. This has in part been due to the increasing presence of lower cost emerging market producers (such as China). Technology goods have also become cheaper with significant quality adjustments in the prices index for items like computer hardware and digital cameras. Public consumption, which tends to be concentrated in public services provision, along with household consumption of services have experienced faster price increases. Here, because output is more labour intensive and less–traded the scope for international competition and productivity gains is more limited.

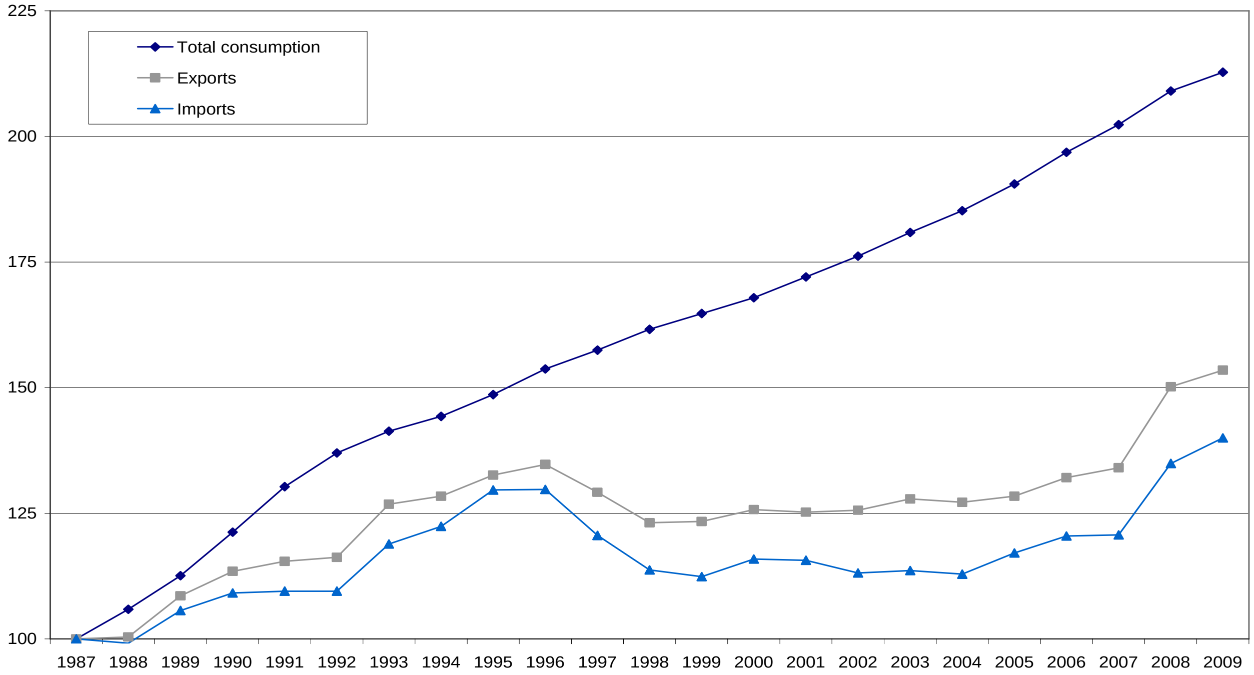
Investment good prices inflation also appears to slow in economic downturns (1990–94 and 2008–09) which would further lower real income measures compared to real GDP measures contributing to the cyclical feature of the data already commented on.

Terms of trade effects

Figure 11 shows that consumption deflator has generally risen faster than the export deflator, which in turn has risen faster than the import deflator. As export prices have risen relative to import prices, it implies that the UK's terms of trade (the ratio of export to import prices) has also improved. Command GDP is a measure that deflates imports by the export deflator, if exports are essentially used to pay for imports then this would give an indication of the command over imports a nation has. Faster growth in export prices than import prices would lead to faster growth in command GDP than in conventional GDP. In looking at command GDP measures for the UK, Chamberlin (2008b) attributes this to the changing composition of UK trade, with exports increasingly reflecting higher value services and more technology intensive goods whilst imports of basic manufactured goods have seen falling prices.

Figure 11 Terms of trade effects

Index (1987 = 100)



Source: ONS Blue Book

The aim of the real income approach in this article is not to estimate the command effect but to relate output measures to current and future consumption possibilities – therefore the terms of trade effect on real income need not be the same as on command GDP.

When the consumption deflator is rising faster than the export deflator then real income will grow less quickly than real GDP. The basic reason is that the lower relative price of exports diminishes current and future consumption possibilities. In terms of real income, increases in import prices only matter to the extent that they pass–through to consumption prices. An increase in the price of imports, which with no other changes would lead to a fall in the GDP deflator but would have no effect on real income. Only if it leads to an increase in the price of consumer goods will real income fall. If the rise in import prices is entirely passed on as an increase in consumption prices then real income will fall whilst real GDP is unchanged.

Conclusions

This article compares growth in UK real GDP with real income – where real income has been calculated to have higher welfare significance by relating to current and future consumption possibilities.

The main finding is that, between 1987 and 2009, real income has grown only marginally faster than real GDP. In this time the composition of UK output has increasingly shifted away from production to services. As production is now less capital intensive than before this has resulted in a downward trend in capital consumption rates raising real income growth relative to real GDP growth. However, at the same time, consumption prices (both public and private) have been increasing faster than the overall GDP deflator – resulting in deflator effects that reduce real income growth relative to real GDP growth. Faster growth in consumption prices also reflects the increasing importance of services consumption in the UK where there is less scope for productivity gains or competition from overseas. These two affects appear to be largely offsetting in that real income and real GDP growth rates since 1987 have been fairly similar. There is also some evidence that real income growth is more cyclical than real GDP growth due to higher rates of capital consumption and lower investment goods price inflation in downturns.

An important final caveat with the real income measures presented here is that each of the three required adjustments to GDP are in themselves difficult to measure. It is widely understood that capital consumption rates are difficult to measure and are usually made with a high degree of judgement. This is easily seen when looking across countries, when for similar assets, there are often different assumptions regarding life–lengths and rates of decay. For these reasons gross measures are often preferred to net measures. Deflation and accurately recording income and investment flows across countries are also tricky issues.

Notes

1. The Human Development Index combines three dimensions: a long and healthy life (life expectancy at birth); access to knowledge (mean years of schooling and expected years of schooling); and a decent standard of living (gross national income per capita).

2. Further information on the Well–being programme at ONS can be found at www.ons.gov.uk/well-being

3. The latest annual Blue Book publication can be found at www.statistics.gov.uk/Statbase/Product.asp?vlnk=1143

4. Current account information can be found in the Pink Book at www.statistics.gov.uk/Statbase/Product.asp?vlnk=1140

5. More detailed data, by asset and by sector, on capital consumption can be found in the Capital stocks, capital consumption and non–financial balance sheets statistical bulletin at www.statistics.gov.uk/Statbase/Product.asp?vlnk=10730. This publication shows slight revisions from the 2010 Blue Book data set.

6. Transfer costs are rather unique in that they are treated as investment and pure capital consumption (that is the investment has no life length and depreciates immediately which also explains why there is no capital stock measure for this asset class).

7. See Dey–Chowdhury (200?) for more information on the Perpetual Inventory Method.

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China and the UK

Changing patterns of international trade and investment

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Summary

China's economic growth over the last two decades has been truly remarkable. Averaging near double–digit percentage growth each year, it is now the second largest economy in the world based on gross domestic product (GDP) and is expected, one day, to overtake the USA and become the largest. China's growth has been predominantly export driven and centred in manufacturing, especially since joining the World Trade Organisation (WTO) in 2001. This article looks at how the rise of China has impacted on the UK's international trade and investment and also how the continuing development of China may affect these in the future.

Introduction

The current account part of the Balance of Payments reflects one nation's transactions with the rest of the world in goods trade, services trade, income flows and current transfers. Since 1992 the UK has run a deficit on its current account averaging around 2 per cent of GDP (**Figure 1**). However, during this period, the UK's current account deficit has varied from 0.1 per cent of GDP in 1997 to 3.4 per cent in 2006. The share of the deficit accounted for by international transactions with China has steadily increased. In 1992 the UK's deficit with China was 0.1 per cent of GDP. By 2009 the deficit had grown to 1.2 per cent, with the size the deficit increasing faster after 1999. Given that the overall UK current account deficit in 2009 was 1.1 per cent of GDP – it shows that once China is excluded the UK's current account position with the rest of the world would actually be in surplus.

The UK's growing current account deficit with China is the result of faster growth in debits (imports and income outflows) than credits (exports and income inflows). Debits with China, as a percentage of all debits, increased from 0.5 per cent in 1992 to 4.3 per cent in 2009, whilst the corresponding share of total credits accounted for by China increased from 0.3 per cent to 1.5 per cent.

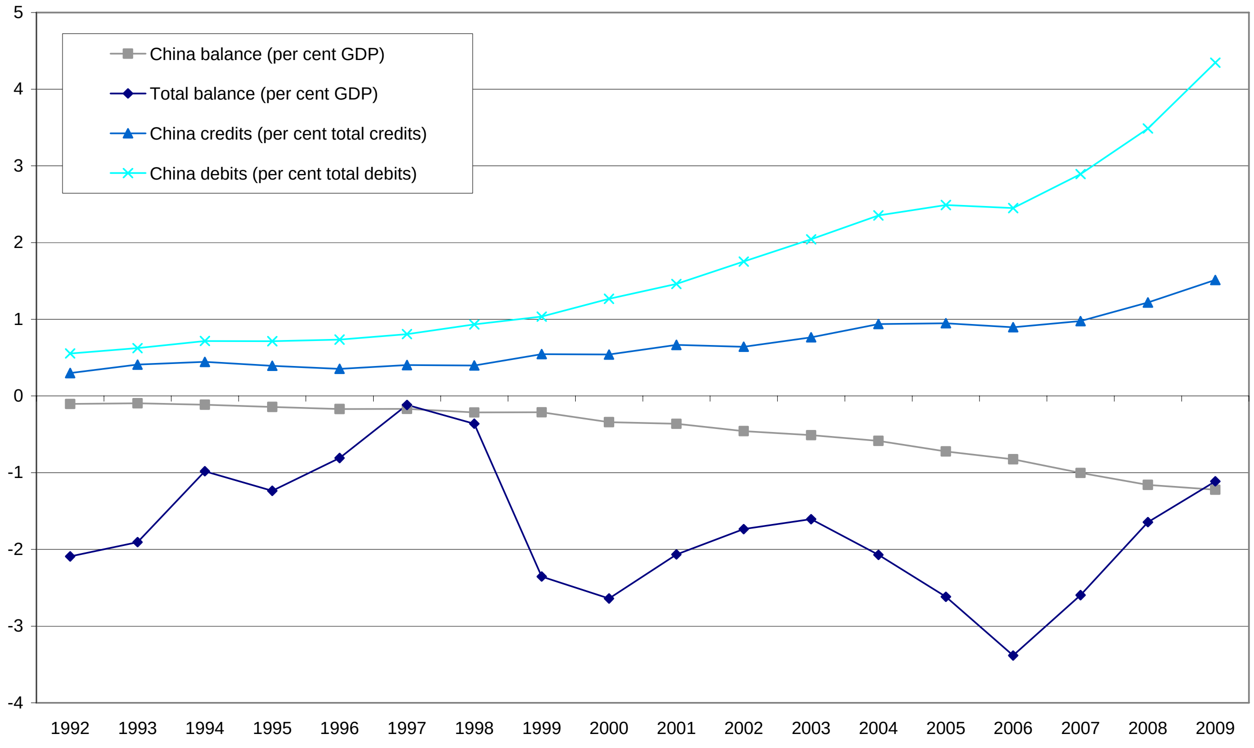
These are interesting figures showing that, despite China's growing importance in the global economy and the UK's Balance of Payments, it still represents a fairly small part of the UK's total trade and income transactions with the rest of the world. Most of the transactions recorded in the UK's Balance of Payments are still with advanced mature economies, particularly within Europe and the USA.

China's main impact on the UK's current account is in the trade in goods balance – particularly as a source of goods imports into the UK. On the other hand, China–UK trade in services and income flows related to the international ownership of financial assets – which are both an important part of the UK's current account due to the high degree of services specialisation in UK output and the role of the City of London as a major international financial sector – are still very small.

The aim of this article is to look at the extent and nature of UK–China trade and investment in more detail, not only recent trends but also how these might change as China continues its remarkable and fast–paced development.

Figure 1 **China and the UK current account**

Per cent



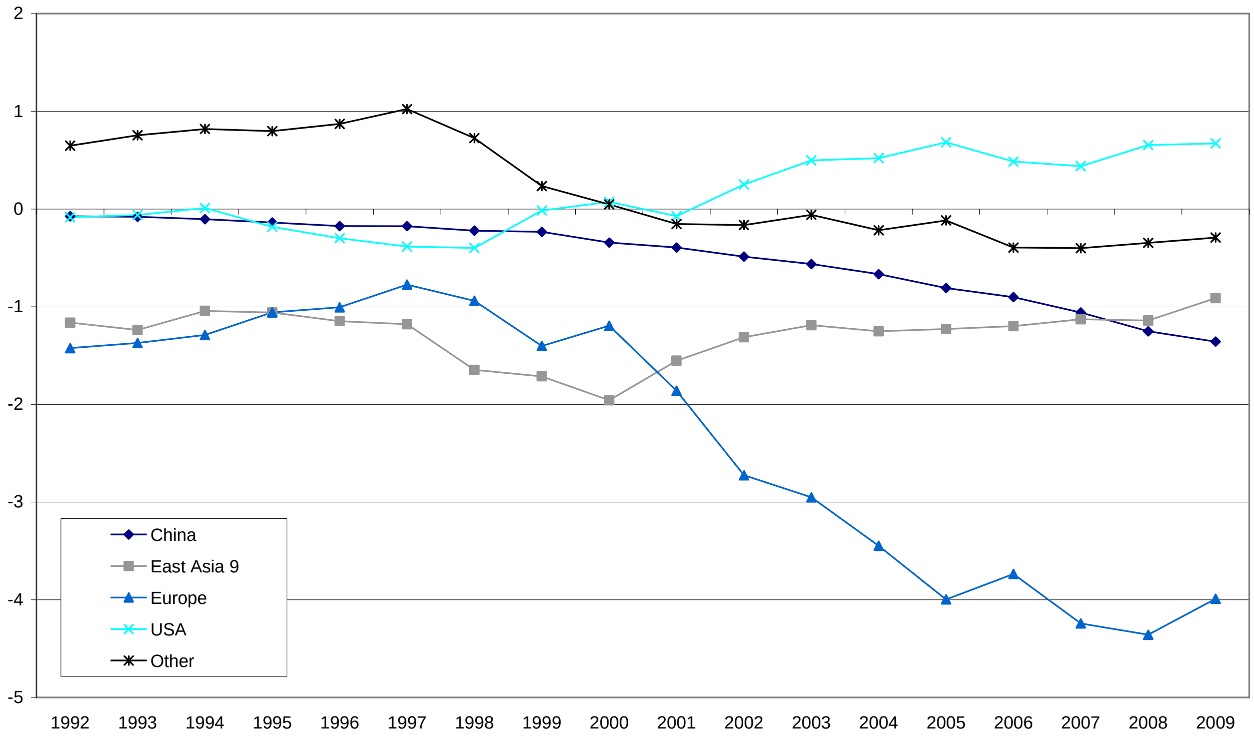
Source: ONS Pink Book

Trade in goods

The UK's deficit with China in the trade in goods has increased from a negligible amount in 1992 to 1.4 per cent of GDP in 2009 (**Figure 2**). The UK now only imports more goods from Germany and the USA than it does from China (**Table 1**). In fact, other than the USA, China is the only non–European country in the top 10 countries by imports (with Hong Kong and Japan just outside the top 10). In 1992 Chinese goods represented about 0.2 per cent of all UK goods imports, by 2009 this share had risen to 7.9 per cent (just below the USA which accounts for 8.0 per cent, see **Figure 3a**).

Figure 2 **UK trade in goods balances, 1992–2009**

Per cent GDP



Source: ONS Pink Book

East Asia 9 – Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand

China has also been a growing market for goods exports but it is still a relatively small one, with most of the UK's goods exports heading to the USA and Europe (**Figure 3b**). China is in the UK's top 10 of countries by goods exports, but accounts for just 2.2 per cent of the total.

It should be noted though, that despite China's growing prominence in goods trade, the UK's goods trade is still predominantly with Europe where the trade in goods deficit was 4.0 per cent of GDP in 2009. Specifically, the group of EU 8 countries, despite seeing their shares of total goods imports and exports fall as a result of the rise in China and Eastern Europe – still accounted for 42.5 per cent of goods imports and 45.7 per cent of goods exports.

Table 1 Trade in goods: country rankings

Imports							**Exports**						
	2009	2008	2007	2006	2005	2004		2009	2008	2007	2006	2005	2004
Germany	1	1	1	1	1	1	USA	1	1	1	1	1	1
USA	2	2	2	3	3	2	Germany	2	2	2	3	2	2
China	**3**	**5**	**5**	**6**	**6**	**7**	Netherlands	3	3	5	5	5	5
Netherlands	4	3	3	4	4	4	France	4	5	3	2	3	3
France	5	4	4	2	2	3	Ireland	5	4	4	4	4	4
Norway	6	6	7	7	8	10	Belgium	6	6	6	6	6	6
Belgium	7	7	6	5	5	5	Spain	7	7	7	7	7	7
Ireland	8	9	9	10	10	8	Italy	8	8	8	8	8	8
Italy	9	8	8	9	7	6	**China**	**9**	**10**	**11**	**15**	**15**	**16**
Spain	10	10	10	8	9	9	Sweden	10	9	9	9	11	9
Hong Kong	11	12	12	12	12	12	Switzerland	11	11	12	10	10	12
Japan	12	11	11	11	11	11	Hong Kong	12	16	16	16	14	14
Sweden	13	14	14	14	13	13	United Arab Emirates	13	15	17	13	9	13
Switzerland	14	16	16	17	18	16	Japan	14	14	10	11	12	10
Poland	15	20	20	18	25	29	Canada	15	17	13	12	13	11
Russia	16	13	15	15	14	15	Singapore	16	21	20	22	21	22
Turkey	17	17	17	19	20	20	Australia	17	18	19	19	17	15
India	18	19	19	23	22	25	India	18	13	14	18	16	17
Canada	19	15	13	16	16	14	Norway	19	20	18	24	19	19
Denmark	20	22	21	13	15	18	Poland	20	19	21	17	26	28

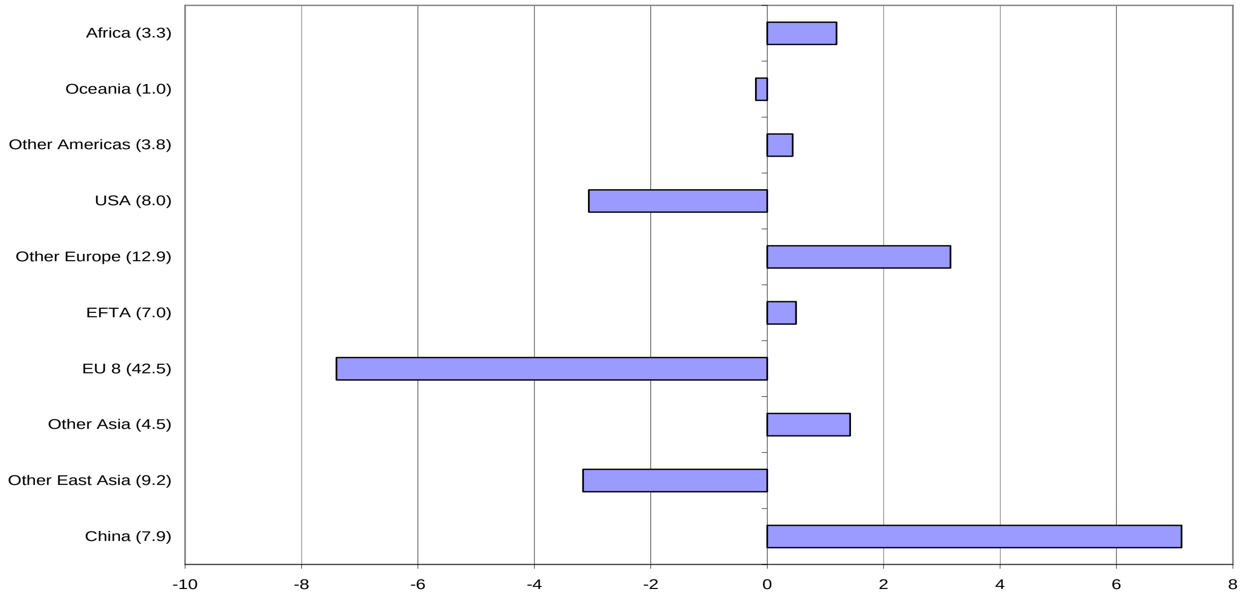
Source: ONS Pink Book

China's surge in goods exports took off in 1992 with the 'open door' as China’s exports grew at 17 per cent per annum on average during that decade. Since 2001 when it acceded to the World Trade Organisation, China quickly became the world’s largest exporter accounting for nearly 10 per cent of global exports by 2009, overtaking Germany, the US and Japan.

The sector in which Chinese exports are most notable are consistent with its comparative advantage in labour–intensive products, such as clothing and textiles (**Table 2**). In fact, it was held back by the Multi–Fibre Agreement that had imposed a global quota system on exports of clothing and textiles. When it ended in January 2005, it freed up Chinese exports to such an extent that safeguards were imposed by the Europeans and Americans.

Figure 3a Changing origin of goods imports*, 1992–2009

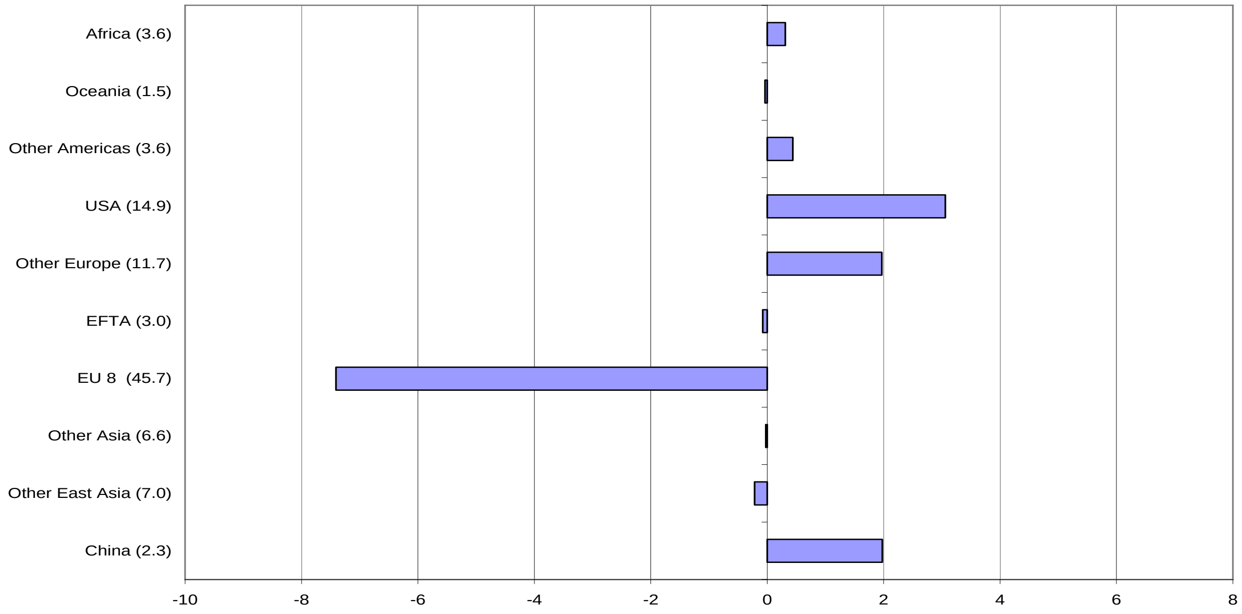
Percentage points



Source: ONS Pink Book

Figure 3b Changing origin of goods exports*, 1992–2009

Percentage points



Source: ONS Pink Book

* Change in percentage shares. Figures in brackets are shares in 2009.

Other East Asia are the East Asian 9 – Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand

EU 8 – Belgium, France, Germany, Ireland, Italy, Luxembourg, Netherlands and Spain

Table 2 Goods imports from China by SITC classification

Standard Industrial Trade Classification (SITC)	Value in 2010 (£ millions)	Share of UK total in 2010 (%)	Share of UK total in 1999 (%)	Change in shares 1999-2010 (%)
84: Articles of apparel and clothing accessories	3,818	25.5	5.9	19.7
89: Miscellaneous manufactured articles	3,593	18.4	6.3	12.2
75: Office machines and ADP machines	3,218	23.8	1.6	22.2
76: Telecoms and sound recording and reproducing apparatus	2,815	16.1	1.9	14.2
77: Elementary machinery, apparatus and appliances	2,318	14.5	2.5	11.9
894: Baby carriages, toys, games and sporting goods	1,945	46.2	19.4	26.8
82: Furniture and parts, bedding, mattresses etc	1,612	33.6	5.7	27.9
69: Manufactures of metal	1,377	19.6	4.8	14.8
85: Footwear	1,128	31.0	5.7	25.3
74: General industrial machinery and equipment	889	8.3	0.9	7.3
65: Textile, yarn, fabrics, made up articles etc	773	17.6	2.8	14.8
893: Articles of plastics	584	16.9	6.8	10.1
66: Non-metallic mineral manufactures	565	6.9	0.9	6.0
83: Travel goods, handbags and similar containers	564	38.5	23.0	15.4
81: Prefab buildings, sanitation, plumbing, heating and lighting	496	25.7	8.8	16.9
68: Non-ferrous metals	357	4.0	1.2	2.8
62: Rubber manufacturers	348	12.5	0.9	11.5
899: Miscellaneous nes	341	18.5	12.0	6.5
78: Road vehicles	335	1.0	0.1	0.9
63: Cork and wood manufactures (excluding furniture)	328	19.2	2.9	16.3
64: Paper and paperboard	311	5.2	0.6	4.6
911: Postal packages	309	35.6	1.4	34.2
51: Organic chemicals	291	3.0	1.2	1.8
71: Power generating machinery and equipment	287	2.1	1.9	0.1
87: Professional, scientific and controlling instruments	265	3.9	0.7	3.2
Total	28,228	7.9	1.8	6.1

Source: HMRC

But, that is not the only area of China's comparative advantage. What has been impressive about the range of goods that China exports is its breadth. Across low–technology goods like toys to higher technology items like semi–conductor chips, there has been a significant upgrading in Chinese exports (the technology composition of Chinese exports is generally consistent with that of a country with three times its average income). But, because foreign–invested enterprises have produced more than half of Chinese exports since the mid–1990s and the share is higher in the more advanced output of high tech goods, there are questions as to whether or not it represents shifting comparative advantage or the centrality of China as a global manufacturing hub.

The high concentration of foreign firms in Chinese exports is the result of long–standing policy that aimed to attract and learn from foreign direct investment to help develop Chinese industry. This policy began at the very start of reforms in December 1978 and centred on developing Chinese–foreign joint ventures through the 1980s which accelerated in the 1990s with the 'take off' of the open door policy. Then, with anticipated opening after WTO accession, wholly foreign–owned enterprises rather than joint ventures gained greater prominence. But, through the past three decades, the intent to attract and imitate the more advanced know–how of multinational corporations has been evident. In some industries, this has resulted in Chinese firms becoming competitive and stealing market share even from foreign firms such as in mobile handsets. But, in other respects, China’s industrial upgrading still has some way to go.

Nevertheless, with rising wage pressures (real urban wages have risen by 10 percent on average during the 2000s) and growing competition from southeast Asian nations such as Vietnam, China had begun to move out of low–end manufactures. China seeks to move up the value chain and had since the mid 1990s, developed High–Technology Development Zones which are akin to science parks, as well as increased spending on technology and innovation. For instance, R&D spending as a part of GDP in China now ranks among the highest even among OECD countries. Therefore, part of the impressive growth across the technical expertise of Chinese exports is also due to a focus on higher value–added production as sustained economic growth will increasingly depend on more total factor productivity (TFP) growth.

Therefore, cheaper nations in southeast Asia may well benefit from the 'flying geese' pattern of trade, first observed when cheap manufactures moved out of Japan to South Korea, Taiwan and then to China and now to southeast Asia. But, for China, becoming competitive to be placed within the regional production chains for electronics trade is more desirable and suits its policies that have attempted to shape its dynamic comparative advantage.

Imports to China have also grown significantly over the last two decades but not so much from the UK (**Table 3**). The main export markets provided by China are high–end capital goods such as those sold by Germany and also by France. For instance, Germany is China’s 6th largest import partner while the UK does not rank in the top 10. Consumer goods still comprise less than 3 percent of all Chinese imports. This is because of decades of protectionism of domestic markets against foreign competition to develop its own firms and industries. The barriers were originally tariff–based, for instance, there had been 100 per cent tariffs on imports. And the only foreign firms allowed to invest in China were restricted to Special Economic Zones where they could produce for export but not to sell their wares in China. After WTO accession, tariffs have fallen dramatically across the board, but non–tariff barriers remain. For instance, permission and licenses can be hard to obtain to access China’s markets. And thus, lack of 'market access' is one of the perennial complaints of Western businesses.

The pattern of imports in China is likely to shift more towards consumer goods, only because there is in general greater opening after WTO accession particularly of the services sector despite the government’s protective policies because services was the sector where China agreed to open under its WTO obligations. And, China is keen to develop its services sector. At 40 per cent of

GDP, it is too low by comparative standards and has plateaued in the past decade despite the government's efforts. As services is partly non–tradable, it also suits the 're–balancing' aims of the Chinese government as it tries to reduce its reliance on exports and increases the contribution of domestic demand to economic growth.

Table 3 Goods exports from China by SITC classification

Standard Industrial Trade Classification (SITC)	**Value in 2010 (£ millions)**	**Share of UK total in 2010 (%)**	**Share of UK total in 1999 (%)**	**Change in shares 1999-2010 (%)**
78: Road vehicles	1,645	7.0	0.1	6.9
28: Metalliferous ores and metal scrap	751	18.5	1.5	17.0
71: Power generating machinery and equipment	624	3.7	0.9	2.8
74: General industrial machinery and equipment	448	4.5	1.8	2.8
54: Medical and pharmaceutical products	424	1.9	0.2	1.7
77: Elementary machinery, apparatus and appliances	348	3.2	0.8	2.4
25: Pulp and waste paper	296	54.6	4.4	50.2
87: Professional, scientific and controlling instruments	288	3.9	0.9	3.0
72: Machinery specialised for particular industries	265	3.9	1.9	2.0
68: Non-ferrous metals	249	4.3	0.5	3.7
89: Other transport equipment	199	1.3	0.2	1.0
79: Other transport equipment	145	1.4	0.5	0.9
57: Plastics in primary forms	130	4.2	0.6	3.6
76: Telecoms and sound recording and reproducing apparatus	127	1.8	2.2	-0.4
73: Metalworking machinery	106	11.9	2.5	9.4
69: Manufactures of metal nes	100	2.2	0.6	1.7
59: Chemical materials and products nes	97	2.1	0.5	1.6
67: Iron and steel	80	1.6	0.7	0.9
33: Petroleum, petroleum products and related materials	80	0.3	1.4	-1.2
75: Office machines and ADP machines	76	1.3	0.2	1.1
21: Hides, skins and furskins	75	46.1	5.0	41.1
51: Organic chemicals	66	0.7	0.5	0.2
52: Inorganic chemicals	62	1.8	1.1	0.7
88: Photographic and optical goods	61	3.5	1.3	2.2
11: Beverages	61	1.1	0.0	1.0
Total	7,225	2.8	0.7	2.0

Source: HMRC

As the Chinese middle class continues to develop consumer goods producers, especially those at the higher quality end, will find that there is a great deal of repressed consumption. The wholesale and retail sector were only liberalised in the late 1980s and early 1990s out of the control of the state-owned enterprises. In fact, food vouchers were only abolished in 1992. Of course, China will continue to import high–tech capital goods since it cannot produce these at the moment and will want to learn from the best technology in the West and Japan. Germany, France and Japan have all grown well from exporting to China and this pattern is likely to continue as China undergoes its second industrialisation. Its 12th Five Year Plan (2011–2015) includes ambitious infrastructure building to supports its urbanisation policy and also China aims to re–orient its capital more efficiently to reform its industries away from obsolete heavy industries and into higher tech sectors. So, unlike the first industrialisation which took place during the command period, China's industry which is still 50 per cent of GDP as it was in 1979 on the eve of reform, will become re–oriented. And urbanisation plus services sector development will require road, rail as well as 'soft infrastructure' to deliver government services across large urbanised areas. All of this will justify continuing capital accumulation growth and continue China's need to import capital goods as well as energy and commodities.

Trade in services

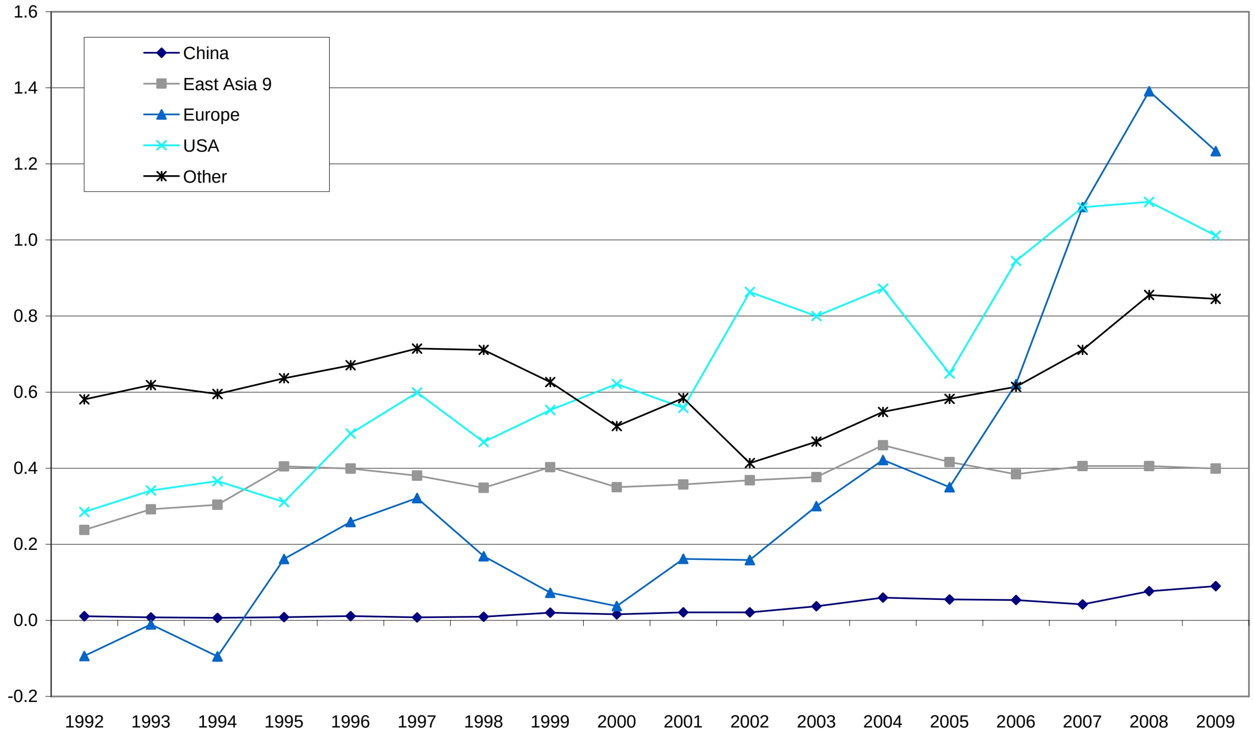
Services trade is very important to the UK current account. It reflects the UK's comparative advantage and goes someway to offsetting its perennial deficit in the trade in goods. Services trade with China has increased in the last two decades but remains a small proportion of the total. The UK's surplus with China in services trade amounts to just 0.1 per cent of GDP (**Figure 4**), tiny when compared to the services trade surpluses with Europe (1.2 per cent of GDP), USA (1.0 per cent) and even the rest of East Asia (0.4 per cent).

Although services imports from China have increased as a proportion of the total since 1992, they still only represent around 1.0 per cent of the total in 2009 (**Figure 5a**) and China is not in the top 20 list of countries by services imports (**Table 4**). China's place in UK exports of services is slightly bigger, but not by much. Although China is in the top 20 list here, China took only 1.5 per cent of all the UK's services exports (**Figure 5b**).

Even though China is, in terms of GDP, the second largest economy in the world, low services trade largely reflects its relatively low development (low consumption), high degree of state planning (limited business services) and relatively closed and restricted financial markets. For instance, in 2009 the UK exported £43.9 billion in financial services, of which just £203 million (0.5 per cent) went to China (**Table 5**). Likewise, business services exports by the UK in 2009 were £42.2 billion, of which £386 million (0.9%) went to China. The UK's largest source of services exports with China in 2009 were in transport (£940 million, 4.5 per cent of the total) and travel (£589 million, 3.1 per cent of the total). Travel is one part of the services industries were some restrictions have been lifted with Chinese nationals being now able to visit foreign countries more freely.

Figure 4 UK trade in services balances, 1992 – 2009

Per cent of GDP



Source: ONS Pink Book

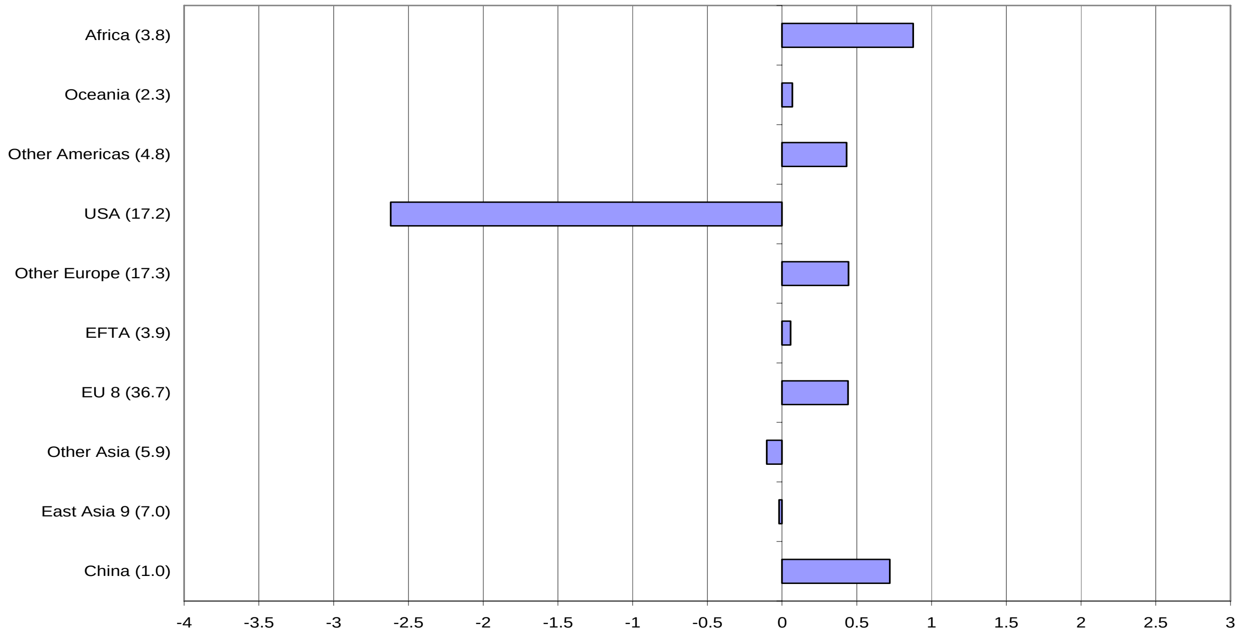
East Asia 9 – Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand

The Chinese service sector is likely to grow quickly in the next decade which may provide export market opportunities for UK firms. Not only because of the WTO obligations but because China wants to develop such services and is using a similar approach to its way of developing manufacturing during the 1980s and 1990s. By attracting British banks and financial companies to become minority equity investors (for example HSBC and Bank of Communications, China's 5th largest bank – a state-owned bank just under the top tier of the big four is a good example as HSBC can only hold up to 20 per cent and the ceiling for foreign shareholding is 25 per cent), it is similar to the joint venture policy for industry. By working alongside foreign firms, Chinese managers and workers can learn best practise and know–how. This model pertains to all services.

The services sector has strong potential to grow because it is starting from a low base. Under the planned economy, there was no need for services as the government provided all of them. Starting in the mid–1980s, the PBOC became a central bank and the state–owned commercial banks were created. In the early 1990s, the two stock exchanges (Shanghai and Shenzhen) were created and financial services grew slowly as it was marred by scandal due to ineffective regulation. But, since WTO accession in 2001, private firms can now list on the stock exchanges and the pace of services development is rapid.

Figure 5a **Changing origin of services imports*, 1992–2009**

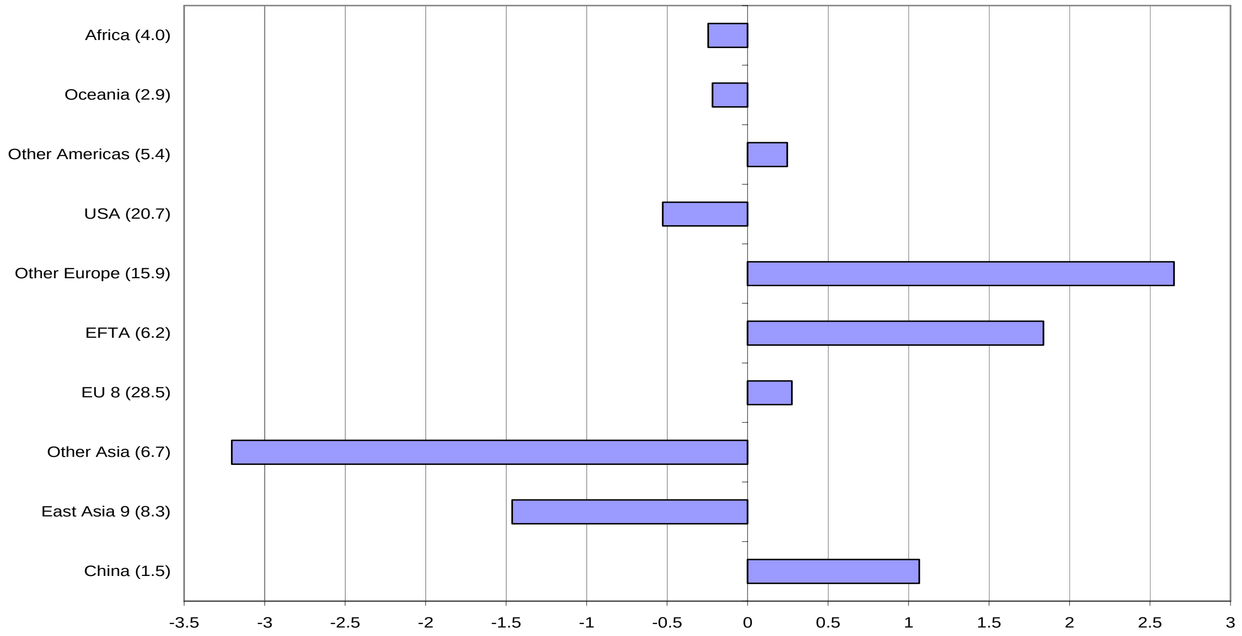
Percentage points



Source: ONS Pink Book

Figure 5b **Changing origin of services exports*, 1992–2009**

Percentage points



Source: ONS Pink Book

* Change in percentage shares. Figures in brackets are shares in 2009.

Other East Asia are the East Asian 9 – Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand

EU 8 – Belgium, France, Germany, Ireland, Italy, Luxembourg, Netherlands and Spain

Table 4 Trade in services: country rankings

Imports							**Exports**						
	2009	2008	2007	2006	2005	2004		2009	2008	2007	2006	2005	2004
USA	1	1	1	1	1	1	USA	1	1	1	1	1	1
Spain	2	2	2	2	2	2	Germany	2	2	2	2	2	2
France	3	3	3	3	3	3	Netherlands	3	3	3	3	3	3
Germany	4	4	4	4	4	4	France	4	4	4	4	5	4
Italy	5	5	5	5	5	5	Ireland	5	5	5	5	4	5
Netherlands	6	7	7	6	6	6	Switzerland	6	6	6	6	6	6
Ireland	7	6	6	7	7	7	Spain	7	7	7	7	8	9
Japan	8	8	8	8	9	11	Italy	8	9	8	9	9	8
Switzerland	9	9	9	9	8	9	Japan	9	8	9	8	7	7
Belgium	10	10	10	10	12	10	Australia	10	11	11	11	10	11
Australia	11	13	12	12	11	13	Singapore	11	13	10	10	12	12
Greece	12	12	11	11	10	8	Belgium	12	12	12	13	11	10
India	13	11	13	13	14	15	Denmark	13	19	17	15	18	17
Sweden	14	18	18	15	15	14	The Channel Islands	14	10	13	14	14	16
Portugal	15	14	14	14	13	12	Canada	15	14	15	16	17	13
Singapore	16	20	29	26	27	28	Sweden	16	18	19	17	16	15
Bermuda	17	17	16	17	43	-	**China**	**17**	**17**	**23**	**21**	**20**	**19**
United Arab Emirates	18	22	23	27	26	31	Norway	18	15	16	18	15	18
Russia	19	26	28	30	32	30	Luxembourg	19	23	24	26	28	28
Turkey	20	16	21	20	18	19	Saudi Arabia	20	16	14	12	13	34
China	**25**	**19**	**26**	**29**	**24**	**29**							

Source: ONS Pink Book

Because of the middle class achieving lower middle income level for the first time in the early 2000s, there is now a need for services. For instance, the lack of financial services and the existence of financial repression (legal/policy measures to distort credit decisions) mean that the high savings of Chinese households (22 per cent of GDP) are inefficiently allocated. The same applies to firms which have a savings rate that is now equal to households for the first time. The need for financial intermediation is apparent and the government is loosening its policies rapidly to develop the sector, albeit on an experimental basis. However, the access for foreign firms is likely to be difficult since like manufacturing before it, the Chinese government is wary of allowing large firms to dominate an under–developed sector. But, with China’s greater global integration, it is more difficult to restrict access and its own firms will play an active role in wanting greater opening to partner with and transact with foreign players.

Shanghai may well rise to eventually become a competitor to London. But, as with the rise of Hong Kong or Frankfurt, there is scope for a number of financial centres and once established, spatial agglomeration studies suggest that it is difficult to dislodge an existing hub of specialisation whether it is the City of London, Hollywood or Silicon Valley.

Table 5 Composition of China–UK trade in services

	Exports						Imports					
	2009			2008			2009			2008		
	China	Grand total	China %	China	Grand total	China %	China	Grand total	China %	China	Grand total	China %
Transportation	940	20,708	4.5	1,012	20,884	4.8	331	19,175	1.7	318	17,707	1.8
Travel	589	19,282	3.1	516	19,598	2.6	306	37,256	0.8	248	32,297	0.8
Communications	40	4,485	0.9	28	4,262	0.7	45	4,346	1.0	41	4,041	1.0
Construction	6	1,625	0.4	..	1,246	..	23	1,095	2.1	8	1,433	0.6
Insurance	25	8,333	0.3	24	7,604	0.3	62	1,108	5.6	65	1,006	6.5
Financial	203	43,852	0.5	387	52,821	0.7	205	13,146	1.6	34	10,933	0.3
Computer and information	20	6,902	0.3	21	7,258	0.3	12	3,391	0.4	14	3,818	0.4
Royalties and license fees	38	7,610	0.5	56	7,987	0.7	5	5,750	0.1	2	5,814	0.0
Other business services	386	42,243	0.9	367	44,727	0.8	343	25,218	1.4	318	27,750	1.1
Personal, cultural and recreational	56	1,951	2.9	..	2,274	..	..	1,094	..	2	667	0.3
Government	12	2,120	0.6	14	2,158	0.6	..	3,884	..	10	3,793	0.3
Total services	2,315	159,111	1.5	2,454	170,819	1.4	1,342	115,463	1.2	1,060	109,259	1.0

Source: ONS Pink Book

International income and investment

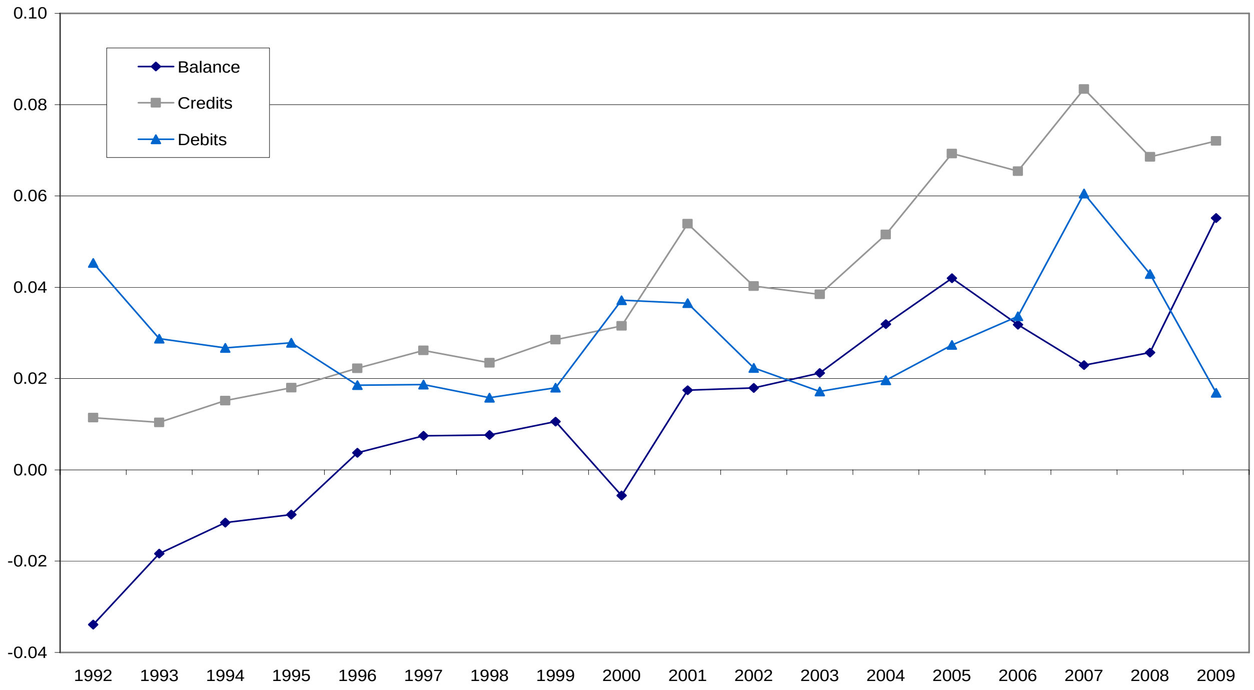
Income flows (and current transfers) are an important part of the UK current account. For instance, in recent years, the UK's surplus on its income balance has sometimes been as important as its surplus in services trade.

Income flows represent earnings and payments relating to the international ownership of financial assets. As the UK has historically been a large (relative to GDP) investor and receiver of international investment the investment income balance has always been meaningful in the Balance of Payments. The City of London's position has a major financial centre is central to this.

Figure 6a shows that the UK's income balance with China has been increasing as a percentage of GDP – but is still fairly small. Income credits and payments have generally been trending upwards (except in 2008 and 2009 when the financial crisis and recession reduced Chinese earnings from UK assets) but are still a low proportion of GDP. **Figure 6b** looks to put the significance of China–UK income flows in a more international context. From a regional perspective, China's share of East Asia credits has been rising, debits have also risen but not as quickly. However, this may in part reflect the aftermath of the Asian financial crisis. China, with its relatively closed financial markets was largely insulated from the crisis. It is still apparent from Figure 6b, that compared to the rest of the world, Chinese income flows with the UK are relatively small and not really growing that fast.

Figure 6a China–UK income balance

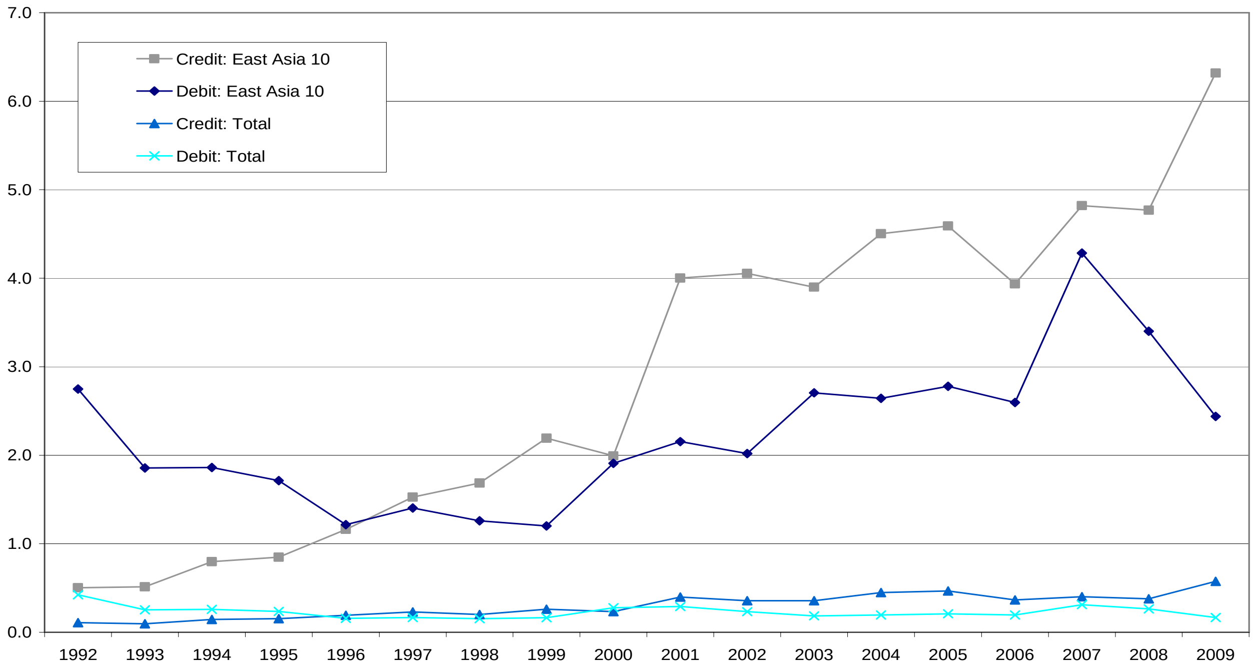
Per cent of GDP



Source: ONS Pink Book

Figure 6b China–UK income flows relative to East Asia and total

Percentage share



Source: ONS Pink Book

East Asia 10: China, Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand

Income flows are connected with the ownership of assets. As an open economy with a large financial sector the UK has a large stock of overseas assets (7.6 times GDP in 2008) and liabilities (7.7 times GDP in 2008). Much of this reflects the City of London's role as an international financial intermediary – for example borrowing £100million from wholesale markets in Asia to lend commercially in Europe and so means the UK ends up with large stocks of assets and liabilities that do not differ that much in size. In comparison, China is a tiny part of the UK's International Investment Position (IIP or net asset position). UK assets in China in 2008 were about (2.1 per cent of UK GDP) and UK liabilities to China were (1.1 per cent of UK GDP).

The UK's IIP with China has increased, both as a proportion of GDP (**Figure 7a**) and relative to the rest of East Asia (**Figure 7b**). However, its incidence is still small, especially compared to the UK's total assets and liabilities with the rest of the world. As **Table 6** shows, most of the UK's international investment is with other advanced economies.

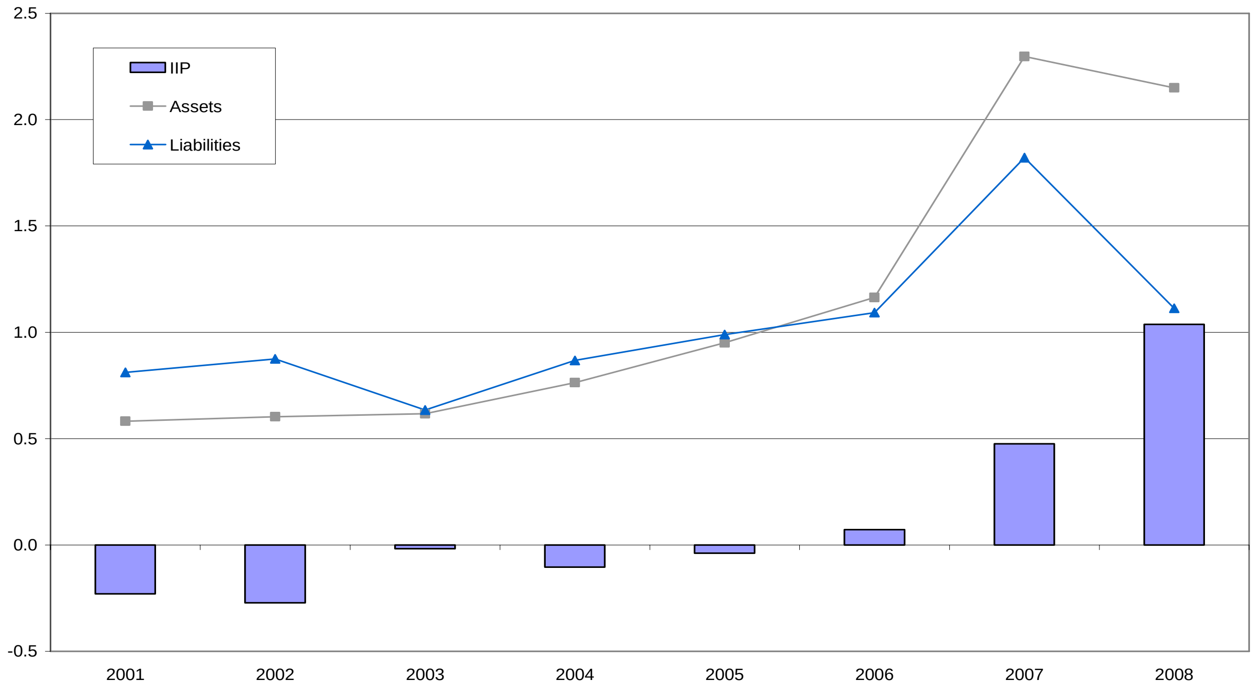
China's low share of assets and liabilities in the IIP is not surprising when considering that most of these assets are portfolio (equities and interest–bearing financial assets) and that China's financial markets are both underdeveloped and closed to international investors. It might be expected that given China's strong position in manufacturing trade and its attraction of foreign firms to joint ventures in Special Economic Zones that direct investments may be more significant. However, as **Figures 8a** and **8b** show, FDI from the UK to China and from China to the UK are still both fairly small compared to the UK's FDI flows with other countries and regions. This may partly reflect the UK's shrinking manufacturing sector, but is mainly due to the fact that FDI positions are generally built up over many years. China is a relative newcomer to the global economy (WTO membership in 2001) and despite this it also maintains a large number of restrictions limiting investment in and out of the country.

China still officially has a closed financial account, though there are some moves to liberalise, mainly around Chinese firms and households moving some of their money to Hong Kong. The stock market is still closed as well. Only select foreign investors can invest, those known as Qualified Foreign Institutional Investors as of 2002, can invest in the 'A' share market which hold the main RMB–denominated stocks. The reasons are because of worries over the fragility of the banks, which have suffered from non–performing loans but are awash with cash because of the trapped savings in China. For instance, the current gap between the deposit and the lending rate in China (300 basis points) is simply to preserve bank margins.

Also, the Chinese are worried about liberalisation effects on the exchange rate. But, because of liquidity pressures (M2 money supply growth has been near 20 per cent in the past year) and the pressure from mature Chinese firms to operate globally, there are numerous policies that are gradually opening the financial account. Domestically, the stock exchanges are also undergoing reforms, including making all of the shares tradable (for most of the reform period, only third of the shares were tradable since all listed firms were state–owned enterprises and the majority of the shares were held by the state and legal persons which were other state–owned enterprises). For instance, exchange traded funds are being developed and greater foreign participation is being encouraged in the financial sector as the Chinese in particular are keen to develop its under–developed capital markets.

Figure 7a China–UK IIP

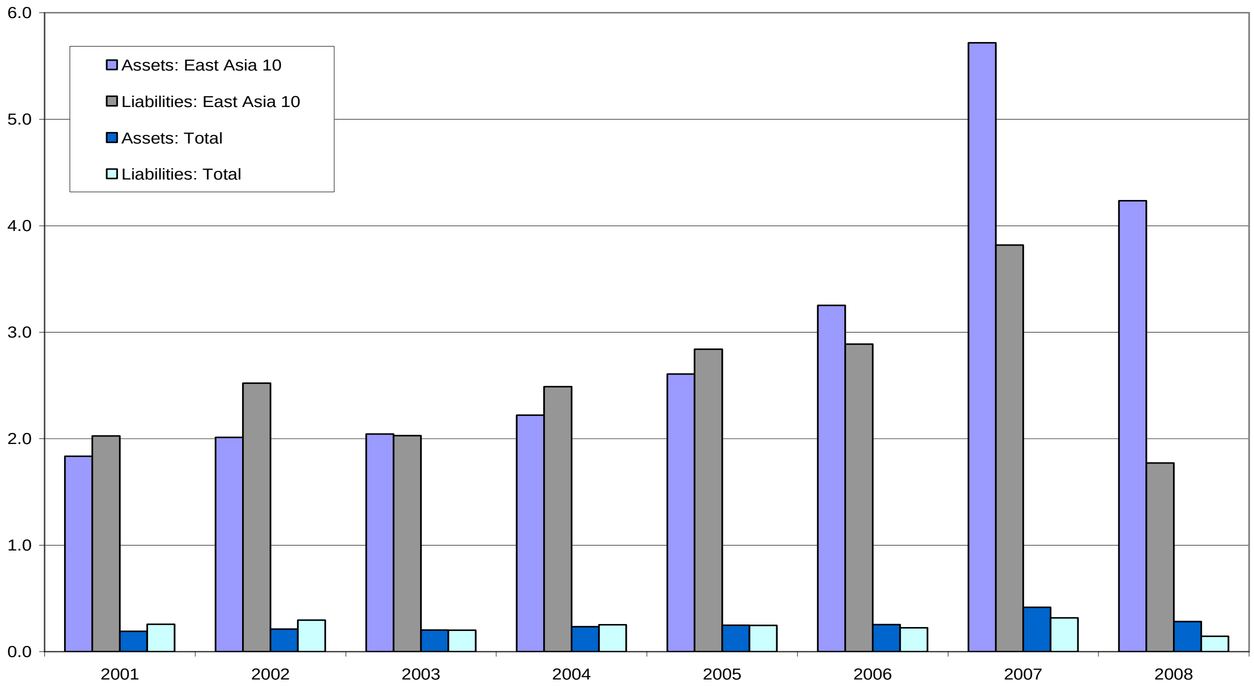
Per cent of GDP



Source: ONS Pink Book

Figure 7b China assets and liabilities relative to East Asia and total

Percentage share



Source: ONS Pink Book

East Asia 10: China, Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand

Table 6 UK IIP assets and liabilities, 2009

Percentage of GDP

UK GDP in 2009 = £1.39 trillion

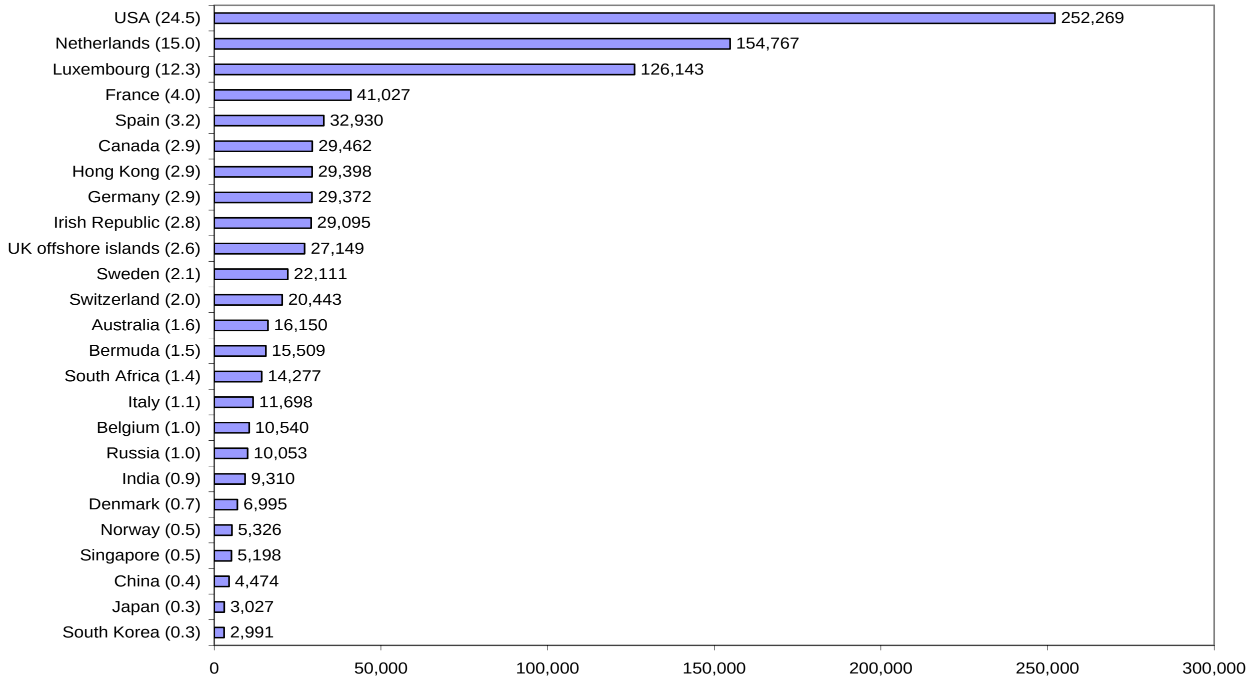
Assets		Liabilities	
Total	759.6	Total	766.6
EU 27	340.9	EU 27	331.7
USA	219.0	USA	210.4
Germany	74.2	Germany	83.8
France	68.3	France	63.8
East Asia 10	50.8	East Asia 10	62.8
Netherlands	45.4	Netherlands	50.7
Ireland	38.6	Ireland	38.4
EFTA	33.3	EFTA	38.3
Japan	27.5	Japan	33.2
Spain	24.6	Hong Kong	13.2
Italy	17.1	Singapore	11.7
Singapore	8.2	Spain	11.5
Hong Kong	7.0	Italy	9.9
South Korea	3.2	South Korea	1.8
India	3.2	India	1.4
China	**2.1**	**China**	**1.1**
Taiwan	1.1	Taiwan	0.8
Malaysia	0.6	Thailand	0.4
Thailand	0.4	Malaysia	0.4
Indonesia	0.3	Philippines	0.2
Philippines	0.3	Indonesia	0.1

Source: ONS Pink Book

Given the policy distortions affecting bank lending which are biased towards state–owned enterprises, capital markets (bond markets are also very under–developed) are needed to offer financing, particularly venture capital to support entrepreneurs and private firms which are credit–constrained despite the excess liquidity in the economy. The first 'dim sum' bonds have been issued (the very first was MacDonald’s earlier this year) which are RMB–denominated corporate bonds issued in Hong Kong to try and raise money from China and entice Chinese savers to put their money somewhere other than housing and the stock markets.

Figure 8a UK stocks of direct investment abroad, 2009

£ millions

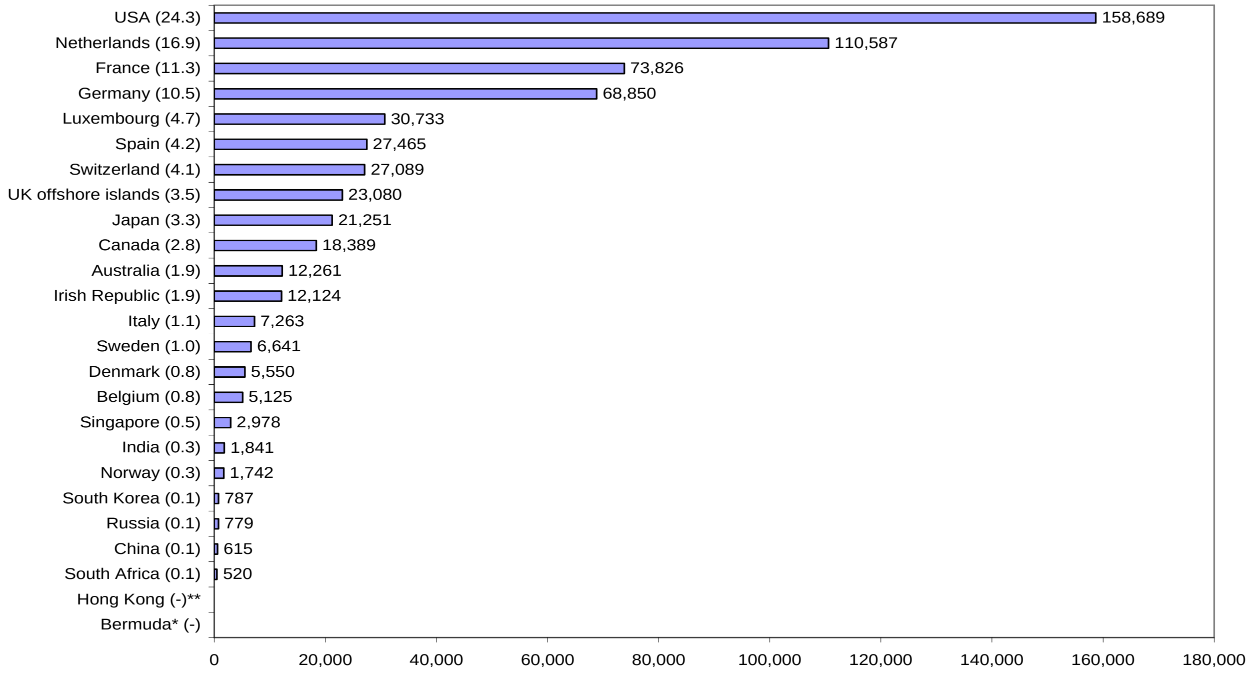


Source: ONS Foreign direct investment

Figures in brackets are percentage shares of total

Figure 8b Overseas stocks of direct investment into the UK

£ millions



Source: ONS Foreign direct investment

Figures in brackets are percentage shares of total

Hong Kong is the place where the Chinese tend to experiment. The 'dim sum' bonds and liberalisation measures extending only to Hong Kong are examples. Hong Kong has 50 years from 1997 to remain a separate economic entity. Its market development is likely to influence Chinese markets greatly, since the financial system is more developed and can positively influence regulation on the mainland. But, because of the gradual nature of Chinese reforms, experimenting in Hong Kong has limited cost especially since Hong Kong still has its own currency so any capital outflows will not affect the RMB. If it works in Hong Kong, then it has a greater chance of being introduced in China.

There is a catalogue of permitted investments by foreigners governed by various ministries, ultimately by the State Council, the highest governing body. The National Development Reform Commission (NDRC) is the highest policy body (they formulate the Five Year Plans) and tend to reveal the policy direction. But, politics and competition among ministries is fierce, which is often why statements can be contradictory. Also, provincial authorities are powerful, and decentralisation is one of the keys for successful Chinese growth, so they experiment and can ignore what the central government says is the criteria for foreign investment. This is unlikely to change as China develops, but more coordinated policymaking is one of the reform goals.

Chinese corporations and sovereign wealth funds are also likely to become more active investors in FDI. There are three sources of sovereign wealth funds

- CIC or China Investment Corporation are the official ones
- SAFE state administration for foreign exchange; and
- China Development Bank – one of the 3 policy banks spun off from the People's Bank of China (PBOC) when it became a central bank

They are trying to diversify China’s capital outflows from its large holdings of US Treasuries by increasing overseas investments. In 2008, two–thirds of FDI was in financials and the rest in non–financials. With $3 trillion in reserves, China will be diversifying more including funding its 'going global' policy.

Launched in 2000, the first ever commercial overseas FDI deal was struck in 2003/4 when TCL bought France’s Thomson brand. This is the 'going out' of Chinese firms to make them multinational corporations. But the pace is slow. They are after what China does not have a comparative advantage in, which is unusual. But, they invest in technology, financial services, all areas where China seeks expertise. These are private firms, but with state connections because they need permission to invest overseas. Also, China is using its reserves to fund such investments which is controversial. But, as countries develop, it is not surprising that outward FDI will begin and multinational corporations form. It is also China’s tool to liberalise the financial account but only through FDI. But, as they also want to internationalise the RMB (making it eventually into a reserve currency), it raises questions about whether they can achieve this objective without further financial account liberalisation.

Final remarks

China's trade has grown rapidly since it adopted its open door policy in the early 1990s and ascended to WTO membership in 2001. However, this has been largely concentrated in the global trade of manufactures, so whilst the UK is now importing more than ever from China exports of goods and services to China are yet to surge. For instance, compared to Germany and France the UK has been relatively unsuccessful in selling its wares to China.

China's continued growth is likely to see demand for consumer goods and services rise – the development of a services sector, especially in finance, may be an opportunity for the UK to deploy its comparative advantage in a new and growing market. However, restrictions on access to the Chinese market are likely to be removed slowly as China looks to protect is domestic firms from foreign competition and seeks to assimilate knowledge through joint ventures.

China's closed financial markets are also likely to be slowly deregulated. It is also likely that Chinese sovereign wealth firms and corporations are likely to look to acquire foreign FDI, in order to diversify reserves away from US Treasuries and as Chinese firms become increasingly mature and look to operate in global markets.

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Volume of capital services: new annual and quarterly estimates for 1950 to 2009

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Summary

Capital services are the measure of capital input preferred for analysing and modelling productivity. Along with quality adjusted labour input, the volume index of capital services is a key input to multi–factor productivity and growth accounting analyses. This article presents new estimates of capital services for 2009 along with revised estimates for 1950 to 2008. The annual series has been extended by an additional year since the previous release (Wallis, Long and Turvey, 2010) with earlier years updated to incorporate revisions throughout the time series. The experimental quarterly series of whole economy capital services has been extended and revised, while this article presents for the first time an experimental quarterly series of capital services growth for the market sector. During 2009 the growth of whole economy capital services fell to its lowest rate since the series began in 1950. Capital services for the market sector experienced negative annual growth for the first time.

Introduction

Capital services represent measures of productive capital that are compiled differently from conventional capital stock estimates within the National Accounts. The key conceptual difference is that the National Accounts seek to capture the *age–price* (or age–value) profile of assets, in order to measure the economic value of capital that is 'used–up' in a reporting period. By contrast VICS seeks to capture the *age–efficiency* profile of assets, that is, to measure the flow of capital into the production process.

Clearly these concepts are related, since in general both the economic value of capital and its productive efficiency can be expected to fall over time. However as quoted by the OECD:

‘A one year old truck may have lost 20 per cent of its market value but it has not necessarily lost 20 per cent of its capacity to transport goods from one place to another.’ (OECD, 2001a)

In principle, capital services can be measured analogously to labour services. Rental prices of different asset classes, and different vintages of similar assets, vary in line with their contribution to output just as wages vary according to age and education. In practise, however, efficient rental markets are scarce and so rental prices have to be imputed. The approach taken to impute the rental price of capital gives rise to three main methodological differences from the compilation of the National Accounts series for net capital stock. Firstly a geometric depreciation rate is used to construct the capital services estimates rather than an arithmetic depreciation rate. This causes the age–price and age–efficiency profiles to follow the same shape by declining quadratically rather than linearly (see Box 5.3 of the Productivity Handbook (ONS, 2007)). Secondly, a constraint is employed such that the sum of the imputed rents for all units of capital exhausts the National Accounts measure of returns to capital. A third difference occurs due to a different disaggregation of asset classes to capture their particular age–efficiency profiles. Computer hardware, purchased software and own–account software are given more weight in the capital services estimation to reflect the higher rental price relative to the asset price.

This article presents new capital services estimates for 2009 along with revised estimates for 1950 to 2008. An accompanying article in the previous edition of *Economic & Labour Market Review* (Acheson, 2011a) presented quarterly experimental quality–adjusted labour input (QALI) estimates for the UK for 1993 to 2009, alongside new annual estimates from 1970. Together with capital services these form the inputs into the multi-factor productivity (MFP) estimates that are published annually by ONS (see Acheson, 2011b).

Estimation methodology

The methodology used to estimate capital services is described in detail in Wallis (2005), Wallis (2009) and in *The ONS Productivity Handbook* (ONS 2007). Wallis and Turvey (2009) describe subsequent changes to the methodology.

The four main stages in the estimation of capital services can be summarised as:

- using the Perpetual Inventory Method (PIM) to calculate a net stock series from a time series of constant price investment series
- pricing the services from each asset using an estimated tax–adjusted rental for each asset
- generating weights, using the estimated rentals and net stock series, which reflect the input of each asset into production; and
- combining the net stock growth using the estimated weights to give capital services growth estimates

The only methodological change in this release is the use of asset specific tax adjustment factors. In the past, the tax adjustment factor used had not been disaggregated by asset type. Instead the previous tax adjustment factor for plant and machinery, which did not incorporate a first year capital allowance, was applied to all assets. For this publication, the tax adjustment factor has been altered, for all years since 1970, to allow for variation between asset types and to take account of recent tax changes. The **Annex** describes the method that has been used to calculate the tax adjustment factor in this publication; more detail is available in Wallis (2011).

The methodology for estimating the quarterly series is described in a later section.

Data

The data used to estimate capital services are the same as those underpinning the UK National Accounts capital stock estimates and are consistent with *Blue Book* 2010. The data set consists of a long time series of annual constant price investment flows, classified by industry, their respective life length means (used to calculate depreciation rates) and price deflators.

The asset breakdown of the available investment series in the National Accounts is:

- buildings (excluding dwellings)
- copyright and license costs
- mineral exploration
- own–account software
- plant and machinery including computer hardware and purchased software
- vehicles

For estimating capital services it is important that both computer hardware and purchased software are given specific treatment as separate assets. This is because their prices relative to other assets have fallen rapidly over time and their economic lives tend to be much shorter than other types of plant and machinery increasing their rental price.

In order to treat computer hardware and purchased software as separate assets, they have to be separated from investment in plant and machinery and the associated price deflators have to be adjusted to account for this (see Wallis and Dey–Chowdhury 2007). It should be noted that, although a realistic life length is used for computer hardware in the National Accounts, currently assumed to be five years, the capital stock estimates for plant and machinery do not separately deflate computer hardware.

Purchased software is currently treated as part of plant and machinery in the National Accounts; it is not separately deflated and is subject to the general life length for all plant and machinery. However, a series for investment in purchased software is available internally at the ONS and is an updated version of the series introduced in Chamberlin, Clayton and Farooqui (2007).

Capital services estimates

This section presents capital services estimates for the whole economy, for the market sector, for the non–oil sector, by eight asset types and by 57 industries.

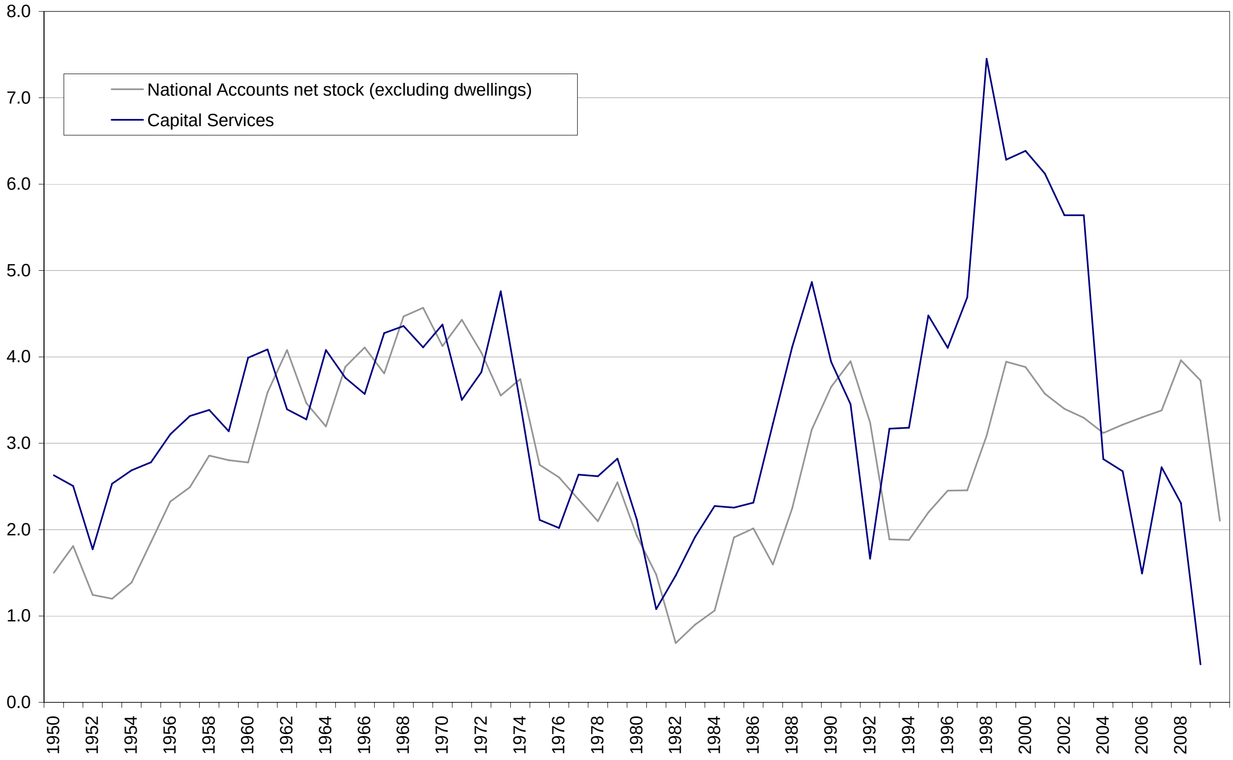
For most asset classes, estimates are available for the period 1950 to 2009. The full set of data cannot be presented in this article, but is available at www.statistics.gov.uk/statbase/product.asp?vlnk=14205

Whole economy capital service estimates

Figure 1 shows the annual growth in capital services for the whole economy and the annual growth rate in the capital stock, net of depreciation, as published in the UK National Accounts. The National Accounts series is the growth in total net stock excluding dwellings, since dwellings are not modelled as part of the productive capital stock. Although measuring different concepts, the close fit of the two series is not surprising given they are based on the same underlying data sources.

Figure 1 **Annual growth in capital services and National Accounts net stock (excluding dwellings)**

Percentages



Source: Office for National Statistics

During the UK economy's latest recession (2008 to 2009) the growth rate of capital services experienced a significant decline. In 2009 capital services grew by just 0.4 per cent, down from a revised figure of 2.3 per cent in 2008. Although total fixed investment (excluding dwellings) fell by around 13.3 per cent in 2009, growth of capital services remained positive. This is because the productive efficiency of capital formed in 2009 more than offset the deterioration of the capital stock.

National Accounts net stock is estimated to have grown by 2.1 per cent in 2009, slower than growth of 3.7 per cent in 2008 but much stronger than the estimate of capital services growth for 2009. This highlights how the differences between the two series can be particularly important during periods of very weak or very strong investment growth. Since 1998 a growing proportion of investment has been in asset types that receive separate treatment in the two series. Growth in this measure in 2009 implies that the value of new investment outweighed the depreciation of the capital stock.

For capital services (but not for the change in the net capital stock) the 2009 growth rate represents the lowest annual growth rate since the series began in 1950 and is well below the average growth rate over 1950 to 2009 of 3.4 per cent. Historically a large degree of cyclicality is exhibited with periods of modest growth coinciding with all UK recessions (1973 to 1975, 1979 to 1982, and the early 1990s).

The differences in these two series can be attributed to the compilation differences laid out in the introduction.

Revisions since previous release

Revisions to capital services estimates since Wallis, Long and Turvey (2010) arise from revisions to the source data series. The primary source of revisions can be attributed to:

- balancing revisions to the constant price investment series
- new tax adjustment factors (see the Annex); and
- new data for 2004 onwards, from the supply–use tables updating the proportion of total plant and machinery investment that allocated to computer hardware.

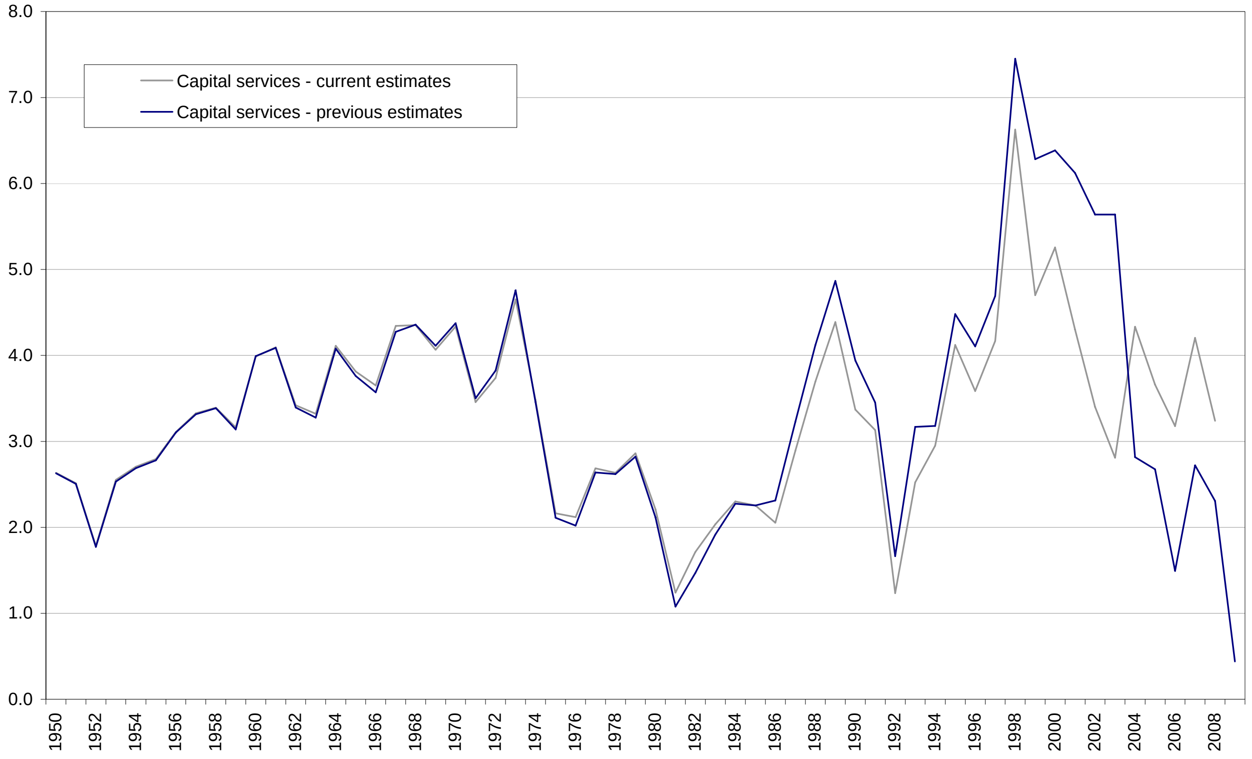
Figure 2 shows the current estimates of whole economy capital services growth against the previously published estimates. Growth in the current series closely tracks that of the previous estimates until the mid–1980s and significant revisions have only occurred to the post–2000 estimates. Revisions to the constant price investment series and new supply use data from 2004 onwards are the primary driver of revisions to the capital services estimates.

The influence of the new tax adjustment factors in terms of the revisions are shown to be relatively insignificant in the Annex.

The open window for revisions in *Blue Book* 2010 was from 2006. Downward revisions to gross operating surplus for 2006 and 2008 (used to constrain imputed rent) also had a large impact on capital services in these years.

Figure 2 **Annual growth in capital services: new and previous estimates**

Percentages



Source: Office for National Statistics

Market sector and non–oil capital services

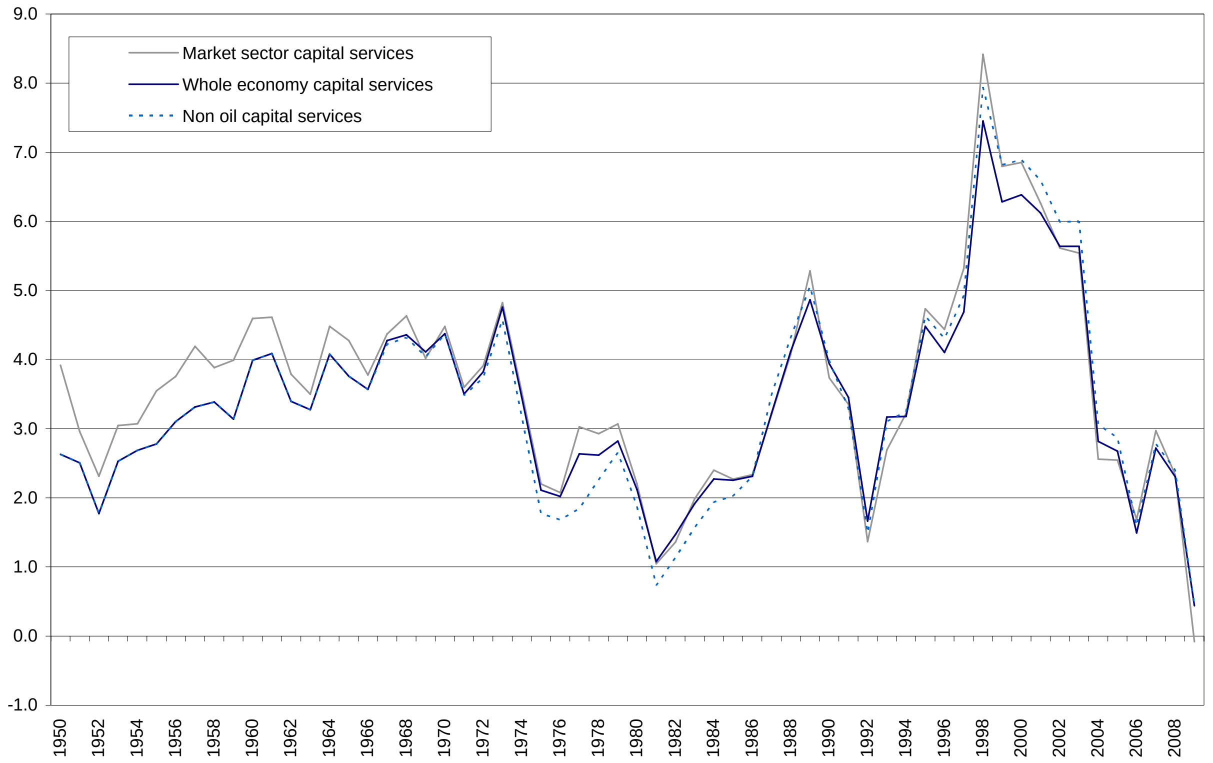
Productivity and other macroeconomic analyses often focus on the market sector rather than the whole economy. The measurement of the market sector is of importance to policy makers as the market sector better reflects the balance of demand and supply pressures of the UK economy. The market sector definition is also used in growth accounting analysis, and when estimating and analysing business cycles.

Macroeconomic analysts are often interested in examining the non–oil sector, as output from the oil sector is considered to have little direct impact on the sustainable level of employment and non–oil economic activity. HM Treasury and the Office for Budget Responsibility use measures of non–oil output in analysis of UK trend growth.

Figure 3 plots the annual growth rates in capital services for the market sector, non-oil sector and the whole economy. The market sector here is consistent with the definition of the National Accounts market sector GVA measure, making it suitable for use in market sector growth accounting analysis. In 2009 market sector capital services fell by 0.1 per cent, the first annual fall on record. Business investment fell by around 18.9 per cent in 2009, taking investment below the rate of deterioration in efficiency which in turn caused the capital stock and the services provided from it to fall. Historically, market sector capital services have been growing on average faster than the whole economy capital services during the period, averaging 3.6 per cent annual growth since 1950 compared with 3.4 per cent for the whole economy.

Figure 3 Annual growth in whole economy, market sector and non–oil capital services

Percentages



Source: Office for National Statistics

Despite a drastic fall in oil prices in early 2009, and a severe decline in exploration at the beginning of the year, capital services for the whole economy experienced identical growth to the non–oil sector for the year at 0.4 per cent. Sustained growth could be attributable to measures taken in the 2009 budget to support investment in the North Sea oil industry, a recovery in prices and the availability of credit towards the end of the year following the financial crisis. The growth rates of non–oil and whole economy capital services follow each other closely for much of the period, reflecting the small size of assets in the oil and gas extraction industry relative to total UK assets. However, the divergence in the growth rates between 1975 and 1985 is due to large capital investment in the oil and gas extraction industry as new oil reserves were found in the mid–1970s.

These high levels of investment contributed to fast capital services growth in the sector over the period. Since the mid–1990s, growth in non–oil capital services has been slightly higher than for whole economy capital services, as oil and gas reserves in the North Sea decline.

Capital services by asset type

Annual growth rates of capital services for the eight asset categories are presented in **Table 1** for 2008 and 2009 and for comparison purposes the average annual growth during previous economic cycles. The only asset categories to experience positive growth in 2009 were buildings, copyright and licence costs and own–account software. By contrast purchased software experienced a fall of 6.1 per cent. The decline in purchased software investment was smaller in local and central government (10 per cent) than in the market sector (14 per cent) as the latter shifted investment towards own–account software. Increased purchased software rental prices were a contributing factor, since its price level was at its highest since 1996. The overall effect on software investment was negative since purchased software is a larger asset category. Computer hardware experienced the largest decline in capital services in 2009 of 6.5 per cent.

Table 1 Annual capital services growth by asset

Percentages

Asset	1986-1997	1997-2007	2008	2009
Buildings	2.8	2.7	3.7	2.9
Computers	19.3	21.1	1.3	-6.5
Copyright and licence costs	4.1	4.4	5.5	6.1
Mineral exploration	-1.7	-9.5	-4.2	-1.0
Plant and machinery	1.1	2.4	0.5	-0.7
Own account software	6.8	5.7	5.4	6.0
Purchased software	20.3	6.4	4.4	-6.1
Vehicles	-0.4	1.6	-0.7	-5.7

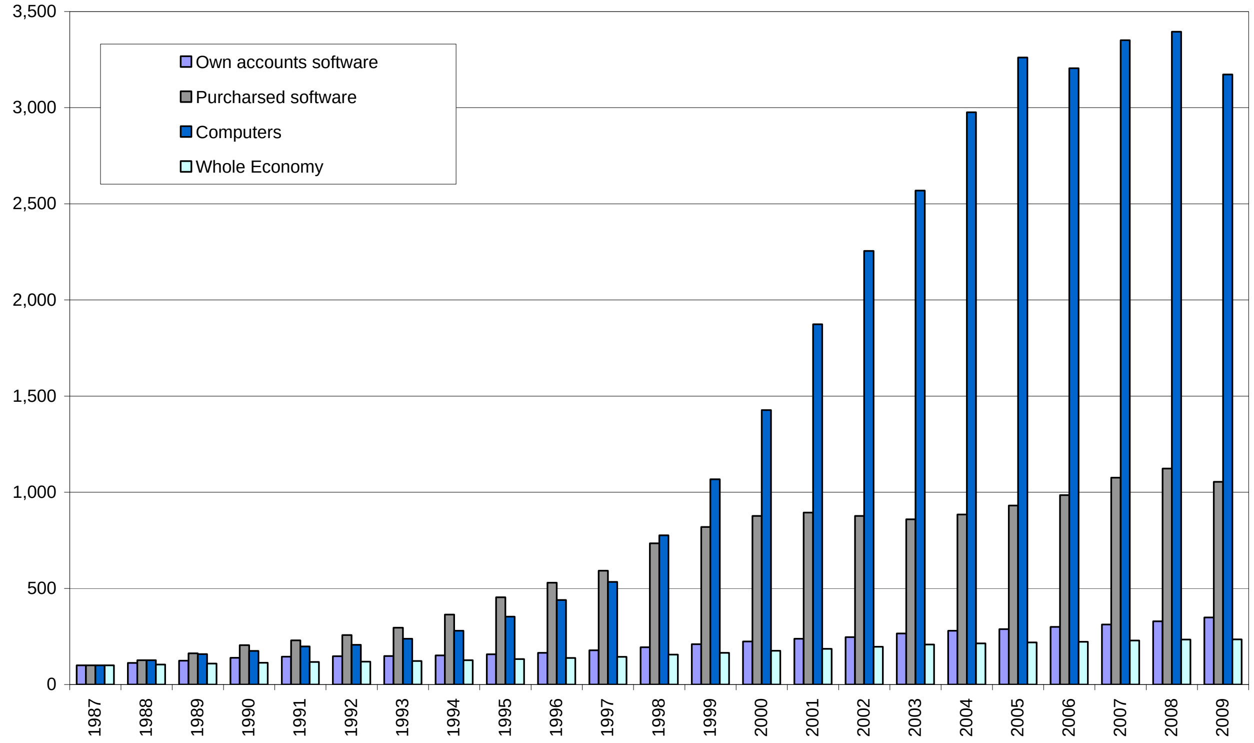
Source: Office for National Statistics

Figure 4 shows the volume of capital services from computer hardware, own–account software and purchased software relative to the volume of whole economy capital services, with all series rebased so that 1987 equals 100. Revisions, as explained above, have changed the pattern of growth in capital services for computer hardware substantially since 2006. As opposed to increasing year on year the series now declines in 2006 and has remained relatively stagnant since then.

From a longer term perspective the volume index of capital services for computer hardware increased 32 fold between 1987 and 2009, while that of whole economy capital services (all assets) only increased 2.35 fold. For purchased software, the volume index has increased 10 fold across the period. This is an important factor in explaining the divergence seen in Figure 1 between the wealth–based National Accounts measures of net stock and capital services. Growth in computer hardware and purchased software capital services has a limited impact at the whole economy level, as the two assets only accounted for 15 per cent of profits in the last economic cycle (see Table 4). Growth in own–account software capital services throughout the period is much less pronounced as, although investment in own-account software has increased quite rapidly, the deflator did not fall as it had for computer hardware and purchased software. This is because the deflator is based on the average wage index of software–related employees whose wage has increased over the period.

Figure 4 Volume index of whole economy capital services: computer hardware, own account software and purchased prices

Indices (1987 = 100)



Source: Office for National Statistics

As with the previous recession in the early 1990s capital services growth was negative for both plant and machinery and vehicles in 2009. The fall in capital services for vehicles in 2008 has been revised from 1.1 to 0.7 per cent, while in 2009 there was 5.7 per cent decline, representing a faster and larger decline than in any previous recession. Owing to the recession negative growth is to be expected since capital services from vehicles is typically the most volatile asset category, exhibiting a high degree of pro–cyclicality. Historically, growth in capital services from buildings is relatively stable, in comparison with the growth in capital services for other asset types, because their efficiency deteriorates at a much slower rate. Although in 2009 capital services growth for buildings experienced a decline of similar magnitude to plant and machinery but from a higher base.

Capital services by industry

Capital services estimates are produced at a 57–industry level, consistent with the most recent supply–use analysis. **Table 2** shows growth in capital services for 2008 and 2009 and for comparison purposes the average annual growth during previous economic cycles. Also included are estimates for aggregate production and aggregate service industries as well as medians and 25th and 75th percentiles. GVA growth for the production and service sectors is shown for comparison.

Interesting points to note from Table 2 are:

- growth in capital services for the production sector was negative in 2009, in line with the trend throughout the last complete economic cycle, after small growth in 2008
- out of the 57 industries only 20 experienced positive capital services growth
- significant declines were experienced in many production industries in 2009 although for some these were less than the average fall across the last economic cycle
- although growth across the service sector was robust through 2008, it has now slowed down to only 0.9 per cent. Renting of machinery and the computer services industries showed substantial falls
- with regards to market sector service industries growth has been maintained in the air transport, ancillary transport and hotel and restaurant industries. Public sector service industries have continued to exhibit positive growth, especially in education; and
- in a small number of industries, including Electricity & gas and Other transport equipment, capital services grew more rapidly in 2008 and 2009 than over the last complete economic cycle. In other industries the fall in capital services was less than that across the last economic cycle

Table 2 Average annual growth rates in capital services: by industry

Percentages

Industry	1972-1978	1978-1986	1986-1997	1997-2007	2008	2009
Agriculture	1.7	0.4	2.2	-0.8	0.6	-0.6
Forestry	1.5	2.6	2.6	-2.4	1.6	-1.8
Fishing	3.9	-6.2	-6.7	-6.0	-5.4	-5.4
Coal extraction	2.4	2.9	-4.4	-4.2	-1.8	-1.4
Oil & gas extraction	32.0	7.9	2.1	-2.2	0.0	0.4
Other mining & quarrying	1.1	-1.9	-1.5	-1.1	-2.0	-5.0
Food products & beverages	3.7	1.6	1.9	1.0	-0.3	-1.2
Tobacco products	3.1	1.2	0.7	-1.1	-3.1	0.2
Textiles	0.2	-2.0	-0.3	-2.6	-2.1	-3.3
Wearing apparel & fur products	1.3	-1.2	-0.2	-2.6	-3.8	-2.5
Leather goods & footwear	22.7	23.3	7.2	-4.0	-4.6	-3.7
Wood & wood products	4.2	-2.4	-0.1	0.7	-1.6	-3.2
Pulp, paper & paper products	35.1	24.0	16.1	1.4	-2.2	-4.3
Printing & publishing	3.4	1.7	2.6	0.9	-4.3	-4.8
Coke, refined petroleum & nuclear fuel	-0.8	2.7	1.5	-2.6	-4.3	-6.3
Chemicals & chemical products	2.3	1.4	3.2	1.0	0.3	-1.0
Rubber & plastic products	3.1	1.6	4.6	-0.1	-1.9	-3.1
Other non-metallic mineral products	6.2	6.7	2.4	1.0	1.0	-3.0
Basic metals	2.0	-3.6	-1.1	-2.2	-2.4	-3.1
Metal products	2.1	-0.4	1.9	1.4	1.1	-3.4
Machinery & equipment	3.1	0.1	1.8	-1.0	-0.5	-1.5
Office machinery & computers	4.9	7.9	9.2	-2.0	-3.7	-1.5
Electrical machinery	3.1	-1.1	1.9	-1.8	-1.7	-4.8
Radio, TV & communication equipment	30.9	24.8	11.2	-3.9	-5.6	-5.1
Medical & precision instruments	4.9	2.9	10.2	4.1	-2.6	-2.4
Motor vehicles	2.3	3.0	3.3	0.4	-0.4	-1.6
Other transport equipment	0.9	1.4	0.1	4.6	10.1	6.5
Other manufacturing	2.9	0.5	4.7	2.3	-4.6	-7.6
Recycling	15.6*	10.8	0.9	8.1	19.9	3.7
Electricity & gas	0.0	0.5	-0.7	-0.2	1.6	2.9
Water	0.7	0.9	8.6	7.3	0.0	3.5
Construction	2.4	-0.5	2.1	7.1	2.1	-3.5
All production	2.8	1.5	1.7	-0.2	0.2	-0.6
25th percentile	1.7	-0.4	0.1	-2.3	-3.3	-3.9
50th percentile	3.0	1.4	2.0	-0.5	-1.7	-2.8

Industry	1972-1978	1978-1986	1986-1997	1997-2007	2008	2009
75th percentile	4.3	2.9	3.6	1.1	0.4	-1.2
Production industries GVA	2.1	1.0	1.8	0.0	-3.1	-10.1
Motor vehicle distribution & repairs, fuel	17.2	19.3	7.3	11.4	3.0	0.8
Wholesale distribution	4.5	3.3	5.6	3.8	-1.3	-3.2
Retail distribution	5.5	3.9	5.2	8.2	5.2	1.7
Hotels & restaurants	4.6	4.1	5.6	8.3	6.4	2.9
Land transport & transport via pipelines	0.9	-0.1	0.7	2.0	-0.1	-1.4
Water transport	-0.3	-9.4	-2.3	0.5	-3.4	-7.0
Air transport	1.2	1.6	2.9	12.6	7.8	7.6
Ancillary transport services	1.8	3.0	6.5	9.5	7.5	3.5
Post & tele-communications	3.8	-0.1	5.2	8.0	3.7	0.6
Financial intermediation	6.2	6.2	8.3	4.9	4.8	-1.5
Insurance & pension funds	11.2	9.0	7.8	2.3	0.1	-2.2
Auxiliary financial services	15.6	19.5	14.4	16.8	12.7	-1.2
Real estate activities	3.6	2.8	6.0	5.5	5.2	2.5
Renting of machinery etc	15.0	10.5	7.7	8.0	-2.1	-9.8
Computer services	23.4	29.2	33.5	16.4	-8.6	-6.6
Research and development	13.7	17.3	19.0	8.2	2.4	4.5
Other business services	10.4	10.0	13.0	11.9	4.7	-2.6
Public administration & defence	2.0	2.0	3.9	2.8	0.9	1.4
Education	2.3	0.8	1.6	5.6	5.8	5.4
Health and social work	5.9	5.0	5.1	4.8	1.6	3.6
Sewage & sanitary services	6.6	3.8	1.3	5.7	4.1	2.8
Membership organisations	23.7	18.9	4.5	8.7	2.2	4.0
Recreational services	5.0	5.6	7.9	9.3	6.5	2.6
Other service activities	15.8	19.6	6.3	5.9	-0.7	-1.4
All services	3.2	2.5	2.8	7.2	3.2	0.9
25th percentile	3.3	2.6	4.3	4.9	0.0	-1.7
50th percentile	5.7	4.6	5.8	8.0	3.4	1.1
75th percentile	14.0	12.2	7.8	9.3	5.3	3.1
Service industries GVA	2.0	2.3	2.9	3.8	0.5	-3.2

*No investment recorded before 1975

Source: Office for National Statistics

An alternative industrial breakdown of capital services is presented in **Table 3**. This breakdown matches the industry breakdown of the associated quality adjusted labour series (see Acheson 2011a). The multifactor productivity release, in this edition of ELMR (Acheson, 2011b) is based on this industry breakdown.

Interesting points to note from Table 3 are:

- the public sector of the economy has exhibited generally robust growth in capital services in the last two years, while many private sectors have shown weakness through larger falls in the growth of their capital services
- the average annual growth rate of capital services for the ‘agriculture, hunting…’ industry has recovered in 2008 and 2009 after declining over the rest of the period, turning negative over the last complete business cycle
- manufacturing is the only industry on this breakdown where the growth in capital services has been negative since the last complete cycle
- hotels and restaurants showed the highest average annual growth rate of capital services in 2009 of 2.9 per cent. Its capital services growth has increased steadily between economic cycles , from 5 per cent in the 1972–1978 economic cycle to 8 per cent for the most recent complete economic cycle
- construction had the largest annual fall in capital services in 2009, at 3.5 per cent; and
- real estate, renting and business activities had the largest decline in the average annual growth rate of capital services compared to the last economic cycle. This is principally due to the financial crisis making credit conditions tighter, and subsequent falls in property values meaning that these industries were among those hardest hit by the recession

Table 3 Average annual growth rates of capital services: by MFP industry group

Percentages

	1972-1978	1978-1986	1986-1997	1997-2007	2008	2009
Agriculture, Hunting and Forestry, Fishing, Mining and Quarrying, Electricity, Gas and Water Supply	3.2	2.1	0.8	-0.6	1.2	1.2
Manufacturing	2.4	1.0	2.5	0.2	-0.6	-2.1
Construction	2.4	-0.5	2.1	7.1	2.1	-3.5
Wholesale and Retail Trade: Repair of Motor Vehicles, Motorcycles and Personal Household Goods	5.1	4.0	5.5	7.0	3.3	0.4
Hotels and Restaurants	4.6	4.1	5.6	8.3	6.4	2.9
Transport, Storage and Communication	1.3	-1.1	2.9	6.5	4.0	1.6
Financial Intermediation	7.3	7.3	8.7	5.5	4.3	-1.7
Real Estate, Renting and Business Activities	7.5	6.7	10.7	11.0	0.7	-2.6
Public Administration and Defence: Compulsory Social Security, Education, Health and Social Work	2.3	1.9	3.4	3.6	2.0	2.8
Other Community, Social and Personal Services Activities, Private Households with Employed Persons, Extra-Territorial Organisations and Bodies	5.5	5.3	5.7	8.2	5.5	2.6

Source: Office for National Statistics

Profit shares

The weight of each asset or industry in calculating whole economy capital services is the share of gross operating surplus attributable to each asset or to each industry. These are usually referred to as profit shares. Profit shares can be volatile from year to year so, except for the last two years available, are shown in **Table 4** as average shares over selected periods.

Table 4 Profit shares* by asset

Percentages

Asset	1986-1997	1997-2007	2008	2009
Buildings	44.0	32.4	51.7	58.0
Computers	8.0	10.1	6.0	5.3
Copyright and licence costs	0.7	1.0	1.2	1.4
Mineral exploration	1.3	0.5	0.3	0.3
Plant and machinery	30.5	36.5	23.0	17.9
Own account software	3.1	5.1	5.8	6.4
Purchased software	3.4	5.3	4.8	4.5
Vehicles	9.0	8.9	7.1	6.1

* Average share over each period

Source: Office for National Statistics

Table 4 shows that the composition of profit shares can change significantly across economic cycles. Of most interest is the recent decline in the profit share of computer hardware and purchased software. This result coincides with the stagnation of capital services growth in these assets since 2005. However the profit share of own-account software has continued to increase, despite being a smaller asset category, as the market sector has maintained higher levels of investment. Own account software now commands a higher profit share than purchased software. Meanwhile the combined profit share of computer hardware and software is similar to the profits share as plant and machinery (16 per cent compared to 17.9 per cent).

The profit share of buildings has almost doubled from around 32 per cent in the last full economic cycle to 58 per cent in 2009. This is a result of the contraction of other asset categories such as plant and machinery which has halved from 37 per cent over the last full economic cycle to around 18 per cent in 2009. The profit share of vehicles has also declined in 2008 and 2009 compared with the last full economic cycle. These trends occur because the productive efficiency of buildings deteriorates at a slower rate than the other assets. Therefore an equal decrease in investment in all assets will cause a less significant fall in the building stock, allowing it to account for a greater proportion of the profits. Also worthy of note is the upwards trend in the profit share of copyright and licence costs, over past cycles and the resilience during the recession.

Table 5 presents the average profit shares by MFP industry group industry for the last complete economic cycles and for 2008 and 2009.

Table 5 Profit shares* by MFP industry group

Percentages

MFP industry group	1972-1978	1978-1986	1986-1997	1997-2007	2008	2009
Agriculture, Hunting and Forestry, Fishing, Mining and Quarrying, Electricity, Gas and Water Supply	18.1	19.5	17.1	13.2	11.6	11.8
Manufacturing	22.9	23.1	18.6	17.4	12.4	10.8
Construction	1.8	1.8	1.2	1.5	1.6	1.4
Wholesale and Retail Trade: Repair of Motor Vehicles, Motorcycles and Personal Household Goods	6.6	7.3	8.0	9.0	9.6	9.6
Hotels and Restaurants	1.7	1.8	1.9	2.4	2.9	2.9
Transport, Storage and Communication	16.4	13.7	11.3	13.5	14.0	14.0
Financial Intermediation	3.6	4.0	5.9	5.2	5.8	5.9
Real Estate, Renting and Business Activities	4.6	6.1	10.2	17.5	12.7	12.6
Public Administration and Defence: Compulsory Social Security, Education, Health and Social Work	20.7	18.4	20.3	13.3	19.9	22.1
Other Community, Social and Personal Services Activities, Private Households with Employed Persons, Extra-Territorial Organisations and Bodies	3.6	4.3	5.4	7.0	9.5	8.9

* Average share over each period

Source: Office for National Statistics

Production industries saw the trend of declining profit shares continue throughout the recession. The greatest impact of the recession occurred in the manufacturing industry, whose profit share remained on a downward trend in 2009, having fallen by around 6 percent since the last economic cycle. The profit share of manufacturing has declined gradually from 22.9 per cent in the 1970s to only 10.8 per cent in 2009 reflecting the contraction of this sector relative to the rest of the economy. The majority of the services industries have seen their profit shares continue to increase throughout the entire time period. Contrary to the results in the previous release, the government related sectors have benefited most during the recession, increasing their profit share to levels not seen since before the 1970s. As a result of the steep fall in capital services growth for the Real Estate, Renting and Business Activities industry, its profit share has also fallen significantly since the last complete economic cycle.

Quarterly estimates

As part of continuous developments to capital services estimates and in response to user demands, an experimental whole economy quarterly series was produced for the first time in

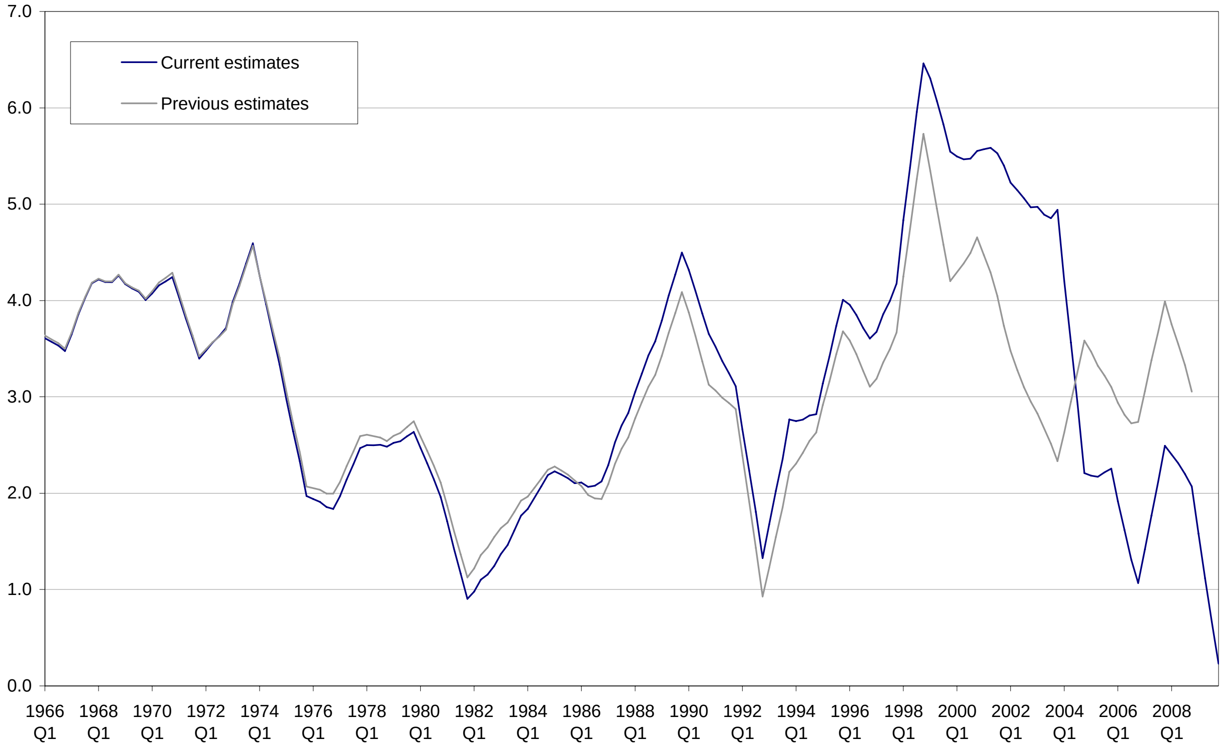
Wallis, Long and Turvey (2010). In this publication an equivalent market sector quarterly series has been produced for the first time. These series require further development and users should note the quality constraints of the series when using it for analysis.

A lack of detailed quarterly investment series means that the method adopted for producing the annual estimates cannot be implemented on a quarterly basis. Instead a quarterly series is approximated using the available annual data together with information on the quarterly path of whole economy investment available from table F of the *Quarterly National Accounts*. The asset specific quarterly investment series available from this release are used to calculate quarterly net stock series. Quarterly capital services growth is then calculated in the standard way, as described in detail in Wallis (2005), Wallis (2009) and in *The ONS Productivity Handbook* (ONS 2007). Annual weights are used in this calculation due to being limited to annual rental series. The series covers the period 1965Q1 to 2009Q4.

Figure 5 shows the current and previous growth rates in quarterly capital service estimates for the whole economy. The quarter on same quarter a year ago series shown has remained positive throughout 2009 measuring 0.23 per cent in 2009Q4. However the growth rate has been decreasing for nine consecutive quarters between 2007Q4 and 2009Q4. Both series look very similar to the annual growth series presented in their respective publications. This is because the methodology constrains the quarterly growth series to the annual estimates, meaning that the revisions are closely related to revisions in the annual series.

Figure 5 Quarterly growth in whole economy capital services

Percentages, quarter on same quarter one year ago

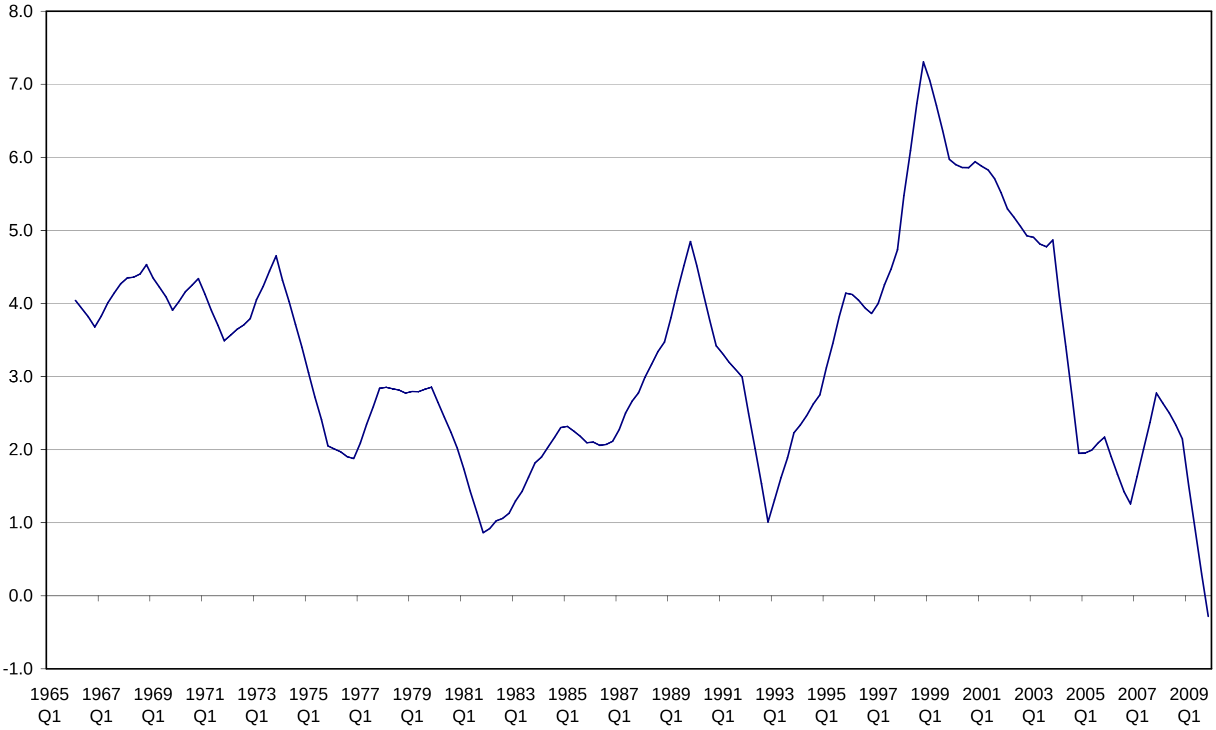


Source: Office for National Statistics

The quarterly market sector estimates are compiled using the same methodology as the whole economy series; however market sector weights are used. **Figure 6** illustrates the quarterly capital services estimates for the market sector. Despite a negative annual growth rate in market sector capital services for 2009, the quarterly growth rate is only negative in Q4, at -0.3 per cent on the same quarter a year ago. In line with the whole economy estimates the quarterly growth rate has been declining for nine consecutive quarters.

Figure 6 **Quarterly growth in market sector capital services**

Percentages, quarter on same quarter one year ago



Source: Office for National Statistics

Conclusion

Capital services are the measure of capital input that is most suitable for analysing and modelling productivity. This article has presented experimental estimates of the capital services growth for the UK as a whole, for the market sector, for the non–oil sector, by eight asset types and by detailed industry. An experimental quarterly series has also been extended since the last release. The estimates presented here have been revised since the previous release due to revisions to the source data.

The main observation is that the growth in capital services for the market sector has been negative for the first time, as a result of the sharp falls in investment during the recession. Although whole economy capital services growth has slowed, it remains positive due to continued investment in the public sector. The high growth in capital services for computer hardware and purchased software has stagnated in recent years and fallen during 2009, with own–account software experiencing the strongest growth in capital services amongst the asset categories. In general the services industries have seen more robust capital services growth during the recession than the production industries, although both have experienced a slowdown. As a result of this there has also been a clear shift in the profit share away from computer hardware as well as plant and machinery, and also from production industries to services industries. The latter reflects the stronger growth in public capital services than in the market sector.

The impact of the recession, between 2008 and 2009, is clear in the capital services data. Investment fell sharply in 2009 but whole economy capital services still grew by 0.4 per cent reflecting a divergence between the public and market sectors.

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Annex: Tax adjustment factor

The tax adjustment factor used to adjust the rental price of capital to take account of taxes on profits and subsidies to investment is given by

$$T_t^a = \left[\frac{1 - u_t \cdot D_t^a}{1 - u_t} \right]$$

where u_t is the corporation tax rate and D_t^a is the present value of depreciation allowances as a proportion of the price of asset type *a*.

The main rate of corporation tax is used and this is available from HM Revenue and Customs. The present value of depreciation allowances as a proportion of the asset price is now disaggregated by asset type. As opposed to previous publications the tax adjustment factor for plant and machinery (p) can now account for the first-year capital allowance. The present value of capital allowances is therefore given by:

$$D_t^p = \frac{(1+\rho_t) \cdot \left(\rho_t \cdot F_t^p + A_t^p \right)}{(\rho_t + A_t^p)}$$

where F_t^p is the first-year capital allowance on plant and machinery, ρ_t is the discount rate and is estimated as a weighted average of the cost of equity finance and the cost of debt finance, and A_t^v is the annual writing down allowance, the rate at which capital allowances can be claimed. For plant and machinery the annual writing down allowance is applied on a reducing-balance basis (geometric).

Vehicles (v) are not subjected to a first–year capital allowance and so the present value of capital allowances for vehicles is given by:

$$D_t^v = \frac{(1+\rho_t) \cdot A_t^v}{(\rho_t + A_t^v)}$$

Buildings (b) are also subject to an annual writing down allowance, although this is applied on a straight line basis, but this is due to be phased out by April 2011. Buildings have never been subject to a first-year allowance but have in the past been subject to initial year allowances. The present value of capital allowance is therefore given by:

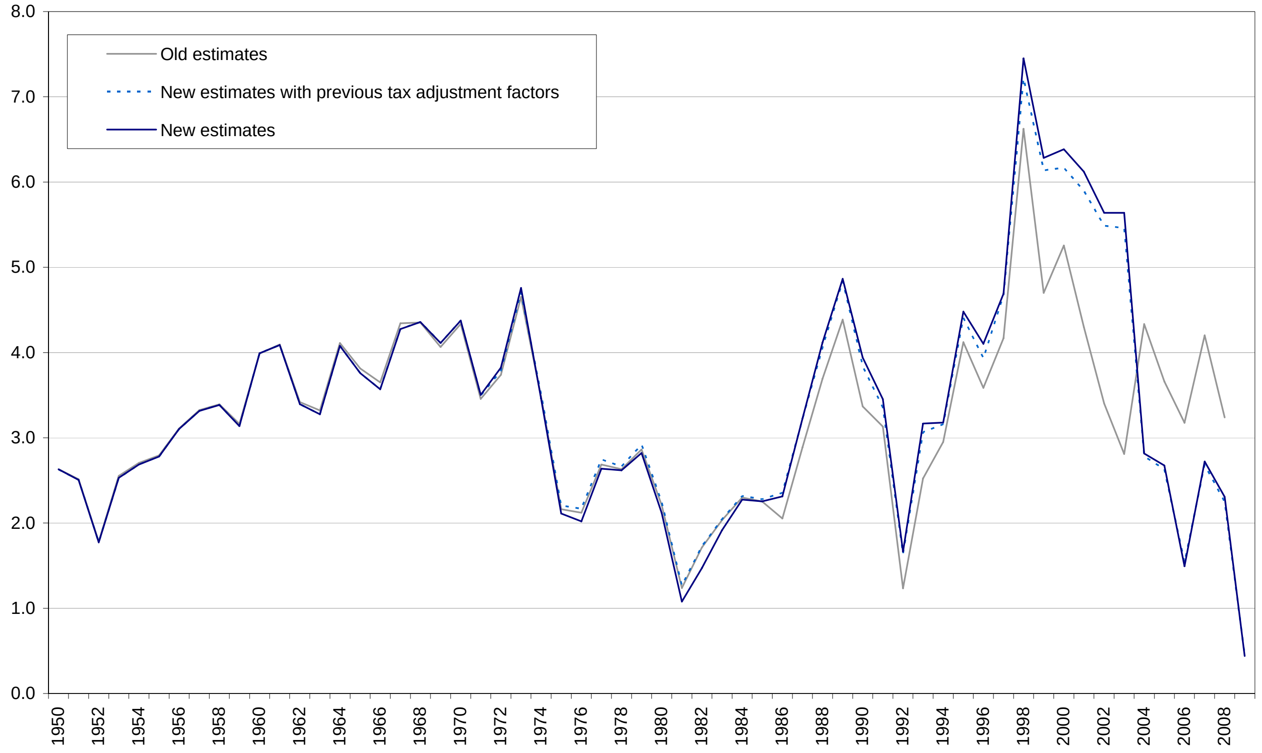
$$D_t^b = \frac{(1+\rho_t) \cdot \left(N_t^b + A_t^b \right)}{(\rho_t (1-(1-\rho_t)^{-(1-N)/A_t^b})}$$

where N_t^b is the initial year allowance on buildings.

For all other assets the plant and machinery tax adjustment factor will continue to be applied. In practice, the tax adjustment factors only have a significant impact on the estimates during period of major corporation tax reform which are infrequent in the UK. The revisions due to the use of the new tax-adjustment factors are minimal, as shown in **Figure A1**.

Figure A1 Annual growth in capital services: revisions from tax adjustment factor

Percentages



Source: Office for National Statistics

Multi–factor productivity: estimates for 1970 to 2009

Jean Acheson
Office for National Statistics

Summary

This article presents multi–factor productivity (MFP) estimates using experimental measures of quality adjusted labour inputs and capital services. Using a growth accounting framework, output growth can be split into the relative contributions of labour and capital inputs, and a residual component called MFP. MFP is also described in the literature as 'disembodied technical change', the 'Solow residual' or total factor productivity. This approach complements traditional measures of productivity, which focus only on one input – labour – and take account only of the volume of labour and not changes in the composition of labour over time. The most recent data highlights how MFP has declined during the recession at both the whole economy and industry level. The article also backcasts the series to 1970 using the EU KLEMS dataset to create a longer run picture of MFP.

Introduction

Using a growth accounting framework, growth in output can be decomposed into contributions from growth in labour inputs (in terms of both its quantity and composition) and from growth in capital services. The residual output growth that cannot be accounted for by growth in labour and capital inputs is hence an estimate of multi–factor productivity (MFP). This term is sometimes referred to as the 'Solow residual' or total factor productivity (TFP). Whilst conceptually this MFP residual can be thought of as capturing technological progress, in practice it may also capture a number of other effects. These may be effects such as an improvement in the quality of the labour force not captured by the quality adjusted labour inputs; changes in management techniques or business processes; or returns from expenditures that are not currently treated as capital formation within the national accounts framework, such as research and development. Some element of MFP will also reflect adjustment costs, economies of scale and measurement error in inputs and outputs.

A distinctive feature of this analysis is its utilisation of estimates of quality adjusted labour inputs, known as QALI. This allows for the contribution of labour inputs to be attributed to both an increase in the *volume* of labour, in terms of actual hours worked, and an increase in the *quality* of the labour, in terms of the skill composition of the work force. The analysis also utilises estimates of volume indices of capital services, referred to as VICS. The VICS measure is analogous to QALI in capturing compositional changes in capital inputs more fully than alternative measures of capital input, such as changes in net capital stocks. For the most recent analysis of QALI, see Acheson (2011). For more on VICS, see Appleton and Wallis (2011).

Growth accounting

The growth accounting framework, first developed by Solow (1957), attempts to measure the contribution of different factor inputs to economic growth. Any output growth not explained by growth in these factor inputs is known as multi–factor productivity growth. The specific methodology adopted in this analysis uses gross value added (GVA) as an output measure and VICS and QALI as its factor inputs. This approach to growth accounting is relatively undemanding in terms of data requirements[1]. The data necessary to produce quality adjusted labour inputs and capital services can readily be found in the National Accounts and Labour Force Survey.

MFP estimates are often interpreted as measuring the effect of ‘disembodied technical change’ – those advances in technology not embodied in capital. Examples of disembodied technical change include increased knowledge due to R&D, improved management techniques, changes in organisational structure or more efficient utilisation of ICT. It is important to note that improvements in the quality of capital are examples of ‘embodied technical change’. In principle, such quality changes are captured in the measurement of capital services (directly analogous to the measurement of labour quality changes) and are not included in MFP. MFP is linked, therefore, not to an increase in the quantity or quality of measured factor inputs but rather to how they are employed.

Methodology

Following Solow (1957), the production function is assumed to take the following form:

$$Y = A(t)\,f(K,L)$$

Where $A(t)$ represents disembodied technical change, K denotes the volume of capital inputs (measured by VICS), L denotes the volume of labour inputs (measured by QALI) and Y denotes the volume of output, measured by gross value added. This production function embodies the assumption of neutral technical change, that is, the disembodied technological shift factor, $A(t)$, leaves the marginal rates of technical substitution of the labour and capital inputs unchanged. It is additionally assumed that factors are paid their marginal products. Given that all factor inputs are classified as either labour or capital, this implies constant returns to scale in the production function.

Taking the total differential with respect to time and dividing by output gives the proportionate growth in output (where dots denote time derivatives):

$$\frac{\dot{Y}}{Y} = A\frac{\partial f}{\partial K}\frac{\dot{K}}{Y} + A\frac{\partial f}{\partial L}\frac{\dot{L}}{Y} + \frac{\dot{A}}{A}$$

If the relative income shares of capital and labour are denoted as follows, $w_k = \frac{\partial Y}{\partial K}\frac{K}{Y}$ and $w_l = \frac{\partial Y}{\partial L}\frac{L}{Y}$ then (noting that $\partial Y / \partial K = A\partial f / \partial K$ and so on) growth in output can be expressed as an income share weighted sum of factor input growth and growth in disembodied technical change:

$$\frac{\dot{Y}}{Y} = w_k\frac{\dot{K}}{K} + w_l\frac{\dot{L}}{L} + \frac{\dot{A}}{A}$$

Here, the assumption of constant returns to scale implies that the capital share of income is equal to one minus the labour share of income, that is, $w_k = (1 - w_l)$. In discrete time, this can be re–arranged and approximated as:

$$\Delta \ln Y(t) = \bar{s}_l(t)\Delta \ln L(t) + \left[1 - \bar{s}_l(t)\right]\Delta \ln K(t) + \Delta \ln A(t)$$

Where $\bar{s}_l$ represents the average labour share of total income between the current and previous period. This states that the growth in log GVA is equal to growth in log labour input weighted by the labour income share plus growth in log capital input weighted by the capital income share plus growth of the disembodied technical change (MFP) parameter. This shows how an estimate of MFP can be recovered as a residual.

This framework can be adapted in order to obtain a decomposition of growth that includes the contribution of labour composition. Letting *H* denote unadjusted labour inputs (measured by hours), then:

$$\frac{\dot{Y}}{Y} - \frac{\dot{H}}{H} = w_k\frac{\dot{K}}{K} + w_l\frac{\dot{L}}{L} - \frac{\dot{H}}{H} + \frac{\dot{A}}{A}$$

which, after some re–arrangement, can be simplified to:

$$\frac{\dot{Y}}{Y} - \frac{\dot{H}}{H} = w_k\left(\frac{\dot{K}}{K} - \frac{\dot{H}}{H}\right) + w_l\left(\frac{\dot{L}}{L} - \frac{\dot{H}}{H}\right) + \frac{\dot{A}}{A}$$

In discrete time this equation can be further re–arranged and approximated as follows:

$$\Delta \ln\left[\frac{Y(t)}{H(t)}\right] = \bar{s}_l(t)\left[\Delta \ln L(t) - \Delta \ln H(t)\right] + \left(1 - \bar{s}_l(t)\right)\left[\Delta \ln K(t) - \Delta \ln H(t)\right] + \Delta \ln A(t)$$

This states that growth in log GVA per hour of labour input (that is, labour productivity as conventionally measured, for example in the ONS quarterly Productivity Statistical Bulletin[2]) can be decomposed into the contributions of weighted labour composition (the difference between the growth of quality adjusted and unadjusted labour inputs), capital deepening (defined as the weighted growth in capital inputs per hour worked) and MFP growth. The quality adjustment measure of labour input explicitly accounts for the heterogeneity of labour inputs by adjusting for changes in labour supply as reflected by education, gender and industry of employment. This is in contrast to a standard aggregation of labour which treats each hour of labour input as homogeneous.

Source data

The labour input measure, QALI, is mainly derived from quarterly Labour Force Survey (LFS) data. This allows information on the educational, industrial, age and gender composition of the labour inputs to be gained. Making the assumption that factors are paid their marginal products, the hours worked by each compositional category are weighted by their share in total labour income. This quality adjustment procedure captures, at least partially, the contribution to output growth of changes in the skill level of the workforce rather than attributing this contribution to MFP growth. For more information on QALI and the latest estimates see Acheson (2011). Unadjusted hours consistent with QALI are also used as an input to the MFP framework.

The capital input measure used in this MFP analysis is the volume index of capital services (VICS). This measures the flow of capital services to the production process in each period. Capital services differ from National Accounts capital stock measures as they weight together the growth in the net stock of assets using rental rather than purchase prices. This is conceptually more appropriate for use in growth accounting analysis since, under the assumption that factors receive their marginal products, rental prices better reflect the marginal productivity of a given capital asset. Capital services estimates also provide a greater level of asset detail than the National Accounts net capital stock measures. The separate treatment of the short–lived ICT assets of computer hardware, purchased software and own–account software is a particular advantage of the VICS measure. Further information about VICS and the latest estimates can be found in Appleton and Wallis (2011).

The output measure used in this MFP analysis is a chained volume index of GVA at basic prices, consistent with Blue Book 2010. The labour share of total income is calculated as the sum of Compensation of Employees (CoE) from the National Accounts and the labour compensation of the self employed as a proportion of total GVA. There is no National Accounts series for the labour income of the self–employed. Instead the National Accounts ‘mixed income’ series includes the returns to both capital and labour of the self–employed. In order to approximate the labour return component of mixed income, the ratio of compensation of employees to the sum of compensation of employees and gross operating surplus in the employed sector is applied to mixed income. The capital share in total income is simply one minus the labour share, due to our assumption that all factor inputs are either capital or labour.

Results

This section presents growth accounting results over the period 1995 to 2009 for the whole economy, ten industry groups (which are detailed in **Table 1**) and for the market sector[3]. Due to the volatility of year on year MFP growth, the results are mainly presented as averages over the periods. The backcasting of the series to 1970 relies on data from the EU KLEMS project[4]. It was not possible to backcast the market sector as EU KLEMS uses a different definition to ONS.

Table 1 Industry descriptions

Industry*	Industry description
ABCE	Agriculture, hunting and forestry; fishing; mining and quarrying; utilities
D	Manufacturing
F	Construction
G	Wholesale and retail trade
H	Hotels and restaurants
I	Transport, storage and communications
J	Financial intermediation
K	Real estate, renting and business activities
LMN	Public administration and defence; education; health and social work
OPQ	Other social and personal services

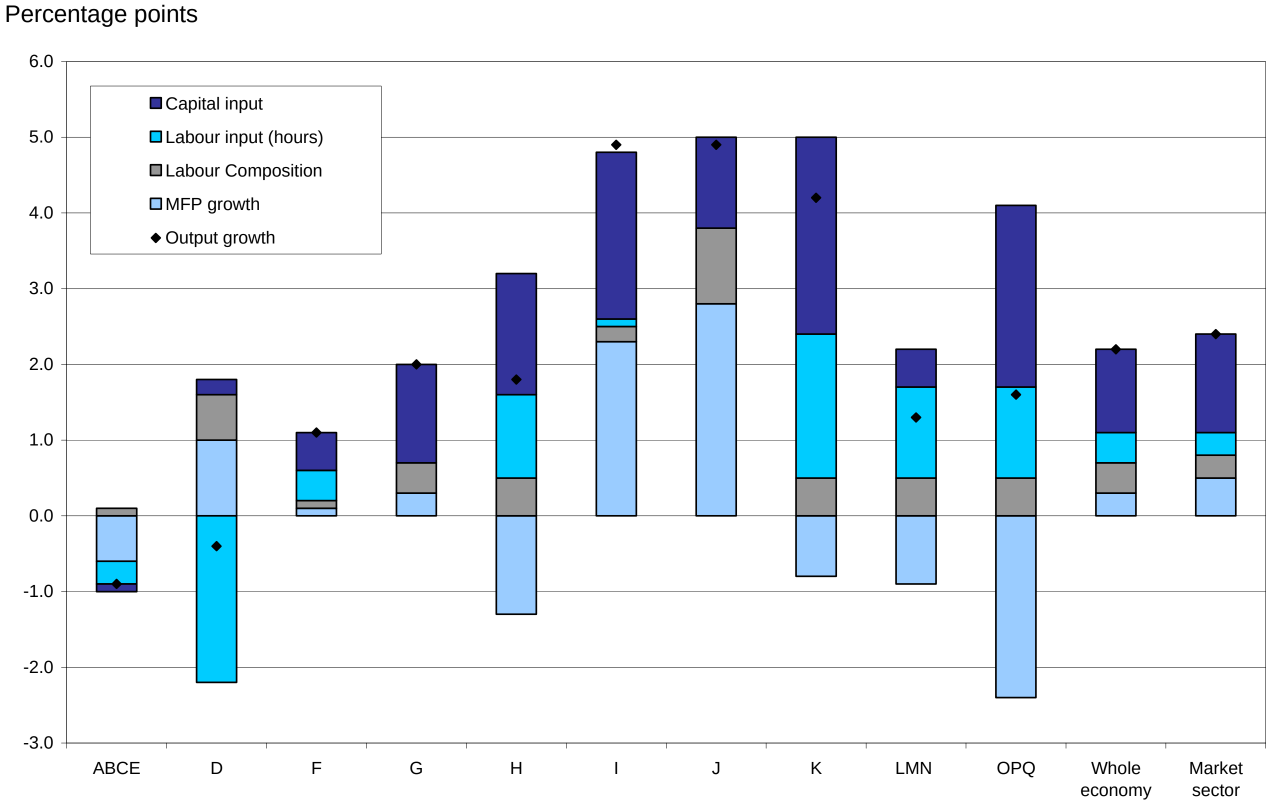
* Standard Industrial Classification (2003)

Figure 1 decomposes the average growth in output from 1995 to 2009 into the contributions from capital and labour input growth, MFP growth and growth in the quality of labour, known as labour composition. At the whole economy level, average annual MFP growth is estimated to be 0.3 per cent, compared with average output growth of 2.2 per cent per annum over the period. The greatest contribution to growth came from capital inputs, which accounts for half of output growth. Growth in the quality of labour composition accounted for a more modest 0.4 per cent of growth per annum.

With an average annual growth rate of half a per cent between 1995 and 2009, MFP represented a fifth of market sector output growth. This more positive contribution of MFP to output growth relative to the whole economy is driven by negative MFP growth in LMN (public administration and defence and so on) and OPQ (social and personal services) which contain a significant amount of non-market output. These industries may not face the competitive pressures to utilise their factor inputs efficiently in the same way that market sector industries do. It is also possible that the measures of non–market sector output are not fully capturing changes in quality. Work is currently ongoing within ONS to improve these output measures[5].

Growth in market sector capital services was similar to that of the whole economy. However the contribution to growth due to labour composition was less than that of the whole economy, due to the strong labour composition effects of LMN and OPQ in particular, whose activities are mainly in the non–market sector.

Figure 1 Decomposition of annual average output growth, 1995–2009



Source: Office for National Statistics

Turning to the industrial groupings, the strongest MFP growth over the period occurred in industry J (financial intermediation) with an annual average growth rate of 2.8 per cent. This accounts for over half of total output growth in this section, reflecting rapid technical progress in communications in particular. Strong MFP growth also occurred in sections D (manufacturing) and I (transport, storage and communication). Labour quality made a positive contribution to output growth in each of the ten industrial groups with J in particular benefiting from the increased utilisation of high skilled labour.

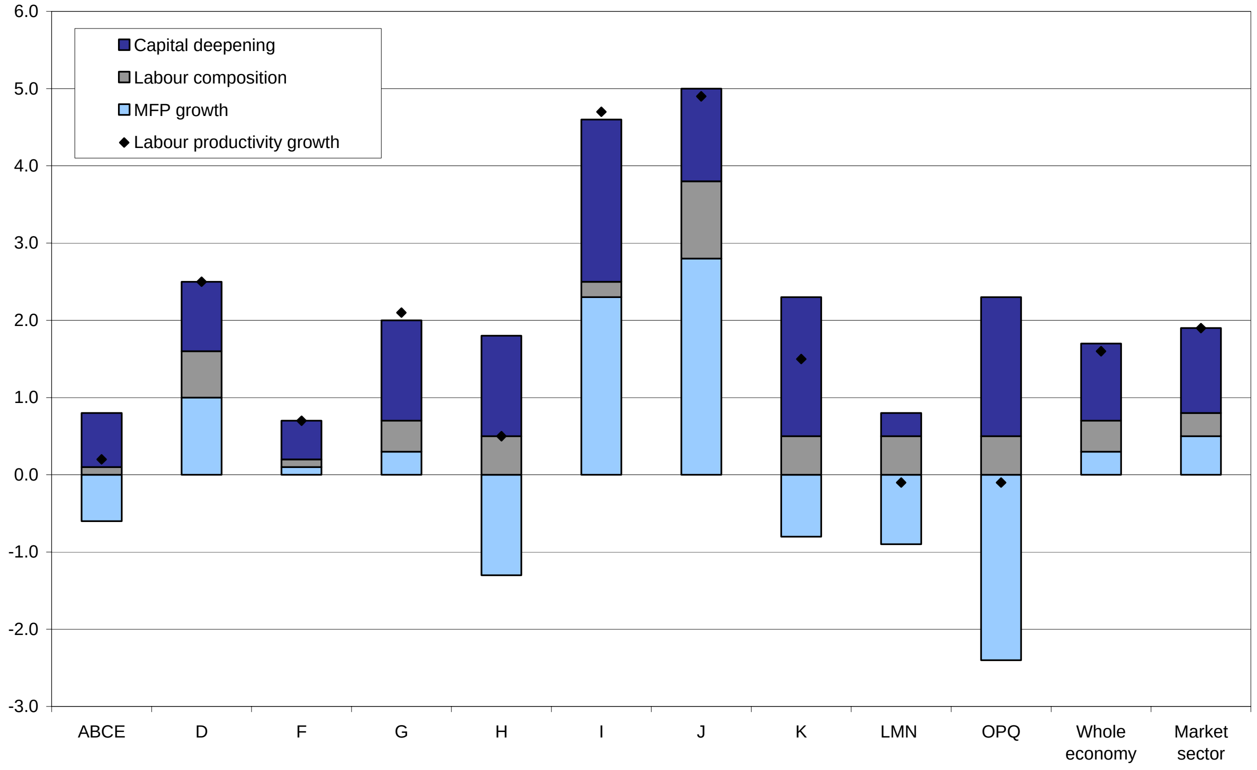
Notwithstanding rapid MFP growth in industries I and J, average annual MFP growth in the service sector as a whole (industries G to Q), lagged behind that of the production sector (industries A to F). A commonly cited explanation for the disparity in productivity between production and service activities is the *Baumol Effect* (Baumol, 1967). The theory behind the *Baumol Effect* is that the relative productivity underperformance of the services sector is due to its relative labour intensity.

This makes it worse placed to benefit from productivity improvements arising from technological advances.

As discussed in the methodology section, a decomposition of labour productivity growth can be used to inform analysis of the drivers of growth in the headline productivity measures. **Figure 2** decomposes labour productivity growth into the contributions from labour composition, MFP and the amount of capital per hour worked (known as capital deepening). The graph highlights divergence in labour productivity growth rates across industries and MFP is a clear driver of this.

Figure 2 Decomposition of annual average labour productivity, 1995 to 2009

Percentage points



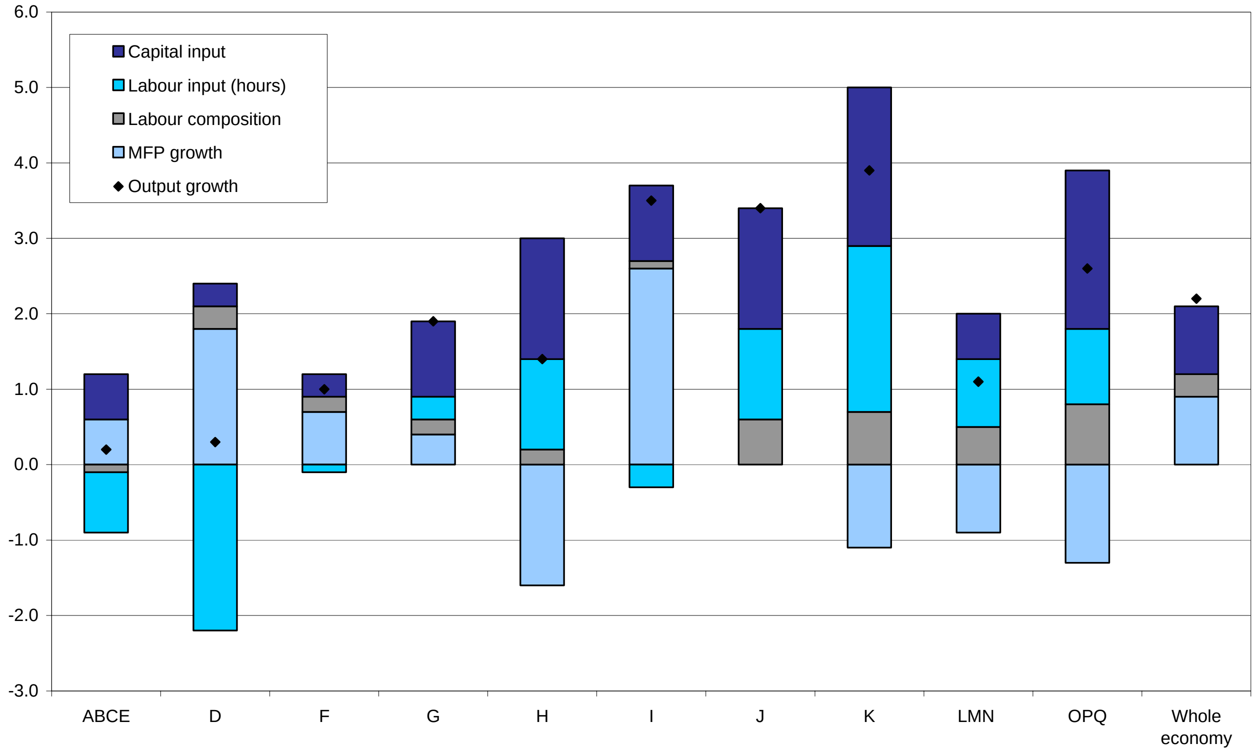
Source: Office for National Statistics

Over 1995 to 2009, capital deepening accounted for over 60 per cent of labour productivity growth at the more aggregated levels of the whole economy and the market sector. In fact a positive contribution from capital deepening occurred in each of the industrial groupings. The industries with the greatest contribution from capital deepening are those in the service sector. This partly reflects rapid growth in ICT investment over the period. The contribution of labour quality was generally much more modest, at both the whole economy and industrial levels, with the exception of K (real estate, renting and business activities) where it accounted for almost a third of labour productivity growth.

Using the EU KLEMS dataset and other National Accounts and Labour Force Survey series, the MFP series for the whole economy and for the industrial groupings was backcast to 1970. **Figure 3** takes the average growth rate for this period and decomposes it into its constituent parts[6]. At the whole economy level, capital input and MFP are the clear drivers of growth; there are significant differences across industries, however. MFP makes a positive contribution to growth in all the production industries, but its performance is mixed across the services. It is strongest in I while it has made a negative contribution to growth in H (hotels and restaurants) and LMN. Labour composition made the largest contribution to OPQ, at almost a third of its average output growth over the period. The lack of MFP growth in J over this longer time period is in marked contrast to the strong positive contribution over the most recent period shown in Figure 1.

Figure 3 Decomposition of annual average output growth, 1970–2009

Percentage points

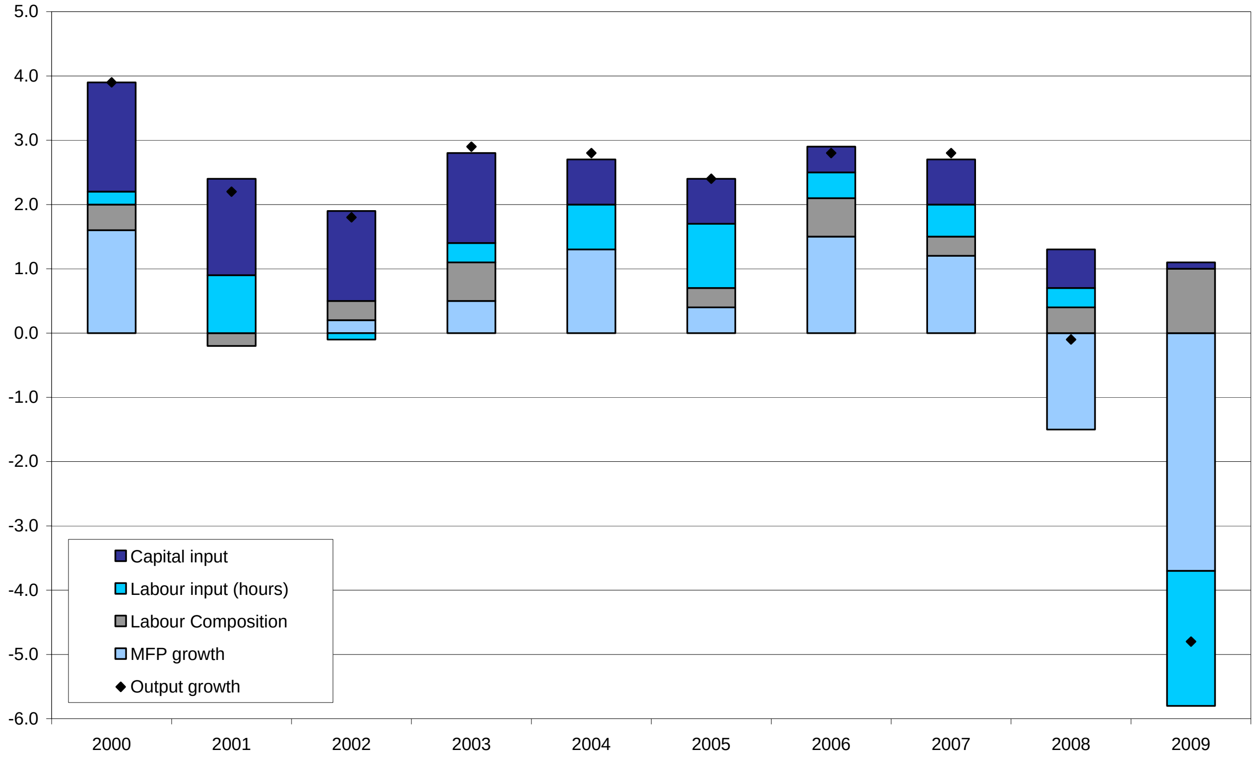


Source: Office for National Statistics

Figure 3 is useful for the long run perspective it gives and for its smoothing out of the economic cycles, but the most recent data is worth examining in closer detail. The time series of the breakdown for the whole economy over the past decade highlights the deterioration in output and MFP growth over the recession. In **Figure 4,** the 2009 growth rate in particular reveals a very different pattern to preceding years.

Figure 4 Decomposition of annual output growth for the whole economy, 2000–2009

Percentage points



Source: Office for National Statistics

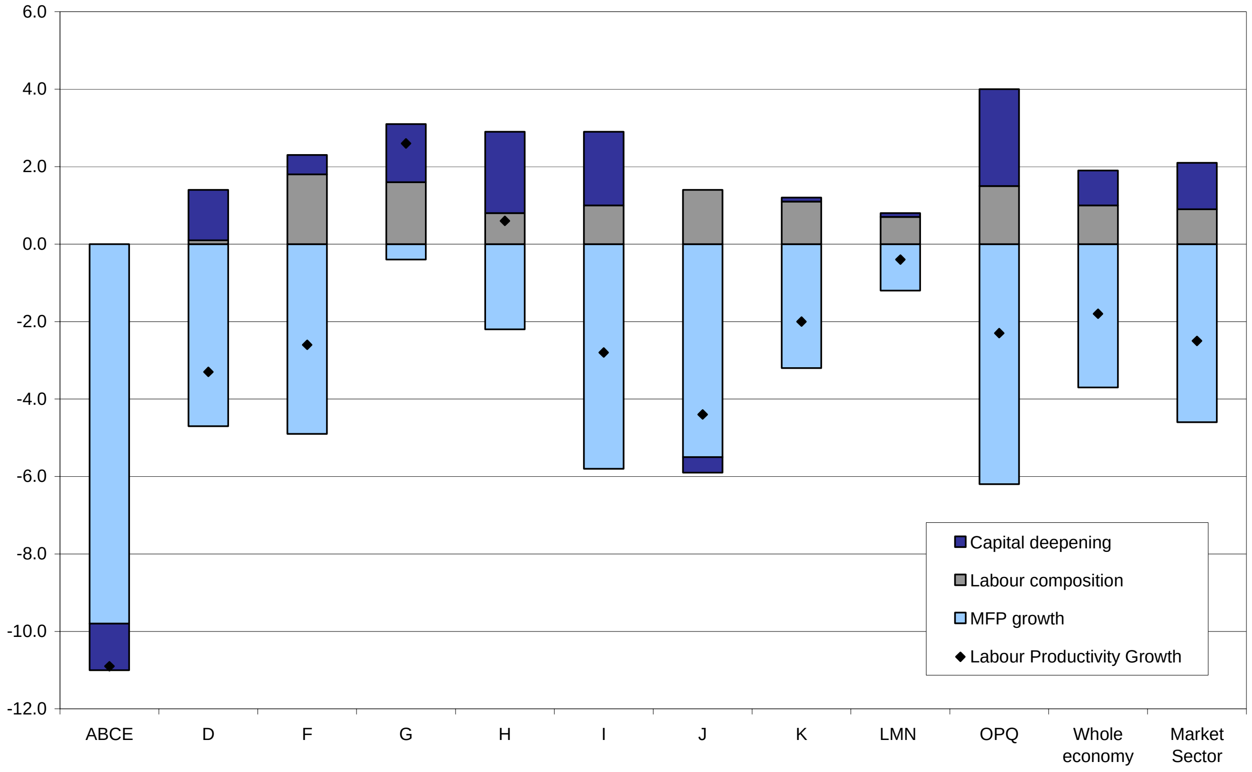
Although growth accounting is not an analysis of causation, the results in Figure 4 show that the contribution of MFP to growth is highly pro–cyclical: the stalling of output growth in 2008 entirely reflects the negative contribution of MFP. And while the volume of labour input fell in 2009, in growth accounting terms MFP accounted for a larger proportion of the decline in output. The fall in labour input is to be expected as labour shedding is common in economic downturns, but the strong positive contribution of labour composition in 2009 reveals that, on average, it was the lowest skilled workers who bore the brunt of the reduction in hours (see Acheson (2011) for further details).

If MFP is interpreted as the efficiency with which other factors are used, the 2009 result suggests the UK economy is not responding robustly to the economic decline as factor inputs are not being utilised to their full capacity. The fall in MFP in 2009 is also greater than its fall in the previous two recessions, although this result may be affected by the greater severity of the 2008/09 recession. The cyclical fall in efficiency could also be heightened by measurement error, for example it is difficult to measure the impact of capacity scrapping on capital services during a turning point in the economic cycle.

A decomposition of labour productivity in 2009 similarly shows the poor performance of MFP across industries (**Figure 5**). This result reinforces the pro–cyclical nature of MFP. However, as stated previously, the yearly estimates of MFP are quite volatile and Figure 5 should mainly be used as a tool to highlight the divergences in productivity across industries.

Figure 5 **Decomposition of labour productivity growth, 2009**

Percentage points



Source: Office for National Statistics

Revisions since previous release

Revisions to the MFP results since Long and Franklin (2010) arise from revisions to the component series and can be categorised into three broad groups:

- revisions to the National Accounts data in *Blue Book 2010*
- revisions to QALI and labour input estimates
- revisions to VICS estimates

There were few changes in the structure of the National Accounts in Blue Book 2010, although GVA was revised due to the updating of the reference year from 2005 to 2006. This impacts on the entire time series but there are no significant revisions to growth rates prior to 2006.

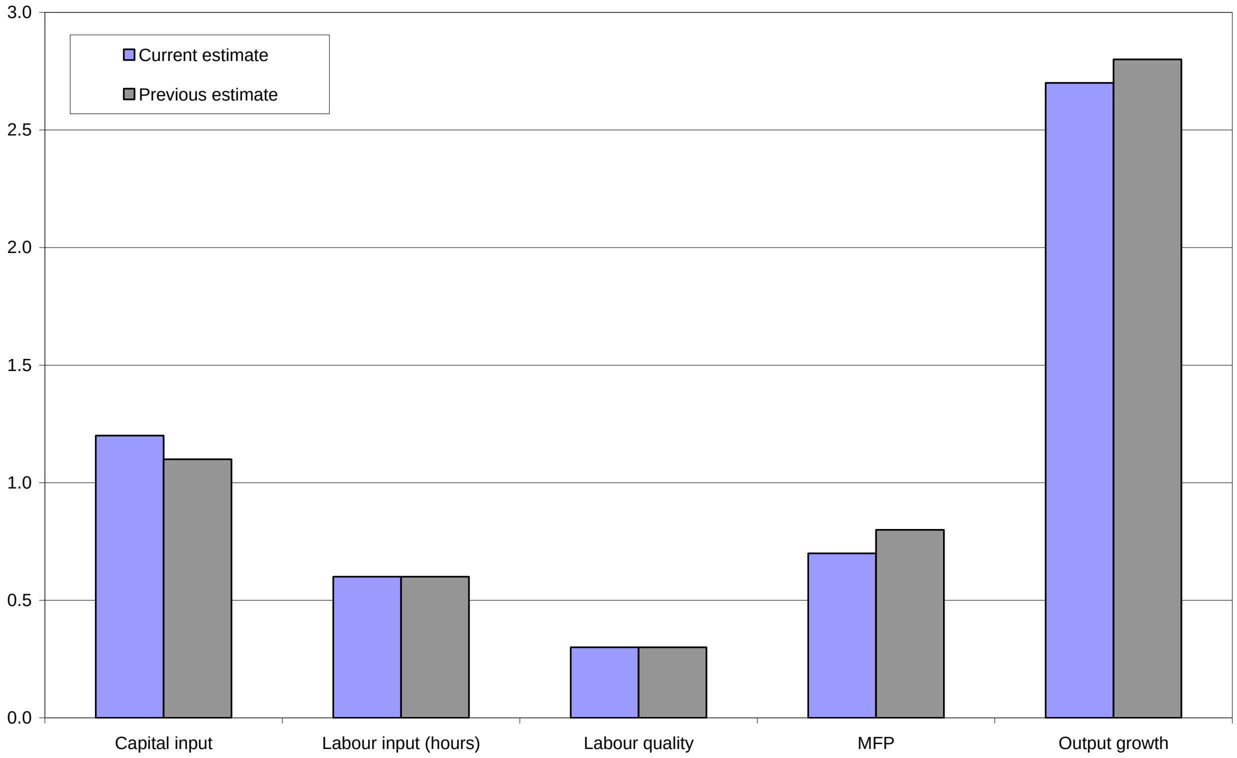
Revisions to the QALI and labour input series are driven by revisions to National Accounts Compensation of Employees data and annual benchmarking of the LFS micro data.

Revisions to the VICS estimates arise primarily from balancing revisions to the constant price investment series, new data on computer hardware investment and a new tax adjustment factor methodology. These revisions are described in more detail in Appleton and Wallis (2011).

To give an indication of the drivers of revisions to output growth, **Figure 6** plots the average contributions at the whole economy level for the most recent and previous estimates. The data cover the period 1994 to 2008, over which comparable data are available. Over this period, average output growth has been revised marginally downwards. Compared to the previous estimates, capital input has been revised upward by 0.11 percentage points, which feeds through into a downward revision of 0.12 percentage points to MFP.

Figure 6 Contributions to whole economy annual average output growth, 1994 to 2008: new and previous estimates

Percentage points



Source: Office for National Statistics

Conclusion

Over the period 1995 to 2009, MFP had a positive impact on growth of the whole economy and market sector; however its performance was mixed across individual industries. Its contribution in the market sector was greater than that of the whole economy due to the negative contribution of MFP to growth in the predominantly non–market industries LMN and OPQ. However, the contribution to growth due to labour composition was larger for the whole economy, owing to greater utilisation of highly skilled labour in LMN and OPQ.

Backcasting the data to 1970 highlighted that MFP and capital inputs have been the drivers of growth for the whole economy over the long run. In transport, storage and communications, MFP has accounted for 75 per cent of output growth, the largest contribution for any industry

Finally, MFP fell sharply over the recession, as did labour hours. However, the pro-cyclical nature of MFP suggests it is to be expected that it will increase again in the coming years, as the UK leaves recession behind

Notes

1. An alternative approach to growth accounting is to use a gross output measure and calculate the contributions to growth not only from capital and labour inputs but from intermediate inputs as well, Phelps (2010). An example of this approach is the EUKLEMS project (see www.euklems.net) which additionally apportions output growth to the intermediate inputs of energy, materials and services. Whilst this approach to growth accounting is conceptually preferred, its data requirements are much more onerous. In particular, constant price supply use tables, which are not currently published by the ONS, represent a barrier to adoption of this approach.

2. See http://www.statistics.gov.uk/cci/nugget.asp?id=133 for the latest labour productivity estimates.

3. The National Accounts define market sector activity as that which is undertaken at prices that are economically significant and where the output is disposed of or intended for sale through the market.

4. The EU KLEMS project, which ran from 2003 to 2008, created a database on measures of economic growth, productivity, employment creation, capital formation and technological change at the industry level for all European Union member states from 1970 onwards. The database's growth accounting variables and its level of industrial disaggregation allow backcasting of ONS series in a consistent manner. Further details available at: http://www.euklems.net/

5. See www.statistics.gov.uk/ukcemga for further information on this development.

6. A breakdown of Figure 3 into shorter time periods is provided in the **Annex**.

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Annex: Average growth rates for 1970 to 2009

	1970-79	1980-89	1990-99	2000-09
GVA				
ABCE	-0.2	0.9	2.9	-2.7
D	0.6	1.0	0.7	-1.2
F	-0.5	3.4	0.2	0.8
G	0.4	3.0	1.7	2.1
H	0.9	2.3	0.8	1.5
I	2.6	2.9	5.9	2.5
J	2.6	3.0	3.5	4.4
K	3.8	4.6	3.9	3.3
LMN	1.7	0.1	0.9	1.7
OPQ	2.7	3.5	3.6	0.5
Whole Economy	2.3	2.4	2.2	1.7
Market Sector	1.9	2.7	2.5	1.7
MFP				
ABCE	-0.3	1.1	3.8	-2.5
D	1.3	3.1	1.3	1.6
F	-0.4	1.9	1.4	-0.4
G	-1.5	1.8	-0.2	1.1
H	-2.1	-1.0	-1.7	-1.8
I	2.2	3.5	4.4	0.4
J	-2.1	-1.6	0.9	2.4
K	-0.8	-1.4	-1.5	-0.7
LMN	-1.5	-1.1	-0.6	-0.7
OPQ	-1.5	-1.2	0.7	-3.3
Whole Economy	1.1	1.6	0.9	0.2
Market Sector			0.7	0.4
Labour Composition				
ABCE	0.1	-0.4	-0.2	0.1
D	0.1	-0.1	0.5	0.6
F	0.0	0.2	0.3	0.1
G	0.2	-0.3	0.4	0.5
H	0.1	-0.3	-0.1	1.0

	1970-79	1980-89	1990-99	2000-09
I	0.0	-0.2	0.3	0.3
J	0.5	-0.1	0.8	1.2
K	1.2	0.9	0.4	0.4
LMN	0.9	0.1	0.6	0.4
OPQ	1.1	1.0	0.5	0.5
Whole Economy	0.4	0.0	0.4	0.4
Market Sector			0.3	0.3
Labour input (hours)				
ABCE	-1.4	-0.8	-1.2	-0.1
D	-1.3	-2.3	-1.9	-3.2
F	-0.4	1.2	-1.8	0.5
G	1.0	0.5	0.3	-0.6
H	0.8	2.1	1.3	0.7
I	-0.6	-0.1	-0.4	-0.1
J	2.3	2.8	-0.1	-0.2
K	2.2	3.2	1.8	1.7
LMN	1.7	0.5	0.2	1.4
OPQ	1.4	1.7	0.1	1.0
Whole Economy	0.0	0.1	-0.2	0.2
Market Sector			0.9	0.0
Capital input				
ABCE	1.4	0.9	0.4	-0.2
D	0.5	0.3	0.6	-0.2
F	0.2	0.1	0.3	0.6
G	0.8	0.9	1.2	1.1
H	2.0	1.5	1.3	1.6
I	0.9	-0.3	1.7	1.9
J	1.8	1.9	1.8	1.0
K	1.2	1.9	3.1	1.9
LMN	0.6	0.5	0.7	0.6
OPQ	1.6	2.0	2.3	2.2
Whole Economy	0.7	0.7	1.2	0.9
Market Sector			1.8	1.0

Enhancing coverage of financial market activity

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Summary

In July 2009 a special edition of Economic and Labour Market Review presented a series of articles identifying areas for improvement in the coverage of financial statistics under the 'Developing financial statistics for policy' programme. This article focuses on the gaps that exist in current statistical coverage of financial activity, especially as it relates to innovation in the financial sector. It is a precursor to the potential development of appropriate statistical measures that will capture the values of new financial instruments and the behaviour of new institutions. The resulting metrics will improve the depth of understanding of financial markets and provide the foundation for relevant and timely macroprudential indicators that will assist in the prediction of systemic risks to financial institutions.

Background

The financial crisis highlighted the need to improve the quality and coverage of financial statistics for policy purposes. At the end of 2008, ONS established a number of related projects to make progress on this agenda. The July 2009 issue of *Economic and Labour Market Review*[1] presented an interim progress report and a further update was published in January 2011 (Walker 2011).

One of the projects focused on gaps in the present statistical coverage of the financial sector.

Reliable and timely information on transactions involving the financial sector is essential for a number of reasons. The financial intermediation sector in the UK accounts for around 7 per cent of GDP and is therefore an important source of economic prosperity in its own right. It is also a facilitator of many forms of economic activity by providing access to the means necessary to finance transactions. Its impact on other sectors is important for understanding the behaviour of the economy.

It is therefore necessary to monitor the financial sector's activity closely to prevent undesirable events that may generate systemic risks. One conclusion to be drawn from recent events is the need to give greater emphasis to systemic prudential oversight as well as to oversight of individual institutions. The Bank of England's discussion paper, *The role of macroprudential policy*[2], noted:

'Effective macroprudential policy instruments are an important missing ingredient from the current policymaking toolkit, in the United Kingdom and internationally. Had they existed, the current crisis might plausibly have been less costly for the real economy.'

The financial crisis highlighted shortcomings in current data sources which failed to capture the rapid pace of innovation in financial markets and may have impeded the authorities in acting in a supervisory capacity. A good understanding of these developments is especially important in the UK, which lies at the centre of a web of financial interconnectivity and product innovation. The need is for better macroprudential indicators embodying aggregated data across institutions and across sectors. This is complementary to microprudential data requirements that are centred on the soundness of individual institutions.

ONS, jointly in partnership with key stakeholders such as HM Treasury, the Bank of England and the Financial Services Authority, is seeking to improve statistics in a way that will enhance understanding of the activities of the UK financial sector. Such a partnership is essential in order to obtain information from all of the relevant financial institutions and markets. More specifically, success requires:

- clarity as to the information and statistics, not currently available, that are needed
- formulation of clear and agreed plans as to how these statistical gaps could be filled, and
- availability of the resources needed to implement these plans and deliver the required results

With particular reference to the rapid pace of financial innovation, this article identifies gaps that have emerged in the existing statistical coverage of financial products and institutional structures, outlining their growth and the resulting potential for risk transmission. It discusses the scope for future improvements to supplement macro financial indicators, and to enhance understanding of the impact of the financial sector on the real economy. Finally, the framework is expanded to cover linkages within the financial sector, and between it and the rest of the economy, to understand the behaviour of financial flows over time and between institutions.

Current coverage of the financial sector

ONS categorises financial sector activity according to the European System of Accounts 1995 (ESA95) framework which provides guidelines for measuring macroeconomic activity within the EU. ESA95 is itself based on the international standard of the System of National Accounts 1993 (SNA93).

Coverage of financial sector activity spans two dimensions. The first relates to production activities and provides details of the distribution and use of income resulting from the 'production' of financial sector outputs. The second covers the accumulation of financial and non–financial assets by each sector of the economy. The financial accounts therefore record changes in financial assets and liabilities that result in each sector's net borrowing to, or lending from, other sectors of the economy.

ONS publishes statistics covering the activities of the UK financial sector in three main publications:

- the Blue Book
- UK Economic Accounts
- Financial Statistics

Blue Book and UK Economic Accounts

These two publications present the activity of the financial sector for the purposes of presenting the National Accounts. Blue Book (BB) figures show annual aggregates consistent with the quarterly coverage of UK Economic Accounts (UKEA).

UKEA covers changes in assets and liability positions of five different types of financial institutions:

- Central bank
- Banks and building societies
- Other financial intermediaries and financial auxiliaries
- Insurance companies and pension funds

Detailed data divide assets and liabilities by maturity period. Maturities of less than one year are categorised as short–term, whilst those in excess of one year are long–term. Assets and liabilities are further reported according to their sub–categories. For banks for example, UKEA and Blue Book report the following sub–categories:

- currency and deposits
- securities other than shares
- loans
- shares and other equity

Some assets and liabilities, such as loans, are further divided into different periods of maturity and details are provided about the counter–party[3].

Blue Book has similar coverage to UKEA, with minor differences. The financial corporations sector covers four major groups of financial institutions:

- **Monetary financial institutions** – central bank, banks, and building societies
- **Other financial intermediaries** – institutions that collect savings and allocate them to investment projects, but have liabilities others than currency and deposits. These include leasing corporations, security and derivative dealers, and venture capital companies
- **Insurance companies and pension funds** – including corporations involved in financial intermediation as a consequence of the pooling of risk[4].

- **Financial auxiliaries** – involved in activities related to financial intermediation but not themselves intermediaries.

An additional feature is a derivative account, but coverage is limited to reported annual positions.

In both publications, the balance sheet data is unconsolidated – that is transactions of assets and liabilities between sub–sectors of the same sector and between institutional units of the same sub–sector are eliminated.

Data presented in the Blue Book and UK Economic Accounts publications meet the requirements of the SNA and ESA, but do not offer full understanding of the impact of the financial sector on economic activity and risk transmission. Data coverage is focused on high level aggregates. Information on sub–positions and maturity period and on the destination of loans – to PNFCs, to households and to other financial corporations – is not reported. Furthermore coverage has not kept pace with the rapid pace of innovation in financial products, or with the evolution of complex institutional structures that are intertwined with shadow banking activity.

Financial Statistics

This monthly publication has two parts. The first shows public and private sector financial and monetary data. Most is monthly in frequency; the rest quarterly. The content is not governed by a rigid framework such as the National Accounts, permitting a greater degree of flexibility in determining the precise coverage.

The data cover income, expenditure and transactions involving monetary financial institutions (Bank of England, banks and building societies), as well as non–bank financial institutions – insurance companies (long–term and others), pension funds, non–monetary sector credit companies, investment trust, unit trusts, property unit trusts, turnover in securities by other financial institutions, institutional investment, securities dealers.

Additionally, it reports insolvencies in England and Wales; liquidity of large non–financial corporations; capital, share and bond issuance; commercial paper issuance; and stock exchange transactions. The coverage of assets and liabilities is quite detailed – for instance, data for banks include assets and liabilities in sterling and foreign currencies, sight and time deposits, sale and repurchase agreements, acceptance guaranteed, certificates of deposit (CDs) and other short term papers issued, items in suspense and transition, and net derivatives. And it provides detailed analysis of sources of deposits and allocation of loans to non–financial sectors.

Part two of Financial Statistics follows an ESA format and, like Blue Book and UKEA, has a National Accounts focus. But certain data are available with greater frequency and coverage is therefore more timely.

As part of its move to a new website in August 2011, ONS will cease publication of compendia volumes such as Financial Statistics. However the full range of information will continue to be available through the website.

Financial sector innovation

Several factors have motivated the rapid pace of financial innovation over recent decades, including the search for risk transfer, portfolio diversification, yield enhancement, arbitrage and efficiency.

The scale and pace of the resulting financial innovation has outstripped the capacity of the available statistics to explain the impact of trends in financial activities on markets and on the economy. This has impaired the capability of policymakers to identify the transmission of financial risk.

This section considers the need for better information on (a) financial products such as derivatives and securitisation, and (b) institutional activities in established banking institutions and in the shadow banking system – the increasingly important role played by non–bank financial sector institutions as non–depository intermediaries between lenders and borrowers. On the whole, detailed measurement of these new instruments has been incomplete at national and international level in most countries, reflecting the fast–moving and confidential nature of financial transactions.

As a starting point, it is necessary to identify the innovations that are most prevalent and that pose potential systemic risk. The prevalence of specific innovations should be quantifiable through data on levels and changes in transaction volumes. The degree to which contagion is likely can be assessed from information on the monetary value of those transactions. Because of the complex inter–linkages within the financial sector, systematic deterioration of balance sheets during times of contraction, as well as sharp rises in value for a given sector or product ,can potentially trigger chain reactions that affect the decisions of households and (non–financial) corporations.

Financial products

Derivatives

Derivatives are financial contracts whose value and profitability are derived according to market conditions, linked to underlying assets such as stock, currency and interest rates or commodities (see **Box 1** for types of derivatives). The outlay in any single transaction can amplify exposure in terms of risk and reward relative to movements in underlying prices.

Improved coverage of the volume of derivatives transactions would aid identification of the exposure of different sectors to these instruments, as well as the level of counterparty risk and the potential for contagion in the event of a deterioration in balance sheets.

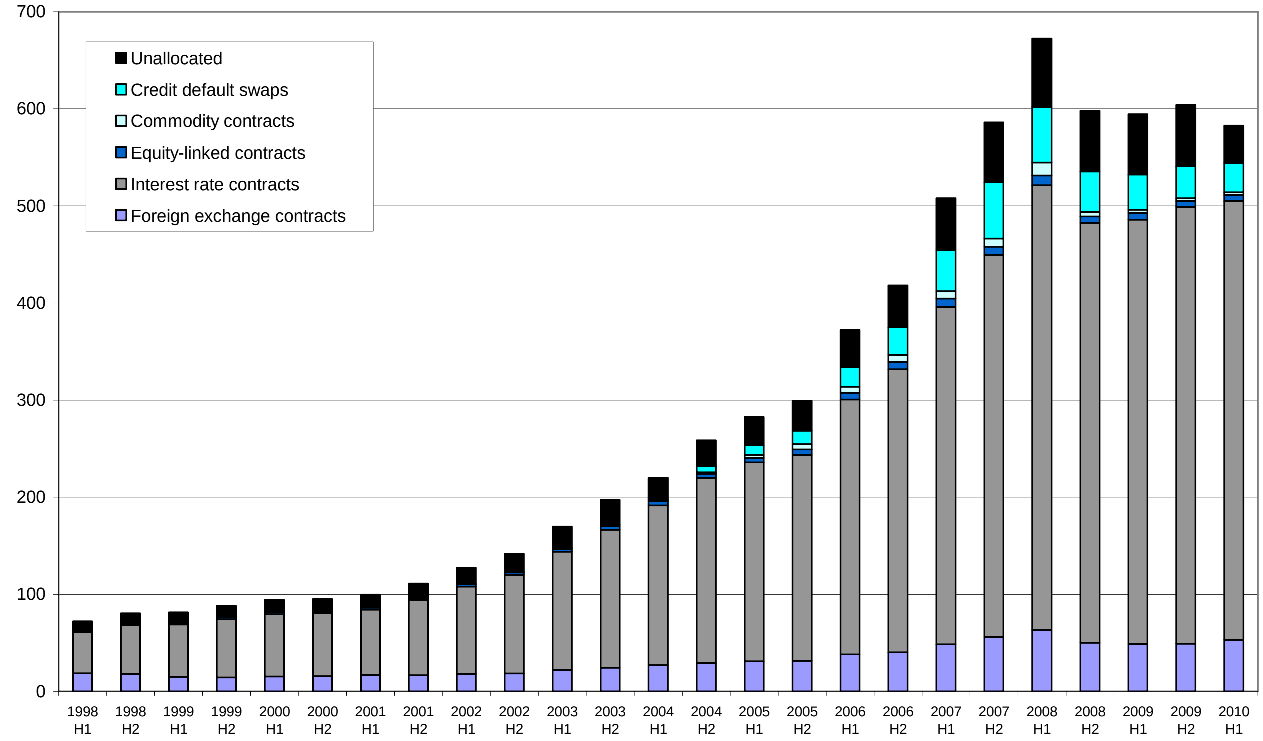
Derivatives are designed to transfer risk and uncertainty away from risk averse investors. To achieve this, they require participants willing to take on and trade that risk. But over time, the market has evolved to the point where risky derivative activity is disproportionate to the hedging needs of the economy that they originally served.

Financial intermediaries are able to match those wishing to hedge market movements and ensure certainty with others who wish to gain market exposure, typically earning fees from originating and trading the instrument. It is not unusual for non–financial companies and households to use the financial markets for interest rate and foreign exchange derivatives, as well as to invest surplus funds in the money markets. In many cases, they may be doing so indirectly or in ignorance via a commercial or retail banking intermediary, and therefore exposing themselves to greater risks than they would knowingly take.

Far from being homogenised, derivatives are complex and highly differentiated instruments. It is necessary to distinguish exchange–traded derivatives – highly standardised, fungible contracts – from over the counter (OTC) derivatives which have features that can be customised with privately negotiated terms and are therefore difficult to re–sell. OTC derivatives therefore have to be unwound through settlement in cash of their market value.

Figure 1 Notional OTC derivatives outstanding

$ trillions



Source: Bank for International Settlements (BIS)

Figure 1 shows the growth of OTC derivatives over the last decade (using global statistics from the Bank for International Settlements (BIS)) which rose from $72 trillion in 1998 to more than $580 trillion by mid–2010, having peaked at some $670 trillion in mid–2008. The rising importance of financial transactions within the economy, combined with the need to engineer bespoke combinations of products, has led to the outstanding value of OTC derivatives reaching a multiple of approximately ten times global GDP.

Box 1 Types of derivatives

Interest rate: Concentrating purely on mitigating the risk arising from changes in interest rates, risk averse investors can choose, in their simplest form, futures that lock in certainty through standardised, exchange traded contracts. Bespoke instruments such as forward rate agreements (FRAs) enable the tailoring of contract size as well as maturity and start dates. Others may wish to use swaps to guarantee a fixed stream of income in exchange for a variable rate. Swaps are attractive to those that are risk averse and prepared to forego the benefit of any unexpected favourable outcome. The development of interest rate options enables participants to divest this obligation at a price.

Credit: Credit default swaps (CDS) provide a means of insurance for lenders against the possibility that the borrower should default. The protection seller is a third party who has an obligation to compensate their counterparty in the event of the original borrower defaulting and receives an agreed set of payments in return. Additionally, protection against default can be bought in the form of a basket or index of borrowers. Correlated risk cuts the cost of insuring a basket, relative to the cumulative cost of each component individually.

Foreign exchange: Forwards offer a guaranteed exchange rate at a fixed date in the future for a given amount of currency. Foreign exchange (FX) swaps are two offsetting forward contracts that initiate and unwind at separate future dates. These ensure that currency is provided at the appropriate time. Options free the purchaser from obligations that would prevent their benefiting from unexpected changes in market conditions and can be designed with exotic features. FX derivatives are almost entirely OTC, tailored to the user’s needs.

Commodity: Futures and options enable hedging of movements in commodity prices in the manner of a standardised trading exchange. Commodity swaps offer a more bespoke level of certainty and are OTC. Commodity derivatives are available for raw agricultural, energy or processed products. When linked to natural resources, they can be used to offset the risk of movements in production costs, often in conjunction with each other.

Equity: Futures and options linked to stocks or indices in standardised exchange traded contracts were traditionally seen as providing sufficient in the way of portfolio insurance strategies. OTC options enable parties to customise the length and terms of the contract as well as the features to make it exotic. In addition to this, spread combination strategies, offering a linear combination of options at similar or different maturities, can create optimal payoff and risk profiles as well as minimising upfront payments.

Interest rate derivatives

Interest rate derivatives are the most popular derivatives by OTC issuance and their versatility makes them the instrument of choice for those wishing to hedge or to speculate on movements in interest rates. With cash as the underlying asset, they offer settlement and valuation with relative ease.

The size of this mature market gives it deep liquidity. Some benchmark interest rates, such as spreads against treasury rates, inflation bonds and overnight indices, can be used to derive indicators of inflation expectations and future interest rates.

Credit derivatives

The evolution of derivatives from an instrument for risk transfer and hedging to a driver of pure trading activity is most apparent in the evolution of credit derivatives. Credit default swaps (CDS) were designed as an insurance mechanism for transforming risky bonds into investments devoid of default risk. With careful co–ordination, they can be used to diversify risk without totally sacrificing yield. Opportunities exist for hedge funds and proprietary trading desks to write contracts for non–insurance purposes to aid spread arbitrage and yield enhancement strategies. Market growth has produced the benefits of depth of liquidity and greater price transparency.

Its evolution from a means of bond insurance to speculative instrument has resulted in the total aggregate values of CDS contracts worth over five times the notional size of the bond market.

Notional and market values

Notional amounts outstanding give an indication of the total amount that is at stake in the event of default by the counterparty, and hence the buyers who are at risk from the inability of the counterparty to meet its obligations. They also reflect the effects of a small number of large transactions, which may outweigh large numbers of small transactions.

Changing market conditions affect the market value of derivative contracts. Market value in this context is the exit cost in the event of liquidation. It is possible for a contract to see its market value fluctuate between negative and positive throughout its lifetime. Swap contracts, composed of two offsetting streams of cash flow, were traditionally structured to have a net initiation price of zero, minimising the impact on the balance sheet. Recent changes in the CDS market have led to a process of ‘recouponing’ to increase fungibility of these contracts so that they are no longer initiated at zero upfront cost.

Market value is therefore a potentially misleading indicator of market growth. But when aggregated across portfolios, institutions and sectors, a sharp decline in market value in a single area may provide an indication of distress and the potential for risk transfer.

Correlation, volatility and hybrids

Key themes in identifying risk transmission are volatility and correlation – for instance where the market value of an instrument is linked to the volatility of stocks, currencies, or commodities. In its simplest form, an option to buy or sell an asset for a fixed price in the future makes the value of the option positively dependent on the volatility of the underlying asset. Applied to a basket of assets whose performance depends on inter–related volatility amongst its constituent assets or derivatives, the correlation – if correctly calculated – offers diversification and risk. But it also amplifies the potential loss, and hence the ability to transmit losses to other sectors. The financial crisis has shown how historical patterns of correlation may become unstable during times of uncertainty.

A hybrid structure combines the features of debt, stock and derivatives. This can be in the form of a note whose final value is linked to the performance of an underlying stock, index, commodity, or other assets. The simplest forms of these have already penetrated the retail market in the form of savings products linked to equity market indices with a guaranteed minimum and maximum value. Recently, financial institutions have issued contingent convertible (CoCo) bonds that can convert into stock in the event of distress.

The hybrid nature of such instruments incurs risk exposure to multiple asset classes, and the degree of risk is amplified if it is mis–priced because of failure to capture the impact of volatility or correlation.

Foreign exchange and commodities as investment assets

Any transaction denominated in a foreign currency is vulnerable to fluctuations in the exchange rate. Similarly production of goods and services that require the purchase of commodities are liable to cost variations. Derivatives can be used to offer insurance against volatile movements in currency and commodity prices.

The foreign exchange and commodity market has developed from a hedging market into a rich source of yield and arbitrage. The OTC nature of foreign exchange forwards and options paves the way for exotic features to facilitate volatility trading, helping achieve an optimal match of hedgers and risk–takers.

Margin trading in various currency and commodity based instruments gives leveraged exposure and is increasing the popularity of these newly investible asset classes. This is most prevalent in the carry trade where borrowing in low interest rate currencies is used to finance re–investment in higher yielding assets in other countries. In the event of this interest rate differential narrowing or reversing, the sale of investment assets and repatriation of funds to unwind the carry trade can amplify capital losses.

Asset securitisation

An important channel of innovation has been the securitisation and slicing of debt to prioritise returns and guarantees. Securitisation is the practice of bundling together assets such as debt into bonds, securities or other obligations, which are then sold to investors (**Box 2**). It has encouraged financial institutions to move away from acting as intermediaries between savers and borrowers towards a business model based on the origination of bulk loans.

Box 2 Asset securitisation

Mortgage backed securities (MBSs): In their simplest form, repayments of mortgage loans are passed through to buyers of securities. These eventually find themselves categorised into residential mortgage–backed securities (RMBSs) and commercial mortgage backed securities (CMBSs), with the distinction between underlying mortgage loans based on housing and commercial property respectively.

Collateralised mortgage obligations (CMOs): As the nature of mortgages involves risk of prepayment and default, the resulting securities are sliced by order of payment priority. When prepayment and default risk are in line with expectations, risk and reward are aligned with the credit rating. CMOs enable efficient segmentation and risk allocation

Asset backed securities (ABSs): These arise from the extension of securitisation into other cash flow producing assets such as credit cards, car loans and student loans, as well as leasing, intangibles and royalties.

Stripped mortgage backed securities (SMBSs): SMBSs allow separation of the payment streams derived from the principal only (PO) and interest only (IO) components to be channelled to different groups of bond holders.

The resulting securities are essentially bonds that have a market value. Their distribution between financial sector entities at any point may be seen as representative of systemic risks in the event of possible de–leveraging caused by economic contractions. Where these securities are linked to specific real activities, such as residential real estate or vehicle finance, enhanced data may also highlight the potential for distress at a sector level.

A key motivation for innovation in asset securitisation is the capacity to move retail, mortgage or commercial loans off balance sheets and onto conduits. The ability to observe movements in these assets between institutional units provides a picture of credit growth and the degree of financial leverage in household and corporate sectors.

Collateralised lending

The inter–bank and wholesale money markets are traditional sources of short term finance. The risk of default, together with rising demand for securities at very short tenors, has created a gap in the market for the facility to lend and borrow cash in exchange for securities. The repo market deals in secured short–term lending through the simultaneous agreement of an immediate sale, and future repurchase, of securities in exchange for cash. Typically in the short–term, the difference in moneys paid at sale and at repurchase represents equivalent interest. In return, the lender of funds has collateral to mitigate for the risk of default.

As the depth of the repo market fulfilled the need for cash, a market emerged for borrowing stocks in return for a cash fee. In essence, securities' lending increases market efficiency through increasing the pool of sellers.

But it raises the prospect that lending of stock could create a vicious circle whereby falling stock prices become self–perpetuating. Whilst it may seem counter–intuitive that holders of assets should assist market participants with an interest in seeing a fall in asset values, the decision to lend is often delegated to managers whose decisions are governed by management fees.

Institutional activities

Financial institutions have increasingly diversified their activities over the past two decades, culminating in the emergence of large and complex financial institutions (LCFIs) that undertake a range of financial activities.

Activities with exposure to financial markets are described in **Box 3**. LCFIs may incorporate some or all of these activities. In addition there are many niche players who focus on just one or two functions.

Wholesale markets and loan origination

As investment banks do not have a depositor base from which to create loans, they operate an originate–and–distribute model for corporate bonds and stocks. This entails syndication with other banks to distribute the securities as financial investments to asset managers and investors. In a liquid market, securities constantly flow from one part of the financial system to another. Information on intra– and inter–institutional flows of securities' origination and trading activity would illustrate emerging risks of over–concentration and imbalance. It would also enable tracking of the credit cycle in the wholesale market for loans, in terms of composition as well as magnitude.

The Turner Review of 2009[5] outlined how the development of securitised credit has led financial intermediaries to move from 'originate–and–distribute' to 'acquire–and–arbitrage' business models. Risk is still held within the system, but lack of transparency prevents identification of the ultimate bearers of that risk. Proprietary trading desks, asset managers, SIVs (structured investment vehicles) or subsidiary hedge funds acquire risky securities, financed by the issuance of short–term low–yielding instruments.

Box 3 Large and complex financial institutions activity

Securities issuance: Raising funds through equity and debt issuance, the capital raising and corporate finance side of an investment bank finances corporations with funds for internal expansion as well as mergers and acquisitions to access funds for capital investment. For shorter term needs, they can use the money markets for working capital.

Wholesale execution: Financial markets match large numbers of buyers and sellers. Aside from distributing securities issued by the corporate finance side of the investment bank, LCFIs can service the transactions needs of large corporations, benefiting from lower costs due to their scale. This is not only for investment of treasury funds but also for financial and risk management.

Prime brokerage: Many hedge funds execute deals with multiple brokers according to their needs. They may find it advantageous to take their financing as well as operational services from a prime brokerage based in a bank or large broker–dealer. In addition to benefiting from their operational, technological and institutional infrastructure, they can benefit from centralised clearing, cross–margining and custody services. Additionally, prime brokers may offer client funds consultancy, capital introduction and marketing services.

Proprietary trading: A recent trend in those large institutions involved in wholesale financial markets has been the dedication of resources to trading for profitability on their own account, in the search for arbitrage opportunities – as opposed to providing transaction services for clients. The asset classes involved in this process are diverse, and typically proprietary desks have been spun off from ‘flow’ activity, although some banks chose to keep the activities combined.

Asset management: Managers of wealth and assets of funds seek to match assets with future liabilities. Increasingly banking conglomerates have a presence in this area, although there is a degree of separation from investment banking activity. They are usually risk averse, and the use of derivatives is limited by restrictions on the asset classes in which they can invest.

Interconnectivity with shadow banks

The shadow banking system comprises entities that are independent of, or at arms length from, depository banks and play an increasingly significant role as financial intermediaries (see **Box 4**).

Linkages between LCFIs and regulated institutions are common, for example the acquisition by SIVs and by hedge funds of securities issued by banks, the financing of private equity through syndicated loan issuance, or the use of prime brokerage services by hedge funds. Data on LCFIs could therefore indicate the degree of risk embedded within the shadow banking system. However these intermediaries are subject to lighter regulation, and disclosure of information is often voluntary rather than mandatory.

Statistical information must be of sufficient detail to provide insight into the high level of inter–connectedness within financial markets. Data on counterparty type and on the distribution between banking and trading book activity, regardless of whether there is an institutional separation, will allow policymakers to observe patterns in proprietary activity, as well as cycles in hedge fund and wealth management, offering a potentially valuable macroprudential perspective.

Box 4 Shadow banking

Private equity

Private equity arises where independent single entities are involved in investing in unlisted operating companies. Investors take overall control of target companies through a mixture of equity fund capital and issuance of debt that is eventually added to the company balance sheet. The financing often involves revolving loan facilities with a rate of interest that increases sharply after expiry of an initial period of usually a year. This increases the risk of financial distress and contagion. Other private equity activity includes venture capital and sector focussed investments.

Hedge funds

Hedge funds are unregulated investment vehicles, usually with an asset or strategy focus. The primary aim – to arbitrage and generate above average returns – works in similar fashion to proprietary trading desks. Seed capital comes from large institutions or high net worth individuals, as well as a significant contribution from managing partners. This capital is subsequently used to gain leveraged exposure to asset classes via the use of derivatives. This multiplication of risk and reward is perpetuated by occasions when offsetting directional positions are taken.

SPVs (special purpose vehicles), conduits, SIVs (structured investment vehicles)

As deep liquidity eroded spreads between lending and borrowing, there has been an increase in the number of off balance sheet entities of banks, designed to free up capital for originating higher volumes of loans. As shadow banks, they are able to use leverage and maturity transformation to earn profits on the difference between lending and borrowing rates.

Statistics for highlighting potential risk transmission

The previous section discussed where to extend and improve the coverage of financial transactions and new financial institutions. This section considers what else is necessary to ensure that the statistical information is collated and presented in a manner which is of greatest benefit in highlighting potential risk transmission.

Greater granularity

Access to greater detail about the scale and nature of financial activity should give policymakers a clearer picture of the extent to which financial innovation facilitates economic activity, for instance the level of business investment and household spending, as distinct from being designed to maximise returns through pure trading activity with other financial institutions.

There are a number of areas where greater detail could be helpful. For the purpose of identifying risk transmission, it is useful to untangle derivative activity by risk exposure. There have been some moves towards this goal under the 2008 revision of the SNA, separating out forwards, options and employee options. Data on financial instruments should also be decomposed to show underlying sub–categories of exposure. The breakdown of information on new financial products should follow BIS definitions for OTC derivatives – separately identifying interest rate, credit, FX, equity and commodity derivatives.

Measuring the level of asset securitisation warrants a breakdown of securities backed by residential property, commercial property and other assets. In order to observe and disaggregate origination activity from asset value changes, total notional amounts outstanding, transaction volumes and market values of derivatives, asset linked securities and hybrid notes should be published periodically.

In addition, there needs to be a slicing of inter– and intra–institutional activity to observe what is held within different sections of LCFIs and within the shadow banking system if possible. Information on assets and liabilities held by regulated bodies within prime brokerage accounts and proprietary desks, as well as within asset management, would allow the quantification of levels of concentration and systemic risk.

Details of transaction levels of collateralised lending classed by type of collateral, and of transactions across proprietary and banking flow desks, would provide important information on trading book trends. Collection of such data presents challenges. Survey results lack timeliness, and positions may have substantially altered by the time of publication. And institutions may not wish to disclose trading positions for reasons of market sensitivity. However financial technology now has the capability to hold and report positions and this may permit access to anonymised data in a timely manner.

By observing levels and rates of change of asset origination, redistribution and execution activity, it should be possible to gain a better understanding of cyclical fluctuations in the level of financial activity in different areas. The ability to see the scale of proprietary trading and flow banking activity, along with the extent of balance sheet growth amongst LCFI entities or their conduits, is an element of this. A sufficiently detailed coverage of activity between hedge funds and prime brokerage, with reasonable timeliness, could indicate the possible build up of imbalances. More importantly, there would be greater clarity about where the critical points lie in the event of forced de–leveraging and re–pricing of risk.

Derived indicators

Aggregated product and institutional category level data can provide a macro picture and is useful in mapping changes in the risks emanating from intra– and inter–sector exposures.

Other diagnostic indicators can be derived from this macro level information to enhance the understanding of financial sector activity. For instance, the ratio of liquid liabilities to liquid assets in each sector is a potential indication of the liquidity profile and thus ability to absorb liquidity stress.

With a breadth of nominal and market values of assets and activity, it would be possible to gauge liquidity and capital adequacy within the sector as a whole through calculated ratios. By using indicators of financial innovation disaggregated by risk exposure and activity in conjunction with already available data on asset and liability levels, there is a better chance of alerting policymakers to the existence of any over concentration or unusual behaviour that might be of potential concern.

National and supranational regulators have been discussing macroprudential policy proposals to address problems of hard wired pro–cyclicality within financial markets. It remains to be seen whether any new policy instruments and targets relating to asset bubble containment will operate through existing monetary policy instruments or through explicit use of such derived macroprudential ratios.

Aggregated regulatory data

Financial regulators are bound by the Basel accords on banking supervision. Basel II[6], established in 2004, has three pillars – *minimum capital requirements, the supervisory review process,* and *market discipline*. In 2010, Basel III[7] – a new global regulatory standard on bank capital adequacy and liquidity – was agreed which further strengthens bank capital requirements and introduces new regulatory requirements on bank liquidity and bank leverage.

As a result of these requirements, national regulators already collect a considerable amount of information on financial activities covering various important dimensions of the financial performance of individual firms, including information on balance sheets, business model, and risk management. They are summarised by the CAMELS acronym – capital adequacy, asset quality, management competence, earning ability, liquidity, and sensitivity to market risk.

Recently the framework has been extended to meet enhanced disclosure requirements relating to trading activity and complexity. It is not currently published at an aggregated level in the UK[8], and provision of this data on a quarterly basis will further enhance the depth and diversity of information available to regulators. By enabling market observers to assess the health of the financial sector in a more robust way, the open publication of regulatory data, subject to constraints of commercial and market sensitivity, will be another step in the process of improving financial statistics.

Business exposures and concentration

With extensive inter–linkages between financial institutions, instruments and practices, an individual financial institution may by itself have the ability to withstand an economic shock. But because of problems among its direct and indirect counterparties, it may face a sudden loss of confidence, with the consequence of reduced access to liquidity and wider second order problems. These repercussions are not limited to links with other financial firms but may also apply to links with non–financial firms and households. The recent problems caused by a sharp fall in US house prices for those financial firms exposed to the US sub–prime loans market have been well catalogued.

In the interests of transparency and market monitoring, it is essential that data on these business exposures and concentrations should be available at a level that does not compromise disclosure principles but at the same time allows a sufficient degree of disaggregation to allow observers to map changes and associated movements in risk. These issues can be analysed by means of flow of fund statements, as well as using more detailed network risk analysis.

Flow of funds

The available statistical information must be collated and presented to good effect if it is to be helpful for the purposes of illuminating the financial behaviour of institutions and sectors, and thereby shifts in the underlying pattern of risk bearing. This requires a framework which ensures the consistent allocation of activities between sectors and over time.

In the US, this has long been achieved by dint of the quarterly flow of funds accounts compiled by the US Federal Reserve and articulated with full sectoral balance sheet information. In the UK, the National Accounts framework goes some way to achieving the same objective. While its coverage of the financial sector is less detailed than the US version, it nevertheless provides a sound framework that imposes an economy-wide consistency on the presentation of financial statistics.

In order to build a macroprudential picture, detailed balance sheet data is required, encompassing innovations in financial products and institutional developments. Financial institutions hold in their position keeping systems the notional (face) value of securities at issuance as well as their market value. These data are not confined to a snapshot of values on their balance sheet but also show flows of transactions as well as historical and qualitative data on counterparties. Considerable resource is allocated by the financial sector to constantly improve the technology and analysis for evaluating this for their internal purposes. In future there may be an expansion in the use of central counterparties and third party trade repositories that hold both individual transactional and aggregated data as a result of regulation requirements to improve transparency and operational efficiency.

With better statistical coverage of the scale of asset and liability levels, origination activity and market value changes across financial products and between institutional activities, this framework would enhance understanding of the flows of funds within the financial sector and with other sectors of the economy.

Flow of funds analysis could help to identify concentration of funds in specific products, sectors or types of institution. The information should give policymakers the benefit of increased awareness of sector balance sheet flows and positions, in addition to existing data on output, inflation and profitability measures.

Network risk metrics

While flow of funds data is an essential step towards proper understanding of macro-prudential risk, it does not by itself tell policymakers where the risks ultimately lie . Highly interconnected financial sector institutions face significant exposure to shocks in other sectors and in the rest of the world, either directly or indirectly. Mapping of these networks of connections is also part of the process for improving financial oversight.

Data from flow–of–funds is generally bilateral in nature, showing flows from one sector to another. Some commentators have gone further by proposing data embodying exposure and network metrics to show product exposure between institutional categories. The analysis of network trails between institutions could be extended to cover exposures across financial instruments and across non-financial sectors. A particular exposure may put financial strain on a single institution which, operating through its network of connections, may begin or exacerbate the process of contagion.

The presentation of such multi-dimensional analysis would require extensive tabular data disclosing the bilateral exposure between institutions. The collation of such data poses steep challenges, requiring legal, political, and administrative issues to be addressed.

Nevertheless the benefits of this extra dimension could be significant. It opens the possibility of providing greater clarity on the potential for network risk transmission. Such metrics could be prepared for the financial sector as a whole, for a specific sub–sector, such as banks, or even for a group of financial firms that are considered pivotal for systemic stability.

Conclusion

ONS has now launched a new phase of its work programme for developing financial statistics. As well as rectifying some of the gaps identified in this article, it will consider how to improve the quality of the sectoral accounts and sectoral balance sheets in order to provide the authorities with the information that they require for the conduct of both macroeconomic and macroprudential policy.

Central to the four–year project will be the new forum of experts from the institutions most directly involved in supplying and using data on financial activities, including the Bank of England, HM Treasury and the FSA, but also other relevant bodies. Among its first tasks will be an assessment of the feasibility and desirability of enhancing the coverage, quality and level of detail of financial statistics, bearing in mind not only the needs of policymakers but also the potential availability of the data sources that will be essential to the assembly of reliable statistics.

Notes

1. The special edition of the Economic & Labour Market Review on 'Developing financial statistics for policy' is available at: www.statistics.gov.uk/elmr/07_09/

2. The role of macroprudential policy – a discussion paper, Bank of England, November 2009. Available at: www.bankofengland.co.uk/publications/other/financialstability/roleofmacroprudentialpolicy091121.pdf

3. ESA 1995 uses three levels of reporting classification: category, sub–category, and sub–position. For more details of classification see Chapter 5. Available at:http://circa.europa.eu/irc/dsis/nfaccount/info/data/ESA95/en/een00231.htm

4. For a complete detail of corporations under each category, see chapter 2 of the ESA 1995.

5. The Turner Review: A regulatory response to the global banking crisis, March 2009. Available at: www.fsa.gov.uk/pubs/other/turner_review.pdf

6. www.bis.org/publ/bcbsca.htm

7. www.bis.org/bcbs/basel3.htm

8. The IMF's annual Global Financial Stability Reports provide data on regulatory ratios at national economy level. www.imf.org/external/pubs/ft/gfsr/index.htm

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