Indicators of short-term movements in business investment

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Business surveys provide more timely news about investment than official data. The surveys also include forward-looking information. This article examines some survey-based indicators of business investment. Using simple techniques, several indicators are found to contain information about the path of investment. Moreover, as official business investment data are often revised, survey data can also usefully supplement the official data when interpreting recent movements in investment.

Introduction

In the short term, the balance of aggregate demand and supply is a key determinant of inflationary pressure. One component of aggregate demand is business investment, which accounted for just under 10% of current-price GDP in 2004. Investment also has an impact on supply, as it adds to the capital stock. So higher investment raises demand, and this will tend to amplify inflationary pressures. But it also increases the supply capacity of the economy, and so can act to dampen pressures on inflation. Analysing the movements in business investment can therefore be important for gauging the likely prospects for inflationary pressure.

Ratios of business investment to output may fall or rise over time, depending on the relative price of investment,

Chart 1
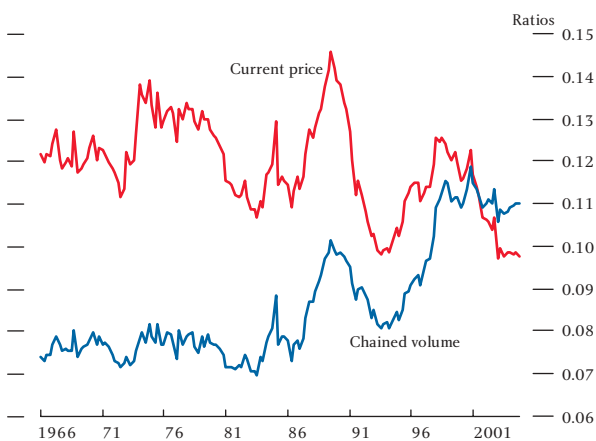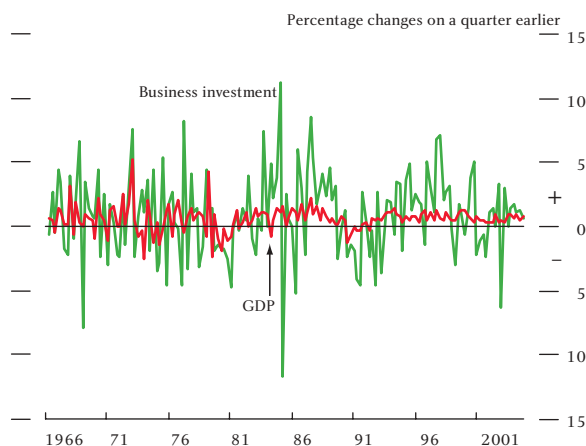**Business investment to output ratios**

Chart 2
Business investment and GDP

and how easily firms can substitute between capital and other factors, such as labour, when producing output. Chart 1 shows two measures — the current-price and chained-volume business investment to output ratios.[1] Over the past 20 years the trends in the two ratios have moved in opposite directions.[2]

Although there are clear long-run trends in the two ratios, both relationships can be extremely volatile in the shorter term. This variability is largely driven by sharp movements in business investment, rather than GDP (Chart 2). Since 1990, quarterly changes in the volume of business investment have, on average, been over five times more volatile than changes in GDP, and four times more volatile than changes in households' spending. This volatility means that business investment can often account for a significant part of *changes* in GDP growth.

(1) Chained-volume measures replaced constant-price measures in the 2003 *Blue Book*. See the box on 'The introduction of annual chain-linking into the National Accounts' on pages 14–15 of the May 2003 *Inflation Report*.
(2) For more discussion of these ratios and their long-term trends see Ellis and Groth (2003).

The volatility of investment is unsurprising, as investment is (part of) the *change* in the capital stock and it is firms' demand for capital that is related to the level of output they expect to supply.[1] In the absence of adjustment costs, investment could vary substantially as firms' desired level of capital changes. And the indivisible nature of many capital projects could lead to investment being 'lumpy'.

Intentions survey indicators of business investment

Business surveys ask firms directly whether they plan to increase or to lower investment spending, sometimes over a specified time period. A net balance of firms — the number of those planning an increase in investment minus those planning a decrease — is then reported. The business surveys are typically published several months before ONS investment data that correspond to the same period, so they provide more timely information on developments than the official releases.

Previous work has looked at how the Bank uses survey information on a variety of aspects of the economy.[2] In particular, surveys of intentions have been used to construct a structural forecasting model of investment.[3] Using certain assumptions about how firms formulate their investment plans, the model matches some of the survey responses to the relevant sectors of business investment. The model also requires information from the National Accounts, which lag the publication of the survey data by around two months.

A timely and simple alternative approach is to consider the correlation between investment intentions surveys and ONS data on business investment growth. Unlike the forecast model discussed above, we do not attempt to impose any assumptions about how firms respond to the surveys. Rather, we allow the survey balances themselves to guide our view about the relationship between the answers given and business investment growth.

We examine the correlation between the growth in the volume measure of business investment as currently published by the ONS and surveys of investment intentions; often the latter are for specific sectors, such as manufacturing. Unlike the forecasting model that matches survey data to ONS sectoral investment data, our approach matches information from the various sectoral surveys to total ONS business investment. We did experiment with matching sectoral surveys to sectoral data, but the results were qualitatively similar, and for brevity are not included here. And there are reasons why sectoral surveys may be informative about business investment as a whole. For example, changes in manufacturing investment will be reflected in business investment as a whole.[4] Later in this article, the information in different sectoral surveys of intentions will be combined to construct a survey-based estimate of business investment. This measure combines information about business investment from the different and overlapping sectoral balances.

Table A presents correlations of different survey measures of investment intentions with quarterly growth of real business investment. The table includes large, well known surveys such as the *British Chambers of Commerce* (BCC) *Quarterly Economic Survey*, but also smaller surveys such as the *3i Enterprise Barometer*.[5] All correlations are calculated using quarterly business investment growth from 1994 to 2004.[6] This allows inclusion of some surveys introduced during the 1990s, such as that conducted by the EEF, but excludes some more recently established surveys, such as the CBI Grant/Thornton service sector survey.[7]

We allowed the surveys to lead official data by up to a year.[8] That is because some survey questions refer to investment growth over the year ahead rather than the current quarter. But it is equally possible that respondents may answer these longer-term questions with near-term spending in mind. For example, some, albeit dated, evidence suggests that respondents to the *CBI's Quarterly Industrial Trends (QIT)* survey have answered partly on the basis of investment that was 'just

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(1) See Ellis and Price (2004) for more detail.
(2) See Britton *et al* (1999).
(3) See Larsen and Newton-Smith (2001).
(4) See for example pages 16–17 of the February 2004 *Inflation Report*.
(5) The wording of the survey questions is shown in the appendix.
(6) The sample size was adjusted for lags between the surveys and ONS data when appropriate.
(7) We also considered a sample period beginning in 1990, where survey data allow this. The results were generally similar in terms of the correlations obtained and the preferred number of lags to those presented in the article, for the full range of surveys. We also examined the CBI *QIT* survey from 1971: the correlations were a little weaker, and were highest for a two-quarter lead, rather than four.
(8) We experimented with longer leads, but results were unchanged for most series.

coming on stream', rather than solely based on future investment plans.[1] Table A reports only the lead with the highest correlation between the survey and the current official ONS data for each survey. For example, the *3i Enterprise Barometer* was positively correlated with business investment growth at all leads we considered. But the highest correlation was for a lead of two quarters, and so that is what the table shows.

Table A
Correlations between quarterly business investment growth and survey measures of investment intentions

Survey	Sector	Capital asset in question (if applicable)	Correlation	Leads (no. of quarters)
3i Enterprise Barometer	Private sector		0.37	2
BCC Quarterly Economic Survey	Services	*Plant & machinery*	0.42	0
	Manufacturing	*Plant & machinery*	0.43	0
CBI Quarterly Industrial Trends	Manufacturing	*Machinery*	0.46	4
		Buildings	0.46	4
CBI Distributive Trades	Distribution		0.39	0
CBI Financial Services	Financial services	*Information technology*	0.35	2
		Vehicles, plant & machinery	0.29	3
		Land & buildings	0.12	2
EEF Business Trends Survey	Engineering		0.40	2

Note: All reported correlations are significant at the 5% level, except the CBI Financial Services Land & Buildings and Vehicles, Plant & Machinery measures. To two decimal places, the standard error of these correlations is around 0.16.

Table A suggests that — compared with quarterly growth in business investment — the intentions surveys that best match ONS data are from the *CBI QIT* survey and the *BCC Quarterly Economic Survey*. Interestingly, the balances from the *CBI QIT* survey appear to lead investment data by a year, despite the potential concern about respondents answering on the basis of recent investment. Most other surveys are also significantly positively correlated with the data, including the *3i Enterprise Barometer*.

Table B presents similar results but this time for correlations with four-quarter business investment growth since 1994. Because quarterly movements in investment are so volatile, it can be easier to spot trends in investment by looking at growth over four quarters. On this basis, the *CBI QIT* and BCC balances are again the most highly correlated with ONS data.

Table B
Correlations between four-quarter business investment growth and intentions survey indicators

Survey	Sector	Capital asset in question (if applicable)	Correlation	Leads (no. of quarters)
3i Enterprise Barometer	Private sector		0.62	2
BCC Quarterly Economic Survey	Services	*Plant & machinery*	0.68	2
	Manufacturing	*Plant & machinery*	0.69	3
CBI Quarterly Industrial Trends	Manufacturing	*Machinery*	0.68	4
		Buildings	0.70	4
CBI Distributive Trades	Distribution		0.46	2
CBI Financial Services	Financial services	*Information technology*	0.63	2
		Vehicles, plant & machinery	0.37	4
		Land & buildings	0.14	4
EEF Business Trends Survey	Engineering		0.66	3
Memo: First lag of annual business investment growth			0.80	1

Note: All reported correlations are significant at the 5% level, apart from the CBI Financial Services Land & Buildings measure. To two decimal places the standard error of these correlations is around 0.16.

However, four-quarter growth data are serially correlated by construction. For example, four-quarter growth in 2003 Q1 compares the level of business investment in that quarter with the level in 2002 Q1. Correspondingly, the respective growth rate in 2003 Q2 will compare the level to that in 2002 Q2. But part of the change in business investment over the year to 2003 Q2 will also be included over the year to 2003 Q1. That means that four-quarter growth in business investment will be correlated with its lagged values. This is also shown in Table B: and indeed, none of the surveys of intentions is as highly correlated with four-quarter business investment growth as is its own lag.

Other survey indicators of business investment

Apart from direct measures of intentions, business surveys contain other information that may be useful as indicators of future investment. For example, surveys of capital goods orders provide direct information about forthcoming investment purchases. Survey measures of profits may indicate the availability of internal funds,[2] which can act to support firms' ability to finance investment if there are additional costs to raising external finance. Surveys of capacity utilisation, business optimism and demand uncertainty may also

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(1) See Price (1977).
(2) We also examined ONS data on profits: however, while the correlation between annual profits growth and annual business investment growth was high, the quarterly correlation was lower than that for survey evidence on profitability. An added complication is that ONS data on profits are revised over time.

contain information about firms' current situation and expectations of the future, which will affect their decisions about future investment.

Table C presents correlations for a number of survey-based indicators with quarterly business investment growth since 1994, on the same basis as Table A. Where there were several different indicators of the same type, only the one most closely correlated with ONS data is shown.

Table C
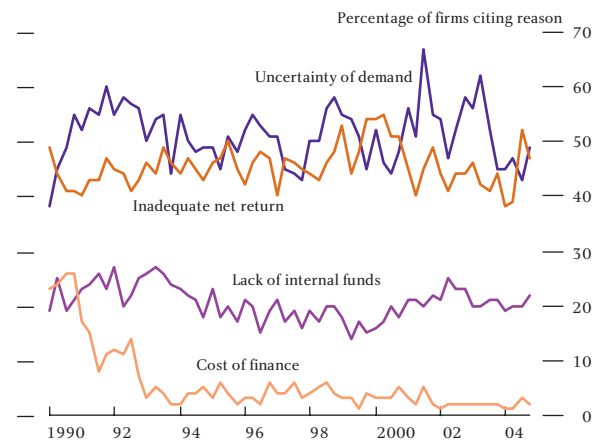**Correlations between quarterly business investment growth and other survey indicators**

Indicator	Measure with strongest correlation	*Details*	**Correlation**	*Leads (no. of quarters)*
Capacity utilisation	*CBI Quarterly Industrial Trends Survey*	*Manufacturing*	0.48	1
Business optimism	*3i Enterprise Barometer*	*Barometer index*	0.41	2
Demand uncertainty	*CBI Quarterly Industrial Trends Survey*	*Factors limiting capital expenditure*	-0.49	1
Capital goods orders	*CIPS Manufacturing Survey*	*Investment goods sector*	0.38	4
Profitability	*BCC Survey (Manufacturing)*	*Confidence about future profitability*	0.36	3

Note: All reported correlations are significant at the 5% level. To two decimal places the standard error of these correlations is around 0.16. For the CIPS orders data we used three-month averages of calendar quarters.

The strongest (negative) correlation is with the 'demand uncertainty' balance from the *CBI QIT* survey. That question asks firms which factors are restraining capital spending, and lists a number of possible alternatives. 'Uncertainty about future demand' is generally quoted by the greatest number of survey respondents: Chart 3 shows the most frequently cited reasons over time. 'Inadequate net return' is also a common concern, but the balance for this factor is less highly correlated with business investment.

The negative correlation between short-run investment growth and demand uncertainty is consistent with economic theory. Many investment decisions are not easily reversible. When a firm invests, it gives up the chance to wait for new information that may affect that investment decision. This 'option value' of waiting before committing to investment projects is higher, the less certain firms are of future conditions.[1] So uncertainty reduces the incentive to invest.

(1) See Dixit and Pindyck (1994).

Chart 3
Factors restraining investment spending: evidence from the *CBI QIT* survey

The second strongest correlation is with the capacity utilisation balance from the *CBI QIT* survey. This correlation could reflect two factors. First, high capacity utilisation today may indicate the need for additional investment to cope with future increases in demand. Second, as both capacity utilisation and investment are procyclical, both variables could be responding to the general state of the economy. But whichever of these two factors is more important, the correlation between capacity utilisation and business investment is positive.

Several other indicators are also correlated with quarterly changes in business investment. The 3i Barometer index was more closely correlated than other survey measures of optimism such as the *CBI QIT* optimism balance, so the latter was excluded from Table C. The 3i index also outperformed the BCC survey balance on confidence about profitability. That is despite its sample size being lower than that of the CBI and BCC surveys.

Relating the survey indicators to business investment growth

The previous sections have discussed the relationship between different indicators and the ONS measure of business investment. But how can we best use the information in the various indicators? The problem is how to extract the unique information about business investment in each survey. There are a number of statistical techniques that are available to do this, such as principal component analysis, which is a way of

finding underlying factors common to different series.[1] But principal component analysis requires a large data set, compared with the relatively few indicators that we have.

Fortunately, there is a simple alternative that is an efficient method of doing the same job when there are relatively few indicators. That is to use basic regression methods to map from the survey indicators to investment. One version of this procedure entails regressing business investment growth on the different survey-based indicators. Following Cunningham (1997), we allow for any bias in the survey balances by including a constant.[2] He also suggests using more detailed survey data than just the headline balance, such as the number of firms reporting rises and falls in investment spending. We do not consider this information as few surveys publish such details and, in any case, Cunningham notes that the impact from including this information is 'very small'.

Although many different indicators may contain information about business investment, it is possible that the information in one indicator is also present in others. In this case, the indicators would be correlated both with business investment and with each other. To address this possibility, we drop indicators that are not significant in explaining business investment growth in the regression. In short, we exclude indicators that do not 'add value' in terms of explaining business investment growth relative to other indicators present in the regression.[3] Using only the statistically significant indicators in the regression, we obtain a 'combined indicator' of business investment growth based on the information contained in different surveys.[4]

Chart 4 presents such a 'combined intentions indicator' based on the different survey measures of investment intentions shown in Table A. In practice, the *CBI QIT* and Distributive Trades Surveys were found to be the most important. Overall, the combined indicator captures around two fifths of the quarterly variation in business investment over the past ten years. As Chart 4 shows, the indicator is relatively smooth compared with actual business investment.

Chart 5 presents an analogous indicator based on the survey indicators in Table C. The most important

Chart 4
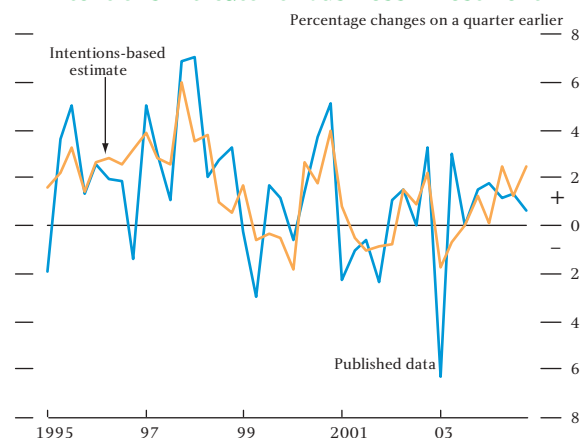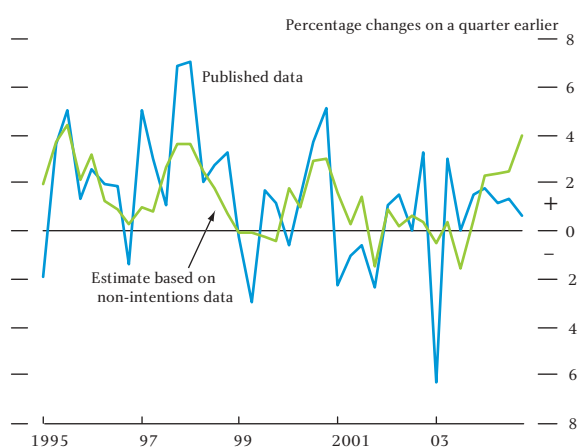**An intentions indicator of business investment**

Chart 5
A non-intentions indicator of business investment

indicators are the CIPS capital goods orders index and the 'demand uncertainty' balance from the *CBI QIT* survey.[5] Together, these indicators can account for around a third of the variance of quarterly changes in business investment. A combined indicator using both intentions and other information from surveys can capture about a half of that variance. The intentions indicators contain some information that is not contained in other survey indicators, and *vice versa*. Together, these indicators appear to capture a significant amount of the variation in investment data, although a substantial amount remains unexplained.

Indicators and revisions to ONS data

Estimates of business investment are published twice each quarter by the ONS. But these data are uncertain, and tend to be substantially revised over time. Revisions are likely to reflect several factors, including late

(1) See for example Jolliffe (1986).
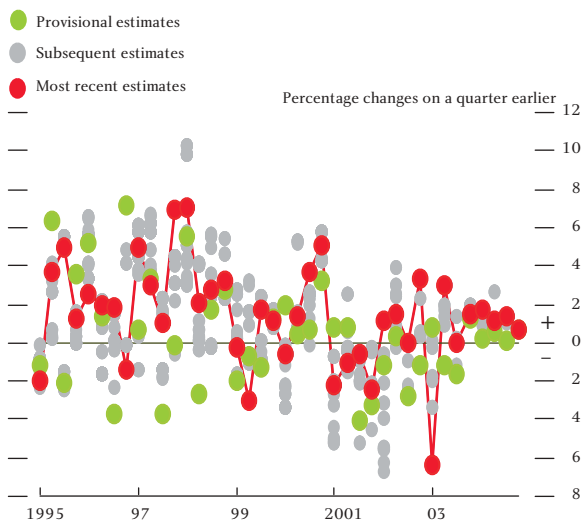(2) Lags in the regressions were chosen on the basis of Tables A and C.
(3) In practice, we dropped indicators with a t-value of less than 1.5. Hendry and Hubrich (2004) note that appropriate t-values for hypothesis testing may not be the same as appropriate values for other activities, such as forecasting.
(4) This is a version of the technique described in Ashley *et al* (2005) in this *Bulletin* (see pages 23–29).
(5) As in Table C, the CIPS orders series used was a three-month average of calendar quarters.

information from survey respondents and the balancing process for GDP: Castle and Ellis (2002) discuss revisions in more detail. They find that investment growth is generally revised by more than the growth rates of the other major expenditure components of GDP. Chart 6 shows estimates of quarterly changes in business investment published by the ONS in different releases: provisional estimates, subsequent estimates and the most recent estimate — the difference between data vintages is often quite large.

Chart 6
Estimates of business investment growth(a)

- Provisional estimates
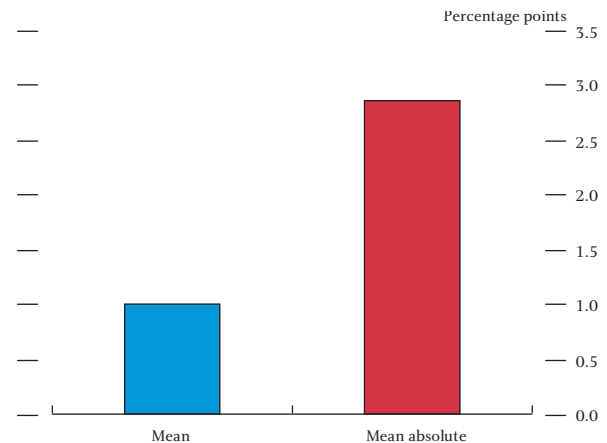- Subsequent estimates
- Most recent estimates

(a) Data published before the implementation of ESA(95) are for 'private other' investment plus investment by 'public corporations'.

The presence of substantial revisions could mean that provisional estimates of business investment growth may not bear much relation to the 'final' published estimates. Chart 7 presents the mean and mean absolute revision to provisional estimates of business investment growth since 1994, based on the latest vintage of data.[1] On average, first estimates of business investment growth have been revised up by around 1 percentage point. But that downward bias in the provisional estimates is dwarfed by the scale of the uncertainty around those first estimates — the mean absolute revision between the provisional data and the latest published estimates was 3 percentage points.[2][3]

It seems that early ONS estimates of business investment growth may not provide a very precise guide to actual

Chart 7
Revisions to provisional estimates of business investment since 1994(a)(b)

(a) See footnote to Chart 6.
(b) Calculated as current estimates minus original data. So some quarters have been revised on more occasions than others.

changes in business investment, as proxied by later vintages of the same data. That suggests that the survey indicators described previously could be useful guides to movements in business investment, at least until the ONS data are revised. So how should we assess initial estimates of business investment, relative to survey evidence?

This exercise is similar to constructing the combined survey-based indicators of investment discussed in the previous section and the method described in Ashley *et al* (2005) in this *Bulletin*. Having constructed a survey estimate of investment growth, based both on intentions and other survey indicators, we can then investigate how much weight should be placed on it, compared with the initial estimate of business investment growth. That can be done simply by regressing the 'final' investment data on the combined survey-based indicator, the provisional estimates of investment and a constant.

But in order to do so, it is necessary to define the 'final' vintage of ONS data. Revisions to data can continue for several years. In practice, to examine the real-time properties of investment we have to define some point at which the data are *taken to be* final. This is a necessary approximation when examining real-time data. For this exercise, data are defined as 'final' where the annual series has been through at least two *Blue Books*: so the

(1) Those were the data released on 24 February 2005. Prior to the introduction of ESA(95) in the 1998 *Blue Book*, business investment is proxied using the sum of 'private other' investment (which excludes dwellings) and investment by 'public corporations'.
(2) This mean absolute revision is similar to the shorter sample (five-year) estimate published in the ONS business investment release; the mean revision over the shorter-sample is smaller.
(3) Note that revisions to business investment growth may not show up in revisions to GDP growth: revisions to other components also matter. It is also worth noting that there are three different measures of GDP, namely the output, income and expenditure measures. So uncertainty around investment data may not translate directly into uncertainty about GDP data, if information from another measurement approach (eg output) is important.

last quarter used in the analysis is 2002 Q4.[1] This, by its nature, is an imperfect approximation.

In principle, we would want to distinguish between information-based revisions and methodological changes, as described in Ashley *et al* (2005). They use a simple 'rule of thumb' for output data: revisions after the second *Blue Book* are assumed to reflect methodology, and revisions prior to that are assumed to reflect new information. However, this may be inappropriate for business investment: data have sometimes been markedly revised after the second *Blue Book*, but without any methodological changes. For example, the 2002 *Blue Book* incorporated revisions to quarterly business investment growth back to 1997: the mean absolute revision was 0.9 percentage points. Yet that was despite no 'substantial methodological improvements' (ONS (2002)). As such, our results are based on the total revision to business investment growth, without attempting to distinguish between revisions reflecting methodology and those reflecting new information.

Chart 8 presents such a survey-based estimate, together with an estimate of 'final' business investment growth based on the provisional releases.[2] The former clearly matches the 'final' vintage of investment data more closely than the latter. Chart 9 shows a combined indicator, that uses both the surveys and initial ONS estimates. The first estimate of business investment growth accounts for a small amount of the information in this indicator, with the remainder accruing to the survey-based indicator. And the results were similar when we examined the second estimate of business investment, published about a month after the provisional data.[3]

One factor that could affect these results is the introduction of annual chain-linking (ACL) in the 2003 *Blue Book*. From time to time, there are major changes to the National Accounts, such as ACL or the implementation of the European System of Accounts 1995 (ESA(95)) in the 1998 *Blue Book*. Such changes can have a significant impact on the published data. So we repeated the weighting exercise just using data

Chart 8
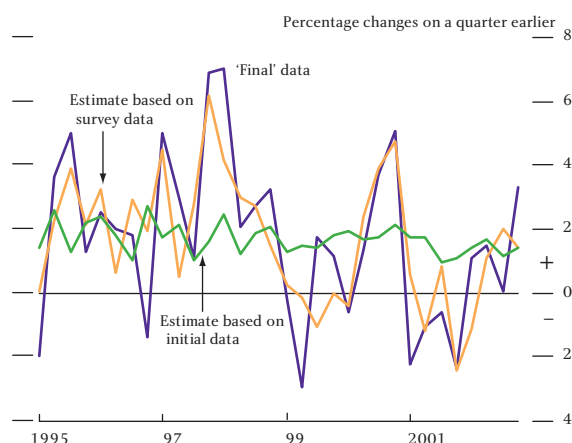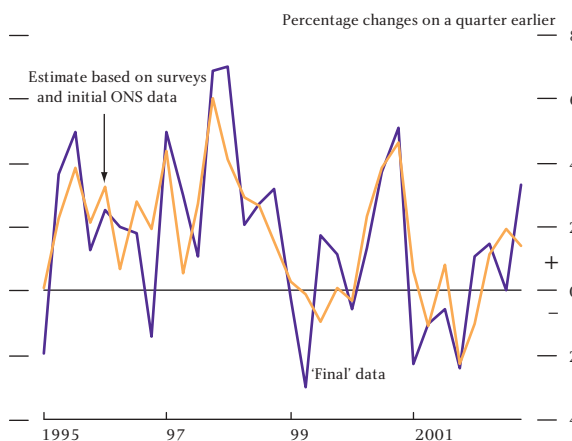**Indicators of business investment growth**

Chart 9
A combined indicator of business investment growth

published before the 2003 *Blue Book,* when ACL was implemented.[4] But the results were broadly unaffected.

Conclusion

Business investment is a volatile component of the UK economy. Business surveys provide a number of timely indicators of investment: among these are surveys of investment intentions and other relevant factors, such as capacity utilisation and demand uncertainty. These survey indicators can capture around half of the short-term movements in business investment over the past decade. And they appear to add useful information to the provisional estimates published by the ONS.

(1) This means that some 'final' quarters will have been revised on more occasions than others. Using an alternative criterion — for example defining 'final' data as having been originally published prior to the 2002 *Blue Book* — did not affect the main real-time results presented in this article, although the precise numbers did differ a little.
(2) This estimate is the 'best fit' of the provisional estimates against 'final' data, rather than the provisional estimates themselves.
(3) We also tested for a breakpoint in 2000, when the sample size of the quarterly capital expenditure inquiry was doubled. But there was no significant evidence of such a break in the weighting equation.
(4) Of course, these data would still be affected by the implementation of ESA(95). For comparison with the previous weighting exercise, data were only included where the annual series had been through at least two *Blue Books*.

Appendix

This appendix lists the surveys and specific investment intention questions discussed in the main body of the article.

Survey	Question
BCC Quarterly Economic Survey	Over the past three months, what changes have you made to your investment plans: (a) for plant and machinery; (b) for training?
CBI Quarterly Industrial Trends Survey	Do you expect to authorise more or less capital expenditure in the next twelve months than you authorised in the past twelve months on: (a) buildings; (b) plant and machinery?
CBI Financial Services	Do you expect to authorise more or less capital expenditure in the next twelve months than you authorised in the past twelve months on: (a) land and buildings; (b) vehicles, plant and machinery; (c) information technology?
CBI Distributive Trades	Do you expect to authorise more or less capital expenditure (including buildings, machinery, cars and commercial vehicles) in the next twelve months than you authorised in the past twelve months?
3i Enterprise Barometer	Over the current quarter do you expect your investment to be up, the same or down compared with the previous quarter?
Engineering Employers' Federation	Planned capital expenditure (trend over the past three months).

References

Ashley, J, Driver, R, Hayes, S and Jeffery, C (2005), 'Dealing with data uncertainty', *Bank of England Quarterly Bulletin*, Spring, pages 23–29.

Britton, E, Cutler, J and Wardlow, A (1999), 'The Bank's use of survey data', *Bank of England Quarterly Bulletin*, May, pages 177–82.

Castle, J and Ellis, C (2002), 'Building a real-time database for GDP(E)', *Bank of England Quarterly Bulletin*, Spring, pages 42–49.

Cunningham, A (1997), 'Quantifying survey data', *Bank of England Quarterly Bulletin*, August, pages 292–300.

Dixit, A and Pindyck, R (1994), *Investment under uncertainty*, Princeton University Press.

Ellis, C and Groth, C (2003), 'Long-run equilibrium ratios of business investment to output in the United Kingdom', *Bank of England Quarterly Bulletin*, Summer, pages 177–87.

Ellis, C and Price, S (2004), 'UK business investment and the user cost of capital', *The Manchester School*, Supplement, Vol. 72, pages 72–93.

Hendry, D and Hubrich, K (2004), 'Forecasting aggregates by disaggregates', paper presented at Euro Area Business Cycle Network (EABCN) workshop at the National Bank of Belgium on 'Recent advances in forecasting combination', 19–20 November.

Jolliffe, I (1986), *Principal component analysis*, Springer-Verlag, New York.

Larsen, J and Newton-Smith, R (2001), 'Using surveys of investment intentions', *Bank of England Quarterly Bulletin*, Summer, pages 189–94.

ONS (2002), *United Kingdom National Accounts: The Blue Book 2002*, The Stationery Office.

Price, R (1977), 'The CBI industrial trends survey — an insight into answering practices', *CBI Review*, Summer.