



BANK OF ENGLAND

Speech

The New Economy: Myths and Realities

Speech given by

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SUMMARY

1 DEFINITION OF A “NEW ECONOMY” (NE)

Some see the NE as synonymous with an acceleration in the diffusion of Information and Communications Technology (ICT). I prefer to ask whether the economy might, for a variety of reasons, have changed enough for it to be material for monetary policy.

2 THE NE AND BUSINESS CYCLES

Some adherents of the NE have, in the past, claimed that the business cycle might become an anachronism. While this notion is increasingly suspect today, there is some evidence suggesting that the variance of output fluctuations has fallen significantly in the US and the UK. However, this might be a temporary phenomenon. Changes in confidence remain unpredictable, and technology spending cycles might now have greater amplitude.

3 THE RECENT FORECASTING RECORD

Perhaps the most persuasive reason for believing that our economies are behaving differently is the fact that, in both the US and the UK, economic forecasters have tended to simultaneously over-predict the level of unemployment and over-predict inflation since around 1993. Factors like the exchange rate cannot, by themselves, explain this sequence and pattern of forecast errors.

4 HAS THE NAIRU FALLEN?

The evidence suggests that the observed forecast errors appear to be consistent with both, a fall in the non-accelerating inflation rate of unemployment (NAIRU), and various temporary factors (e.g. lower import prices). The NAIRU has plausibly fallen because of labour market reform and the intensification of product market competition.

5 THE NE AND PRODUCTIVITY GROWTH

Academic studies are now growingly supportive of the notion that the underlying rate of productivity growth has, in recent years, increased in the US. These studies also suggest that ICT investment has played an important role. Indeed, there is some evidence suggesting that the growth contribution of ICT in the past 25 years outstrips that of electricity and railroads over comparable periods. In the UK, the contribution of ICT to productivity growth has risen significantly in recent years, but UK productivity growth actually decelerated in the 1994-98 period. It is possible that the reduction in long-term unemployment, the high pound and measurement error have obscured the benefits from the NE for UK productivity growth.

6 THE PROSPECTS FOR PRODUCTIVITY GROWTH

It is possible that an economic slowdown, a weaker stock market and some past over-investment might lead to a significant slowing in productivity growth.

Historically, periods of significant technological change have sometimes been associated with significant volatility of share prices and corporate investment. For example, the average share price of electrical companies fell by around 93% after the 1882 electrical mania and this did lead to a collapse in investment spending. However, it did not stop us from reaping the benefits of electricity eventually. Similarly, survey evidence suggests that UK business continue to expect e-business to become more important over the next few years.

Interpreting productivity growth statistics through a downturn will require extreme care as it is possible that the NE might have increased the average growth rate of productivity while also increasing its cyclical variability. In any case, deriving accurate estimates of the cyclical contribution to productivity growth is virtually impossible.

7 THE NEW ECONOMY, MEASUREMENT ERROR AND MONETARY POLICY

It is possible that measurement issues have led forecasters to overestimate inflationary pressures in the UK economy.

For example, a preliminary set of estimates of the flow of capital services to industry has, in recent years, grown much faster than a conventional, wealth-based measure of the capital stock. Preliminary work suggests that this might have implied a lower level of “capacity utilisation” and, hence, less inflationary pressure in the Bank of England’s Medium-Term Macroeconometric Model (MTMM).

To take another example, if one makes alternative assumptions about the classification of software spending and also substituted US-style price indices for computers and software, then, preliminary, illustrative calculations suggest that productivity growth might have been underestimated by as much as 0.4 percentage points per annum over 1994-98. Preliminary work suggests that this alternative data would have lowered the estimate of the equilibrium rate of unemployment NAIRU in the MTMM by around 0.5 percentage points in 1999 which, if interpreted mechanically, would have significantly lowered estimates of inflationary pressure.

The ONS is working closely with the Bank to continue progress in the area of capital stock measures, and the issue of quality adjustment of computer prices was addressed in the Quality Review of Short Term Indicators of Output released by the ONS. We await further developments with keen interest.

1 INTRODUCTION

Mr Chairman,

It is a great pleasure to be here today, on the occasion of the annual Travers Lecture.

Developments in Information and Communications Technology (ICT, hereafter) have generated much excitement in recent years. Even allowing for the enthusiasm that might be expected from one of the pioneers, I recall being struck by the boldness of Mr Gates'¹ claim in Davos earlier this year that

“The PC is the best thing that Man ever created.”

Being awestruck by the technological advances we have seen also appears to go hand-in-hand with a belief that the economic benefits are likely to be correspondingly large. Hence, notwithstanding the significant decline in the share prices of technology companies over the last year, Mr Chambers, also speaking in Davos² asserted that

“The productivity gain that will be delivered by IT will be at least as great as the electricity, transportation and telephone revolutions put together.”

There has, in recent years, been much discussion of the ‘New Economy’ (NE, hereafter). There is no generally accepted definition of what one means by the NE.³ Recall that the term NE, in the early 1980s, implied an economy that was driven by services rather than manufacturing.⁴ Then, the worry was that a service-driven economy was going to create poor, low-wage jobs. More recently, the use of the term NE has been transformed radically. Unsurprisingly, there are those who see the NE as being synonymous with an acceleration in the diffusion of Information and Communications Technology (see, e.g. Gordon (2000)). However, I regard that as a rather narrow definition. Recall that John Travers was, of course, active in the free

¹ The Chairman of Microsoft, as quoted in *The Independent*, 29 January 2001.

² The President of Cisco, also quoted in *The Independent*, 29 January 2001.

³ See Browne (2000) for an extensive discussion of this issue.

⁴ See, eg Mandel (2001).

trade movement during the mid-19th century. Indeed, much that might be different about the economy today relates not just to ICT advances, but also to the effects of globalisation, intensifying product market competition, labour market reform, financial market liberalisation and several other factors.

A more appropriate characterisation of how a central banker might define the NE is, perhaps, that provided by Chairman Greenspan.

“... it is certainly true that we have a new economy. It is different. It is behaving differently and it requires a different type of monetary policy to maintain its growth than we had in the past.”⁵

I shall, therefore, discuss today some of the important ways in which our economies seem to be operating differently as compared to, say, the seventies and eighties. Although I do not always believe some of the more extravagant claims that are made for the NE, my best guess is that enough has changed for it to be material to the setting of monetary policy.

2 IS THE BUSINESS CYCLE DEAD?

In recent years, it had become increasingly fashionable to assert that recessions were a thing of the past. For example, consider the following quote from the Wall Street Journal in 1996:

“From boardrooms to living rooms and from government offices to trading floors, a consensus is emerging. The big, bad business cycle has been tamed.” (15 November 1996),

or, more recently, a columnist⁶ in the same journal

“The business cycle – a creation of the Industrial Age – may well become an anachronism.”

⁵ Testimony before Senate Banking Committee, 23 February 2000.

⁶ “So Long, Supply and Demand”, Thomas Petzinger, Jr, 31 December 1999, R3.

Of course, since late last year, sentiment has deteriorated significantly, with increased concern about a recession in the US. While the notion that the business cycle might be dead might seem even more questionable now, the less extreme view that economies might have become more stable is clearly worth taking seriously.

Research at the Federal Reserve Bank of New York⁷ has shown that a significant decline in the volatility of US GDP growth has occurred since the mid-eighties – specifically, the variance of output fluctuations over the 1953-83 period is more than four times as large as the variance for the period since 1984. They show that the reduction in volatility largely emanates from a reduction in the volatility of durable goods production and that, further, this appears to correlate with a decline in the share of durable goods accounted for by inventories. One hypothesis that might explain their results are that changes in inventory management, such as the use of ‘just-in-time’ techniques, have helped bring about a reduction in the share of durables inventory. Of course, ICT advances have facilitated some of the improvements in inventory management techniques as information now flows more speedily than before.

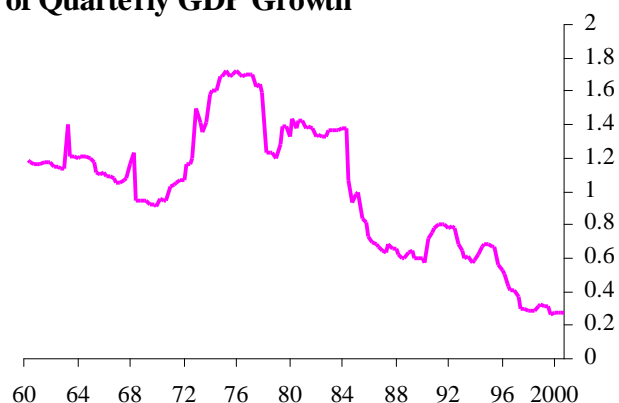
Figure 1 shows that a similar reduction in the volatility of output growth has also occurred in the UK. Table 1 shows, though, that unlike the US, little of the decline in the volatility of output is accounted for by stocks – instead, the largest arithmetical source of the decline in the volatility of GDP growth is what has happened to the volatility of consumption growth.

A variety of possible factors could potentially explain the decline in the volatility of consumption growth, though one possibility is that financial liberalisation might have reduced the effect of credit constraint-induced lurches in consumption growth. Given that the stock-output ratio has fallen in the UK as well, and the wealth of anecdotal evidence on ‘just-in-time’ stocks, it does, at first sight, seem surprising that stockbuilding has not become less volatile. This merits further research.

⁷ See McConnell and Quiros (2000).

FIGURE 1

**Rolling 5-Year Standard Deviations
of Quarterly GDP Growth**



**TABLE 1
VOLATILITY OF THE COMPONENTS OF GDP GROWTH¹**

	1955-1984	1985-2000
GDP ¹	1.24	0.58
STOCKS ²	0.73	0.69
CONSUMPTION ²	0.78	0.47
INVESTMENT ²	0.47	0.46

1 Standard deviations of quarterly growth.

2 Standard deviations of the contributions to quarterly GDP growth

Although the decline in observed output volatility is encouraging, it is appropriate to be cautious. First, one should recall that previous, long-lived economic expansions have led to the misplaced belief that lower volatility was here to stay, e.g. Browne (2000) reminds us that, in 1968, the US Commerce Department dropped the title, “Business Cycle Developments” from one of its publications, concluding that the business cycle was dead.

Second, there are many other causes of recessions which are unaffected by the NE. For example, the sharpness of the fall of business and consumer confidence in the US in the last few months has been a surprise. However, Chairman Greenspan⁸ reminds us that -

“The unpredictable rending of confidence is one reason that recessions are so difficult to forecast. Our economic models have never been particularly successful in capturing a process driven in large part by non-rational behaviour.”

Third, and perhaps most importantly, some of those who believe that we have a NE also think that the business cycle has not been repealed, but “... been reincarnated in a different garb ...”.⁹ Michael Mandel, the economics editor of Business Week, a magazine that was early to forecast an upturn in productivity growth in the US, has recently published a book with the title “The Coming Internet Depression”. He argues that in a downturn, a vicious cycle might develop.

Specifically, if investment sags, productivity growth will slow, which might cause the stock market to fall. Of course, the fall in the stock market will further reduce investment and adversely affect the flow of venture capital, which, in turn, will reduce productivity growth further. Mandel draws specific attention to the fact that, historically, venture capital funding cycles have a significant amplitude – for example, between 1987 and 1991, first-round financing for new companies fell by 75%.

We shall return to a discussion of Mandel’s hypothesis when I consider the cyclicity of productivity growth below, but suffice it to say that there is nothing in the NE view, properly understood, to suggest that recessions will not occur. Historically, periods of rapid technological change have not been recession-free.

That is why I have never fully understood authors who have argued that the NE can contribute to much higher share prices because it can rationalise a very low, or even

⁸ Monetary Policy Report to Congress, 28 February 2001.

⁹ See, eg Mandel (2001) page 52.

zero, equity risk premium. A representative example is that of a Wall Street equity strategist, arguing, in May 1998, that the “risk premium is dead”¹⁰, because

“There is no threat of world conflict There is no recession in sight ... American prosperity is structural, not transitory.”

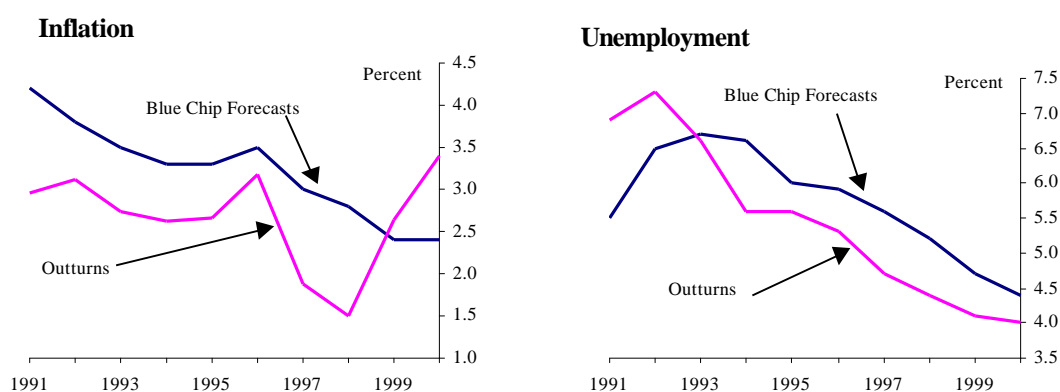
Of course, recent events have reawakened perceptions of risk associated with holding equities.

Notwithstanding the re-emergence of recession risk and a higher equity risk premium, it is, nevertheless, true that the US and UK economies appear to have behaved differently in recent years, and it is to a consideration of this evidence that I turn next.

3 THE RECENT FORECASTING RECORD

Figure 2 compares the forecasts by Blue Chip panellists for unemployment and inflation in the US as compared to the actual out-turns over the 1993-2000 period.¹¹

FIGURE 2



¹⁰ Byron Wien of Morgan Stanley in a piece, “Risk Premium – R.I.P”, though I should emphasise that these sentiments were by no means unusual.

¹¹ Kohn (1999) presented a similar picture of the 1991-97 period.

Note that forecasters have, for most of the period, over-predicted the level of the unemployment rate. Nonetheless, they have simultaneously over-predicted inflation until recently.

Similarly, economic forecasters have been persistently too gloomy about the UK economy since the departure from the ERM.

Table 2 displays the average forecast errors that have been made over this period.¹² Focussing on the average of all forecasts (i.e. ‘the consensus’), notice that, on average, GDP growth has been underestimated by about 0.5% pa, which is a large error in relation to the actual average annual growth rate of around 2.9%.

TABLE 2
AVERAGE FORECAST ERRORS¹ IN THE UK, 1993-99

	AVERAGE ³ ERROR	SIGNIFICANT ⁴ AT 10% LEVEL
<u>GDP GROWTH FORECAST</u>		
CONSENSUS ²	+0.48%	YES
<u>INFLATION (RPIX) FORECAST</u>		
CONSENSUS ²	-0.53%	YES

- 1 Four quarter-ahead forecast errors.
- 2 Consensus forecast taken from ‘Consensus Economics’.
- 3 Sample period: 1993 I – 1999 IV.
- 4 Using a t-test over this sample period, with Newey-West standard errors.

¹² These numbers are based on preliminary work by Nick Davey and Jennifer Greenslade of the MPC Unit at the Bank of England, i.e. they are a part of the group of economists who work with the ‘external’ members of the MPC.

Now, a conventional view holds that if GDP growth were faster than expected over a sustained period of time, then,¹³ on average, actual inflation must also be higher than expected. However, the actual inflation out-turn over this period was, on average, 0.5% lower than the ‘consensus’ inflation forecast. Hence, economic forecasters appear to have been simultaneously too gloomy about, both, GDP growth and inflation. I should say, in passing, that virtually all forecasters (including the Bank of England) failed to spot this benign sequence of events during the 1990s. There are a variety of possible explanations for this phenomenon. One class of hypotheses would envisage a significant change in the structural relationships that underlie the forecasting processes. I discuss some of these hypotheses in the next section, as policymakers must always be alive to the possibility that historical relationships might be breaking down.

Before doing so, I note that some argue that the low inflation out-turns are attributable entirely to a strong exchange rate. I find that implausible as sterling was weak during the 1992-96 period, and only strengthened significantly thereafter. Hence, the exchange rate can only potentially explain the surprisingly low inflation out-turns for a part of the sample period. Further, we are trying to explain the simultaneous occurrence of higher-than-expected GDP growth and lower-than-expected inflation. While an unexpectedly high exchange rate can readily explain surprisingly low inflation out-turns, in most standard macro-models, a stronger-than-expected exchange rate would cause lower-than-expected GDP growth (not higher-than-expected). Further, I have argued previously (see Wadhvani (1999)) that a part of the explanation of the strength of sterling versus the continental European currencies is the possibility that the UK has embraced the NE more readily than Europe. If true, then a part of the disinflationary impact of strong sterling can be attributed to the NE.

I now turn to consider some direct evidence for the structural changes that underlie the NE hypothesis.

¹³ Conditional on potential output growth having remained constant.

4 HAS THE NAIRU FALLEN?

An example of a structural change which might explain the pattern of observed forecast errors would be a fall in the so-called non-accelerating inflation rate of unemployment (NAIRU hereafter).

An impressive feature of recent US experience is that, over the period 1992-2000, although unemployment fell from 7.5% in 1992 to 4.1% in 1999, the rate of price inflation was essentially constant. Moreover, when the unemployment rate first fell below 6% (the then prevailing 'consensus' estimate of the NAIRU), many economists predicted an acceleration in inflation which failed to materialise. UK experience has been quite similar. In 1995, the consensus estimate of the NAIRU was that it was around 6½ - 7% (using the claimant count definition). Yet, unemployment has fallen steadily to the current 3.4% without, as yet, triggering any discernible rise in inflation.

Of course, various alternative hypotheses have been advanced in an attempt to explain these facts. In the US, they include:-

- a) Temporary factors It is argued that lower import prices (a higher dollar, the Asian crisis etc) and decelerating health insurance costs have played an important role in temporarily depressing inflation, and that the NAIRU is actually higher than the current unemployment rate.¹⁴

A variant of this view argues that the acceleration of productivity growth in the 1990s has not, as yet, been fully reflected into wages because wage aspirations respond slowly to increases in productivity growth.¹⁵ As aspirations catch up, inflation will rise so the fall in unemployment may only be partially sustainable.

- b) Permanent Factors One might expect the fall in unemployment to be sustainable if the NAIRU has actually fallen for NE-type reasons.

¹⁴ See, eg Blinder and Yellen (2001).

¹⁵ See, eg Ball and Moffitt (2001)

Now, the NAIRU might fall either because of improvements in the workings of the labour market, or because of the intensification of product market competition. In terms of the labour market, various hypotheses that have been advanced include changes in how people look for work (e.g. temporary help agencies), or differences in the demographic composition of the workforce.¹⁶ The increased openness of the US economy, product market deregulation and, more recently, the Internet are all possible explanations for the widely-repeated perception of an intensification of product market competition, which might also have helped lower the NAIRU.

As one would imagine, various authors have attempted to trace the evolution of the NAIRU in the US¹⁷, but given the well-known difficulties with this kind of work, obtaining a precise split between the rate of the temporary and permanent factors is difficult. However, I find it difficult to believe that temporary factors could entirely explain why inflation has been so benign even as unemployment has fallen. For instance, one needs a whole sequence of temporary factors for an eight-year period to explain what has happened. In any case, several studies point to some role for an enduring decline in the NAIRU.

Turning to the UK, I have previously discussed the far-reaching changes that have occurred in the labour market over the last two decades (see Wadhvani (2000a)), so I will not have much to say on that topic today. However, Table 3 reminds us that, along a variety of dimensions, a great deal is different today (cf. 1998 vs 1980). Union membership and strike activity are much lower. Imbalances in the pattern of labour demand and supply have diminished significantly. Turning to the unemployment benefits regime, the conventional replacement ratio (i.e. the ratio of out-of-work benefit to estimated in-work income) has fallen. Further, the New Deal, and other measures which have tightened the availability of benefits have also probably been influential. Also, Barwell (2000) suggests that some of the decline in unemployment can be attributed to changes in the age structure of the labour force.

¹⁶ See, eg Katz and Krueger (1999), for a discussion of some of these hypotheses.

¹⁷ See, eg Staiger, Stock and Watson (2001), and the many references therein.

It is notable that if one takes the wage equation that is to be found in the Bank of England's core macro-econometric model (see Bank of England (Sept 2000)), then, there is evidence that it has over-predicted wage growth in recent years (i.e. since around 1992).

TABLE 3
SOME KEY FEATURES OF THE LABOUR MARKET (1998 VS 1980)

<u>FACTORS</u>	<u>1998</u>	<u>1992</u>	<u>1980</u>
UNION DENSITY	0.30	0.36	0.49
NUMBER OF WORKING DAYS LOST (000s)	30	48	957
<u>MISMATCH</u>			
(a) INDUSTRIAL*	0.24	1.26	1.18
(b) SKILLS **	4.9	8.0	8.00
REPLACEMENT RATIO	0.18	0.18	0.24

*Annual (absolute) change in the ratio of employee jobs in the production and construction industries to total employee jobs.

**Ratio of manufacturing firms reporting skilled labour shortages to those reporting shortages of other labour (source: CBI Industrial Trends Survey).

It is sometimes pointed that while many of the labour market variables that are supposed to underlie the NAIRU changed during the 1980-92 period, much of the evidence for a lower NAIRU appears to post-date 1992. Hence, some argue that the changes in the labour market cannot be the explanation for the change in the NAIRU.

On the other hand, industrial relations experts like Professor William Brown of Cambridge argue that the structural improvements in the labour market during the 1980-92 period did not translate into improved wage performance until other catalytic events induced firms to undertake radical industrial relations change in the early 1990s. Possible candidates as catalysts are the 1990-92 recession, and the re-election of the government in 1992, which implied that many of the structural changes in the labour market were not going to be reversed. There is case-study evidence in favour of both these factors having played some role (see e.g. Brown et al (1999)). Other possible catalytic events include the reduction in inflation expectations, which began during the recession in the early 1990s, but was possibly aided by the adoption of an

explicit inflation target after 1992. Personally, I have no problem with the notion that structural changes can take time before they manifest themselves in improved macroeconomic performance. Any changes to the way labour is used (e.g. reforming pay systems, improving selection, etc) requires managerial effort, and takes time to put in place and be effective.

Of course it is plausible that some of the improvement in the wage-unemployment trade-off during the late 1990s in the UK is also attributable to temporary factors like lower import prices – caused by a combination of an appreciation of sterling, weak commodity prices during the 1997-98 Asian crisis and possible supply-side improvement in other countries. Note though that the trade-off appeared to improve after the UK left the ERM in 1992 even though a fall in sterling boosted import prices, so I am relatively confident that structural changes have also played a role.

Of course, many of those who have been excited by the potential economic impact of ICT, typically think first of the impact on productivity – it is to a discussion of that issue that I turn next.

5 THE ‘NEW ECONOMY’ AND PRODUCTIVITY GROWTH

As long ago as 1995, various people were arguing (e.g. Business Week) that the NE had led to an acceleration of productivity growth in the US.

This view was initially resisted by academic economists.¹⁸ Then, the view gradually evolved as a mixture of data revisions and the passage of time appeared to lead to a discernible change in the trend rate of measured productivity growth. Even then, there was some further resistance to accepting the possibility of a change in the rate of structural productivity growth. The rise in actual productivity growth was initially characterised as cyclical, then said to be confined only to the ICT-producing area, and then only to the durables manufacturing sector and so on.¹⁹ This is an active research area, and the debate continues to move ahead.²⁰

¹⁸ A representative view was that of Blinder (1997), who characterised it as “mostly poppycock”.

¹⁹ See Gordon (2000) for discussion of some of these issues.

²⁰ See Bosworth and Triplett (2000) for a recent survey.

We know that non-farm labour productivity growth has increased from 1.5% over 1973-95, to around 2.9% in the 1995-2000 period. Although different studies disagree on the precise magnitudes, we also know that:-

(a) Boost to capital per head

About one-third to one-half of the acceleration in labour productivity growth has come through the boom in corporate investment. Much of the capital deepening that occurred is largely accounted for by more ICT capital per head. At least some of this extra investment has occurred because the price of ICT capital was falling fast, in part, because of Moore's law, according to which the processing power of a silicon chip would double every 18 months.

(b) Other factors

In terms of the remainder of the increase in productivity, different studies disagree about the relative importance of –

- (i) More efficient production of ICT equipment itself.
- (ii) The benefits conferred by the use of ICT in non-ICT sectors.
- (iii) The stage of the business cycle, with productivity growth tending to be higher in booms.

However, some of the more recent studies argue that the productivity rebound was not merely confined to a few new-economy sectors, but that various other sectors also did well.²¹ Also, Basu et al (2000) attempt to allow for the influence of temporary factors like factor utilisation on productivity growth, but conclude that “.... the recent increase in productivity growth does appear to arise from an increase in technological change”. Notwithstanding this work, it remains extremely difficult to know as to how much of the increase in productivity growth has been related to the fact that GDP growth has been high.

²¹ See, e.g. Nordhaus (2001) or Basu et al (2000).

Nevertheless, so far, the academic evidence in the US is growingly supportive of the notion that ICT investment has played an important role in increasing labour productivity growth in a variety of sectors of the economy, which is broadly consistent with predictions made by various NE advocates from around 1995 onwards.

Of course, one must recall that the post-1973 period was one of relatively slow productivity growth which spawned a large number of studies which attempted to explain the productivity “slowdown” that occurred from around that date. Hence, the post-1995 acceleration of growth has occurred in the context of productivity growth having been weak in the preceding period. The recent spurt in productivity growth in the 1995-2000 period is by no means historically unprecedented, e.g. non-farm business productivity grew faster in 1960-65 than in 1995-2000.

On the other hand, the contribution of ICT to productivity growth is, by historical standards, impressive. The creation of a railway system must have had an important effect on John Travers’ wholesale grocery business. It is therefore significant that Crafts (2000) argues that “... the growth contribution of ICT in the past 25 years outstrips that of electricity and even more so that of railroads over comparable periods”. This is documented in Table 4, which shows that even before the post-1995 period, the contribution of ICT to growth compared favourably relative to these other innovations.

TABLE 4
RELATIVE CONTRIBUTION OF DIFFERENT TECHNOLOGIES TO US GROWTH
(percentage points per year)

	1974-90	1991-95	1996-99
ICT	0.65	0.76	1.54
	1839-70	1839-90	
RAILROADS	0.21	0.35	
	1894-1929	1919-29	
ELECTRICITY	0.56	0.98	

Source: Crafts (2000)

Turning now to the UK, anecdotal evidence suggests that ICT investment has grown at a healthy rate in recent years – indeed, Table 5 suggests that, investment in software and telecoms equipment in the UK has matched or exceeded growth rates in the US in the last decade.²² While the UK has not matched the stunning 35% growth rate in computer investment in the US, investment in that area has nevertheless grown at a healthy clip (28% pa).

TABLE 5
GROWTH RATES OF ICT INPUTS IN THE UK AND US

	US		UK	
	1990-95	1995-99	1989-94	1994-98
SOFTWARE	12.8	13.1	17.8	12.6
COMPUTERS	17.5	35.9	18.6	28.4
TELECOMMUNICATIONS EQUIPMENT	3.6	7.2	8.7	13.5

Source: Oulton, Bank of England

Table 6 displays the relative contribution of ICT to productivity growth in recent years. As one might expect, they show the contribution of ICT capital to productivity growth rising in both countries (from around 0.4% in 1974-90 to around 1% in the post-1995 period in the US, and from 0.35% in 1979-89 to 0.6% in 1994-98 in the UK).

The level of the ICT contribution is lower in the UK, in part because the income share of ICT inputs started at a lower level.²³ However, notwithstanding the rising

²² Table 5 is based on the measures of ICT investment discussed in Section 7 below.

²³ Note that these estimates of the ICT contribution to growth in the UK are rather higher than those in Kneller and Young (2000), in part because those authors excluded the contribution of software and telecommunications. The calculations reported in Goldman Sachs (2000) also potentially understate the contribution of ICT because they do not correct for the potential understatement of software investment.

contribution from ICT, productivity growth in the UK decelerated in 1994-98 vs the early 90s, while it accelerated in the US. This is puzzling.

Kneller and Young (2000) argue that a part of the decline in productivity growth may be attributed to the high pound, which depressed investment in ‘other capital’, whose (see Table 6) contribution fell markedly over this period. They also argue that the

TABLE 6

**PRODUCTIVITY AND THE CONTRIBUTION OF ICT:
A US-UK COMPARISON**

	US			UK		
	1974-90	1990-95	1995-99	1979-89	1989-94	1994-98
Growth of						
Output per hour (% pa)	1.43	1.61	2.67	2.20	2.57	1.58
Contributions from (pp pa)						
ICT capital	0.44	0.50	0.96	0.35	0.39	0.62
Other capital	0.37	0.11	0.14	0.52	0.96	0.11
TFP plus labour quality	0.62	1.00	1.57	1.32	1.23	0.85

Source: US: Oliner and Sichel (2000)
UK: Oulton, Bank of England

unemployed who were absorbed into employment over the 1994-98 period were, on average, less productive on account of having lost skills during their spell of unemployment. On the basis of these hypotheses, one would argue that the benefits of ICT might have been obscured during the 1994-98 period, and that as the adverse effects of a high pound wear off and/or the rate at which the long-term unemployed enter employment diminishes, productivity growth can be expected to pick up.

Certainly, productivity growth has picked up more recently – the four-quarter growth rate is currently²⁴ around 2.5%.

²⁴ 2000 Q3

Another possibility is that measured productivity growth understates actual improvements in productivity. There are reasons to believe that this has been an important factor in the US (see, e.g. Corrado and Slifman (1999)), where it is likely that productivity growth has been increasingly understated in recent years. Now, work on possible biases in the measurement of ICT in the UK suggests that GDP and labour productivity growth may have been understated by perhaps around 0.4 pp pa during 1994-98²⁵ (that is already allowed for in the estimates in Table 6).

Of course, there may be other reasons for believing that productivity growth has been understated during the late 1990s. I have previously discussed this issue at some length (see Wadhvani (2000b)), so I shall be brief here, but I would point to –

- (i) Official data suggest that manufacturing productivity growth was zero during 1995-97, while survey responses from the CBI Pay Databank sample suggested productivity growth averaged around 4% pa over this period.
- (ii) No-one has satisfactorily explained why the measured deceleration in manufacturing productivity growth appeared to coincide with a rise in profitability (over the 1995-97 period).
- (iii) The “hard-to-measure” service sectors have become more important over time.

Of course, more research is needed, but it is possible that measurement issues have obscured some of the benefits from the NE on UK productivity.

6 THE PROSPECTS FOR PRODUCTIVITY GROWTH

Notwithstanding evidence that ICT technology has made a significant contribution to productivity growth, there has, of course, been a significant change in sentiment recently. For example, the Financial Times recently proclaimed:

²⁵ I discuss this work further in Section 7.

“Another pillar of the new economy story is under threat. First, the internet stock bubble burst. Then the hopes of an end to business cycles were dashed by recent economic data from the US. And yesterday, the predictions of permanent increase in productivity growth began to look suspect.” (8 February 2001)

Of course, some of the rise in productivity growth that occurred in the US in recent years can be attributed to the fact that output growth was high. An above-average increase in output growth boosts productivity growth through higher utilisation and through returns-to-scale effects. Although it is virtually impossible to accurately estimate the precise impact of the cycle on productivity growth, some attempts to do so²⁶ suggest that a significant proportion of the rise in productivity growth that we have seen cannot be directly attributed to the cycle.

Nevertheless, with the US economy having decelerated significantly in recent months, it would be surprising if productivity growth did not decelerate for purely cyclical reasons, without that having any necessary implications for the NE view that the medium-term trend of productivity growth has risen.

We noted earlier that a significant fraction (perhaps one-third to one-half) of the upsurge in labour productivity growth in the US can be attributed to an increase in capital accumulation. We have already seen signs of investment spending growth in the US moderating significantly, which, given its high growth rate in the previous year, and with the stock market down significantly over the last year, is scarcely surprising. If it were true that the stock market had been “irrationally exuberant”, it would be surprising if some of the corporate investment decisions that were made over the last 2-3 years were not similarly based on irrational exuberance. Hence, a significant reduction in investment growth caused, in part, by a perception that some over-investment had occurred could also significantly reduce labour productivity growth. I have previously discussed Mandel’s (2001) view that the fall in the stock market can be expected to be associated with a significant reduction in venture capital finance. The associated slowing in innovation then reduces productivity growth. What happens next depends, in part, on how the stock market reacts to the slide in measured productivity growth.

²⁶ E.g., Basu, Fernald and Shapiro (2000).

Significant share price (and investment) volatility around periods of significant technological change is not unusual. In their discussion of the 1882 Electrical “Mania”, Kennedy and Delargy (1997) calculate that the average share price of their sample of quoted electrical companies fell by around 93% between the peak in 1882 Q3 and trough in 1884 Q4! Similarly, in discussing the electrical ‘mania’; in 1882, the Economist newspaper²⁷ recalled an earlier mania –

“The greatest invention of the century resulted in the railway mania of 1845-46 In August 1846, London and North-Western stock was selling at 235, North British at 155 And never since, prosperous as our railways have been, have such high prices been touched.”

The fluctuations in the stock market affected the ability of the electrical industry to raise money, and thereby develop. Kennedy and Delargy (1997) point out that while the prospective electrical supply undertakings raised over £2m at the height of the mania in 1882 alone, they were only able to raise around £235,000 in the subsequent five year period, and they contend that -

“The pace of electrical development paralleled the flow of funds into the industry closely. By the time electrical investment began its feeble recovery after 1887, British firms were already technologically backward.” (p 76)

It is, though, easy to become excessively gloomy. Although share price volatility probably affected the time-path of investment in, say, electrical undertakings, it did not stop us from reaping the benefits of electricity eventually.

Similarly, notwithstanding the possibility that the downturn in share prices depresses ICT-related investment for some time, one would still expect the benefits associated with ICT-related developments to be realised over the medium-term. In that regard, one might draw some comfort from a recent e-business survey conducted by the CBI²⁸ which found that 41% of companies reported that e-business was already having a real impact on all aspects of the organisation, with 99% of respondents expecting some impact in the next 2-3 years.

²⁷ 20 May 1882, pp 604-05.

²⁸ “The quiet revolution: A report on the state of e-business in the UK”, CBI and KPMG consulting, February 2001.

The proportion of turnover expected to be derived from e-business was expected to rise significantly over the next 2-3 years (see Table 7).

TABLE 7
E-BUSINESS TURNOVER – CURRENT AND EXPECTED

PERCENTAGE OF TURNOVER	CURRENT	ANTICIPATED
0%	38%	7%
1-5%	38%	14%
6-10%	11%	21%
11-20%	8%	20%
20+%	5%	38%

Source: CBI (2001)

It is also plausible that Mandel (2001) is too gloomy about the prospects for productivity growth in the US. Many firms feel that they have not, as yet, taken advantage of the new technologies at their disposal. Also, scientists claim that Moore's law is likely to continue to operate, so the falling price of ICT investment is likely to continue to stimulate spending.

If it did turn out that a deceleration in GDP growth and/or the decline in share prices did lead to a pronounced decline in productivity growth, then there will be many who will proclaim that no sustainable increase in the growth rate of productivity had occurred in the US. Indeed, I have already noticed some commentators declare that the NE hypothesis will be seen to have failed if productivity growth in the US falls to levels associated with past cyclical downturns. This is mistaken.

It is perfectly possible to envisage circumstances under which the NE has increased the average growth rate of productivity, but also simultaneously increased its cyclical variability. This could be true if, say, corporate investment had become more

sensitive to movements in the stock market than in the past. This merits further investigation.

In addition, if we have had a period of over-investment, one would expect the subsequent adjustment period to be characterised by unusually low investment, which might temporarily depress productivity growth, thereby masking an underlying improvement in the trend rate.

I fear that, therefore, some of the conventional methods of cyclical adjustment for productivity growth may not be appropriate. For example, Gordon's (1999) method of cyclically adjusting labour productivity growth relies on a stable relationship between detrended (cyclical) changes in hours and corresponding cyclical changes in output. Yet, if the behaviour of, say, investment growth were different over this cycle relative to previous cycles, then it is not obvious that the hours-output relationship would remain stable. Also, recall that pre-war US business cycles were quite different from the post-1945 business cycle. For example, recessions during pre-war cycles were longer-lived, as they often arose from the bursting of speculative bubbles in the financial markets, and recessions were associated with the elimination of overhangs. By contrast, many of the post-war cycles have been associated with inflation-fighting by the Fed. There are those who argue that the current cycle more closely resembles the pre-war cycles.²⁹

In any case, extrapolating longer-term growth trends on the basis of a period that includes a significant cyclical downturn can be a rather unreliable way of estimating long-term growth. Oulton (1995) discusses the hypothetical situation of attempting to forecast US economic growth over the long term from the vantage point of being in 1937. Table 8 sets out the average peak-to-peak growth rates over selected periods. By focussing on the very recent period (including the Depression), the forecaster

²⁹ While methods that cyclically adjust TFP growth rather than labour productivity growth (e.g. Basu et al (2000)) appear to control the cyclical growth of investment, recall that investment sometimes has "spillover" effects on TFP, and also that an important part of the rise in TFP growth in the US is the growth of the ICT-producing industries. Hence, a cyclical slowing in investment growth that was disproportionate relative to the slowing of hours could appear to be misleadingly associated with a slowing of the cyclically-adjusted TFP residual.

would have no idea that the US economy was poised to grow at the exceptionally healthy rate of 4.6% over the subsequent 16 years. Indeed, the forecaster would have got closer to the final outturn by excluding the Depression altogether, though that would have been virtually impossible to do in 1937.

TABLE 8
AVERAGE ANNUAL GROWTH RATES OF US GNP

PERIOD	% PER ANNUM
1913-29	3.26
1919-29	3.48
1929-37	-0.25
1929-41	2.09
1917-37	1.80
1937-53	4.63

Source: Oulton (1995)

Note: 1913, 1929, 1937 and 1953 were cyclical peaks.

1919 was the first 'normal' year after World War 1. 1941 was the last year before US entry into World War 2.

7 THE NEW ECONOMY, MEASUREMENT ERROR AND MONETARY POLICY

I have discussed how the structural changes associated with the NE make it difficult to assess the underlying rate of productivity growth, or the equilibrium rate of unemployment (NAIRU). However, our problems are compounded by the potential existence of measurement error. Indeed, I wish to offer some examples of measurement error **which have become more important** as the amount of ICT investment has risen, making the setting of monetary policy even more challenging.

I shall argue that the types of potential measurement error that I discuss below may have led us to significantly over-estimate the degree of inflationary pressure in recent years. There are those (see e.g., Krugman (1997)) who argue that the possibility that

we may be understating productivity growth through mis-measurement should have no implications for our assessment of inflationary pressure as both actual and trend GDP growth are understated leaving our assessment of the output gap unchanged. However, I shall offer examples today where instances of potential measurement error are seen to have a material impact on our assessment of “capacity utilisation” and the NAIRU.

My first example relates to alternative conceptual measures of the capital stock.

7.1 ALTERNATIVE CONCEPTUAL MEASURES OF THE CAPITAL STOCK

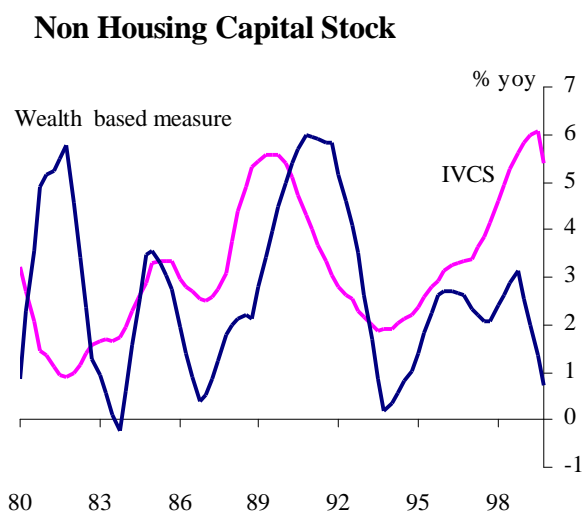
At the Bank, one of our methods of computing the supply potential of the economy relies on summing the weighted growth rates of employment, the capital stock and technical progress. Among other things, it is obviously rather important to use a measure of the capital stock which reflects its productive potential when performing this calculation. Different methods of obtaining a measure of the capital stock can yield rather different results.

For example, current ONS estimates of the capital stock are a so-called ‘wealth type measure’, where each item is weighted by its current asset price. While this is a valid measure for balance sheet purposes, it will be less appropriate for an assessment of productive potential, where one might want to compute an index of the volume of capital services (IVCS hereafter) instead. Note that in the IVCS, each item of capital is, in principle, weighted by its contribution to output (i.e. its marginal revenue product) rather than its asset price. A consequence of using the IVCS is that it increases the weight accorded to shorter-lived assets such as machinery, equipment and software, relative to buildings. If the stocks of shorter-lived assets (e.g. computers) are growing more rapidly than other types, then the IVCS will, in turn, grow more rapidly than the wealth-based measure.

Nicholas Oulton of the Bank of England has computed a preliminary measure of the IVCS, which may, for purely illustrative purposes, be compared to the wealth-based aggregate (see Figure 3). Joint research with the ONS is ongoing on this issue.

Note that the IVCS estimate has shown a rather higher growth rate in recent years, a period when we know that ICT investment accelerated. However, notice also that there are periods (e.g. the early 80s), when the wealth measure of the capital stock grew more quickly than the IVCS measure.

FIGURE 3



Of course, there is no straightforward link between the rate of growth of the capital stock and estimates of potential output because changing one’s view of the appropriate capital stock will also affect one’s estimate of what economists call total factor productivity (TFP, hereafter). Nick Davey and Jennifer Greenslade of the MPC Unit at the Bank of England have examined these issues in the context of the Bank of England’s Medium-Term Macroeconometric Model.³⁰ Because they use alternative capital stock data, various relationships have to be re-estimated. Their work is ongoing, but some interesting results from their pilot study include the possibility that the alternative capital stock data would have yielded a different picture for “capacity utilisation” in recent years - see Figure 4, which displays alternative proxy capacity utilisation series based on the wealth and the IVCS measures, respectively.³¹

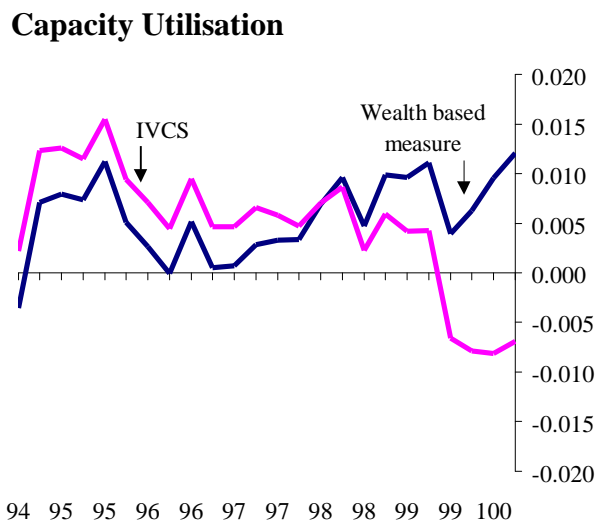
³⁰ They base their analysis on the November 2000 version.

³¹ Note that, in the Bank of England model, “capacity utilisation” is an estimated quantity provided by residuals of a production function where the direct inputs are employment (measured in hours), the non-residential capital stock and labour augmenting technical progress. Further details may be found in Bank of England (2000). Davey-Greenslade re-estimate the relevant parts of the model to obtain the alternative series displayed in Figure 4.

Although the two measures moved broadly in line until the end of 1997, they have diverged since then. Hence, in 1999, the series based on the wealth measure suggested “overheating” while that based on the IVCS suggested that there was still some slack in the economy. Obviously, these two different views about the absence (or otherwise) of spare capacity can have an important effect on an assessment of the degree of inflationary pressure. Davey-Greenslade’s preliminary results suggest that the use of the IVCS series for the capital stock instead of the wealth measure might lead one to reduce one’s estimate of the extent of inflationary pressure implied by the macroeconomic model in recent years. This may be, in part, because the disinflationary impact of a higher measured growth rate of the capital stock more than outweighs the inflationary consequences of somewhat lower measured TFP growth in recent years. Of course, more work is needed in this area, which is true of most issues relating to the NE. We await the results of the Bank-ONS project on the IVCS with great interest.

I turn now to another example where the NE and potential measurement error-related issues interact in a way that makes monetary policy formulation quite difficult.

FIGURE 4



7.2 ALTERNATIVE MEASURES OF ICT INVESTMENT

There are various subtle issues relating to the appropriate measurement of ICT investment, some of which I discussed in an earlier speech (see Wadhvani (2000c)). Nicholas Oulton of the Bank of England has applied US methods for measuring ICT investment. He has used US price indices for computers and software, because they incorporate a substantial amount of research into adjustment for quality change. Because ICT products are extensively traded internationally, it is plausible that the rate at which quality adjusted prices are falling should be much the same in all countries (after adjustment for exchange rate changes). However, it should be noted also that the measurement of price indices for computers is conceptually very challenging due to the rate of technological change and no single approach of quality adjustment is without its drawbacks.

Obviously, if inflation in computer and software is overstated in the UK, then real growth has been understated, since it is money values that are measured directly. Using US-style price indices should lead to higher estimates of ICT investment, GDP growth and productivity growth for the UK (as we discuss below). In the recently released *National Statistics Quality Review* report, there are some calculations which suggest that using US price indices for the computer industry (but not changing the assumptions regarding software), the level of industrial production in 2000 Q1 would have been about 6% higher, with much of the gap being established in the post-1997 period. There are those who believe that the hedonic price indices used by the US actually somewhat understate inflation, and this is clearly a controversial area. However, on the basis that it is important to be aware of the quantitative importance of alternative assumptions about price indices in the ICT sectors, I shall discuss some preliminary illustrative estimates of the potential biases in estimated GDP growth below.

Note that there are other important differences between ICT measurement practices in the US and the UK which might also have the effect of understating the amount of ICT investment in the UK versus the US.

For example, although the growth rate of nominal software investment (measured in current prices) is very similar in the US and the UK, there is a large discrepancy in the levels. Specifically, in the US, software investment has averaged 140% of computer investment, while, by contrast, the corresponding ratio was only 39% in the UK. Since people buy computers to run software, it seems very unlikely that there should be such a large discrepancy between the UK and the US. This striking difference in the estimated levels of software investment might arise because of differences in the interpretation of what is investment, and what is intermediate consumption in computer services – in the US, about three-fifths of the total products of the computer services industry is classified as investment – in the UK, the corresponding proportion is less than one-fifth.

In some interesting recent work, the head of the National Accounts Department at INSEE in France, Lequiller (2001) documents the fact that the proportion of software spending that is counted as being investment is substantially lower in the UK than in several European countries (e.g. France, Germany, Italy and the Netherlands), though he also points out that the corresponding proportion is higher in the US than in all European countries that he considers. Work on this issue is ongoing at the OECD.³²

Oulton suggests, for illustrative purposes, that it might be appropriate to inflate the UK figure for software investment by a factor of 3, which is at the lower end of the possible range of grossing-up factors considered by him. Of course, this is an extremely difficult area, and because of the paucity of reliable information, what might seem a conservative assumption to someone, might appear to be too high to another. However, as a policymaker, it is important to be aware of the full range of possibilities, and it is in that spirit that I look at alternative illustrative computations of ICT investment. I also look forward to ongoing research into this issue at the ONS.

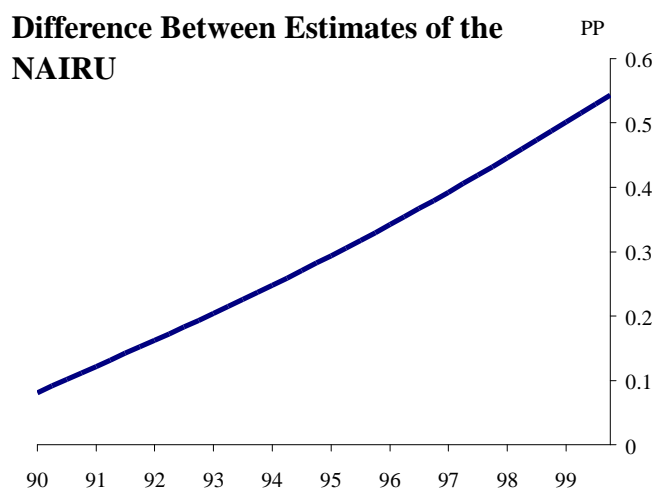
³² Interestingly, in a French context, Lequiller finds this software adjustment to be much more quantitatively important than the adjustment for the much-discussed hedonic pricing.

Note that these adjustments imply that GDP growth may have been underestimated by as much as 0.4pp pa over 1994-98. Importantly, for the assessment of underlying inflationary pressure in the economy, the size of the GDP growth bias has grown over time. Had the bias been constant over time, it would be unlikely to affect the results from a conventional econometric model. However, the GDP growth bias has risen from around 0.1pp pa for 1979-89 to about four times that in 1994-98.

Further, and perhaps even more importantly, the software adjustment implies that nominal GDP growth has been understated as well as real GDP growth, and consequently, the labour share might be lower than is conventionally measured. Of course, in conventional macro-models (e.g. the Bank's MTMM or Batini, Nickell and Jackson (2000)), a lower labour share implies lower inflation. Hence, Davey-Greenslade find that allowing for the ICT adjustments in a macro-econometric model can have important implications for the assessment of inflationary pressure.³³ In particular, they find that, other things being equal, using the alternative data instead of the official data would have led to a lowering of the estimate of the NAIRU by around 0.5 percentage points in 1999 (see Figure 5), which could, if interpreted mechanically, have altered a 2-year ahead RPIX forecast made in 1999 by as much as 0.6 percentage points. Their estimates of the impact of using the alternative numbers on ICT investment on the NAIRU has grown over time in recent years (see Figure 5), e.g. the effect was close to zero in the early 1990s, so it is possible that we have overestimated inflationary pressure to a growing extent in recent years.

³³ It is important to emphasise that their result of an impact on the NAIRU depends critically on the existence of a software adjustment, which affects the measured labour share. Of course, the much-discussed hedonic price adjustments have no implications for the measurement of the labour share, since they leave nominal GDP unchanged.

FIGURE 5



Note: NAIURU for Official GDP - NAIURU for Oulton variant

Of course, they have only undertaken a pilot study, so more research is necessary, but standard economic theory suggests that the direction of the bias to the inflation forecast should be in the same direction as what they find, though the actual estimate might change.

Also, the preliminary estimates of the alternative data series are predicated on particular assumptions and are designed to be purely illustrative. It is possible that further work (with the active and essential cooperation of the ONS) might lead to different point estimates of the size of the biases in GDP growth. However, the direction of the bias in GDP estimates and the direction in which the bias is moving seem relatively uncontroversial and as policymakers, it is important for us to be aware of them.

One reason that I have spent so much time today on what might seem like a relatively arcane discussion of the intricacies of how we measure things, is that I suspect that this might, in part, explain why economic forecasters have overestimated the degree of inflationary pressure while having simultaneously underestimated growth in the 1990s.

CONCLUSIONS

Today, we have discussed how the NE has changed some of the underlying relationships that we rely on for the purposes of monetary policy, and have also considered possible implications for how we measure things. However, we also saw that some of the claims that have been made for the NE are far too extravagant. There is much about the NE that remains uncertain, and therefore, I look forward to learning more over the next few years.

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