

INFLATION IN THE CONTEXT OF REAL TMR

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The ENA has asked us to comment on Ofgem's approach to interpreting inflation evidence when estimating Total Market Return (TMR) in particular in the light of its decision to use CPIH as its inflation assumption at future price controls.

INTRODUCTION AND SUMMARY

UK regulators including Ofwat and Ofgem are considering a switch of inflation index used for the price controls from RPI to CPIH. Different inflation indices provide different empirical estimates of historical and future inflation. As a result, the inflation index relied upon to derive real TMR from evidence on nominal returns carries considerable significance.

In this note, we discuss the following:

- Due to a range of data quality issues around historical inflation there is no definitive answer to the estimation of the real TMR.
- In making its estimation of TMR Ofgem has effectively chosen to place very material weight on one unreliable source of historical evidence on inflation, i.e. the BoE Millennium dataset;
 - This BoE dataset suggests that historical average CPI and RPI inflation are similar and that – counterintuitively – long run CPI measured inflation is higher than DMS long run inflation.
 - This is implausible as over the period for which CPI and RPI have both been published RPI has almost always been above CPI.
 - At this point, alarm bells over data quality should already be ringing.
 - Taken at face value, this data suggests that historical real returns, hitherto interpreted as real versus RPI, can be essentially reinterpreted as real versus CPI.
 - However, our view is simply that this inflation data, drawn from a dataset prepared by BoE researchers for a celebratory anniversary publication, is insufficiently robust to be used in regulatory proceedings
 - Given how the historic “CPI” data has been constructed, it cannot possibly be regarded as consistent with actual published ONS CPI as it is presently prepared. Quite simply, there can be no presumption of consistency between the two.

- The use of this inflation data contributes to an estimate of TMR that is amongst the lowest conceivable given the evidence on returns; and hence
- The Ofgem interpretation of the data is inconsistent with regulatory precedent and in our view represents a breach of a commitment given to the sector to ensure that the change from RPI to CPIH would be made on a value neutral basis.

Ofgem's approach is, in our view, unjustified, given the importance of regulatory stability and predictability in setting allowed returns and the unreliable nature of the inflation evidence it has relied upon.

OFGEM'S PROPOSED DECISION AND THE UKRN RECOMMENDATION

Ofgem in its December consultation document¹ took the view that the recent UKRN Cost of Capital² paper recommends a range for the TMR of 6%-7% in CPIH real terms. This was based on a recommendation set out within that paper.

"Recommendation 5 (The Expected Market Return): We recommend that regulators should continue to base their estimate of the EMR on long-run historic averages, taking into account both UK and international evidence, as originally proposed in MMW. We suggest a modest downward adjustment of the original range proposed by MMW, to a range of 6-7%, primarily reflecting a smaller adjustment from geometric to arithmetic returns."

It is worth noting TMR was a topic on which MPW took the lead. Burns did not formally dissent from this recommendation as, at the time the report was concluded, it was not made clear that MPW intended this recommendation to be interpreted as giving a measure of real TMR on a CPI basis i.e. the recommendation of 6-7% TMR real was understood to be real versus RPI.

Indeed, all discussion of this recommendation during work on the UKRN paper had been framed with the view that MPW were recommending a small downward adjustment to their existing recommendation from the 2003 Smithers report. The recommendation in respect of TMR from Smithers 2003 is reproduced below:

*'Our central estimate of the cost of equity capital is around 5.5% (geometric average), and thus 6.5% to 7.5% (arithmetic average). 95% confidence intervals are, at a conservative estimate, of up to two percentage points either side of the point estimates.'*³

We draw attention in particular to the wording of the recommendation, which proposes 'a modest downward adjustment'. In our opinion a reduction of 0.5% to both the top and bottom of the range, to reflect new evidence that has emerged since 2003, seemed on balance reasonable. We do not consider that an effective

¹ Ofgem (2018), RIIO-2 Sector Specific Methodology Annex: Finance

² Wright, Burns, Mason and Pickford (2018) Estimating the cost of capital for implementation of price controls by UK Regulators - An update on Mason, Miles and Wright (2003), UKRN

³ Smithers & Co Ltd (2003), A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K., Third bullet, page 49.

reduction of 1.5% to both the top and bottom of the range could be reasonably described as modest.

Ofgem's interpretation of recommendation 5 arose after the paper was concluded, as Ofgem sought to embody the UKRN paper in its developing range for the cost of equity. Burns was invited, at very short notice, to offer support for Ofgem's view that 6-7% could be interpreted as CPI-real, and declined to do so, noting that this was only one potential interpretation of the inflation data, that it was a break with precedent and that considerably more robust research was needed before such a marked change in quantum could be justified. In this note we address those issues more fully.

ESTIMATION OF THE REAL TMR

In a world where statistical offices had routinely collected and published both RPI and CPIH in the past, the adjustment from RPI to CPIH would be relatively straightforward. In practice, we do not have perfect data. One must therefore attempt to infer a reasonable estimate of historical CPIH based TMR from the data that is available.

Ofgem has undertaken this task in its December consultation paper. In stylised form and to illustrate the key steps, the logical flow Ofgem has followed, is as follows:

1. Take a reputable estimation of the real geometric mean TMR (such as DMS data based on its own inflation index).⁴ Suppose for illustration this base value was 5.5%;
2. Adjust this TMR series to place it on a CPIH inflation adjusted basis. So, if CPIH has historically been lower than the inflation rate used in step 1, then this would imply an increase in the real TMR expressed in CPIH terms, say, to 6%;
3. Apply an adjustment (e.g. between 1% and 2%) to convert to an arithmetic mean basis to derive a range for the TMR in CPIH terms of, e.g. between 7% and 8%;
4. Adjust this range by the expectation of the difference between RPI and CPIH, where RPI is expected to be approximately 1% lower in future, in order to derive a cross check on TMR in RPI terms (of 6%-7%).

We discuss each step in turn.

Step 1

In step 1, the reputable measure of the real TMR that has been used is the well-known DMS measure, which identifies a real TMR value of 5.5% on a geometric average basis.

DMS use a number of different inflation indices over different time periods to calculate these real returns, as set out in Figure 1.

⁴ Dimson, Marsh and Staunton (2018), Credit Suisse Global Investment Returns Yearbook.

Figure 1 Inflation measures used by DMS

Years	Price index used by DMS
1900 - 1961	Index of retail prices
1962 - 1988	RPI
1988 - 2017	CPI

Source: DMS, *Credit Suisse Global Investment Returns Yearbook 2017*, p.212

Note: Prior to the 2016 Yearbook, DMS used RPI for the entire period from 1962. In the 2016 Yearbook this was changed to CPI from 1988 onwards.

The DMS dataset therefore relies on various inflation indices overtime for the UK equity return series, as it arguably tries to identify the most appropriate inflation index (available at the time).

This was reflected by the fact that in the 2016 edition of the publication they switched the inflation index from 1988 onwards from RPI to CPI due to “continuing concern about the upward bias in RPI”. This led to an increase in the reported average real equity return for the UK in the latest editions of the DMS data.

Step 2

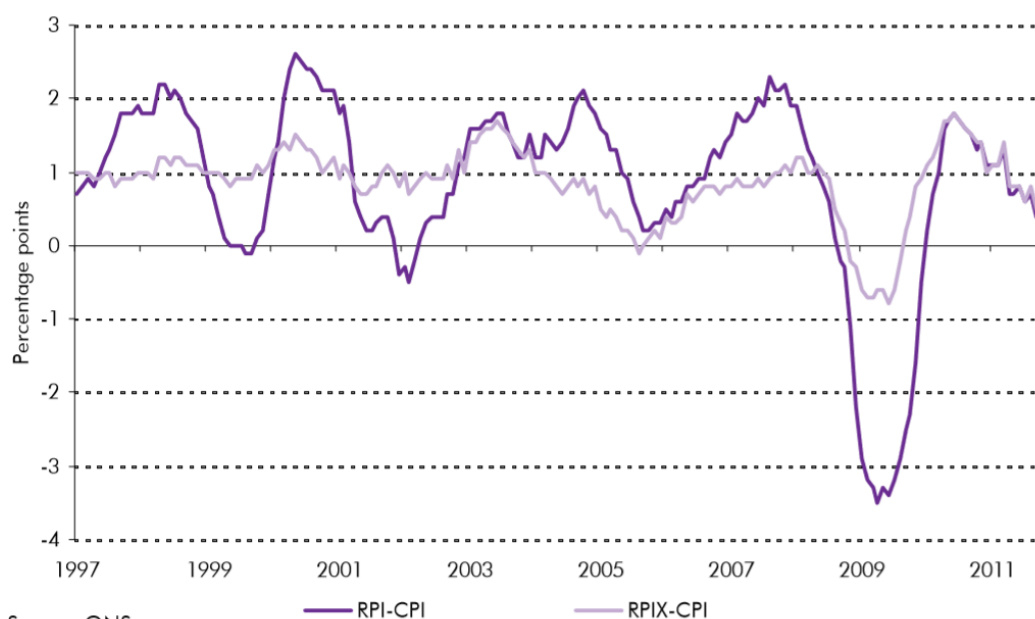
Step 2 requires the construction of a long run of CPI data to convert the DMS real TMR to a real measure based on the CPI. It is at this point that we believe Ofgem has made a poorly justified and one-sided decision,

Ofgem’s decision to interpret the real TMR as 6%-7% in real (CPIH) terms draws on BoE inflation data presented in Annex D of the UKRN paper. In Annex D Pickford derives an estimate of CPI real geometric average TMR of 5.23%. This same 5.23% figure can be found in Appendix 2 of Ofgem’s December Consultation finance annex⁵.

In our view however, this BoE inflation data is not a reliable basis for Ofgem’s proposal for a number of reasons:

First, as a simple, initial sanity check, CPI, for the great majority of periods for which it has been produced, has almost always been lower than RPI (putting to one side unusual periods such as during the credit crunch when the UK property market crashed), as shown in Figure 2 below.

⁵ See Figure 18 on page 87.

Figure 2 Wedge between RPI and CPI since 1997

Note: Chart replicated from OBR report: *The long-run difference between RPI and CPI inflation, November 2011*. The wedge continued around 1% since 2011 until present.

As a matter of logic, when all non-CPI components have been stripped from the DMS inflation measure, the real TMR should increase. However Pickford and Ofgem estimate that it should fall from 5.5% to 5.23%. This is not credible, and this fact alone should set off alarm bells over placing strong dependence on the BoE dataset.

Second, the historical data that Pickford and Ofgem use is not a historical run of CPI data at all. It is based on a dataset developed by Bank of England researchers to mark the 50th anniversary of BoE bulletins.⁶ The Bank of England sets out clear caveats in the dataset:⁷

“What is the spreadsheet intended for ? It is hoped the spreadsheet will be of use to students and researchers of the UK’s economic history. It has been constructed on a ‘best endeavours’ basis by a small number of Bank staff with the co-operation and assistance of many academic colleagues. It should be noted the data do not represent official Bank of England data or National Statistics. Although best efforts have been made to check the data and iron out transcription and formula errors it is likely that some remain although we have tried to set up the spreadsheet in a way that makes it easy for users to correct any obvious errors themselves. We will also document any corrections as they are made. In general the spreadsheet should be viewed as ‘work in progress’ and is intended to be a shared research resource that will evolve and expand over time.”

It is clear from the above quote that BoE does not endorse this dataset as official BoE data (and we presume that the ONS would certainly not recognise it as a

⁶ Bank of England (2010) *The UK recession in context – what do three centuries of data tell us?* <https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2010/the-uk-recession-in-context-what-do-three-centuries-of-data-tell-us.pdf?la=en&hash=B8F64B8B811EC94F8BA10B3143FFFCDD366F0985F>

⁷ Bank of England (2017), *A millennium of macroeconomic data*, tab A47. Wage and Prices 1209-2016, <https://www.bankofengland.co.uk/statistics/research-datasets>

National Statistic). We conclude that this data is unfit for use for regulatory purposes, in particular given that it is being used to inform on a critical element of one of the key planks of incentive regulation.

Third, the historical data in the BoE Millennium dataset is labelled as CPI, but it is actually rooted in the RPI data. Figure 3 below compares the underlying inflation series used by DMS and the BoE CPI index, as well as the BoE RPI-based index which is also published in the ‘millennium’ dataset.

Figure 3 Comparison of indices underlying DMS and BoE inflation series

Years	Index used by DMS	Index used by BoE CPI index	Index used by BoE RPI-based index
1900 - 1913	Index of retail prices	Cost of Living Index, Feinstein (1991)	Composite Consumer Price Index, O'Donoghue et al (2004)
1914 - 1948		Composite Consumer Price Index, O'Donoghue et al (2004)	
1949 - 1961		Long-term CPI, ONS	
1962 - 1974	RPI, ONS		
1975 - 1987			
1988 - 2017	CPI, ONS		RPI, ONS

Source: DMS, Credit Suisse Global Investment Returns Yearbook 2017, p.212; Bank of England ‘Millennium’ dataset

Both DMS and the BoE CPI index use CPI from 1988 onwards. It is important to note that CPI was first published in 1997 as the Harmonised Index of Consumer Prices, and therefore true CPI data is only available from 1996 onwards.

All CPI figures published between 1988 and 1996 are estimates.⁸ The ONS states that these “should be treated with some caution: in particular, the weights were derived from the RPI and are therefore based on a different population to later data.” In addition, prices for some items that are included in CPI were not available over that period and are therefore excluded. Both DMS and the BoE index use these estimates.

The BoE CPI index also includes ONS estimates for the CPI from 1949 to 1987⁹. The ONS state that, “the method provides only approximate results and there is no way to determine how accurate our method is as sufficient data to calculate the CPI do not exist prior to 1987.” Indeed, the back series must rely on underlying RPI data. The authors take RPI growth rates, with detailed weights and component indices, and use this to model the formula effect and remove this to estimate CPI.

Between 1914 and 1949, the BoE CPI series uses a Composite Consumer Price index, which was developed by O'Donoghue, Golding and Allen in 2004.¹⁰ As its name suggests, this index is itself composed of a number of underlying indices from different sources. However, over the period for which the BoE uses it, it is based on “the implied deflator for consumers’ expenditure”, based on the unofficial national accounts of the UK and prepared by Feinstein (1972). This is unlikely to

⁸ ONS, <https://www.ons.gov.uk/economy/inflationandpriceindices/methodologies/consumerpriceinflationincludesall3indicescpihcpiandrpimi>

⁹ ONS, <http://webarchive.nationalarchives.gov.uk/20160107031523/http://www.ons.gov.uk/ons/rel/cpi/modelling-a-back-series-for-the-consumer-price-index/1950---2011/index.html>

¹⁰ O'Donoghue, Goulding (ONS) and Allen (House of Commons Library) (2004) Consumer Price Inflation since 1750, Economic Trends 604

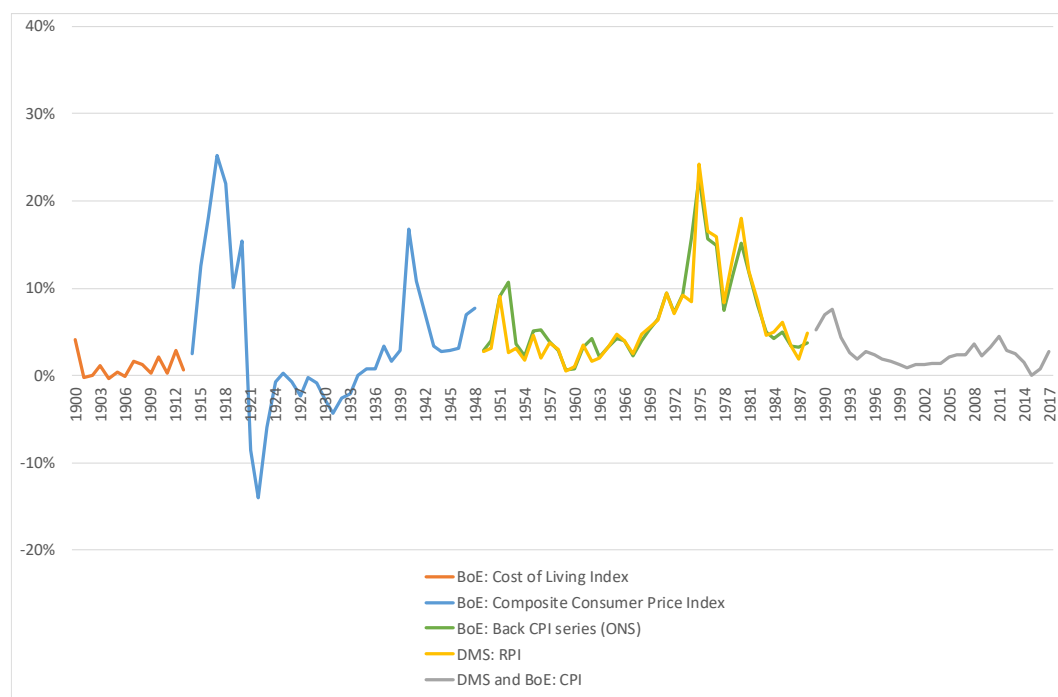
mirror a CPI measure. In fact, the BoE's RPI-based index in its 'millennium' dataset uses the same index up to 1974.

Finally, the BoE CPI index uses the Cost of Living Index (COLI) between 1900 and 1913. This index was produced by the former Ministry of Labour. O'Donoghue et al. describe it as having a number of flaws, particularly because the weights used were very subjective and based on "what constituted legitimate expenditure for a working-class family." Again, this is not a CPI index.

It is clear, given this description of how the "CPI" data has been constructed, that it cannot possibly be regarded as consistent with actual published ONS CPI as it is presently prepared. Quite simply, there can be no presumption of consistency between the two.

Given the description of how the data has been collected, it is consequently much more likely to resemble the DMS data series, since both are rooted in the RPI for much of the sample period, as shown in the figure below.

Figure 4 Comparison of inflation series used by BoE CPI series and DMS series



Source: ONS CPI and RPI series, Bank of England 'Millennium' dataset

As an additional sense check, the DMS publication before 2016 actually used exclusively RPI index for the period of 1962-present. The geometric average inflation published in the 2015 DMS edition for the UK for the period of 1900-2014 was 3.9%.¹¹ In comparison, the BoE data shows a re-constructed "CPI" average of 3.95%, which is not consistent with the fact that CPI has been lower than RPI for almost all of its existence.

Indeed, this demonstrates clearly that Pickford and Ofgem's estimate of the CPI-real geometric average lands on the wrong end of its intended adjustment (i.e. a

¹¹ Dimson, Marsh and Staunton (2015), Credit Suisse Global Investment Returns Source Book.

counter-intuitive downward adjustment instead of an expected upward adjustment).

In conclusion, therefore, we do not agree with the way Annex D of the UKRN report or Annex 2 of Ofgem's December Consultation modify the inflation interpretation of the long-term historic average TMR published by DMS. To consider that the evidence supports a CPI-real geometric average return of 5.23% is only sustainable if one places very significant reliance on a "CPI" dataset that actually has very little CPI data in it. To put the point a slightly different way, given that the "CPI" dataset that Ofgem and Pickford has derived is, to all intents and purposes, rooted primarily in RPI, it amounts to little more than an alternative estimation of the DMS TMR.

Step 3

The next step is the conversion from geometric average to arithmetic average returns. There is largely consensus that the expected equity return will be closer to the arithmetic average than the geometric average of the long-term average, a point recognised by all the authors of the UKRN report, DMS, and the CMA. However, there is also some consensus that the observed arithmetic average may not be the most appropriate estimate, and some kind of adjustment might be needed. What is less clear is what the most appropriate adjustments should be. We note the following observations:

- The 2003 UKRN report argued that arithmetic average observed in the data may be subject to spurious volatility and a better way to estimate the arithmetic average is to start with the geometric average, and add 1%-2% uplift depending on how much the regulator wishes to account for the potential serial correlation in annual returns.
- Annex E of the recent UKRN Cost of Capital paper departs from that 1%-2% adjustment due to concerns on serial correlations in the returns data, and proposes to adjust its geometric average of 5.23% to a range for the arithmetic average of 6%-7%, effectively imply an adjustment of 0.77% -1.77%. There is little detail to explain why this range is justified apart from the resulting arithmetic average falling in a rounded range. Ofgem adopts this adjustment in its December Consultation¹².
- DMS has argued in its original publication "Triumph of the Optimists" that arithmetic average is the most appropriate estimate for the expected equity return, but also describes that it is better to use an estimated arithmetic average rather than the observed one.¹³ However, DMS proposes an adjustment equal to a half of the variance (the square of the standard deviation) of the arithmetic averages.
- The CMA has looked into the choice between geometric and arithmetic average through the lens of assumed holding period of the equity shares (e.g. in the Bristol Water 2010 and NIE 2014 determinations). It then takes a Blume unbiased estimator approach that estimates the weighted average of the

¹² Again, see Figure 18 on page 87 of the finance annex.

¹³ Dimson, Marsh and Staunton (2002) *Triumph of the Optimists – 101 years of global investment returns*, page 183.

geometric and arithmetic averages taking into account the holding period, N , and the total length of the period, T .

In summary, starting from a DMS real TMR of 5.5% (without prejudice on what an appropriate adjustment into a CPI real geometric average would have added to this), an arithmetic average could be potentially estimated:

- The UKRN authors would adjust this by 0.77% and 1.77% to arithmetic, resulting in a range for the real arithmetic return of 6.27%-7.27% (although we note if the UKRN authors were aiming for the round 6%-7% arithmetic average as final results, their adjustment could be further adapted for this outcome);
- The DMS adjustment would take the standard deviation on real returns (19.5%), square it and half it, resulting in an estimated arithmetic real return of 7.4% based on a geometric real return of 5.5%;
- The CMA approach would take some assumption on the holding period, e.g. a reasonably conservative holding period of 10 years would result in an estimate of 7.1%.

The combination of all of these interpretations results in a range of 6.27%-7.4% in real terms, although we note that the majority of the methods point to the top end of the range, as the low end is only supported by one of the three sources above.¹⁴

Step 4

By the time Ofgem reaches step 4, it has calculated the TMR on a CPI basis as lying between 6% and 7%. This appears to be based on:

- DMS's estimate of 5.5%;
- Reduced down to 5.23% based on Pickford's analysis of the historical CPI data in step 2;
- With a range of c. 0.77% to 1.77% applied, leading to a CPI-based range of between 6% and 7%.

Since CPI will be around 1% lower than RPI in future, the TMR is in the range of 5% to 6% on an RPI basis.

Whilst the calculation flow is non-controversial, the outcome is. Since the decisions taken in step 2 are controversial, the effect of Ofgem's proposal is to cherry pick the treatment of CPI – it makes no meaningful adjustment for the difference between CPI and RPI on a historical basis, but makes a very significant adjustment on a forward-looking basis. This means that on a forward-looking basis the TMR is far too low.

To make the point a different way, faced with the considerable difficulty in measuring historical CPI, Ofgem has effectively assumed that CPI and RPI are very similar historically (indeed that CPI has been slightly higher than RPI), but very different on a forward-looking basis and consequently Ofgem has chosen the harshest possible treatment of the switch from RPI to CPIH.

¹⁴ We note that although the CMA used the unbiased estimator for the arithmetic average, it also employed other techniques such as non-overlapping averages and the small sample estimator.

We also note that the latest CMA precedent (NIE 2014) for TMR is 6.5% real in RPI terms.¹⁵ This was based on the CMA's analysis of various strands of evidence, including the contemporaneous DMS arithmetic average of 7.1% and a geometric average of 5.2%.¹⁶ This was calculated over the period of 1900-2012, where the RPI index was used to deflate the nominal return for the period of 1962-2012 and the index of retail price for the period of 1900-1962. Since that CMA determination, DMS adjusted its inflation index for the UK from RPI to CPI for the period from 1988, leading to an increase in the real TMR estimates of 7.3% arithmetic and 5.5% geometric respectively.¹⁷

It is difficult to see how this update in data could lead a regulator to assume that a marked downward adjustment in TMR is justified. This adds to the evidence that the underlying real expected return has not change significantly since the NIE determination.

By re-interpreting the inflation basis without adjusting the real return in a consistent fashion Ofgem has effectively lowered assumed TMR as part of its switch to CPIH. Moody's recent assessment on Ofgem's approach confirms this point:

"Ofgem has said that investors have tended to rely on the prevailing official measure of inflation in forming their expectations and that historical RPI- and CPI-based real returns data can therefore be used interchangeably. This implies that Ofgem would use the same "real" market return regardless of its chosen inflation index. If this is the case, the change from RPI to CPIH is likely to be NPV-negative."

Ofgem's approach is, in our view, unjustified, given the importance of regulatory stability and certainty in setting allowed returns and the unreliable nature of the inflation evidence relied it has relied on.

¹⁵ CMA (2014) Northern Ireland Electricity Limited price determination, Final determination March 2014

¹⁶ Dimson, Marsh and Staunton (2013), Credit Suisse Global Investment Returns Source Book.

¹⁷ Dimson, Marsh and Staunton (2018), Credit Suisse Global Investment Returns Yearbook.