

# The UK's External Balance Sheet – The International Investment Position (IIP)

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## Abstract

The paper describes the path of the UK's international investment position (IIP) with the rest of the world. The paper shows that both UK assets and liabilities grew considerably during the past decade. Liabilities always outstripped assets during this period, mainly reflecting the persistent current account deficits, which meant that the UK consistently ran a net liability position. Although the size of the net liability position increased over the decade, its growth has been volatile. The paper presents a model which shows that in the long term flows had driven the changes to the UK's net IIP, while the volatility in the short term was driven by other changes. The model showed that in 2008 exchange rate effects were the main driver of the UK's improved net liability position; this was because sterling depreciated sharply against all three major currencies. The deterioration in the net liability position in 2009 and 2010 was explained mainly in terms of price effects, as equity markets began to recover; but also exchange rate effects as sterling began to rally, particularly against the euro; and flows as investors turned to UK gilts in preference to euro denominated government debt.

## Acknowledgements

1. The author would like to thank Peter Patterson, John Bunday and Jacqui Jones for their helpful comments. Any errors are the author's responsibility.

## Introduction

2010 annual benchmarking estimates were incorporated in the Balance of Payments (BoP) 3rd quarter 2011 statistical bulletin. These benchmark estimates contributed to a re-assessment of the United Kingdom's IIP. This paper analyses the latest estimates of the UK's IIP and updates the work previously published by Whittard and Khan (2010).

The article is in two parts. The first section describes changes to the UK's gross and net IIP between 2000 and 2010; it provides a breakdown of these changes by functional category, and compares the UK's comparative position with other European Union (EU) member states.

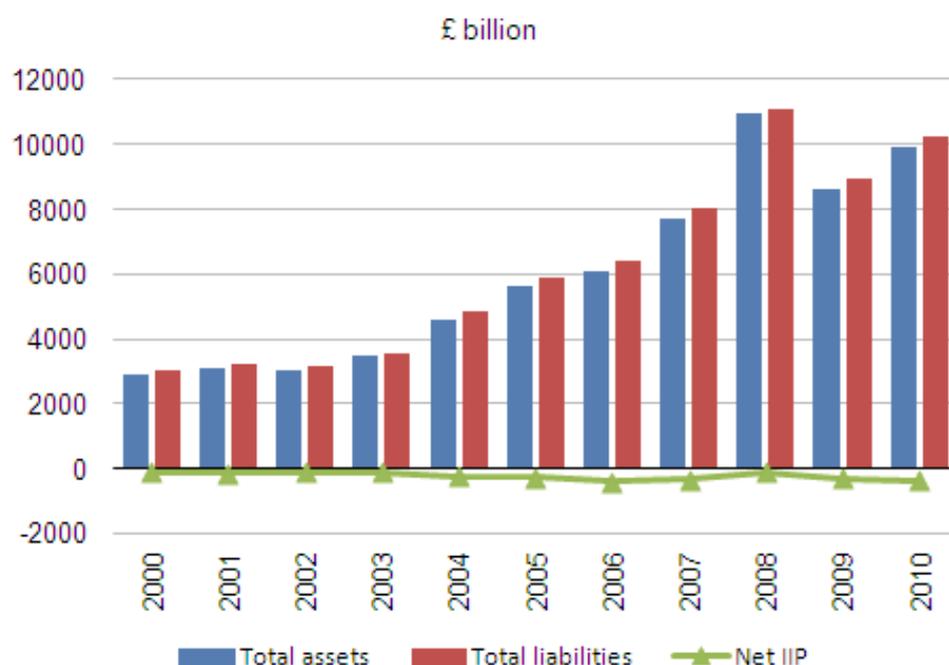
The second section discusses the two mechanisms that drive changes to the external balance sheet: flows and other changes. It then presents a breakdown of these changes for the years 2000

to 2010. A model is estimated which disaggregates the other changes into its constituent parts; exchange rate, price and other changes in volume.

## The UK's IIP

The IIP is a statement of the UK's balance sheet with the rest of the world. It records the holdings of (gross) foreign assets by UK residents and the holdings of (gross) UK assets by foreign residents at a specific point in time. Foreign assets held by UK residents are recorded as assets in the UK's IIP, whereas UK assets held by foreign residents are recorded as liabilities. The net IIP (assets minus liabilities) shows the excess of the stock of UK claims on the rest of the world over the rest of the world's claims on the UK. Figure 1 records the UK's gross assets/liabilities and net IIP, from 2000 to 2010.

**Figure 1: UK's gross assets, liabilities and net IIP (2000-2010)**



Source: Office for National Statistics

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The magnitude of UK assets and UK liabilities are large but similar. The result of this is that the net IIP, still considerable in its own right, is relatively small in comparison to the large gross positions.

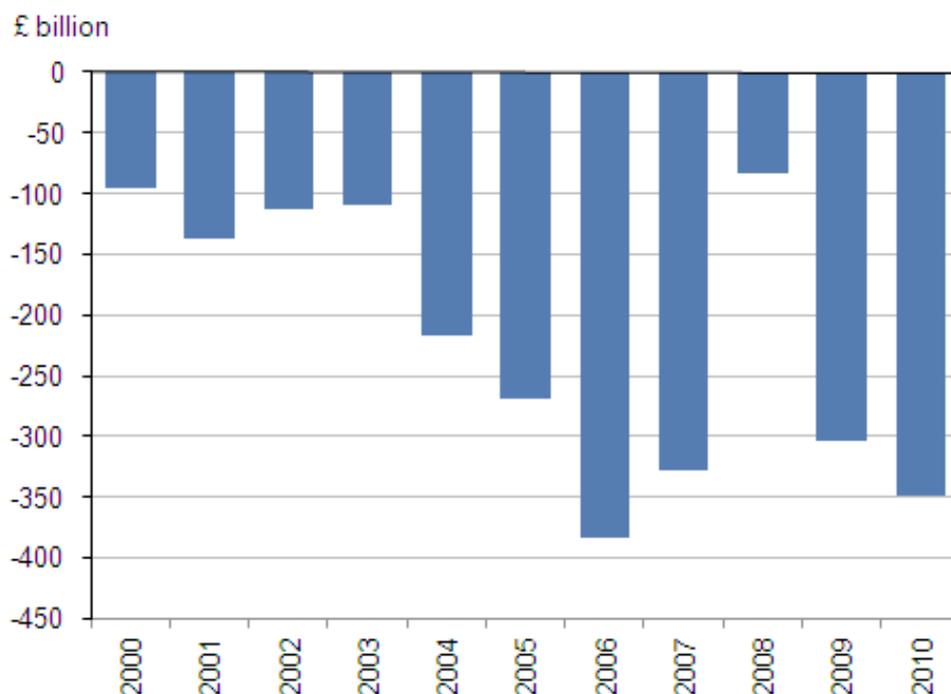
The graph shows that between 2000 and 2008, both UK assets and liabilities increased by over three and a half times; gross assets increasing by 275 per cent and gross liabilities by 266 per cent. In 2008 UK assets and liabilities both peaked and topped the £10 trillion mark for the very first time. Between the end of 2008 and the end of 2009 both UK assets and liabilities fell as a result of the

world recession brought on by the financial crisis; assets dropping by 21 per cent and liabilities by 19 per cent. In 2010 UK assets and liabilities recovered some of the falls recorded in the previous year, to record a level of £9.9 trillion and £10.3 trillion respectively.

## Net IIP

Figure 2 plots the net IIP from 2000 to 2010. It reveals that the UK's IIP recorded a net liability position (i.e. where liabilities exceed assets) in all periods presented - the last time the UK recorded a net asset position was in 1994.

**Figure 2: The UK's net IIP (2000-2010)**



Source: Office for National Statistics

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The UK's net liability position quadrupled between 2000 and 2006. This led to a record net liability position of £384 billion at the end of 2006. By 2008 these increases were reversed to leave the UK with a net liability position of £84 billion; this was the smallest since 1997. The reduction was short lived as in 2009 the net liability position more than trebled to £304 billion. In the latest year, 2010, the UK's net liability position increased further to £349 billion.

## The functional categories contribution to the UK's net IIP

The IIP is made up of a number of constituent parts known as functional categories. The UK's IIP is compiled up to 2003 using estimates for four functional categories:

- Direct investment (DI)
- Portfolio investment (PI)
- Other investment (OI)
- Reserve assets (RA)

From 2004 an additional functional category is added to the UK's IIP:

- Financial derivatives (FD)<sup>1</sup>

Direct investment occurs when a resident entity in one economy obtains a lasting interest in an enterprise in another economy, has a significant degree of influence, and owns at least 10 per cent equity.

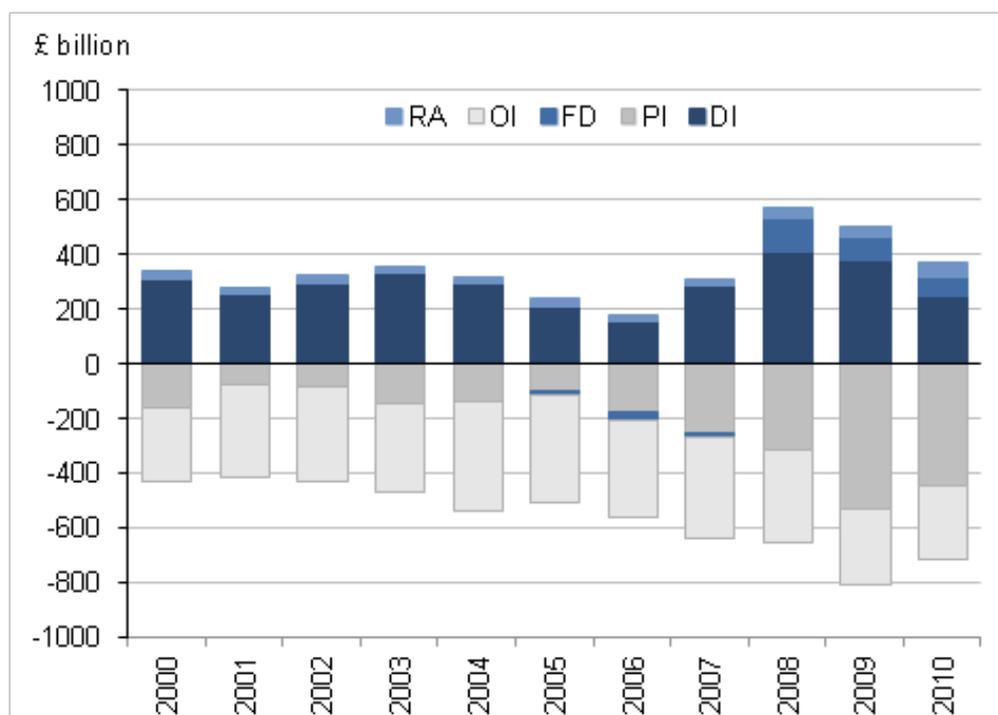
Portfolio investment is recorded when an investment is made representing less than 10 per cent of the equity capital. It includes equity and debt securities in the form of bonds and notes, and money market instruments.

Other investment is all investment other than that included in the four other functional categories. It includes trade credit, loans, currency and deposits, and other assets and liabilities.

Reserve assets are the UK's official holdings of short term assets that can very quickly be converted into cash. It includes gold, convertible currencies, Special Drawing Rights and changes to the UK reserve position in the IMF.

Financial derivatives are financial instruments that derive their value from underlying assets, events or conditions. They include options, futures, warrants, and currency and interest rate swaps.

Figure 3 records the contribution of each of these functional categories to the UK's overall net liability position.

**Figure 3: Contribution to the UK's IIP by functional category (2000-2010)**

Source: Office for National Statistics

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Figure 3 reveals that the net liability position is being driven by other investment (OI) and portfolio investment (PI), which more than offset the net direct investment (DI) asset position.

From 2000 to 2007 other investment was the main driver of the net liability position. This was primarily driven by currency and deposits and by loans. From 2007 onwards, the other investment net liability position began to decline; this was due to loans switching from a net liability position to a net asset position (Pink Book 2011).

Portfolio investment has contributed to the UK's net liability position in every year. From 2007 onwards, however, its contribution to the net liability position increased considerably, primarily due to growth in the net liability position of debt securities (Pink Book 2011). From 2009 portfolio investment overtook other investment as the largest contributor to the UK's net liability position.

The main offsetting effect to the net liability position was the direct investment net asset position. This means that the UK owns more direct investment assets abroad than non-residents own direct investment assets in the UK. Between 2000 and 2004 the direct investment net asset position was relatively stable before a considerable deterioration in the following two years. The direct investment net asset position rebounded in the subsequent years and peaked at £408 billion in 2008. In the last two years there have been subsequent falls; in 2010 the direct investment asset position was £251 billion.

Due to the nature of direct investment, it is difficult to accurately estimate the true value of the stock (i.e. the value at market price). Research into this phenomenon has concluded that the UK's net direct investment asset position may be undervalued. Further information on this issue can be found in the supporting information section.

Banking sector financial derivatives assets and liabilities are included in the IIP from 2004, while for securities dealers they are incorporated from 2010. The figures reveal that from 2004 to 2007 financial derivatives marginally contributed to the UK's net liability position before switching to partially offsetting it in 2008 to 2010.

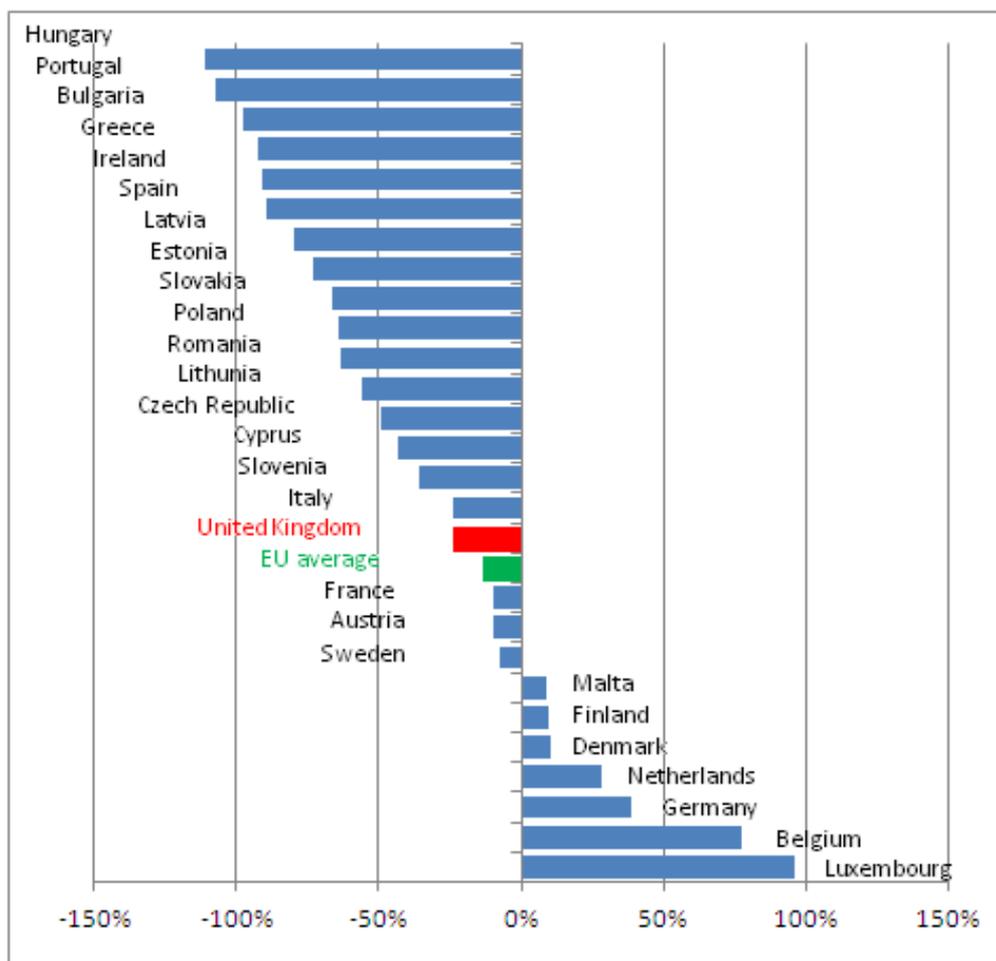
Unsurprisingly reserve assets have had a continual offsetting effect to the UK's net liability position throughout the period. As the name suggests, reserve asset can only be an asset to a country. The overall effect, as with financial derivatives, however, is relatively small compared with the three other main functional categories.

## Notes

1. In 2010 banking sector financial derivatives were incorporated in the UK's IIP for 2006 onwards; in 2011 they were incorporated for 2004 onwards. In 2011 financial derivatives data were also added for the securities dealers sector, with data starting in 2010. Currently financial derivatives data for insurance companies and pension funds are excluded as the data continue to be validated.

## International comparisons

To facilitate a meaningful comparison of the IIP from different countries, the net IIP is standardised by the size of its economy (i.e. GDP at market prices). Figure 4 records the net IIP as a percentage of GDP for the 27 countries of the European Union (EU) in 2010.

**Figure 4: EU comparisons of the net IIP as a percentage of GDP (2010)**

Source: Office for National Statistics

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Figure 4 reveals that Hungary and Portugal's net liability position was greater than its total output in 2010. Hungary has the largest net liability position as a percentage of GDP of any EU country (111%), and Luxembourg the largest net asset position (97%). As the eastern European markets opened, Hungary, as with many other eastern European countries, was host to large scale direct investments which contributed to increasing their net liability position. Luxembourg's net asset position on the other hand, was driven, at least in some part, by the strength of its financial services sector which has been built on its advantageous tax laws.

Of all the 27 EU countries, 20 recorded a net liability position while the remainder recorded a net assets position. The UK's net liability position was -24 per cent of GDP; this placed it 11th in terms of ranking (Luxembourg being 1st) and in the top two-fifths of all EU countries. In terms of overall score, however, it was 10 percentage points below the EU's average of -14 per cent of GDP, and seven percentage points below the USA's ratio of -17%.

## Drivers of the changes to net IIP

The second part of this article explains the sizeable movements in the UK's net IIP between 2000 and 2010 (see Figure 2) by disaggregating the changes into their constituent parts.

### Relationship between the net stock position, net new flow of assets and other changes

Changes to the UK's external stock position (i.e. net IIP) are driven by net flows ( $F$ ) and other changes to the stock of financial assets and liabilities ( $OC$ )

#### Changes in IIP

$$\Delta IIP = F + OC$$

$$F = \text{Flows} \quad (1)$$

$$OC = \text{Other changes}$$

The description for this equation is currently unavailable. ONS apologises for any inconvenience caused.

Flows measure transactions in financial assets and liabilities over a specific period and show whether a country has been a net lender to, or net borrower from, the rest of the world. Flows can be measured one of two ways: either directly via the financial account balance or indirectly by combining the current account and capital balances.

#### Flows

$$F = FA = CA + CAP$$

$$FA = \text{Financial account balance (i.e. net lender or net borrower)} \quad (2)$$

$$CA = \text{Current account balance}$$

$$CAP = \text{Capital account balance}$$

The description for this equation is currently unavailable. ONS apologises for any inconvenience caused.

In practice, as they come from different data sources, there tend to be differences between the current and capital account balance and the financial account balance. In order to restore this identity, a balancing item titled 'net errors and omissions' is applied. This balancing item is added to the financial account, as the current and capital account estimates are thought to be more robust. The current and capital account balance, therefore, is seen as a more accurate measure of the net flow of financial assets and liabilities.

Other changes can be broken down into revaluation effects ( $R$ ) (exchange rate and price effects) and other changes in volume ( $OCV$ ).

## Other changes

$$OC = R + OCV$$

$R$  = Revaluation effects (3)

$OCV$  = Other changes in volume

The description for this equation is currently unavailable. ONS apologises for any inconvenience caused.

Unlike other changes in volume, revaluation effects do not reflect a change in the asset or liability itself but record a change in valuation. Revaluation is split between exchange rate changes ( $X$ ) and other price changes ( $P$ ).

## Revaluation

$$R = X + P$$

$X$  = Change in net asset values due to exchange rate movements (4)

$P$  = Change in net asset values due to price change

The description for this equation is currently unavailable. ONS apologises for any inconvenience caused.

Exchange rate effects occur when assets and liabilities are denominated in a currency other than the domestic currency used to record the IIP. When movements between the foreign and domestic currency occur, this has the effect of revaluing foreign-denominated assets and liabilities. For example, UK residents may hold \$1,500 of US assets purchased at an exchange rate of £1:\$1.5. This is recorded as £1,000 of UK owned foreign assets in the UK's IIP. At the end of the period, if the sterling exchange rate had depreciated to £1:\$1, the UK still owns \$1,500 of foreign assets, but they are now worth £1,500 because of exchange rate movements. The result is an increase of £500 to the UK's net IIP although the quality of the asset has not changed. In this example, US liabilities are unaffected; they are still recorded as \$1,500 in the US IIP.

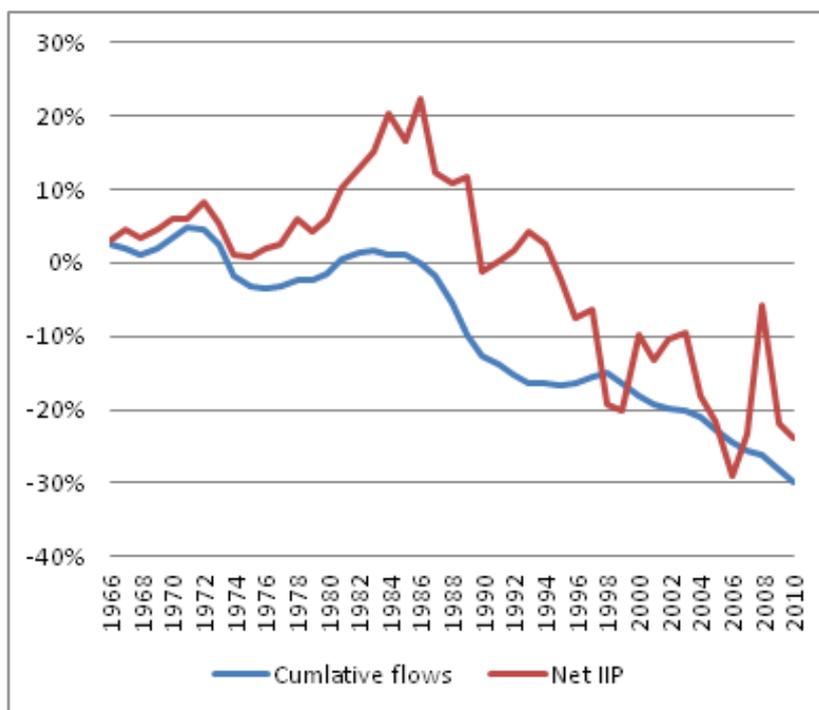
Price changes occur as the market price of assets and liabilities fluctuates. This is most clearly demonstrated by the movements in the price of equity and debt traded on the world stock markets. For example a UK household could own £10,000 worth of shares of an IT company. Due to its excellent sales performance over the Christmas period, the IT company's shares increased by 10 per cent. The shares are now worth £11,000. The result is that the UK's assets, and hence UK's net IIP, have increased by £1,000.

Examples of other changes in volume include; debt cancellation and write-offs, reclassifications, entities changing residence, and changes in actuarial assumptions. The financial crisis was a recent example of when resident and non-resident banks wrote billions of pounds off their balance sheets due to the provision of bad debt.

## Cumulative flows and the net IIP

In order to appreciate the interconnections between the flows and the IIP, Figure 5 charts the long-run movement in cumulative flows together with the net IIP - both indicators are standardised as a percentage of GDP. In the graph, flows are measured by aggregating the current and capital account balances. The graph reveals that over the long-term the cumulative flows drive the changes to the net IIP. There are, however, a number of short-term fluctuations where the net IIP diverges from the trend of the cumulative flow. In these periods, it is other changes that are driving the overall change.

**Figure 5: Net cumulative flows and IIP as a percentage of GDP (1966-2010)**



Source: Office for National Statistics

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In the early period the two series broadly followed each other. In 1976 the series began to diverge and generally continued until the IIP reached a peak net asset position of 22 per cent of GDP in 1986. Over the next decade, although the difference between the stocks and cumulative flows remained heightened, and there was some evidence of volatility, stocks generally followed the pattern of cumulative flows. The end of 1997, however, signalled the start of a sustained period of volatility as stocks began to diverge from cumulative flows. This was due to increased volatility of revaluations and other changes in volume. At the end of 1998 the stock position went below cumulative flows for the first time before returning to more normal levels in 2000. In 2006 the stock position was a record -29 per cent of GDP and once again fell below the cumulative flows. In 2008, however, revaluation effects meant that the net liability position fell to just -6 per cent of GDP; the

smallest ratio since 1995. In the latest two years, 2009 and 2010, the stock position as a percentage of GDP returned to the levels of the previous few years.

## Other changes and the net IIP

To understand what was driving the volatility in the IIP, the Office for National Statistics (ONS) created a model to estimate how much of the change in the IIP was attributed to flows and other changes. Other changes were then subsequently broken down into exchange rate effects, price effects and other changes in volume. The breakdown was calculated for both gross assets and gross liabilities for the three functional categories of direct, portfolio and other investment. The gross results were then aggregated and net changes calculated. A description of the data sources, methodology and assumptions used to create the model to estimate this decomposition can be found in the supporting information section (Whittard and Khan, 2010).

Table 1 shows the net IIP from 2000 to 2010. The first column reports the net IIP, calculated by subtracting liabilities from assets. Changes from the previous year's IIP are reported in the second column. The changes are then attributed into flows (as measured by the current and capital account balance) and other changes.

**Table 1: UK's net IIP and change in IIP (2000-2010)**

	£ billion			
	Net IIP	Change in Net IIP	Flows	Other changes
<b>2000</b>	-96	92	-24	116
<b>2001</b>	-137	-40	-20	-21
<b>2002</b>	-112	25	-17	42
<b>2003</b>	-109	3	-17	20
<b>2004</b>	-217	-108	-23	-85
<b>2005</b>	-270	-52	-31	-21
<b>2006</b>	-384	-114	-42	-72
<b>2007</b>	-328	55	-32	88
<b>2008</b>	-84	245	-17	261
<b>2009</b>	-304	-220	-17	-204
<b>2010</b>	-349	-45	-45	0
<b>Cumulative total</b>		<b>-161</b>	<b>-285</b>	<b>124</b>

Table source: Office for National Statistics

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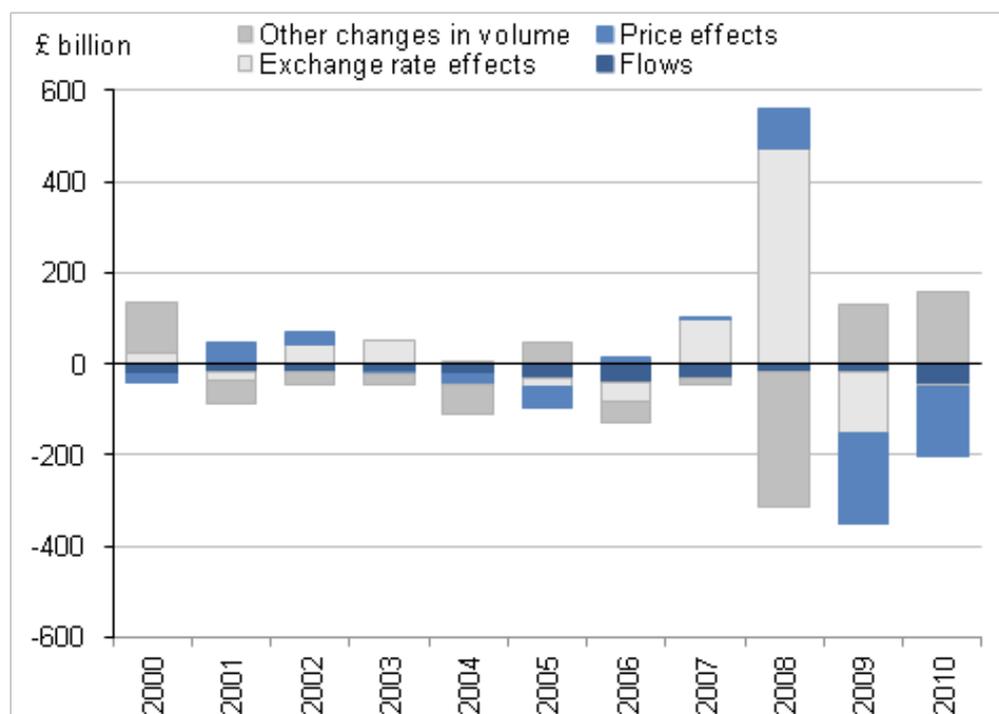
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Table 1 shows that the UK has consistently been in a net liability position in all years and, as the UK has had a current account deficit in every year of the reported period, flows have consistently increased the UK's net liability position. The net liability position peaked in 2006, before declining to reach a recent low in 2008. Between the end of 2007 and the end of 2008 the net liability reduced by £245 billion despite the UK continuing to borrow £17 billion from the rest of the world. The reason it was able to reduce its net liability position, whilst simultaneously increasing its borrowing, was due to £261 billion of other changes.

Figure 6 and Table 2 shows the results from the model decomposition. Caution should be taken when directly interpreting the figures as revaluation effects for reserve assets and financial derivatives are included in other changes in volume<sup>1</sup>.

**Figure 6: Changes in the UK's net IIP (2000-2010)**



Source: Office for National Statistics

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**Table 2: Change in UK's net IIP (2000-2010)**

£ billion

	Change in Net IIP	Flows	Currency Changes	Price Changes	Other changes in volume
<b>2000</b>	92	-24	23	-18	111
<b>2001</b>	-40	-20	-16	45	-49
<b>2002</b>	25	-17	40	29	-27
<b>2003</b>	3	-17	50	-5	-25
<b>2004</b>	-108	-23	3	-23	-65
<b>2005</b>	-52	-31	-18	-48	45
<b>2006</b>	-114	-42	-42	15	-45
<b>2007</b>	55	-32	99	0	-11
<b>2008</b>	245	-17	474	86	-299
<b>2009</b>	-220	-17	-135	-198	129
<b>2010</b>	-45	-45	-6	-152	159
<b>Cumulative total</b>	<b>-161</b>	<b>-285</b>	<b>471</b>	<b>-269</b>	<b>-78</b>

Table source: Office for National Statistics

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### Notes

1. Revaluation effects have not been estimated for reserve assets due to the relatively small size of assets, nor for financial derivatives due to the fact that full sector coverage is currently unavailable.

### Flows

In every year presented flows have negatively contributed to the change in the UK's net IIP. In 2006 and 2010 the negative contributions were the largest, recording borrowing (i.e. increasing the UK's liabilities) of £42 and £45 billion respectively. In 2006 net borrowing was primarily driven by direct investment in the UK, and in 2010 by net payments of financial derivatives (Balance of Payments Statistical Bulletin, 3rd Quarter 2011).

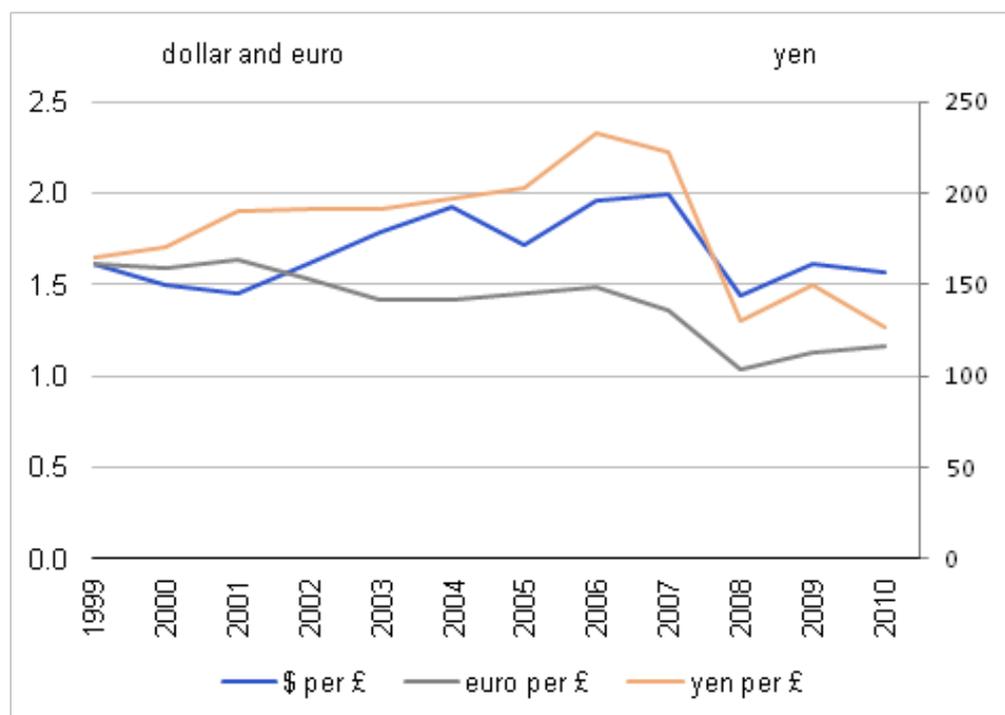
Table 2 shows that, in absolute terms, flows were not the single largest contributor to change in any one period. Due to the offsetting nature of these movements, however, flows accounted for a substantial proportion of the change in the years in which the net liability position increased. For example in 2005 and 2010 flows accounted for 60 per cent and 100 per cent of the increase in the net liability position respectively.

## Exchange rate movements

Exchange rate effects occur as the UK's IIP is denominated in sterling while assets, and to a lesser extent liabilities, are denominated in foreign currency. In simplistic terms this means that if sterling depreciates against foreign currencies, overall its net stock position will improve and visa versa.

Table 2 shows that in four of the five years from 2000 to 2004, exchange rate effects had a positive effect on the UK's net IIP. This was because sterling depreciated against the dollar and euro from 1999 to 2000, and then from 2001 carried on depreciating against the euro while simultaneously appreciating against the dollar - Figure 7 plots the exchange rates of three major currencies against sterling (i.e. depreciation in sterling is signalled by a fall in the line). The sterling depreciation against the euro from 2001 to 2004 outweighs the appreciation against the dollar as proportionally more UK assets and liabilities are denominated in euros rather than dollars.

**Figure 7: Exchange rates - middle closing spot rate, end period (2000-2010)**



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In 2005 and 2006 sterling's appreciation, initially against the euro and yen and then subsequently also the dollar, led to a deterioration of the UK's net IIP of £60 billion over the two years.

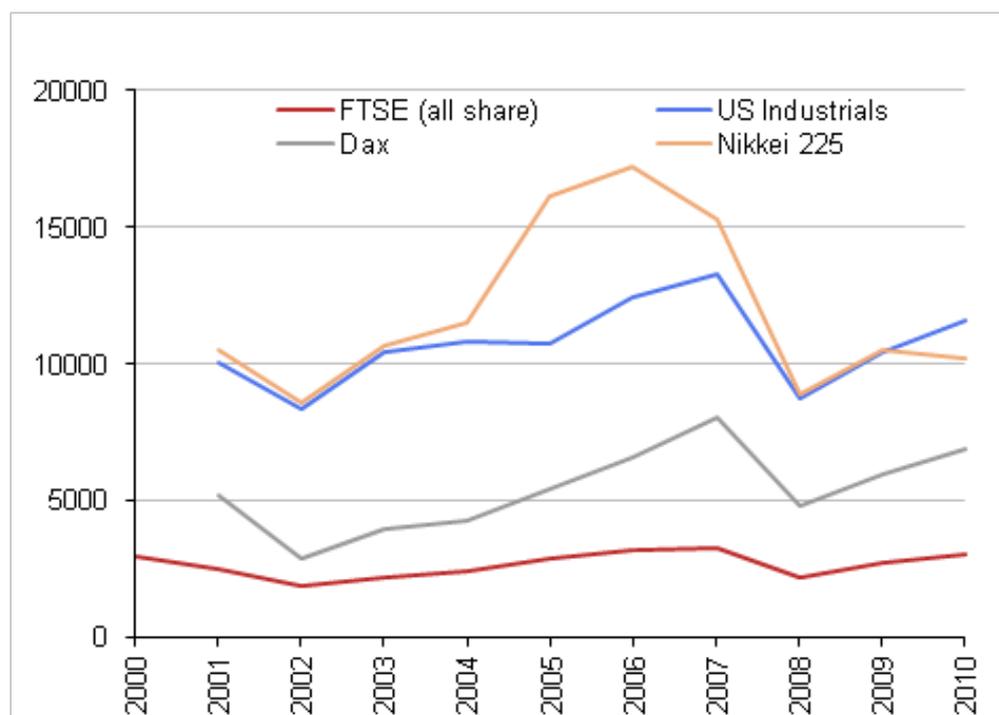
From the end of 2006 sterling began to weaken significantly against the major world currencies; between the end of 2006 and 2008 sterling weakened by 27 per cent against the dollar, 30 per cent against the euro and 44 per cent against the yen. This was the main reason the UK's net IIP improved so dramatically during this period. Exchange rate effects alone led to an improvement of £573 billion to the UK's net IIP between 2006 and 2008. In 2009 sterling rallied against the world's major currencies which resulted in a deterioration of the UK's net liability position by £135 billion. In 2010 sterling appreciated against the euro while depreciating against the dollar and yen. The overall effect on the IIP was largely offsetting with the UK's net liability position increasing by £6 billion due to currency effects.

## Price movements

Price effects reflect changes in the market values of asset and liabilities which are traded on world stock markets; these include both equities and bonds. Due to the integrated nature of the world markets, price movements tend to be less pronounced than exchange rate movements. This is because UK and other world stock markets generally move in the same direction. The result of this is that price changes to gross assets and liabilities move in tandem and cancel each other out when calculating the net position.

Table 2 shows that in 2001 and 2002 there was a positive price effect on the UK's net IIP. During this period the world was in the midst of a recession and, as Figure 8 shows, global equity prices were falling – Figure 8 plots stock market indices for the UK (FTSE), US (Dow Jones Industrials), Germany (Dax) and Japan (Nikkei 225). Non-residents own a larger stock of UK portfolio investment equity than the UK owns portfolio investment equity abroad (i.e. UK portfolio investment equity liabilities are greater than its assets). The drop in value of non-resident owned UK equity outweighed the drop in value of UK owned non resident equity. As UK equity liabilities fell by more than assets, this led to a positive net effect on the IIP.

In terms of debt, over this period, US government bonds indices (UK assets) increased at a faster rate than UK government bonds (liabilities). This also had a positive effect on the UK's net IIP as the increase in the value of UK assets was greater than the increase in UK liabilities.

**Figure 8: Stock market indices (2000-2010)**

Source: Office for National Statistics

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From 2003 until 2005, as world stock markets all increased, due to the UK's larger stock of portfolio investment liabilities than assets there was a negative effect on the UK's IIP, the largest being -£48 billion in 2005.

In 2008 there was an £86 billion positive revaluation due to price effects. As in the early part of the millennium, the increase coincided with a world recession and asset prices dropping.

In 2009 and 2010 price effects were the main reason why net liabilities increased once more. There were three main drivers behind this movement; firstly world stock markets grew, as the UK has a considerably larger stock of portfolio investment liabilities than assets, the overall net effect on the UK's IIP was negative; secondly, the growth rate of the FTSE was greater than the three main indices between 2008 and 2009 and faster than the Nikkei 225 between 2009 and 2010, this increased the price of UK liabilities by more than the price of UK owned foreign assets; and thirdly, the UK government gilts index was initially growing at a faster pace than US and Japanese government bonds, and then subsequently, as the euro zone crisis took hold and investors took flight to safety, growing at a faster pace than EU government bonds.

## Other

In the model presented here other changes are calculated by residual. As well as capturing the true effects of other changes of volume, such as write down, write offs and reclassifications, it also includes reserve asset and financial derivatives revaluations. Possibly more importantly, however, is that it also captures any over or under estimation of direct, portfolio and other investment revaluation effects.

It is therefore difficult to make any firm inference, except to say that other changes are of considerable importance. In five of the eleven years (2000, 2001, 2004, 2006 and 2010) other volume changes are the single biggest contributor in absolute terms to the change in the UK's IIP.

In six out of the seven years (2002, 2005, 2007, 2008, 2009 and 2010) other changes recorded an offsetting entry to exchange rate and price effects. In the last three years (2008-2010) these offsetting estimates are relatively large. The offsetting nature of other volume changes does suggest there maybe some element of overestimation of the revaluation effects in the model – full detail of the construction of the model and limitations of the assumptions are included in the supporting information.

What we do know, however is the last four years (2007-2010) were a particularly difficult period for the global economy. Therefore, during this period we would expect considerable write downs and write offs of both assets and liabilities. The world recession began late in 2007 and took a sharp downturn in September 2008 when Lehman Brothers filed for bankruptcy. This effect is captured within the gross flows as other changes for both assets and liabilities were negative in 2007 and 2008 and negative for liabilities in 2009 and 2010.

## Background notes

1. Details of the policy governing the release of new data are available by visiting [www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html](http://www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html) or from the Media Relations Office email: [media.relations@ons.gsi.gov.uk](mailto:media.relations@ons.gsi.gov.uk)

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## Issues with measuring direct investment

In line with international guidance and to ensure comparability across international accounts, the UK's Balance of Payments (BoP) is produced at market prices. For direct investment however, when equities are not openly traded, a proxy for the market value is used. The preferred method is to use own funds at book value<sup>1</sup>, but due to data limitations, historic costs are also applied. In both cases this can lead to a bias in under recording the market value.

The United States Bureau of Economic Analysis (BEA) presented direct investment estimates in the IIP at historic cost, current-cost and market costs. The revaluation from historic to market costs increased its assets by over 40% (Landefeld and Lawson, 1991).

Pratten (1994) conducted research into estimating the market price of direct investment assets in the UK's IIP; the author estimated that the market price should be approximately double. Senior et al (2001) updated the work and estimated that assets and liabilities could be as high as three times book value. The analysis concluded that the overall effect was probably to underestimate the UK's net external assets.

This assessment was supported by Whitaker (2006) and Chamberlin (2009) who reported that UK stocks of foreign assets generated higher rates of return than stock of UK assets held by foreign residents. The authors believed that the rate of return of direct investment assets was higher, partially due to an underestimation of the value of direct investment assets (i.e. book value rather than market value).

## Notes

1. Own funds at book value is the estimated value of the asset provided by the direct investment enterprise (DIE) from its accounting records, as opposed to the direct investor (DI). Estimates from DIE are believed to be closer to market value than estimates provided by the DI.

## Decomposition of IIP changes: data sources, methodology and assumptions

The data used in the model came from a number of data sources: IIP stock and financial account flow data came from ONS and BoE survey sources. The aggregate stock and flow data were published in the ONS's United Kingdom Economic Accounts. Currency changes were calculated using exchange rate movements for the dollar, euro and the yen - exchange rates were provided by the BoE. Price movements are modelled using a combination of stock and bond indices. Stock movements used weighted end quarter share prices for the Dow Jones, Euro Stoxx and Nikkei. These were adjusted close prices for the latest day in the period. Weighted bond indices were used for UK, US, Europe and Japan - the data are recorded for the last day in each period.

The model decomposed the change in stock into financial account flows, currency, price and other changes in the IIP. Theoretically other changes should capture volume changes such as write-offs, re-classifications and corrections. Due to data limitations, however, other changes in the model were calculated as a residual. Therefore, other changes capture any change not attributable to flows, currency and price effects<sup>1</sup>. The model estimates the changes at the level of asset and liability for the three functional categories of direct investment, portfolio investment, and other investment. The changes are then aggregated to total assets, total liabilities and total net position.

The currency change was calculated by applying a currency coefficient (Cc) to the starting stock and half the flows. The reason that the currency coefficient is applied to only half the flows is that it is assumed that flows and currency changes are attributed evenly across the period, and therefore half of the flow transactions will already include the currency effect.

To compose the currency coefficient ( $Cc_t$ ) a geographical weighting ( $G$ ) is applied to the change in exchange rate ( $X$ ) for that time period ( $t$ ) before summing the components.

### Currency coefficient

$$Cc_t = \sum G_i \Delta X_i$$

$Cc$  = Currency coefficient

$G$  = Geographic weighting (5)

$X$  = Exchange rate

$t$  = time period

$i$  = USA, Europe and Japan

The description for this equation is currently unavailable. ONS apologises for any inconvenience caused.

Finally to deduce the currency change the currency coefficient ( $Cc_t$ ) is applied to the stock (IIP) at the beginning of the period and half the flows ( $F$ ).

### Currency changes

$$C_t = (IIP_{t-1} + F_t / 2) * Cc_t$$

$C$  = Currency change

$IIP$  = International investment position (6)

$F$  = Flow

$t$  = time period

The description for this equation is currently unavailable. ONS apologises for any inconvenience caused.

The price revaluation follows a similar framework to that for currency revaluation. The price coefficient ( $Pc$ ) is calculated using a geographical weighting of the proportion of investment applied to movements in the change of stock market indices for that region ( $IW$ ). Equity price movements are given by Dow Jones, Euro Stoxx Nikkei and FTSE and the changes in the price of debt securities are given by changes in bond indices ( $SI$ ).

## Price coefficient

$$Pc_t = \sum IW_i \Delta SI_i$$

$Pc$  = Price coefficient

$IW$  = Investment weighting (7)

$SI$  = Stock market indices

$t$  = time period

$i$  = USA, Europe, Japan and UK

The description for this equation is currently unavailable. ONS apologises for any inconvenience caused.

As with the currency change, the price change (P) is then estimated by applying the coefficient to the stock at the beginning of the period and half the flows.

## Price change

$$P_t = (IIP_{t-1} + F_t / 2) * Pc_t$$

$P$  = Price change

$IIP$  = International investment position (8)

$F$  = Flow

$Pc$  = Price coefficient

$t$  = time period

The description for this equation is currently unavailable. ONS apologises for any inconvenience caused.

The model includes a number of assumptions have been made in terms of the type of revaluation and the basis on which the item is to be revalued. For example, direct investment is assumed to be recorded at book value and therefore not subject to any price change effects. Direct investment liabilities (i.e. foreign investment in the UK) are assumed to be all in sterling and therefore not subject to any currency effects. Direct investment assets (UK investment abroad) are available with a geographic split rather than a currency split. The assumption is that any investment is made in the currency of the host country; in reality this will not always be the case. For simplicity the analysis has been based on currency changes for three main areas - USA, Europe and Japan. These countries account for over 75 per cent of total UK assets and liabilities. Table A1 provides a scheme for the model with a full list of assumptions and comment on their validity based on type of revaluation, by functional category and transaction broken down by asset and liability.

[Table A1: Scheme of reconciliation and assumption can be found here \(25 Kb Excel sheet\).](#)

## Notes

1. Outside of the decomposition model, financial derivatives and reserve asset revaluations are added to the estimate of 'other volume changes'.