



Use of Inflation Indices in Water Sector

Water UK

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Foreword by Water UK

Water UK is hosting a “market place for ideas” as part of promoting and facilitating a mature and constructive debate on how the water sector meets future challenges, while retaining the strengths that have delivered sustained benefits to customers over the last twenty five years. During the last six months, over twenty five contributions have been made to this market place, covering a wide range of topics.

This report is the latest contribution, commissioned by Water UK on behalf of its members, covering what might at first sight seem to be a technical matter – the choice of which inflation index or indices to use in the water industry’s regulatory framework. However, this is a critical question for all the industry’s stakeholders and, most importantly of all, its customers.

The choice that is made has the potential to affect the level of bills and we have commissioned NERA to consider a series of options from the perspective of the long term interests of customers. NERA’s report consists of detailed modelling, to demonstrate the possible impact in theory of different options, and a summary of investor perceptions, whose behaviour in practice could also have a material effect on the interests of customers. We hope both dimensions will help inform the debate about the best way forward.

Michael Roberts

Chief Executive, Water UK

January 2016

Executive Summary

Water UK, which represents all major statutory water and wastewater service supply organisations in England, Wales, Scotland and Northern Ireland, commissioned NERA Economic Consulting (NERA) to undertake an independent study of the implications of a change to the index used in setting price controls from the perspective of the long term interests of customers.

Indexation Options set out in Water 2020

In its recent consultation, Ofwat proposed to change its approach to indexing prices and regulated capital values (RCV) from RPI to CPI. Ofwat's proposed change follows from a decision by the UK Statistics Authority (UKSA) to cancel the designation of RPI as a national statistic given that the measure no longer meets international standards, and a UKSA commissioned report that recommended that Government and regulators should work towards ending the use of RPI as soon as practicable.¹ Given the greater emphasis on CPI as a measure of general price inflation (e.g. as adopted by the Bank of England's Monetary Policy Committee), and concern about the robustness of RPI, Ofwat considered that CPI may be viewed as more legitimate than RPI, and more commonly understood.²

In its consultation, Ofwat set out the following indexation options::

- *Status quo:* retention of indexation of prices and RCV by RPI, as per the current arrangements;
- *Dual indexation:* prices are indexed by CPI from April 2020 and the RCV continues to be indexed by RPI. Under this option, there is a true-up at the end of each price control to correct for the outturn variation in CPI-RPI relative to forecast at review;
- *Ofwat's preferred option:* prices are indexed by CPI from April 2020, with 50% of RCV indexed by CPI and 50% by RPI for the 2020-2025 period, and Ofwat reducing the proportion of RCV indexed by RPI at each periodic review from PR24 onwards³;
- *Old RCV RPI linked, new RCV CPI linked:* prices are indexed by CPI from April 2020, existing RCV as at April 2020 is indexed by RPI, new RCV from April 2020 is indexed by CPI; and
- *A full switch to CPI indexation.*

Ofwat has stated that if it were to use an alternative to RPI, such as CPI, as long as it used the same index in both indexing the RCV and deriving a real allowed return, and this index was applied to derive nominal charges, then the impact on customer bills and nominal company revenues should be neutral. It has also stated that it would consider offsetting the increase in

¹ Johnson, P. (2015), UK Consumer Price Statistics: A review. Link: https://www.statisticsauthority.gov.uk/wp-content/uploads/2015/12/images-ukconsumerpricestatisticsarevie_tcm97-44345.pdf

² Ofwat (December 2015) Water 2020: Regulatory framework for wholesale markets and the 2019 price review – Explanatory document, p. 118.

³ Ofwat has made no explicit proposals in relation to its approach post 2024. For the purpose of our modelling, we assume a 25% reduction in the RPI linked component of the RCV at each subsequent review.

allowed revenues in the near term that would result from a switch to CPI indexation through adjustments to companies' pay-as-you go (PAYG) ratios or companies' RCV run-off rates. Overall, Ofwat has stated that it will "*commit to ensuring that the impact of [CPI indexation] is neutral to both company (nominal) revenues and customer bills in net present value terms.*"⁴

Investors Views, and the Intention of the DMO

Our investigation of the different indexation options involved discussions with around twenty financial institutions active in the water and wider utility sector, including debt and equity investors, Standard and Poor's and Moody's Rating Agencies, as well as a selection of water companies Treasury teams, and a discussion with the Debt Management Office (DMO).

Investors are concerned about the impact of a shift to CPI on credit metrics and do not perceive that any change will be *value neutral*

In general, investors are concerned that Ofwat's proposal to implement a switch to CPI indexation at PR19 is going to lead to additional financing costs for the industry due to the entrenched use of RPI-linked debt and RPI-linked loans and swaps as the historical basis for financing the industry.⁵

This concern is greatest for Ofwat's policy option that entails a full switch to CPI indexation from 2020 but is also significant for Ofwat's preferred option where 50% of the RCV is indexed by CPI for the 2020-2025 period. In both cases, investors consider there will be an increase in financing costs for (at least) some companies where the embedded use of RPI debt is greatest.

While investors understand that in theory the proposed shift from RPI to CPI could be implemented as to be *revenue neutral*, there was scepticism about Ofwat's ability to deliver *value neutrality*, that is, whether Ofwat would adjust the real allowed return to accommodate (lower) CPI indexation of the RCV and compensate companies for increases in financing costs.

Our modelling of financial ratios shows that there will be a deterioration in key credit metrics (e.g. AICR) where the revenue impact is offset through PAYG (as Ofwat intends), even if any change is implemented in a value neutral way. However, if Ofwat does not implement the change in a value neutral way, e.g. it fails to reflect the full RPI-CPI wedge in setting a CPI based allowed return, does not compensate companies for increased financing costs, and/or allow for higher CPI based totex allowances, financial ratios can deteriorate sharply.

⁴ Ofwat (December 2015) Water 2020: Regulatory framework for wholesale markets and the 2019 price control review. Link: <http://www.ofwat.gov.uk/consultation/water-2020-consultation/>, p.123

⁵ As Moody's recently notes: "The Retail Prices Index (RPI) has been used to adjust revenues for UK water and energy networks since privatisation 25 years ago, and is deeply entrenched in the Regulated Asset Base (RAB) and in the industry's capital structure." (p.2). "Water companies and energy networks have over £20 billion of RPI-linked bonds outstanding, as well as significant RPI-linked loans and swaps. Together, these represent around 50% of operating company net debt at rated water companies". (p.6). Source: "Transition to CPI creates risks for water and energy networks", Moody's, 13th January 2015.

Ofwat raises the prospect of adjusting companies' PAYG ratios to defer the revenue profiles and limit the impact of this change on customer bills. Our analysis shows that PAYG ratios would need to be reduced by around 6-10% to offset the impact of a higher CPI based WACC. However, this option is not necessarily costless: rating agencies have noted that pressure to offset bill increases through adjustments to PAYG could erode confidence in the regulatory framework, and increase financing costs.

In summary, many investors acknowledged that the CPI index was a more robust measure of price inflation, and therefore more legitimate in the eyes of customers. However, investors were concerned that Ofwat had not factored into account financing cost increases in its analysis, which will be borne by companies and ultimately by customers.

Increases in financing costs will arise due to increased exposure to basis risk and the absence of a CPI government-led debt market

Investors are concerned about the mis-match between the RPI linked debt on companies' balance sheets and a CPI linked RCV, or basis risk, which may need to be hedged. However, investors considered that instruments to hedge CPI risk are imperfect, and would involve higher financing costs. For example, CPI-linked products generally have a substantively shorter duration than the tenor of RPI debt (e.g. up to 5 years), commonly include break clauses, and are higher cost than RPI-linked products.

In addition, all investors that we interviewed considered that an efficient CPI market – for both corporate bonds and derivative products (e.g. swaps) – is unlikely to develop in advance of a decision by the DMO to develop a CPI ILD gilt market given the central role of sovereign debt in creating liquidity and a pricing benchmark.

We understand that the development of a CPI ILD gilt market will not proceed before there is evidence of substantive demand for CPI related products, resolution of uncertainty over the definition of CPI (notably, the treatment of housing costs), and resolution of risks around market fragmentation. In relation to demand, the pension market remains focused on hedging its RPI linked exposure, although an increase in CPI related pension liabilities should result in demand for CPI related products over time. In relation to the stability of CPI, the UK Statistics Authority (UKSA) has yet to set out its recommendations to government on the definition of UK inflation measures, and then the government may decide on the form and future roles for inflation measures. The DMO may then undertake its own consultation on the CPI ILD issuance. Overall, the DMO is only likely to proceed if and when it can issue CPI ILD in a cost-effective and systematic manner.

In the absence of any DMO intention to issue CPI gilts, investors considered that the market for CPI corporate debt would not develop into a sizeable efficient market. As a result, they see risks that financing costs will increase not just in the short-medium run but also over the long run since companies will be unable to properly hedge the CPI indexation risk in prices in their funding strategies.

Evaluation of options

We have evaluated the options from a customer's perspective against the following criteria: i) the overall impact on companies cost, and allowed revenues and bills; ii) incidence effects; iii) bill volatility; iv) inter-generational equity, and v) legitimacy.

Companies are likely to face an increase in financing costs under a CPI framework

As explained above, our analysis shows that companies' financing costs will increase under CPI indexation. If these financing costs are passed through to customers, our analysis suggests that customers' bills could increase by around 2%.⁶

Our analysis shows that higher costs (either for companies or customers) are greatest under a full CPI switch, but are also material under Ofwat's proposed transitional arrangement where 50% of the RCV is linked to CPI from 2020. The effects and risks are moderated where new RCV additions are indexed to CPI, as the existing RCV indexed by RPI continues to provide a hedge for RPI ILD. There should also be relatively low risk of higher costs around option 2 – dual indexation – although there is risk around the conduct of the true-up at review for the outturn relative to assumed RPI-CPI wedge. The retention of the status quo implies the lowest cost risk under this criterion.

Incidence effects: Customer bills will increase by around 4-7% over 15 year period (relative to RPI) under Ofwat's preferred approach

Our analysis shows that customers' bills will increase by between 4-7% under a full CPI switch at 2020 relative to RPI indexation, and by approximately the same amount over the 15 year period under Ofwat's preferred transitional arrangement. The impact on bills is moderated where CPI indexation is applied to new RCV additions only – i.e. the increase in k is spread over a prolonged period – and the year-on-year changes are indiscernible from the status quo.

As noted above, Ofwat has proposed companies adjust PAYG ratios to defer the revenue profiles and limit the impact of this change on customer bills. However, while this may offset the impact on customer bills, this could increase financing costs further if rating agencies and investors perceive this change as introducing greater regulatory risk and discretion.

Bill volatility is hard to evaluate across proposals since it will depend on implementation

Bill volatility is hard to evaluate across proposals since it will depend on implementation of the proposals, the transition period and other adjustments to the regulatory methodology to accommodate this change e.g. how companies' PAYG ratios are adjusted.

⁶ Our assumed bill increase is based on an assumed 50 bps increase in the cost of new debt issuance based on evidence from RPI ILD markets that liquidity premium can increase by as much as 80 bps in times of heightened market illiquidity (see section 6.2). The increase in customer bills of 2% is the expected increase in bills over the long-term assuming that all new debt is refinanced at the 50 bps premium (see section 4.3.2.1.)

In principle, there are two offsetting impacts of the shift to CPI on bill volatility. First, a shift to CPI (even with a transition period) will lead to an increase in bills if applied without adjustments to PAYG ratios. Second, based on evidence that CPI is less volatile than RPI historically, indexation using CPI could reduce the volatility of customers' bills over the longer term. However, any reduction in bill volatility from a shift to CPI from RPI is likely to be relatively small, and could be achieved through other less costly means, e.g. within period smoothing mechanisms. Therefore, we cannot easily differentiate the options based on this criterion.

CPI provides no clear advantage in terms of inter-generational equity

The ONS considers that CPI is an improved measure of general price inflation relative to RPI. On this basis, we may consider that CPI indexation results in greater equity over time. However, intergenerational equity requires that *costs* are borne equitably over time, and our analysis suggests that RPI is a better measure of water companies' costs relative to CPI (although we acknowledge that a deeper study is needed on this issue). If Ofwat were to switch to a CPI regime, it should therefore incorporate real price effects (RPE) adjustments in setting real totex allowances if companies are able to recover expected nominal costs. Therefore, CPI provides no clear advantage compared to RPI.

CPI is a more legitimate measure of inflation than RPI

As cited by Ofwat, UKSA's decision to cancel the designation of RPI as a national statistic, and a UKSA commissioned report that recommended that Government and regulators should work towards ending the use of RPI as soon as practicable given concerns about its robustness, imply that CPI has greater legitimacy than RPI.⁷ Ofwat also considers that there is greater common acceptance of CPI relative to RPI in other areas, such as the Bank of England's Monetary Policy Committee target, and recent changes by some economic regulators to use CPI.

In terms of options, those that realise the transition to full CPI the earliest score best on legitimacy criterion. In relation to option 2 –dual indexation – on the face of it, the option addresses legitimacy by linking headline changes in prices to CPI but fundamentally relies on RPI.

⁷ Johnson, P. (2015), UK Consumer Price Statistics: A review. Link: https://www.statisticsauthority.gov.uk/wp-content/uploads/2015/12/images-ukconsumerpricestatisticsarevie_tcm97-44345.pdf

Table 1
The Pros and Cons of the Different Options

Options	Overall Assessment
Status Quo	No increase in cost to customers or companies but does not achieve the legitimacy sought by Ofwat
Dual Indexation (CPI-prices; RPI-RCV)	No apparent increase in financing costs although concern around the “true-up” for CPI-RPI deviations, and within-period basis risk. The approach does not meet fully legitimacy concerns given the underlying use of RPI.
Ofwat proposal (50% - 50%)	Increase in financing costs especially for highly leveraged companies, and therefore increases in costs to companies and/or customers but achieves step towards legitimacy objective.
RCV additions only	Provides for a longer transition to help minimise costs; may still result in higher financing costs over longer term depending on DMO decision
Full CPI switch	Greatest increase in financing costs, and therefore costs to companies and/or customers

Overall Conclusions

While the use of CPI is becoming increasingly prominent, in general investors consider that Ofwat has not made the case for a change to RPI. Companies' risks and costs will increase under Ofwat's proposed switch to CPI, which will eventually feed into customers' bills. Although many investors acknowledged the greater legitimacy of CPI as a measure of inflation, the prospective increase in costs needs to be factored into any consideration of a change to indexation. Most investors considered that the prospective increase in costs outweigh Ofwat's legitimacy concerns.

Investors understand that the changes could be designed to be *revenue* neutral for companies, but Ofwat has not acknowledged the likely costs of a change, and therefore there is a concern about adequate compensation for costs and *value* neutrality.

As a consequence, there is general support for the retention of current arrangements, at least until there is a clear understanding of the development of a liquid government led CPI IL gilts market which could take some time.⁸ The impetus is on the UK Treasury to lead any transition, and only then for Ofwat to follow once an efficient CPI gilt market is established.

If Ofwat proceeds with any change, Ofwat could seek to address concerns by acknowledging differences in companies' capital structures to allow companies with high levels of RPI ILD to transition over an extended period, to minimise the mis-match between long-dated RPI ILD and CPI indexation, and to therefore minimise increases in costs. For similar reasons, many investors considered that any transition should involve indexing the 2020 RCV by RPI. Investors also considered Ofwat should also provide clear guidance on the transition path given the long-term nature of financing decisions.

⁸ For example, our analysis of RPI ILD gilt market suggests that it took around twenty years to achieve volumes such that liquidity premium was negligible. (See section 6.2.)

1. Introduction

Water UK, which represents all major statutory water and wastewater service supply organisations in England, Wales, Scotland and Northern Ireland, has commissioned NERA Economic Consulting (NERA) to undertake an independent study of the implications of a change to the inflation index used in setting price controls.

This report will be published on the market place of ideas⁹ hosted by Water UK as a contribution to Ofwat's Water 2020 programme. Under Water 2020, Ofwat is consulting on the regulatory framework for wholesale markets and the 2019 price control review, including the form of indexation of the price control.¹⁰

The report is structured as follows:

Section 2 summarises Ofwat's proposals and discusses the inflation index options;

Section 3 discusses the views of investors interviewed by NERA over the course of this project;

Sections 4 and 5 set out NERA modelling results quantifying impact on customer bills and financial ratios under the proposed options;

Section 6 discusses the evidence on future financing costs under the CPI;

Section 7 discusses the relative merits of CPI and RPI in tracking water companies' costs; and,

Section 8 sets out our evaluation of the options and draws conclusions.

The appendices to this report provide additional information.

⁹ Ofwat has encouraged a “market place of ideas” inviting views from companies and other stakeholders on how the sector should develop. See for example, Ofwat (July 2015), Towards 2020 – policy issues: promoting markets. Link: http://www.ofwat.gov.uk/wp-content/uploads/2015/11/pap_tec201507markets.pdf

¹⁰ Ofwat (December 2015), Water 2020: Regulatory framework for wholesale markets and the 2019 price control review. Link: <http://www.ofwat.gov.uk/consultation/water-2020-consultation/>

2. Summary Ofwat's Proposals and Inflation Indices

In this section, we briefly describe the role of indexation in price controls, Ofwat's options for changing indexation (which we evaluate in subsequent chapters), and describe the different potential indices (RPI, CPI and CPIH).

2.1. The Role of Indexation in Price Controls

Ofwat sets allowed prices in the water sector by compensating investors for the effects of inflation through indexing the regulated capital value (RCV) by RPI, and consistent with this, setting an allowed return (based on the weighted average cost of capital or WACC) on a real basis, deflated from observed nominal values using RPI. Investors receive a contemporaneous real return, and compensation for inflation is deferred through accretion of the RCV.

In addition, at each price control review, the annual price cap is defined in real terms and is translated into nominal customer bills using RPI. In setting the price cap, in theory, Ofwat makes an assumption about the extent to which companies' input prices will evolve relative to RPI (real price effect or RPE) to be incorporated within the real allowed revenues. The objective is that the outturn nominal revenues compensate companies for (expected) nominal costs. In practice, in past reviews, Ofwat has generally assumed that companies' input prices evolve along with RPI, and has not made any systematic adjustment for RPEs in setting allowed revenues.¹¹

2.2. Ofwat's Proposals

In its recent December consultation, Ofwat proposed to change its approach to allowing for inflation in setting allowed revenues. In particular, it proposed to use CPI or alternatively CPIH (which includes housing costs), rather than RPI, for indexing both the RCV and allowed revenues (and therefore prices). Ofwat's proposed change follows from a decision by the UK Statistics Authority (UKSA) to cancel the designation of RPI as a national statistic given that the measure no longer meets international standards, and a UKSA commissioned report that recommended that Government and regulators should work towards ending the use of RPI as soon as practicable.¹² Given the greater emphasis on CPI as a measure of general price inflation (e.g. as adopted by the Bank of England's Monetary Policy Committee), and concern about the robustness of RPI, Ofwat considered that CPI may be viewed as more legitimate than RPI, and more commonly understood.¹³

Ofwat has stated that if it were to use an alternative to RPI, such as CPI, as long as it used the same index in both indexing the RCV and deriving a real allowed return, and this index was

¹¹ See e.g. documentation relating to PR14, accessed here: <http://www.ofwat.gov.uk/regulated-companies/price-review/price-review-2014/>

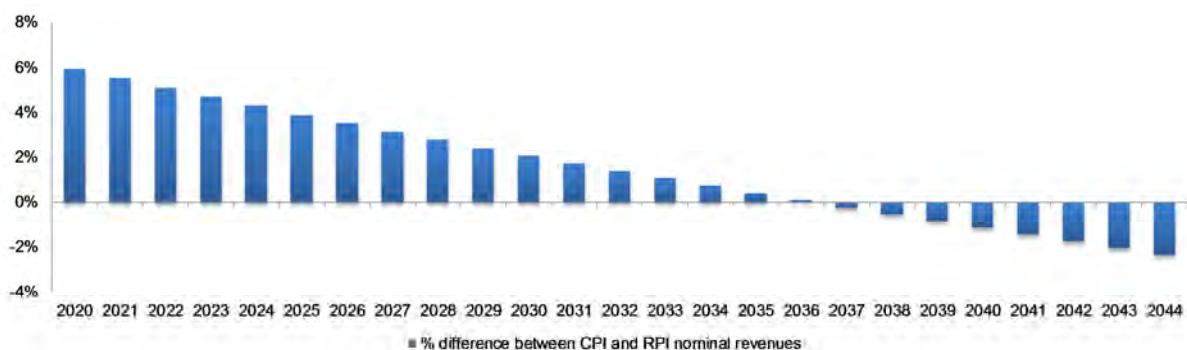
¹² Johnson, P. (2015), UK Consumer Price Statistics: A review. Link: https://www.statisticsauthority.gov.uk/wp-content/uploads/2015/12/images-ukconsumerpricestatisticsarevie_tcm97-44345.pdf

¹³ Ofwat (December 2015) Water 2020: Regulatory framework for wholesale markets and the 2019 price review – Explanatory document, p. 118.

applied to derive nominal charges, then the impact on customer bills and company nominal revenues should be neutral in the long run (in present value terms). Ofwat has stated that it will “*commit to ensuring that the impact of [CPI indexation] is neutral to both company (nominal) revenues and customer bills in net present value terms.*”¹⁴

As CPI is expected to be lower than RPI,¹⁵ if Ofwat were to adopt CPI indexation, the real WACC calculated on a CPI basis would be higher than if Ofwat were to use RPI. By contrast, the growth in a CPI indexed RCV will be lower. Overall, the impact of a change to CPI would be to increase revenues and bills from 2020, but offset by reductions in revenues over the longer-term.

Figure 2.1
Implementation of CPI Indexation Increases Bills in the Early Years, Offset by Lower Bills from late-2030s



Source: NERA modelling

As well as Ofwat’s proposed transition to CPI (through indexing half RCV by CPI from PR19), Ofwat has also suggested that the impact on cash-flows could be offset through adjustments to pay-as-you-go (PAYG) or RCV run-off rates.¹⁶

In its consultation, Ofwat sets out a number of policy options varying as to the extent of CPI indexation (whether applied to prices or to both prices and RCV), and any transitional arrangements.

Ofwat’s preferred option is to apply a transition mechanism that applies CPI to allowed revenues, but allows for half of the RCV to be indexed by RPI for PR19 (i.e. from 2020 to 25) with the other half subject to CPI indexation. Ofwat explains that:¹⁷

¹⁴ Ofwat (December 2015), Water 2020: Regulatory framework for wholesale markets and the 2019 price control review. Link: <http://www.ofwat.gov.uk/consultation/water-2020-consultation/>, p.123

¹⁵ See for example, ONS (2011), The long-run difference between CPI and RPI. Link: <http://budgetresponsibility.org.uk/wordpress/docs/Working-paper-No2-The-long-run-difference-between-RPI-and-CPI-inflation.pdf>

¹⁶ Ofwat (December 2015), op. cit., p.127

¹⁷ Ofwat (December 2015), op. cit., p.8

"Under our notional capital structure, this is equivalent to indexing all existing embedded debt by RPI with the remaining RCV accounted for by new debt and equity. This will provide time for existing RPI linked debt to unwind."

Beyond 2025, Ofwat states that its intention is to reduce the RPI indexation of the RCV (from the 50/50 RPI/CPI split in 2020-25) as the proportion of existing embedded debt reduces over time and taking account of the development of CPI linked debt markets.¹⁸

Ofwat has set out four different policy options in its consultation. In brief, these are:

- Option 1: Status quo (i.e. retain use of RPI to index both RCV and allowed revenues)
- Option 2: Apply CPI indexation to prices but not to RCV
- Option 3: Apply CPI indexation to both prices and RCV, but with a transition to RPI indexation. Ofwat has identified the following examples:
 - For the period 2020-25, 50% RCV indexed by RPI, and 50% indexed by CPI, with the expectation that the proportion of RCV indexed by RPI would decline over time (Ofwat's preferred option)
 - From 2020, apply RPI to the existing RCV, and apply CPI only to new RCV additions made from the start of PR19
- Option 4: Apply CPI indexation to both allowed revenues and RCV with no transition

The options are summarised in Figure 2.2 below.

**Figure 2.2
Ofwat's Policy Options (Preferred Option = 3)¹⁹**

Our policy options/ dimensions	1	2	3	4
Whether to change inflation measure	No, retain RPI		Yes, signal preferred move to CPI (subject to final UKSA recommendations)	
Full or partial implementation?	NA (no change)	Partial – only apply to prices	Full – apply to both prices and RCV (therefore allowed revenues)	
Immediate change, or with transition	NA (no change)	Immediate (linked to partial application)	With transition	Immediate change
Form of transition	NA (no transition required)		CPI only applied to % of RCV	NA (no transition required)

¹⁸ Ofwat (December 2015), op. cit., p.126

¹⁹ Ofwat (December 2015), op. cit., p.121

2.3. Summary of Key Differences in RPI and CPI

In January 2013, following a consultation, the Office for National Statistics (ONS), concluded that the formula used to produce RPI “*does not meet international standards*”, and the UK Statistics Authority acting on the ONS advice de-recognised RPI as a national statistic.²⁰

In 2015, UKSA commissioned Paul Johnson, Director of the Institute of Fiscal Studies, to consider the future usage of RPI. He reconfirmed that the measure contained a flaw, and concluded that: “*The Authority and ONS should make it clear to users that the RPI is not a credible measure of consumer price change*”, and recommended that “*Government and regulators should work towards ending the use of the RPI as soon as practicable.*”²¹

However, Johnson’s recommendations allowed for continued use of RPI where there is clear justification stating that: “*Where they decide to keep using it the UK Statistics Authority should ask them to set out clearly and publicly their reasons for doing so.*”²²

2.3.1. Reasons for the differences in inflation measures

The RPI and CPI indices are both measures of inflation, i.e. both track the average price of a fixed basket of goods and services, comprised by averaging across a sample of 180,000 individual prices across more than 650 representative items²³. However, there are a number of key differences between the indices, summarised below:

- **Index Construction Formula** – RPI and CPI use a different methodology for aggregating individual prices at the lowest level of aggregation – specifically, while RPI uses an Arithmetic Average (AM) to aggregate prices, CPI uses a combination of Arithmetic and Geometric Averages.²⁴ The implication is that RPI is more sensitive than CPI to increases or decreases in variation in the sample of price changes.²⁵

²⁰ UK Statistics Authority (March 2013), Assessment of compliance with the Code of Practice for Official Statistics, Assessment Report 246. Link: https://www.statisticsauthority.gov.uk/wp-content/uploads/2013/03/images_assessmentreport246theretailpricesinde_tcm97-42695.pdf

²¹ Johnson, P. (2015), UK Consumer Price Statistics: A review, p.15. Link: https://www.statisticsauthority.gov.uk/wp-content/uploads/2015/12/images-ukconsumerpricestatisticsarevie_tcm97-44345.pdf

²² Johnson, P. (2015), op. cit., p.15.

²³ Office for National Statistics, Information Note: Differences between the RPI and CPI Measures of Inflation. Link: https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwiUhe7ahLTKAhVlow4KHbGWD34QFgggMAA&url=http%3A%2Fwww.ons.gov.uk%2Fons%2Fguide-method%2Fuser-guidance%2Fprices%2Fcpi-and-rpi%2Fdifferences-between-the-rpi-and-cpi-measures-of-inflation.pdf&usg=AFQjCNHOty98RHNnmpkM9gUorfLY_BKSVA&sig2=eT41OI6zgWIINrqdoxNGBg

²⁴ Ibid. E.g. In the RPI index, the average of two measured prices, one that increased by 25% and one that decreased by 20% would be calculated as the average of these two: $(125+80)/2 = 102.5$, constituting an average increase of 2.5% relative to the base index level of 100. In the CPI index, the same change would result in no change relative to the index, as the geometric average is calculated as $\sqrt{125 * 80} = \sqrt{10000} = 100$.

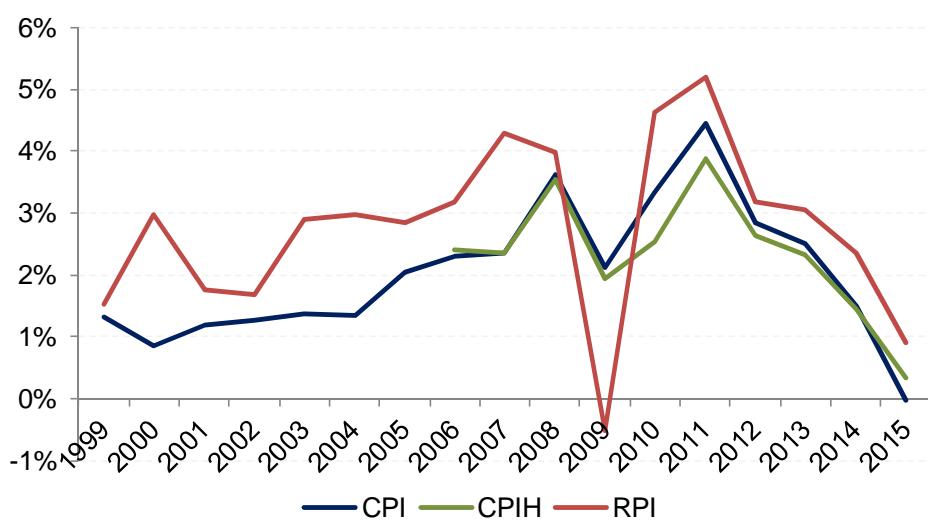
²⁵ ONS (December 2010), CPI and RPI: Increased impact of the formula effect in 2010, p. 3. Link: <http://www.ons.gov.uk/ons/guide-method/user-guidance/prices/cpi-and-rpi/cpi-and-rpi--increased-impact-of-the-formula-effect-in-2010.pdf>.

- **Coverage** – RPI and CPI indices cover a different basket of goods and services. RPI includes (the more variable) mortgage interest payments, and housing components, such as owner-occupiers' housing depreciation and council tax and rates, as well as housing insurance and house purchase costs, which are excluded from CPI. CPI on the other hand includes brokerage fees, student accommodation fees and overseas students' tuition fees.
- **Population base** – RPI represents the majority of private UK households excluding highest earners and pensioner households dependent mainly on state benefits. CPI, on the other hand, is representative of all private UK households, and includes the expenditure of institutional households and foreign investors.
- **Index weights** – Expenditure data (“weights”) for RPI are derived predominantly from the ONS’s Living Costs and Food Survey, while weights for CPI are derived from the National Accounts data and can therefore differ from RPI weights for similar components.

Figure 2.3 shows the annual average change of the alternative measures of inflation currently under consultation. As seen in Figure 2.3, the RPI index change displays higher variation compared to the alternatives (CPI and CPIH), and is on average higher than the alternatives, likely driven by both the differences in aggregation (RPI uses arithmetic, rather than geometric averages) as well as composition (RPI includes mortgage interest payments).

The CPIH index is similar to the CPI index except that it also includes a measure of owner occupiers' housing costs, i.e. the costs associated with owning, maintaining and living in one's own home. However, unlike RPI, CPIH uses a method called “rental equivalence” which uses the rent paid for an equivalent house in the private sector as a proxy for housing costs of an owner. As seen in Figure 2.3, the CPI and CPIH indices are strongly correlated with a coefficient of correlation of 0.98 (measured on the annual average index changes).

Figure 2.3
Annual Average % Change of Proposed Indices - CPI, CPIH, RPI

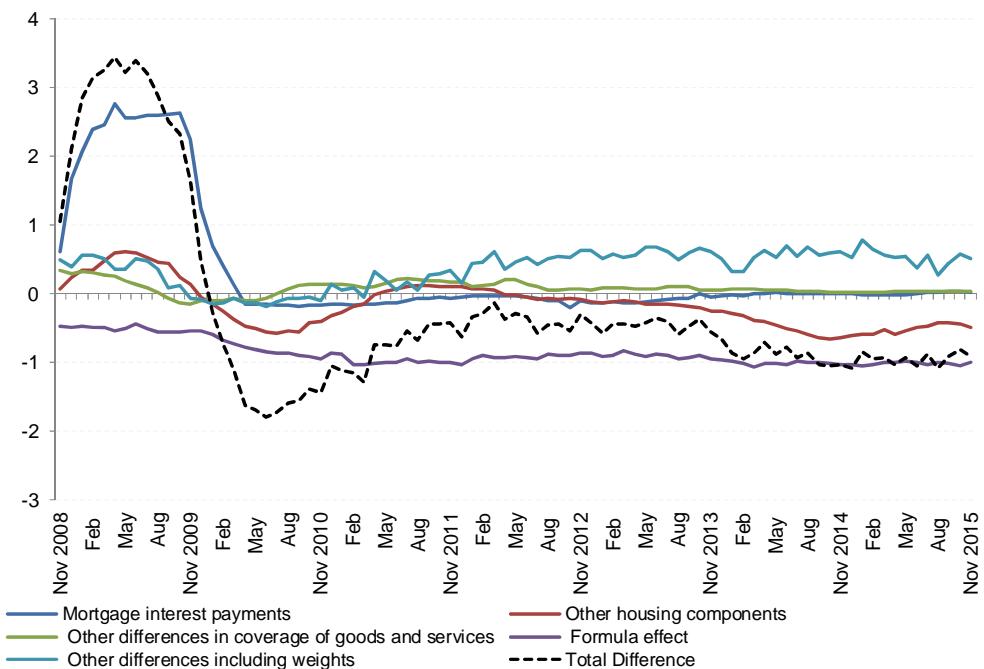


Source: NERA Analysis of ONS data.

ONS publishes estimates of the magnitude of each component attributing to the difference in RPI and CPI on a regular basis. Figure 2.4 shows ONS' latest decomposition of the CPI-RPI differential. As shown in Figure 2.4, the “formula effect” has increased since around 2010,

and mortgage interest payments contributed notably to the variation in RPI relative to CPI in the early part of the series.

Figure 2.4
Decomposition of CPI-RPI Wedge



Source: NERA Analysis of ONS data.

According to a summary by Moody's²⁶ of the expected long-term CPI-RPI wedge, based on a long-term view of each component contributing to the difference between the two, the RPI-CPI wedge is expected to range between 100 and 130bps (see Table 2.1).

For purposes of modelling financial ratios (section 4), we adopt the latest RPI-CPI wedge forecast from the Office for Budget Responsibility of 100bps, although we acknowledge that there is uncertainty over the size of the wedge. To assess risk around this estimate, we simulate the joint distributions of RPI and CPI as correlated random processes calibrated based on historical data, detailed in Appendix D.

²⁶ Moody's, UK Transition to CPI: Redefining real: adoption of CPI will transform index-linked debt market, raise risks for regulated sectors, p. 3.

Table 2.1
Moody's and Government Forecasts of the Long-run RPI-CPI Wedge Range
from 100 to 130bps

Source	Long-run RPI-CPI wedge	Notes
Moody's	130 bps	-
Office for Budget Responsibility (Economic and Fiscal Outlook, March 2015)	100 bps	Formula effect 90 bps, housing 50 bps, other – 40 bps
Pension Protection Fund (Funding Strategy Review 2015)	110 bps	-
Bank of England (Inflation Report, February 2014)	130 bps	Formula effect 90 bps, housing 60 bps, other -20 bps

Source: Moody's (2016), UK Transition to CPI: Redefining real: adoption of CPI will transform index-linked debt market, raise risks for regulated sectors, p.3.

2.3.1. Status of CPIH as a headline UK inflation measure

The Johnson Review²⁷ concluded that in concept the CPIH form of index would provide the best overall measure of inflation for the UK. However the index is not yet in wide use. As implemented in the UK, CPIH is a relatively new index. The details of its computation have been subject to change until quite recently. CPIH was first published by the ONS in March 2013 and was accredited as a National Statistic²⁸ in November 2013. However this status was suspended in 2014, apparently because of emerging flaws in the way the owner-occupiers' housing cost component was calculated. Revisions were made and publication of CPIH recommenced, with the UK Statistics Authority (UKSA) now due to reconsider the status of the index.²⁹ Confirmation of its accredited status will give users more confidence.

To date CPIH does not have its own statutory foundations - unlike RPI which is governed by specific UK legislation, and CPI which is governed by the agency Eurostat under European regulations. Legislative underpinning for CPIH would tend to promote transparency and confidence for parties considering relying on CPIH over long periods. The UKSA is currently part way through a broad consultation on inflation indexes for the UK. Its consultation document was published mid-2015 and a summary of the responses was published late 2015. The conclusions and recommendations are expected to follow in 2016.

Those recommendations may include suggested roles for CPI and CPIH which the government may in turn consider and adopt after due consultation and debate; for example, one or other index could be given a role in the Bank of England's targeting of a measure of

²⁷ Johnson, P. (2015), op. cit.

²⁸ "National Statistics" are a subset of official statistics which have been certified by the UK Statistics Authority as compliant with its Code of Practice for Official Statistics.

²⁹ See Office for National Statistics, Statistical Bulletin, Consumer Price Inflation, 16 June 2015. Link: http://www.ons.gov.uk/ons/dcp171778_406554.pdf

inflation, or given a role in the statutory procedures for uplifting pension payments to reflect inflationary outcomes. Confirmation from government that CPI or CPIH is to be used for such roles would be expected to affect the wider understanding and credibility of the index, and would be expected to alter the extent to which there is interest in financial products linked to it.

3. Investors' Views of Proposed Changes

As a key part of our investigation of the implications of a change to indexation we undertook detailed interviews with around twenty organisations. The interviewees comprised a range of debt, and equity investors in the water and wider UK utility sector, Standard and Poor's and Moody's Rating Agencies, and four water company treasury teams. We include the structured interview template in Appendix A.

As well as these entities, we also met with the Debt Management Office (DMO) to discuss its timetable and plans for the development of a CPI ILD gilt market which (as our discussions with investors confirms) is integral to the development of a corporate CPI ILD market. We describe the DMO's plans in section 6.1.1.

We summarise the views of these stakeholders below on a non-attributable basis.

3.1. Investors are Generally Aware of Ofwat's Plans for Indexation but Surprised

In general, there was a high degree of investor awareness around Ofwat's proposed changes to indexation. A number of investors told us that they have been following the issue of indexation since Ofwat's proposed (but subsequently dropped) "Section 13" licence change.³⁰

Many investors were surprised that Ofwat seemed to be pushing the case for a change in indexation ahead of the establishment of a liquid CPI bond market, when they felt that a better approach would be to wait for the government to establish a CPI market first and then move the regulated entities to CPI regulation (discussed in more detail in section 3.4 below).

Many investors acknowledged that the CPI index was a more robust measure of price inflation, and therefore more legitimate in the eyes of customers but were concerned that Ofwat had not factored into account financing cost increases in its analysis of options.

Other stakeholders commented on the costs of keeping up with the wide-range of changes proposed by Ofwat (in terms of both regulatory framework and competition), and concerns about the increased complexity and risk.

3.2. There is Scepticism about Ofwat's Ability to Credibly Commit to Value Neutrality

In its Water 2020 consultation, Ofwat has stated that if it were to use an alternative to RPI, such as CPI, as long as it used the same index in both indexing the RCV and deriving a real allowed return, and this index was applied to derive nominal charges, then the impact on customer bills and nominal company revenues should be neutral in the long run (in present

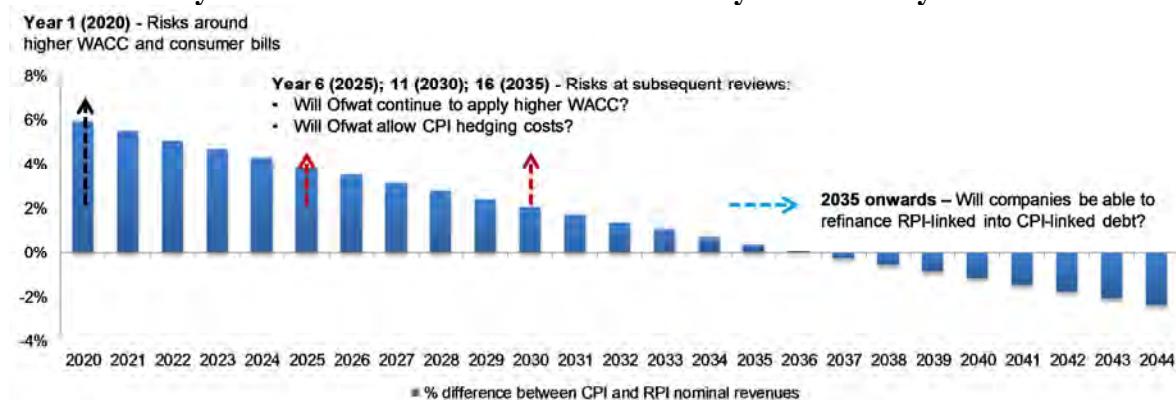
³⁰ See Ofwat, Consultation on Ofwat's section 13 proposals to modify company licences, Link: http://www.ofwat.gov.uk/wp-content/uploads/2015/10/lic_pro20121221s13all.pdf

value terms). Ofwat has stated that it will commit to the neutrality of any changes on company's nominal revenues.³¹

Investors distinguished between revenue neutrality, i.e. whether any change will result in the same revenues in present value terms, and value neutrality, i.e. whether, in addition, companies will be compensated for additional costs. There was scepticism about Ofwat's ability to deliver value neutrality given the inherent contradiction in ensuring value neutrality for investors, and no impact on customer bills. Investors viewed a change to CPI indexation as being likely to result in additional financing costs for companies which, to achieve value neutrality, would need to be reflected in customers' bills. Investors perceive that instead these costs will be borne by companies.

Figure 3.1 summarises the key risks to revenue and value neutrality identified by investors.

Figure 3.1
Key Risks to Revenue and Value Neutrality Identified by Investors



Source: NERA analysis

In general, investors considered that it was difficult for Ofwat to credibly commit to neutrality given Ofwat's discretion in relation to setting the allowed rate of return, i.e. the switch to CPI should lead to a higher cost of capital but Ofwat can always "*expropriate value*" through setting a lower rate of return than otherwise, and it would be difficult to design a test to hold Ofwat to account.

There was also particular concern that there would be upward pressure on bills from any switch which would put pressure on Ofwat to reduce overall cost allowances. For example, one investor told us:

"The concern is that prices cannot increase in 2020; therefore the implied increase in prices from the switch from RPI to CPI will be absorbed through a reduction in value (e.g. through a reduction in the allowed return element)."

Interviewees also noted that it will be difficult for Ofwat to credibly commit over multiple AMPs as it is not able to bind future Ofwat Board decisions. Investors expressed a concern

³¹ Ofwat (December 2015), op. cit., p.123

that Ofwat would not provide the long-term clarity required given the long-term nature of financing decisions:

"We accept that there will need to be changes in the regulatory environment – but on something as fundamental as indexation Ofwat needs to set out a clear long-term solution (given financing decisions are long-term)."'

A number of interviewees considered that Ofwat should allow companies to choose whether to switch to CPI or retain RPI (to allow companies with high switching costs to retain RPI), and such an approach could act as a commitment or an "*honesty mechanism*" (see for example proposals put forward by Anglian Water summarised in Box 3.1 below).

Such an approach would require Ofwat to set out an allowed return based on both a CPI and an RPI based WACC, and make companies indifferent to CPI or RPI indexation. That is, as well as mitigating higher costs for companies with high switch costs, this approach would increase transparency since it would require Ofwat to clearly set out how its proposed CPI based WACC compares to the RPI WACC, and (perhaps also) require Ofwat to demonstrate its proposals were financeable under both RPI and CPI regimes.

Box 3.1

Anglian Water Proposes "Hybrid Approach" to Allow Companies Flexibility to Manage Transition

Anglian Water recently published *Potential approaches for transition from RPI to CPI* in which it argues that if Ofwat were to decide to switch to CPI indexation, allowing gradual and flexible approach so that companies can manage their RPI exposures is key:

"If a decision is made to move to CPI then the transition should be gradual, and possibly flexible, to give companies an opportunity to manage the hedge between their revenues and costs. This has been a key attraction for investors that has allowed companies clear access to markets at attractive terms – benefits of which are passed on to customers (lower bills at PR14 was one example of that). Every effort should be made to retain and build on that investor confidence."

Anglian Water proposes a "hybrid approach" for the transition, whereby 1) companies are allowed to retain RPI linkage for the existing 2020 RCV, while new assets are indexed to CPI (creating a new "CPI RCV"); and 2) Companies are allowed to manage the transition through their choice of run-off rates:

"Companies already manage PAYG and run-off rates (financeability tools); under this approach companies will also manage the transition to CPI. Given companies have different levels of RPI liabilities with varying maturities, it is sensible for companies to own the transition."

Pros	Cons
<ul style="list-style-type: none"> ▪ Suitable for WASC's and WOC's (companies to take control of their plans including speed of transition to CPI) ▪ No spike in customer bills ▪ No mis-match of revenues & costs ▪ No hedging required. Allows time to manage transition in an orderly manner ▪ Allows time for CPI market to develop ▪ Suitable for WASC's and WOC's (companies to take control of their plans including speed of transition to CPI) 	<ul style="list-style-type: none"> ▪ RPI retained for a period of time

One investor also commented that an approach that provided companies with a choice over whether to switch to CPI indexation and the optimal transition period would allow companies to consider the switch in the context of the customers' requirements for changes in outputs and service levels. For example, customers could be offered a choice between outputs and the indexation approach, and customers/ companies could opt to retain RPI indexation where there was upward pressure on bills from changes in outputs.

One respondent considered Ofwat's statement on revenue neutrality immediately raised the question as to why Ofwat were implementing such a change, given risks and associated costs.

The interviewees put forward a number of options for greater commitment by Ofwat to revenue and value neutrality which we summarise in Box 3.2 below.

Box 3.2 Proposed Options for Greater Commitment by Ofwat to Value Neutrality

The interviewees proposed a number of options which in their view would reinforce Ofwat's commitment to revenue and value neutrality, including:

1. Detailed calculations on how revenue/value neutrality would be maintained e.g. using PR14 outcomes as an example;
2. Publication of **both** RPI and CPI WACC estimates at the next price review and detailed reconciliations of how these estimates have been derived and how they compare across other regulated sectors;
3. Publication and commitment to a PR19 allowed rate of return well in advance of the 2019 price review (in order to reduce Ofwat's discretion to reduce the allowed rate of return at a late stage in the price review process);
4. Detailed calculations on how hedging costs and additional costs of CPI debt will be taken into account;
5. Greater transparency about what will happen after 2025 on the transition profile to CPI indexation.

3.3. Instruments to Hedge CPI Risk are Imperfect and Will Increase Financing Costs

In its consultation, Ofwat notes that any change from RPI to CPI will mean that companies will bear the risk that the growth in a RPI indexed RCV and allowed revenues change at a different rate to companies' debt costs, which may expose companies to additional risk, although Ofwat consider that the risk could be reduced for other reasons, such as the lower volatility of CPI compared to RPI.³²

Ofwat has suggested that the mis-match between RPI index-linked debt and a CPI indexed RCV may be hedged, although it has noted that this would come at a cost. Ofwat also raises the prospect of companies issuing CPI indexed linked debt³³.

However, investors do not expect companies to be able to easily or efficiently hedge existing RPI positions if there is a switch to CPI indexation. Investors considered that CPI-RPI swaps are likely to have short tenors, e.g. around 5 years but potentially up to 10 years, and much shorter than RPI ILD tenors. The relatively short tenors expose companies to re-financing risk. The swaps also typically include break clauses and accretion clauses, exposing companies to further risk. Investors also noted that banks may be reluctant to offer derivatives given the potential difficulty trading out the risk (i.e. to find a party to hold the reverse side of the derivative), given the absence of a CPI-related product market.

More generally, investors questioned the banking sector's willingness to offer substantive derivative hedges for this RPI/CPI risk, particularly given the water industry is likely to approach the market at the same time. It was also noted that the banking sector is currently heavily exposed to RPI derivatives with UK water sector, which will further limit its appetite and capacity for further derivative positions.

Investors also told us that any derivative positions may expose companies to counterparty financing risk which is a negative factor in its credit rating. (See commentary by S&P on the impact of switch on companies' credit rating summarised in Box 3.3). A number of interviewees considered that smaller companies would be particularly exposed given the single or concentrated RPI issuances which cannot be easily hedged or switched into RPI.

Additionally, one WoC noted that swaps are not fully envisaged or provided for in the early Artesian RPI-linked financing deals, which helped small WoCs to raise debt on favourable terms. Therefore, these agreements would likely require amendments and/or separate arrangements to permit swap issuance, which may require monoline approval which could be costly and/or difficult to obtain.

³² Ofwat (December 2015), op. cit., p.119

³³ See Ofwat (December 2015), op. cit., p.119.

Box 3.3**S&P Highlights Changes Could Increase Financing Risk and Hedging Costs
(Counterparty risk)**

In its recent Inside Credit note on *Proposed U.K. Water Regulatory Changes Could Dilute Utilities' Credit Quality*, Standard & Poor's (S&P) argue that proposed change could lead to negative credit actions:

"We consider that Ofwat's proposal to link revenues and regulatory capital value (RCV) to CPI rather than RPI as a potentially significant risk to the capital structure of some companies in the sector. We continue to forecast a large, and even increasing, positive spread between RPI and CPI...Therefore, the switch to CPI may have a negative impact on utilities' financial ratios because companies with a disproportionately high proportion of RPI-linked debt may see their cost of debt rise faster than revenues."

"In our view, companies with a high proportion of RPI-linked debt, higher leverage than Ofwat's notional assumption, or long-term RPI-linked debt maturities could be exposed to a significant mismatch in revenues and financing costs."

"We also consider that if utilities are able to effectively swap RPI exposure to CPI, the counterparty credit risk would be considerable and also persistent in some cases, given the long-term maturities, up to 45 years, of the existing RPI-linked debt."

3.4. An Efficient Corporate Debt Market Requires CPI IL Gilts Market

The investors that we spoke to do not expect the development of a liquid CPI market in the short or medium-term. Investors noted that there was far less demand for CPI ILD and other CPI related products given the lower levels of CPI linked pension liabilities.³⁴

Furthermore, investors consider that the DMO has no immediate intention to develop a CPI market (an issue that we discuss in detail in section 6.1). The absence of CPI linked gilts means that there is no benchmark rate for corporate ILDs which will make corporate CPI ILD more difficult to price (and therefore more expensive and less liquid). In addition, corporate RPI ILD is commonly sold to investors on the basis of the "credit spread" relative to the gilt, and investors that purchase the corporate instrument commonly sell out the gilt. For example, one investor told us:

"A bond investor requires liquidity – and will not be keen to buy a bond but not be able to trade out of the market at a reasonable price. This liquidity is underpinned by issuance by the UK government."

There was also a wider concern about the need or legitimacy of Ofwat moving first. It was felt that the water sector should not move ahead of the DMO, for example, investors told us:

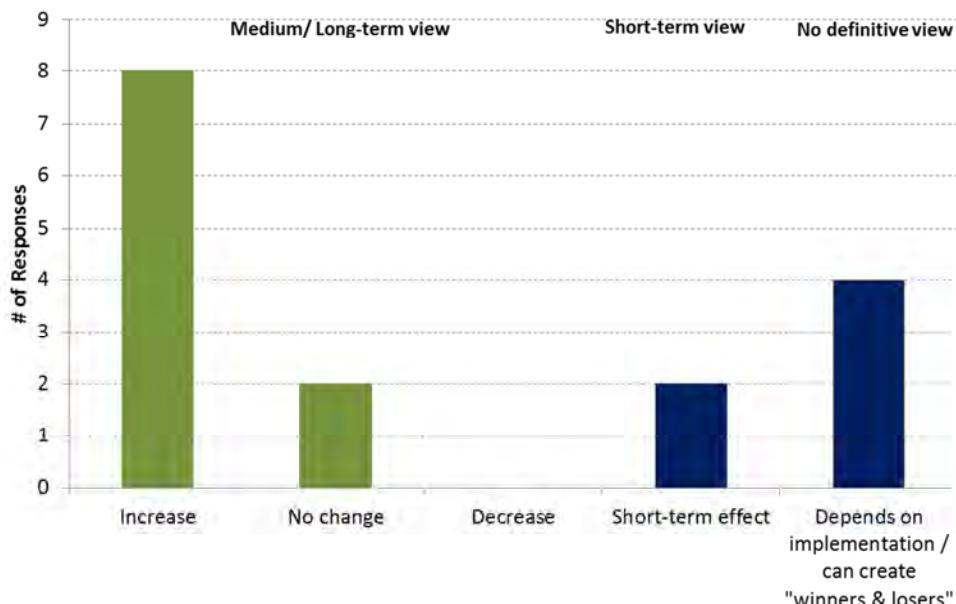
³⁴ See section 6.1.2 for evidence on demand for CPI products.

"It is not the water companies' or Ofwat's role to create a new CPI market, and it should not move ahead of the DMO."

3.5. Overall, a Change to CPI Will Increase Risk and Overall Financing Costs

Predominantly, interviewees consider that Ofwat's proposal will increase risk, as shown in the summary of responses below (see Figure 3.2). This is in part explained by the view that the change will not be value neutral to companies.

Figure 3.2
"Do the Proposed Changes Affect Your View of Risk of Investing in Water Sector?"



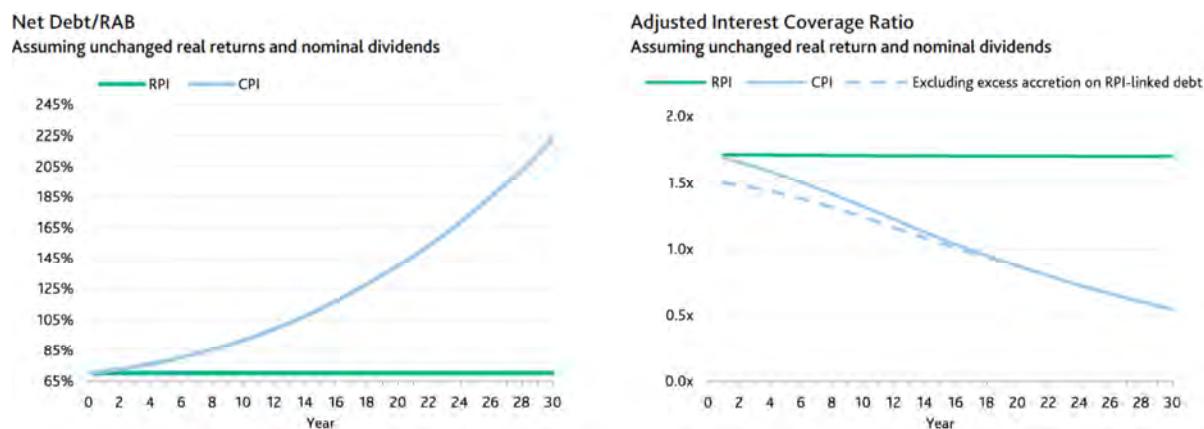
Source: NERA Analysis of interview responses.

Note: Answers not independent as some investors had a view on long-term vs. short -term effect on risk from proposed change.

Interviewees also noted that companies will be exposed to greater financing risk given the mis-match between RPI ILD, and CPI indexation (or “basis” risk), and the limited prospects for hedging such risk (or at least, hedging efficiently), as explained above.

Some investors considered that short-term credit metrics may improve but any improvement may be more than off-set by downside asymmetric risk, and deterioration of credit metrics over the longer-term. Moody's recent publication shows the potential negative impact on credit metrics from implementation risk, and our own modelling shows a similar picture (see section 4).

Figure 3.3
Moody's Analysis Shows a Deterioration in Ratings in the Extreme Case where the CPI Real Return is not Adjusted Upwards to Reflect the Lower Inflation Benchmark



Source: Moody's (January 2016), *Transition to CPI creates risks for water and energy networks*, p. 5.

Investors also expressed concern that any pay-as-you-go (PAYG) adjustments introduced to address customer bill impacts may not be recognised by Rating Agencies, and could increase risk. Indeed, Moody's has confirmed that “*use of regulatory levers to offset bill increases could erode confidence in the regulatory framework.*”³⁵ See summary of Moody's commentary on the proposed changes to indexation in Box 3.4.

In terms of impact on companies' cost of capital, rating agencies could require stronger financial ratios to address basis risk. For example, rating agencies told us that they will need to consider whether they adjust views of the riskiness of the sector for basis risk and wider regulatory uncertainty (particularly given the other changes), which could imply higher thresholds to maintain investment grade rating with implications for the cost of capital. More generally, the changes to indexation, along with other changes under Water 2020, have increased investors' perception of regulatory risk, and potential financing costs.

For example, one investor considered that the water sector once represented the “gold standard” – with a reduced spread to gilts for water companies’ debt of around 20 bps relative to other networks. However, the lower financing cost is no longer observable, and other networks’ debt issuance is more attractive given recent Ofwat changes to regulation.

³⁵ Moody's (January 2016), *Transition to CPI creates risks for water and energy networks*, p.1.

Box 3.4**Moody's Lists Four Key Risks Arising from Change to CPI Indexation**

In a recently published note (“*Transition to CPI creates risks for water and energy networks*”), Moody’s highlights the following key risks for water and energy networks arising from the transition:

- 1) **“Total returns could fall if regulators underestimate CPI – RPI differential”** – Moody’s highlight that while in principle higher returns today should offset lower RAB growth, total nominal returns would fall if regulators (1) underestimate the CPI-RPI wedge or (2) balk at resulting increase in bills.
- 2) **“Use of regulatory levers to offset bill increases could erode confidence in the regulatory framework”** - Moody’s argue that while higher capitalization of total expenditures could be used to protect customer bills at present, if such revenue deferrals result in companies not being able to realize the “allowed” return in the long-term, this would weaken Moody’s view of the regulatory framework.
- 3) **“Cost allowances could fall if real price effects are not fully modelled”** – Moody’s also argue that while regulators typically forecast nominal prices, for cost categories that are difficult to forecast or individually trivial, regulators could assume these rise with the index, which over time would result in weaker cashflows, as costs are assumed to rise with CPI rather than RPI.
- 4) **“Effect on balance between revenues and interest will depend on capital structure”**- Moody’s also argue that many companies have significant outstanding RPI-debt exposure, leading to a mismatch between revenues and the cost of this debt. However, Moody’s note that a CPI-linked allowed return may be a better match to interest costs on nominal debt, and so the effect may not be negative.

3.6. If CPI Indexation is Adopted, Investors Prefer the Arrangements to Apply to New RCV Additions Only

Ofwat sets out four different policy options in its consultation. To summarise, these are:

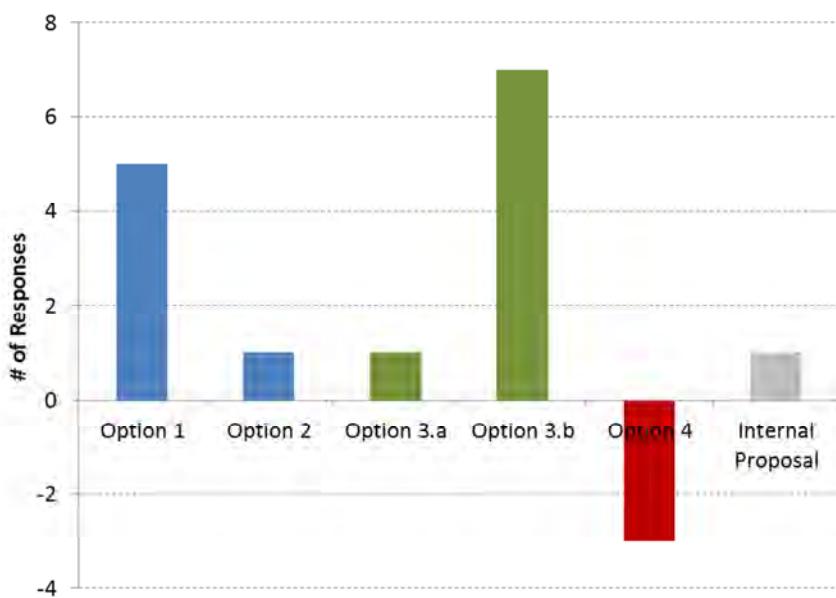
- Option 1: Status quo (i.e. retain use of RPI to index both RCV and allowed revenues)
- Option 2: Apply CPI indexation to prices but not to RCV
- Option 3: Apply CPI indexation to both prices and RCV, but with a transition to CPI indexation. Ofwat has identified the following examples:
 - for the period 2020-25, 50% RCV indexed by RPI, and 50% indexed by CPI, with the expectation that the proportion of RCV indexed by RPI would decline over time (Ofwat’s preferred option)
 - From 2020, apply RPI to the existing RCV, and apply CPI only to new investments made from the start of PR19
- Option 4: Apply CPI indexation to both allowed revenues and RCV with no transition

The options are summarised in Figure 3.4 below.

Figure 3.4
Ofwat's Policy Options (Preferred Option = 3)³⁶

Our policy options/dimensions	1	2	3	4
Whether to change inflation measure	No, retain RPI		Yes, signal preferred move to CPI (subject to final UKSA recommendations)	
Full or partial implementation?	NA (no change)	Partial – only apply to prices	Full – apply to both prices and RCV (therefore allowed revenues)	
Immediate change, or with transition	NA (no change)	Immediate (linked to partial application)	With transition	Immediate change
Form of transition	NA (no transition required)		CPI only applied to % of RCV	NA (no transition required)

Figure 3.5
“Of the options set out by Ofwat, what is your preferred option?”



Source: NERA Analysis of interview responses.

Note: We count as “negative” the responses where the interviews opted against a certain option.

In general, investors consider that the case has not been made for CPI indexation. Although many investors acknowledged that the CPI index was a more robust measure of general price

³⁶ Ofwat (December 2015), op. cit., p.121

inflation, it is likely to result in higher costs, and higher customer charges. In general, investors considered that the increase in costs would outweigh any benefit in terms of legitimacy.

Of those expressing an opinion, there was widespread support for the retention of option 1, at least until there was a decision from the DMO on the development of CPI gilt issuance, and prospects for the development of an efficient CPI corporate market.

There was relatively minimal support for option 2 with some respondents expressing concern about the risk around any end of period true-up, and increased complexity from the use of two indices.

If Ofwat implements a transition to CPI, there was a relatively prominent view that the time-path should be as long as possible to ensure that companies retain the RPI hedge, and to provide time for the development of a CPI-linked debt market. In relation to the transition options, most supported the application of CPI to new RCV additions only to provide a suitable transition path and to protect the 2020 RCV.

No interviewee supported the full adoption of a CPI; with most respondents considering that this would impose high risks and costs on investors.

3.7. Conclusions

While investors understood that in theory the proposed adjustments could be implemented to be *revenue* neutral, there was scepticism about Ofwat's ability to deliver *value* neutrality, that is, whether Ofwat would adjust the real allowed return to accommodate (lower) CPI indexation of the RCV, *and* compensate companies for increases in financing costs.

Investors noted that there was an inherent contradiction in ensuring value neutrality for investors, and no impact on customer bills. Investors viewed a change to CPI indexation as being likely to result in additional financing costs for companies which, to achieve value neutrality, would need to be reflected in customers' bills. Investors perceive that instead these costs will be borne by companies.

Investors acknowledged that CPI may have greater legitimacy than RPI as a measure of general price inflation. However, there is a general view that Ofwat has not considered the likely increases in financing costs in its assessment of the customer benefit.

In terms of options, there was clear support for the retention of current arrangements, at least until there was a clear understanding of the development of a CPI ILD gilts market. If Ofwat were to proceed with any change, then the transition should be over a long-term to avoid a mis-match between companies' long-dated RPI ILD and CPI indexation, and to minimise risks and costs. There was also strong support to apply any CPI to new RCV additions only, and retain RPI for the 2020 asset value.

4. Impact on Customer Bills, and Financial Ratios – Full CPI Switch

4.1. Approach to Modelling

We have built a stylised financial model to assess the impact of a change in indexation approach. We describe our modelling approach in detail in Appendix B.

The overall objective of our modelling exercise was to consider two key questions:

1. What is the impact on customer bills under the different indexation options?
2. What are the implications for credit rating and risk of a switch to CPI indexation, taking into account the existing stock of RPI index-linked debt?

We model allowed revenues and credit metrics for a “typical” WaSC and a “typical” WoC, allowing for different financing structures (i.e. corporate finance model, and highly-leveraged model). For bill impacts, we show results for a “typical” WaSC and “typical” WoC, based on industry average costs and asset values. For our financeability modelling, we focus on results for a “corporate financed” WaSC and “highly-leveraged” WoC as these two models span the set of results for all models.

We make the following assumptions for the stylised companies’ financial structure³⁷:

- “Corporate financed” WaSC defined as: 65% gearing and 36% ILD share in 2015 with gradual repayment (0% ILD achieved in PR59);
- “Highly leveraged” WoC defined as: 85% gearing and 90% ILD share in 2015 with one-off repayment in PR34.

We model the impact under different regulatory options including Ofwat’s proposed approach to transition as well as other alternative approaches. Options considered include:

- *Status quo*: retain current arrangements where both prices and the RCV are indexed by RPI;
- *Dual indexation*: prices are indexed by CPI from April 2020 and the RCV continues to be indexed by RPI;
- *Ofwat’s proposals*: prices are indexed by CPI from April 2020, with 50% of RCV indexed by CPI and 50% by RPI for the 2020-2025 period, and Ofwat reducing the proportion of RCV indexed by RPI by 25% at each periodic review from PR24 onwards³⁸.

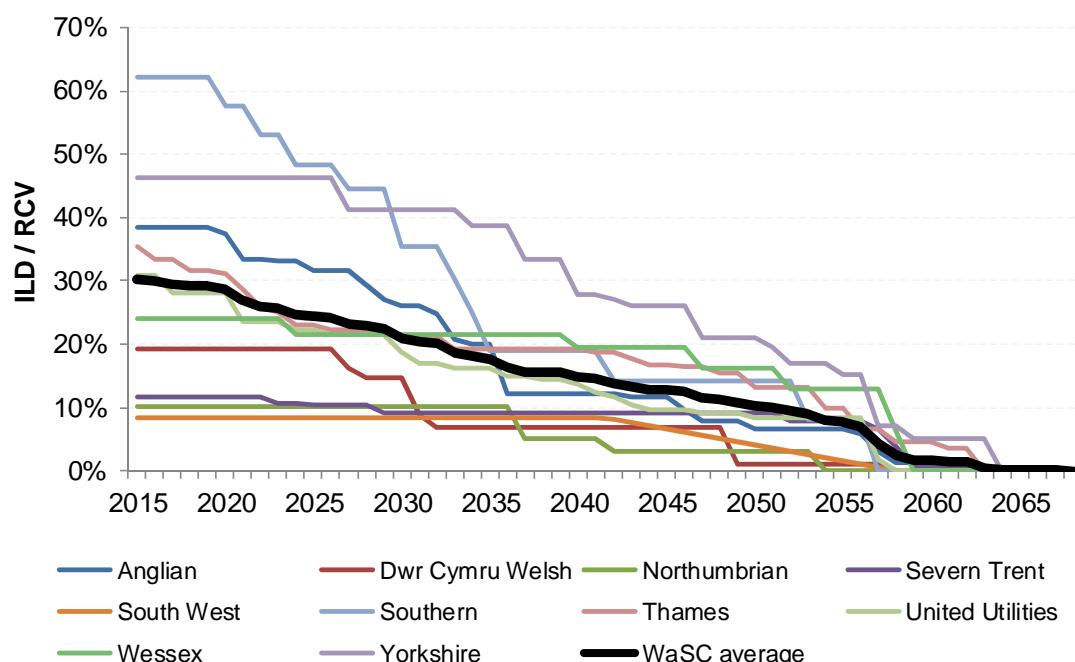
³⁷ The stylised companies’ characteristics were derived based on data from companies’ financial accounts on debt levels, share of ILD and ILD portfolios. See Appendix B for our data sources.

³⁸ Ofwat has made no explicit proposals in relation to its approach post 2024. We assume a 25% reduction in the RPI linked component of the RCV at each subsequent review.

- *Old RCV RPI linked, new RCV CPI linked:* prices are indexed by CPI from April 2020, existing RCV as at April 2020 is indexed by RPI, new RCV from April 2020 is indexed by CPI
- *Full CPI switch:* prices and RCV are fully indexed by CPI from April 2020; with the option to adjust PAYG to offset the impact on customer bills.

In this section, we set out modelling results for the full CPI switch. We discuss the different transition options in Section 5. We note that the modelling results presented here and in Section 5 are based on stylised companies derived from industry average data. However, there is significant variation among companies, notably in relation to percentage of RCV funded with index-linked debt (as shown in Figure 4.1 below), which may magnify the exposure to risk for companies deviating significantly from the industry average. We discuss companies' variation in ILD positions in more detail in Appendix C.

Figure 4.1
Variation in Share of ILD in Financial Structure for WaSCs



Source: NERA analysis of company annual report, Bloomberg and Ofwat data.

4.2. Modelling Results: Impact on Customer Bills

In this section, we discuss the impact of a full switch from RPI to CPI indexation on customer bills for a “typical” WaSC and a “typical” WoC, based on industry average cost and asset value inputs.

Before turning to the modelling results, we first briefly discuss the role of the inflation index in setting tariffs, which explains the intuition behind the modelling results. We then show the impact on customer bills of a full CPI switch without any changes to other regulatory parameters as well as consider the required adjustment (to e.g. PAYG) to mitigate the impact of the change in the indexation approach on customer bills.

4.2.1. Role of inflation index in setting tariffs

Under Ofwat's approach to setting tariffs, investors recover their nominal cost of capital via two sources:

- inclusion of a “real” allowed rate of return in the calculation of tariffs; and
- indexation of the RCV over time with outturn inflation.

This regulatory approach means that investors receive a real cost of capital within period but the inflation component is deferred into the future via indexation of the RCV. As long as the same inflation index is used to calculate the real cost of capital and to index the RCV over time, the choice of inflation index used for regulatory purposes has no impact on the present value of revenues charged to customers. However, the inflation index determines the balance between the amounts recovered within period versus those deferred into the future and as a result affects the profile of bills over time.³⁹

Any change in the inflation index used for price setting purposes will be *revenue* neutral (i.e. it will not affect the present value of expected revenues charged to customers), if the elements of the price setting formula are appropriately adjusted to reflect the new index. Specifically:

- the real allowed rate of return needs to be adjusted to bring it in line with the new index to ensure investors can earn the same nominal rate of return in expectations; and
- forecast totex allowances need to include an appropriate adjustment for real price effects relative to the new inflation index, to ensure nominal costs can be recovered in expectations.

In order for any change to be *value* neutral to investors (i.e. no change in present value of net cash-flows), in addition to the adjustments to the allowed return and forecast real totex allowances, Ofwat would also need to recognise any additional costs associated with any change to the index, e.g. in relation to hedging or debt financing costs.

A switch from a higher RPI inflation index to a lower CPI inflation index will result in an element of the allowed return which was previously deferred into the future via rolling up into the RCV to instead be recovered within year under the CPI framework. As discussed above, to ensure the switch is revenue neutral, the allowed WACC in real terms needs to be adjusted upwards by the difference between RPI and CPI inflation. As a result of the increase in the “real” allowed rate of return, revenues in the early years increase relative to RPI indexation. The higher allowed rate of return in real terms will be offset by a lower growth in RCV in line with the lower CPI index, but the effect of greater allowed return will dominate in the early years, thus increasing customer bills in the short run. In the medium term, the effect of lower RCV under CPI indexation will dominate the effect of higher real allowed rate of return and CPI linked revenues will fall below RPI revenues.

³⁹ The higher the inflation index used, the greater the deferral which results in lower charges in the short run which are offset by higher charges in the long run (due to higher the RCV which includes the deferred amounts).

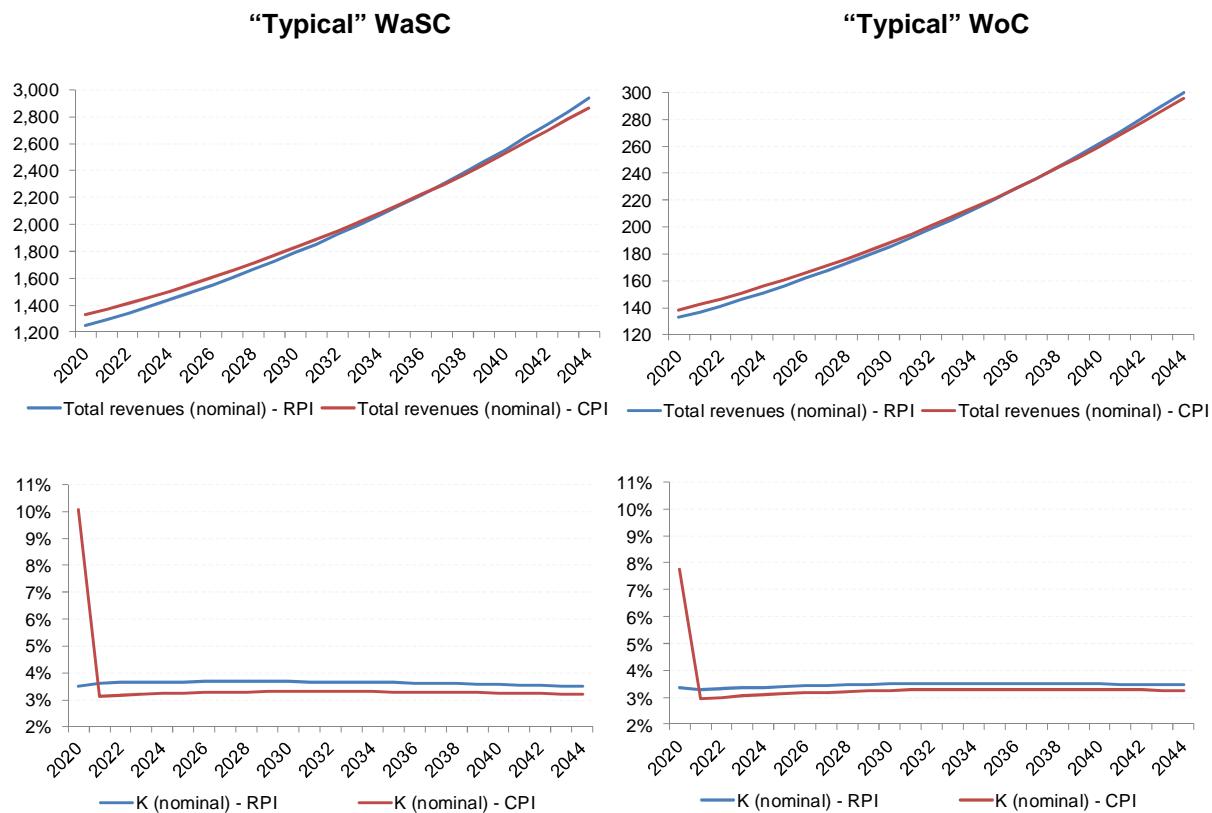
In our modelling, we assume a wedge between RPI and CPI of 1 per cent.⁴⁰ A 1 per cent increase in the real allowed WACC increases the allowed return by more than 25 per cent (relative to the real “RPI” WACC of 3.6 per cent assumed by Ofwat for PR14), increasing bills significantly in the first year immediately following the switch (unless offset by adjusting other regulatory parameters). We note that the larger the wedge, the greater the increase in bills required in the first year following the switch. The increase in bills also depends on the relative proportion of allowed return in total allowed revenues which in turn depends on the size of the RCV relative to totex.

4.2.2. Impact on customer bills of CPI indexation

Figure 4.2 shows the impact on nominal revenues and on k from a switch from RPI to full CPI indexation. For comparability purposes, we measure k as the percentage change in nominal revenues, given that different regulatory options are associated with different inflation indices applied to “real” allowed revenues (RPI and CPI respectively). We show separate results for a “typical” WaSC and a “typical” WoC, based on industry average cost and asset value inputs. We assume the switch to CPI happens in 2020, in line with Ofwat’s proposals.

⁴⁰ See Section 2.3. Our assumption is based on the latest estimate of the RPI-CPI wedge by the Office for Budget Responsibility. OBR (March 2015), Economic and fiscal outlook, p.62; http://cdn.budgetresponsibility.independent.gov.uk/March2015EFO_18-03-webv1.pdf.

Figure 4.2
Impact on Revenues and k (nominal) of Full Switch from RPI to CPI Indexation



Source: NERA modelling

As shown in Figure 4.2, in the first year immediately following the switch, nominal revenues under CPI indexation (red line) increase above nominal revenues under RPI indexation (blue line). We calculate bills would increase by around 7 per cent for a “typical” WaSC and around 4 per cent for a “typical” WoC under CPI relative to RPI indexation in the first year immediately following the switch.⁴¹

Following the one-off increase in the first year, revenues under CPI indexation grow at a lower rate compared to the RPI framework. Consistent with that, the k as shown in Figure 4.2 is lower under the CPI scenario (red line) compared to the RPI one (blue line). Our analysis shows that nominal revenues under the CPI framework will be higher than RPI revenues until 2036 for both “typical” WaSC and a “typical” WoC (the switch point), when CPI revenues fall below RPI revenues.

As demonstrated above, a switch to CPI indexation without any further adjustments would require a significant one-off increase in customer bills in the first year (offset by a lower increase in bills over time compared to an RPI indexation approach). As discussed by Ofwat in its consultation document, such a one-off increase in bills may not be acceptable to

⁴¹ The lower increase in bills for a “typical” WoC is explained by the lower share of allowed returns in allowed revenues compared to a “typical” WaSC.

customers and companies would be expected to “*engage with their customers on the use of PAYG tools to smooth the impact of moving to CPI indexation*”.⁴² We consider potential adjustments to other regulatory parameters to alleviate the impact of a switch to CPI indexation on customer bills in the following section.

4.2.3. Implication for PAYG to mitigate increase

As set out by Ofwat, to offset the immediate effect on customer bills of a change to CPI indexation, companies may consider “deferring” recovery of other elements of costs into the future via e.g. adjusting the capitalisation rate and/or adjusting the run-off rate/asset life assumption. A higher capitalisation rate and/or a longer asset life compared to the RPI scenario will defer the recovery of operational or capital costs into the future, thus offsetting the immediate impact on customer bills from the change in indexation approach.

We calculate the required adjustment to PAYG to fully compensate the impact of switch from RPI to CPI for a “typical” WaSC and a “typical” WoC for the four AMPs following the switch in 2020. The results are summarised in Table 4.1.

Table 4.1
Required Adjustment to PAYG to Offset Bill Impact of CPI Switch
(Relative to PR14 Value)

	PR19	PR24	PR29	PR34
“Typical” WaSC – water PAYG	-8%	-9%	-9%	-10%
“Typical” WaSC – sewerage PAYG	-10%	-10%	-11%	-11%
“Typical” WoC	-6%	-6%	-7%	-7%

Source: NERA calculations

For a “typical” WaSC, we calculate a required reduction in PAYG of around 8 per cent for water and around 10 per cent for sewerage in PR19, to offset the increase in bills under a full switch to CPI indexation in 2020. We calculate an adjustment of similar (or marginally higher) magnitude would have to be maintained to offset the impact for the following AMPs. For a “typical” WoC, the equivalent reduction in PAYG would be around 6 per cent in PR19 which would also need to be maintained over the following AMPs.⁴³

4.2.4. Conclusion

Based on our modelling of a revenue neutral switch from RPI to full CPI indexation, we draw the following conclusions:

- A change to a lower CPI index would increase customer bills in the short term, offset by a reduction in bills in the long-run.

⁴² Ofwat (2015), op. cit., p.127.

⁴³ The lower required adjustment to the PAYG for a “typical” WoC reflects the fact that the impact on customer bills is lower compared to a “typical” WaSC.

- Based on our modelling of a “typical” WaSC and WoC, we calculate a one-off increase in bills of 7 per cent and 4 per cent respectively would be required to implement a full switch to CPI indexation in 2020 (without any other adjustments).
- As acknowledged by Ofwat, such increases may not be acceptable to customers and companies would be expected to adjust other regulatory parameters to offset the bill impacts of the move to CPI indexation. Such adjustments could be achieved via capitalising a greater proportion of totex/ reducing depreciation charges.
- We calculate a reduction in PAYG of around 8 to 10 per cent for a “typical” WaSC and 6 per cent for a “typical” WoC would be required to offset the effects of switching to CPI indexation in 2020. However, such adjustments create the potential for increasing regulatory uncertainty and may have implications for companies’ financeability (we discuss this issue in detail in the next section).

4.3. Modelling Results: Implications for Financeability

In this section, we discuss the implications of a full switch to CPI indexation on credit metrics and financeability.

We assess credit metrics using Moody’s methodology which scores water utilities against a range of criteria, which contains a number of non-financial risk indicators (60% weight) and four financial ratios (40% weight). The key financial ratios are summarised Table 4.2.

**Table 4.2
Key Financial Ratios Considered by Moody’s for Rating Water Companies**

	Ratio definition	Weight in Moody’s assessment
Adjusted Interest Cover Ratio (AICR)	(FFO + interest – regulatory depreciation)/interest	12.5%
Gearing	Net debt/RCV	10%
FFO/net debt	FFO/net debt	12.5%
RCF/capex	(FFO-dividends)/capex	5%

Source: Moody’s (December 2015), Rating Methodology Regulated Water Utilities.

In our modelling we focus on gearing and AICR which we understand are the key financial metrics Moody’s considers for assessing UK water companies’ financial risk profile.

In its calculations of financial metrics, Moody’s explicitly acknowledges the cash-flow benefits of index-linked debt by considering only *cash* interest when calculating AICR (with the inflation accretion element not explicitly recognised as part of interest costs).⁴⁴ However, as discussed by Moody’s in its recent published note commenting on the potential

⁴⁴ This approach differs from S&P who include the full interest expense, i.e. cash cost and accrued interest, in its calculation of financial ratios.

implications of a switch to CPI indexation, it may no longer “*be appropriate to give full credit for the deferred interest if it is no longer matched by the growth of the RAB*”⁴⁵.

Consistent with Moody’s statement, when calculating the AICR under different indexation options, we only recognise the benefit of inflation accretion in the ratio calculation which corresponds to the inflation index used to index the RCV. That is, under the RPI indexation framework, we recognise the full benefit of RPI accretion in the calculation of cash interest cost. But in the CPI indexation scenario, we only recognise the benefit associated with the CPI element of interest accretion, including the difference between accretion based on RPI and CPI as part of cash interest costs.

The AICR as calculated by Moody’s can be simplified to represent a relationship between allowed rate of return and the cost of debt. This interpretation is important in understanding the implications of changes in indexation approaches on the AICR. The simplification is derived as follows:

- the term in the numerator can be re-written as: *revenues – opex – tax – regulatory depreciation*, which reflects nominal allowed rate of return; this can be further re-written as *real WACC*nominal RCV*;
- cash interest in the denominator can be rewritten as *cost of debt (cash)*gearing*nominal RCV*;
- cancelling the nominal RCV term in the numerator and denominator, the AICR can be simplified as: *real WACC/cost of debt (cash)*gearing*.

In the next section, we discuss the impact on AICR and gearing of a full switch to CPI indexation based on our modelling. The impact of a switch to CPI indexation on financial metrics depends on the level of gearing as well as the share of index-linked debt in companies’ financial structure. As set out in section 4.1, we focus on results for a “corporate financed” WaSC and “highly-leveraged” WoC as these two models span the set of results for all models.

In our modelling, we include the stock of ILD and the associated repayment schedule as defined for our stylised companies, but we assume any new debt is issued at a nominal fixed rate (given the uncertainty about the ability to issue RPI ILD going forward).

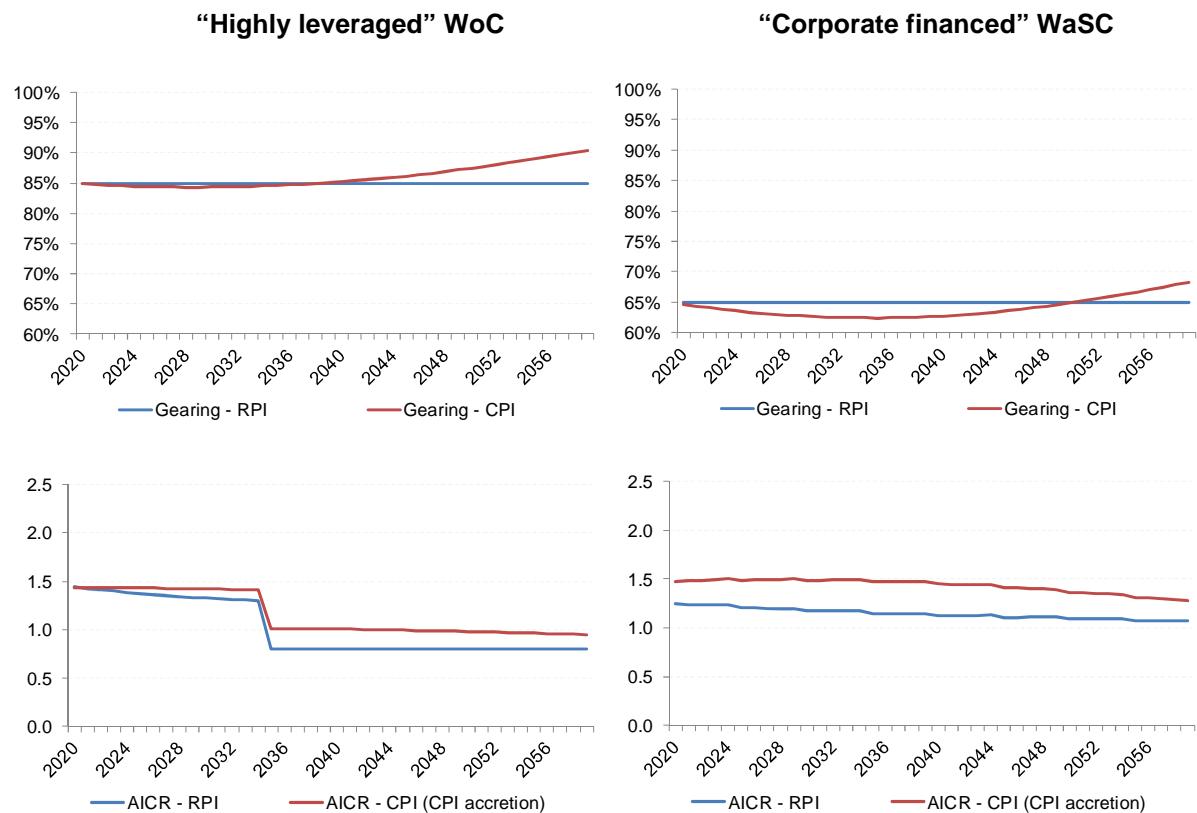
4.3.1. Base case impact on financeability

As discussed in Section 4.2, a switch to CPI indexation results in a re-profiling of revenues, with higher cash-flows in the short-term, offset by lower-cash flows in the long-run compared to the RPI framework. Following the switch, cash-flows increase to reflect the higher real allowed rate of return, but continue to grow at a lower rate compared to the RPI indexation scenario. In the long run, the effect of lower RAB growth will dominate the increase in the real allowed return and cash-flows under CPI indexation fall below the cash-flows under the RPI framework. The impact on credit metrics of the cash-flow re-profiling will depend on companies’ debt profile which in turn will depend on companies’ dividend policy following the switch.

⁴⁵ Moody’s (January 2016), Transition to CPI creates risks for water and energy networks, p.4.

As a first scenario (Scenario 1), we consider the impact on ratios, assuming companies keep dividends constant in nominal terms, as under the RPI indexation framework. Our modelling results are summarised in Figure 4.3.

Figure 4.3
Scenario 1: Impact on Gearing and AICR Assuming Dividends Fixed in Nominal Terms as Under RPI Framework



Source: NERA modelling

The blue lines in Figure 4.3 reflect the gearing and AICR ratios under the RPI framework, whereas the red lines ratios under CPI indexation. As discussed above, consistent with Moody's approach, our calculation of AICR under CPI indexation recognises only the benefit of the CPI element of total accretion, including the difference between RPI and CPI accretion as part of cash interest costs.

The effects of a switch from RPI to CPI indexation on credit metrics are summarised as follows:

- Immediately following the switch cash-flows increase, reflecting the increase in allowed revenues as a result of an increase in the “real” allowed rate of return.
- As we assume companies’ dividends are fixed in nominal terms as per the RPI indexation scenario, the additional cash received due to front-loading of revenues results in a reduction in companies gearing and an associated improvement in the AICR (as shown in Figure 4.3 above).

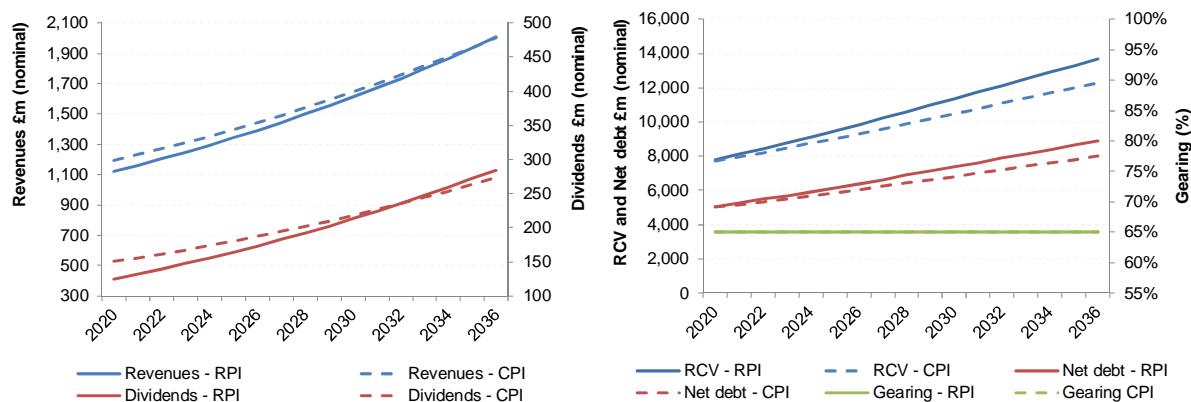
- Gearing continues to fall until switch point where nominal revenues under RPI exceed revenues under CPI (in mid-2030s). From then onwards gearing starts to rise, reflecting the fact that cash-flows under CPI framework are below those under RPI indexation but dividends remain as per RPI. The original level of gearing is achieved for our stylised “highly leveraged” WoC in 2040 and “corporate financed” WaSC in 2050.
- However, the AICR under CPI indexation (red line) does not fall below the AICR under RPI indexation (blue line) once the original level of gearing is achieved. The reason for this is that at the point where the original gearing level is achieved under CPI indexation, both our stylised companies’ financial structures are dominated by nominal debt. And as recognised by Moody’s, a CPI indexation approach provides a better match for companies financed with nominal debt as it reduces the gap between real cash-flows and nominal interest payments.⁴⁶
- The impact on the AICR for a company financed with majority of nominal debt can be understood in the context of our simplified AICR expression as: *real WACC/cost of debt (cash)*gearing*.
 - For a nominal debt financed company, a switch to CPI indexation increases the real WACC in the numerator by 1 per cent, but leaves the cost of debt unchanged in nominal terms. This leads to an improvement in the AICR, unless offset by an increase in gearing which works in the opposite direction, reducing AICR.
- If dividend policy remains unchanged and follows the RPI revenue profile, gearing levels would continue to rise which would eventually cause the AICR under CPI indexation to fall below AICR under RPI indexation.
- Note that the step change in the AICR in 2035 for our stylised highly leveraged WoC is driven by the repayment of index-linked debt in 2034, which we assume is replaced with nominal debt. As a result, from 2035 onwards nominal interest costs are fully recognised in the calculation of AICR, causing it to fall below 1.

In the above scenario, we have considered the impact of a switch to CPI indexation on financial metrics, assuming companies’ dividends remain unchanged in nominal terms as under the RPI framework. However, as recognised by Moody’s, this approach is unlikely to be followed in practice (not least because companies may not be able to use the additional cash to repay existing stock of debt in the early years following the switch). As Moody’s states, following a switch to CPI, it would instead expect companies to increase dividends in the short-run to reflect the increase in cash-flows associated with the higher real allowed equity return and then grow them at a lower rate, in line with the lower indexation of the RCV over time compared to the RPI framework.

Such dividend policy would effectively ensure that the profile of dividends matches the profile of cash flows, leaving gearing (measured as net debt/RCV) constant. This is not to say that debt *levels* will be the same under the RPI and CPI scenarios, but rather that the dividend policy would adjust to follow the profile of real allowed returns to ensure debt *as a proportion of the RCV* would remain constant. This effect is demonstrated in Figure 4.4 below.

⁴⁶ Moody’s (January 2016), op. cit., p.7

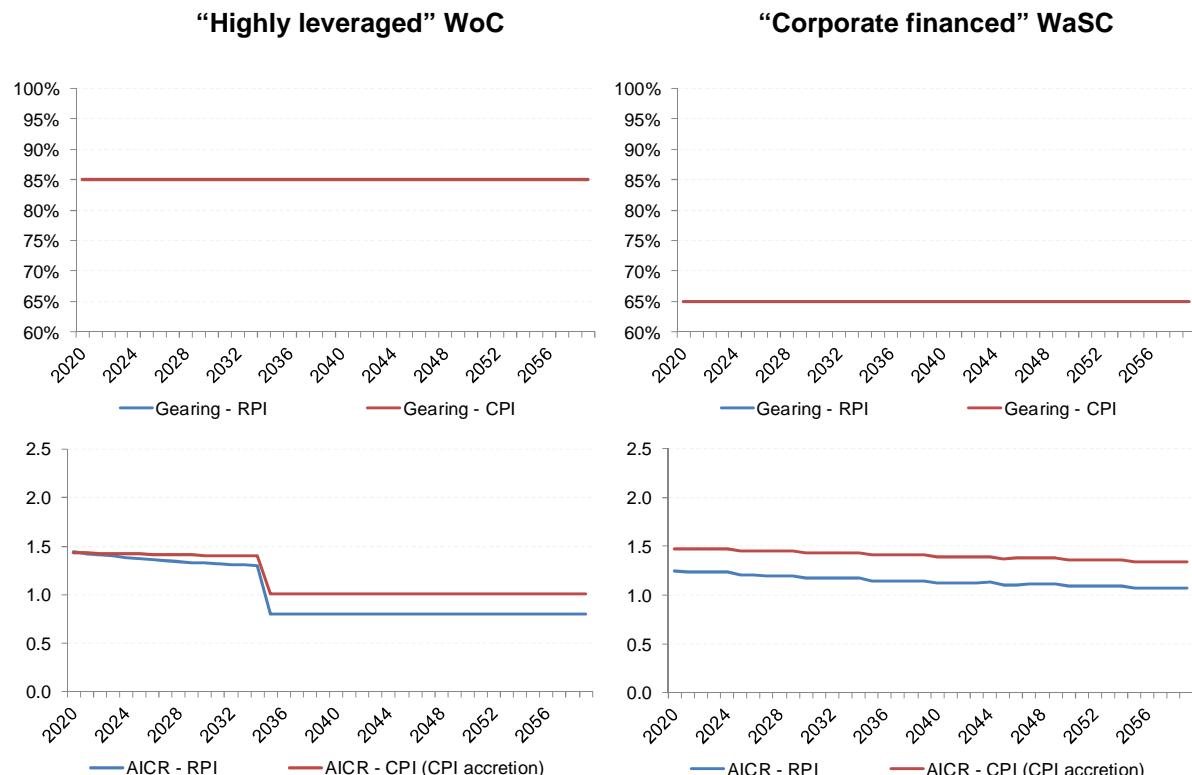
Figure 4.4
If Companies Pay-out CPI based COE as Dividends, Net debt/RCV Will be Constant over Time



Source: NERA modelling

In Figure 4.5, we show the impact on credit metrics of a switch to CPI indexation under the alternative scenario (Scenario 2) where companies' dividend policies adjust to the new revenue profile.

Figure 4.5
Scenario 2: Impact on Gearing and AICR Assuming Dividends Adjust to New Revenue Profile



Source: NERA modelling

Under Scenario 2, we have modelled dividends as follows:

- Following the switch, dividend policy adjusts to pay out the new (higher) real cost of equity, i.e. dividends increase at first and then grow at a slower rate compared to the RPI framework.
- Any RCV growth (RCV additions in excess of allowed depreciation) is part funded by equity/dividend retention, reflecting the equity share in the capital structure (measured as 1-gearing).

As a result of the above assumptions on dividend policy, gearing stays constant under both the RPI and CPI scenarios (as shown in Figure 4.5). As demonstrated in Figure 4.4, this does not mean debt amounts are the same, but rather that debt as a proportion of the RCV is constant.

The effects of a switch from RPI to CPI indexation on credit metrics are summarised as follows:

- Gearing remains constant (dividend policy adjusts to reflect new cash-flow profile).
- For the stylised “highly leveraged” WoC, the AICR under CPI shows only a marginal improvement in the first AMP (where we assume starting ILD share of 90% in 2020).
- The effect of the switch on a company with a high level of ILD can be understood in the context of our simplified AICR expression as: *real WACC/cost of debt (cash)*gearing*.
 - As a result of the switch, the real WACC in the numerator increases by 1 per cent.
 - However, the “cash” cost of debt also increases by 1 per cent, under our approach of recognising only the benefit of CPI element of total accretion in the AICR.
 - Given that gearing remains constant, the numerator and denominator of the AICR increase by 1 per cent, leaving the ratio broadly unchanged.⁴⁷
- For the stylised “corporate financed” WaSC, the switch to CPI indexation results in an improvement in AICR, because CPI provides a better match to nominal debt.
- The improvement in AICR for a (predominantly) nominal debt financed company is permanent (as long as gearing remains constant). This effect can again be seen from our decomposition of the AICR into *real WACC/ cost of debt (cash)*gearing*.
 - As a result of the switch, real WACC in the numerator increases by 1 per cent. Cost of debt (in nominal cash terms) and gearing remain constant. As a result, AICR unambiguously increases. As long as dividend policy adjusts to the new cash-flow profile, ensuring debt as a proportion of RCV remains constant, this improvement in the AICR will be permanent.

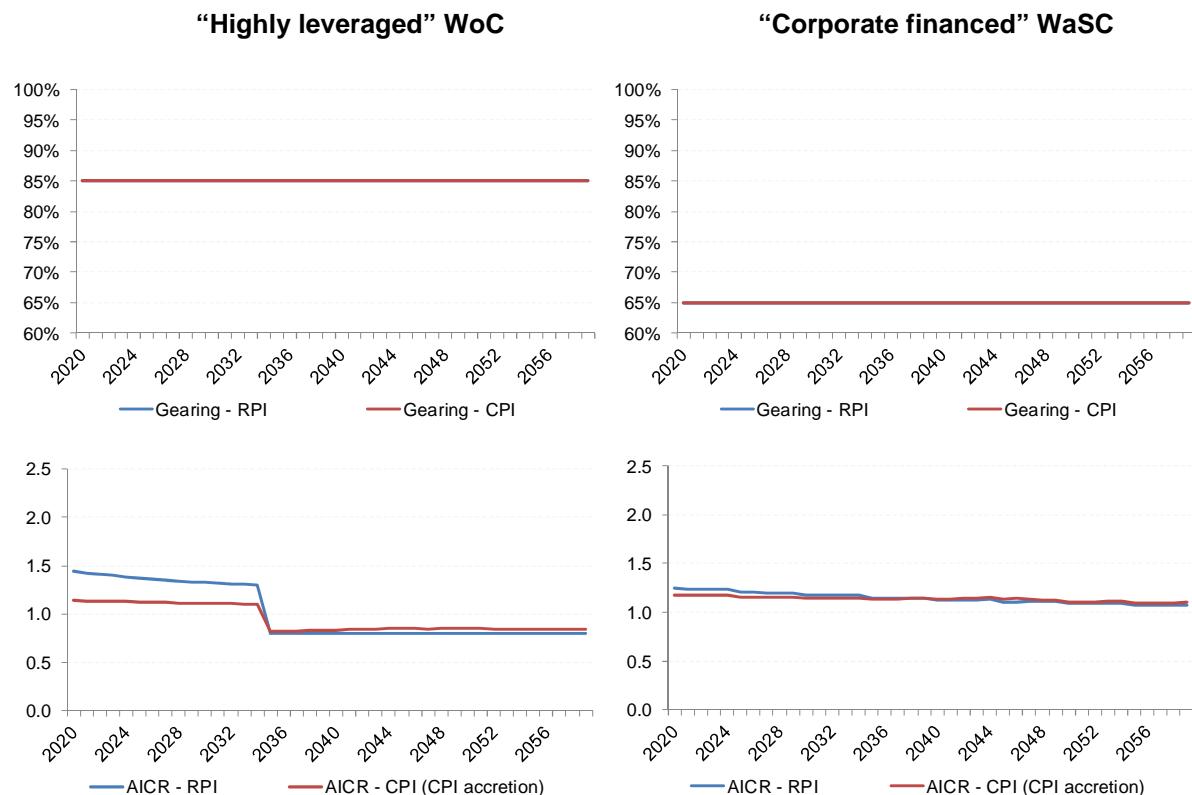
The results in Figure 4.5 show that under certain conditions (revenue neutral implementation of the switch to CPI without any further adjustments to regulatory parameters, adjustment in

⁴⁷ In the example of our stylised “highly-leveraged” WoC, the AICR improves over time due to issuance of nominal debt (to fund RCV growth) for which CPI provides a better match. The ratio deteriorates in 2035 when ILD is repaid and fully replaced by nominal debt.

dividend policy in line with new revenue profile and financial structure dominated by nominal debt), the switch to CPI indexation can result in a permanent improvement in AICR.

However, as discussed in Section 4.2.3, Ofwat expects companies to offset the impact of a switch to CPI by adjustments to other regulatory parameters to mitigate the impact of the switch to CPI on customer bills. In Figure 4.6 below, we show the impact on financial ratios of the PAYG adjustments set out in Section 4.2.3 (Scenario 3).

Figure 4.6
Scenario 3: Impact on Gearing and AICR Assuming Companies Adjust PAYG to Eliminate Increase in Bills from Switch to CPI



Source: NERA modelling

Under this scenario, the PAYG is adjusted to ensure revenues under the new CPI framework (with PAYG adjustment) remain unchanged relative to the RPI scenario to eliminate impact on customer bills. As a result, cash flows are also unchanged relative to the RPI framework.

Consistent with Moody's recent note⁴⁸, we have calculated AICR reflecting the true proportion of totex expensed within year, rather than the regulatory assumed PAYG (which has been artificially reduced to offset the effects of CPI indexation).

The impact on ratios under Scenario 3 can be summarised as follows:

⁴⁸ “Our assessment of companies’ credit ratios will look through the effect on cash-flows of a different pace of expenditure recovery from actual opex/capex split as reported in the financial accounts”. Moody’s (2013), Speed of Money Cannot Address Potential Financeability Concerns, p.8.

- As a result of the adjustment to reflect “true” PAYG (i.e. based on actual opex-capex shares), the AICR for our stylised “corporate-financed” WaSC remains unchanged compared to the RPI framework. This reflects the fact that the PAYG adjustment effectively eliminates the impact of a revenue neutral switch to CPI indexation and restores the cash-flow profile as under the original RPI framework.
- However, we observe a deterioration in the AICR for our stylised “highly leveraged” WoC. While the numerator of the AICR remains broadly unchanged, given the same cash-flow profile, the denominator of the AICR deteriorates for the “highly leveraged” WoC due to our approach of recognising only the benefit of the CPI element of total accretion in the AICR.
- As a result, even though cash-flows are unchanged relative to the RPI scenario, AICR can deteriorate for companies financed with high levels of index-linked debt, as long as benefits of accretion only reflect the lower CPI.

In addition to key financial ratios considered by Moody’s, we have also considered the impact of changes in indexation on financial ratios considered by S&P. The core credit ratios used by S&P to assess financial risk of UK water companies are FFO/net debt and debt/EBITDA. As before, we assume companies adjust PAYG to mitigate impact of change in indexation approach on customer bills (as per Scenario 3).

As discussed above, the PAYG adjustment used to mitigate bill impacts of the transition to CPI results in revenues under the new CPI framework (with PAYG adjusted) to remain unchanged relative to the RPI scenario. As a result, cash flows (as well as debt amounts) are also unchanged relative to the RPI framework and there is therefore no impact on the FFO/net debt or Debt/EBITDA ratios from a switch to CPI for both our stylised “highly leveraged” WoC and “corporate financed” WaSC. Unlike Moody’s, S&P does not recognise the cash benefit of accretion for ILD, we therefore observe no deterioration in ratios for the companies with high levels of ILD.

4.3.1.1. Conclusion

Based on the modelling results presented above, we conclude that the impact on financial metrics of a revenue neutral switch to CPI indexation is as follows:

- Assuming dividend policy adjusts to reflect the new cash flow profile (dividends increase immediately following the switch in line with an increase in the real allowed cost of equity but grow at a lower rate in line with CPI), gearing will remain constant.
- Assuming constant gearing, companies financed with (predominantly) nominal debt would experience a permanent improvement in AICR, reflecting the fact that CPI indexed revenues provide a better match for nominal interest payments. AICR for high share of ILD companies does not improve significantly, as long as the benefits of accretion only reflect CPI indexation.
- However, an improvement in AICR is unlikely to materialise in practice as Ofwat expects companies to offset the effect of a switch to CPI indexation via adjustments to PAYG. Such adjustments offset the impact of the switch to CPI on customer bills and restore the same cash-flow profile as under the current RPI framework. As a result, financial ratios are unchanged for companies financed (predominantly) with nominal debt and may

deteriorate for companies financed with high share of ILD, as long as benefits of accretion only reflect the lower CPI.

- Our stylised results also reveal that the AICR for highly geared companies could fall below 1 in the event of inability to issue new ILD once existing ILD matures. This implies that in the absence of RPI or CPI ILD corporate debt, companies may need to deleverage to maintain investment grade credit rating, with a potential increase in financing costs.

4.3.2. Risk and implications for financeability

In the previous section, we have discussed the implications for credit metrics of a switch to CPI indexation assuming a full compensation for the differential between RPI and CPI inflation in allowed returns as well as totex allowances by Ofwat. That is we have assumed the switch will be revenue neutral, i.e. that the NPV of expected revenues under both RPI and CPI indexation options would be the same.

As highlighted by a number of stakeholders as part of our interviews, there is a perception among investors that the switch to CPI may not be revenue and value neutral, i.e. there is a risk that Ofwat does not recognise both the full RPI-CPI wedge in setting the CPI based allowed rate of return, *and* recognise any additional financing costs. We have categorised the types of risks highlighted by stakeholders into two groups: regulatory and external risks. We discuss these in more detail below.

4.3.2.1. Regulatory risk

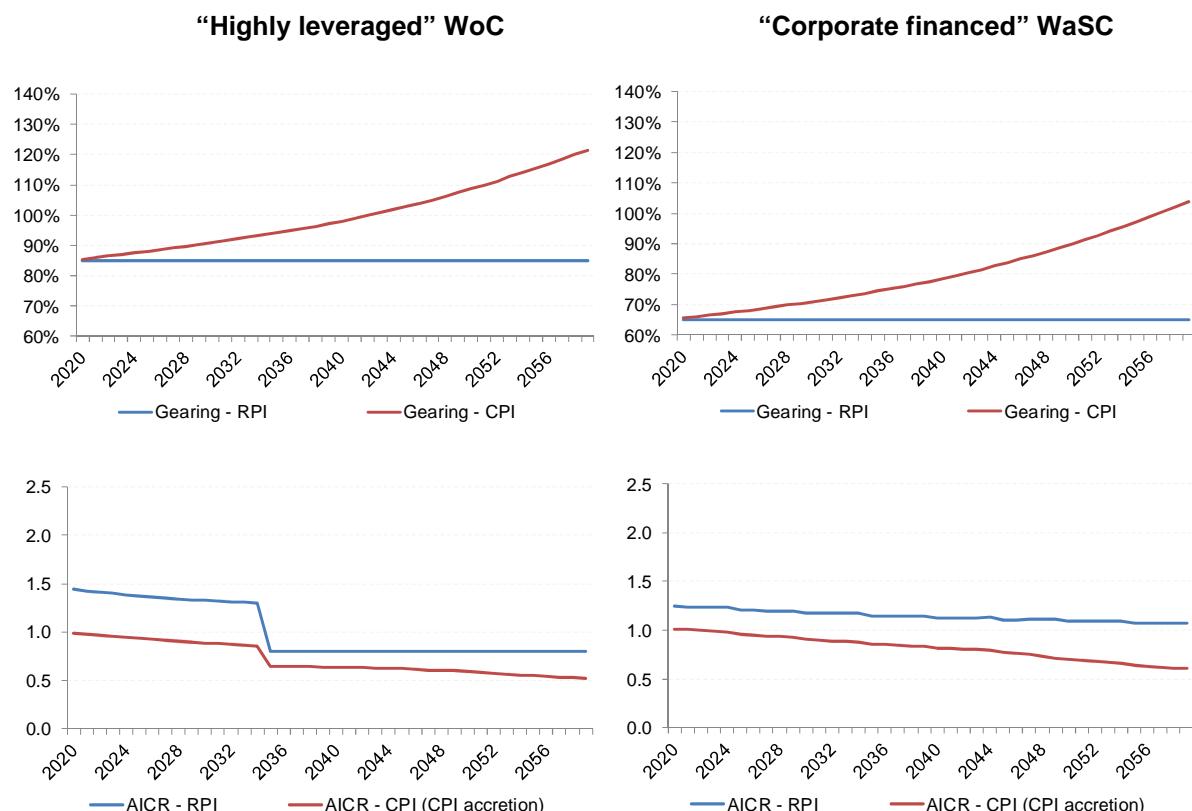
As discussed in section 3, a number of investors highlighted regulatory risk as the key risk associated with the change in the indexation approach. Specifically, stakeholders have raised concerns that to alleviate the pressure on customer bills from a switch to CPI, Ofwat may not allow the full increase in real allowed rate of return for the difference between RPI and CPI inflation. In such an event, the switch to CPI indexation would no longer be revenue and value neutral in NPV terms as investors would no longer have the expectation to earn the same nominal WACC as under the RPI framework. In addition, as highlighted by Moody's, “*systematic errors [in estimating the CPI-RPI wedge] could significantly undermine the value of regulated companies and, absent drastic dividend reductions, impair credit quality.*”⁴⁹

We model the impact on financial ratios of a switch to CPI indexation, but assuming Ofwat only allows 50% of the RPI-CPI wedge in the new real allowed WACC, whereas actual dividends (and cost of debt) reflect the full wedge (Scenario 4). This is equivalent to assuming Ofwat allows only 50% of the cost of capital increase as a result of the change in the inflation used to index the RCV over time. We also assume companies mitigate the impact of the switch to CPI on customer bills via PAYG adjustments, as we understand this represents the most likely scenario. The results are shown in Figure 4.7 below.

⁴⁹ Moody's (January 2016), op. cit., p.4-5.

Figure 4.7

Scenario 4: Impact on Gearing and AICR, Assuming Ofwat Only Allows 50% of RPI-CPI Wedge but COD and Dividends Reflect Full Wedge and Companies Adjust PAYG to Eliminate Bill Increase from Switch to CPI



Source: NERA modelling

Ofwat not recognising the full wedge in the new real allowed WACC under CPI indexation would result in a rapid increase in gearing and deterioration in the AICR. (As discussed above, we assume dividends and cost of debt reflect the full wedge and therefore the unfunded amounts need to be covered via issuance of new debt.)

However, gearing levels as shown in Figure 4.7 are not realistic for companies to achieve in practice. Instead, companies would have to significantly reduce dividends early on to cover the unfunded amounts, leading to value destruction for equity investors.

Other sources of regulatory risk (which would have a similar impact on credit metrics and potential for value destruction as above) include additional costs arising as a result of the switch but which are not recognised by Ofwat in the allowed rate of return. Such costs include for example additional hedging costs, and/ or the additional costs from issuing corporate CPI ILD in an illiquid market. As set out in section 6.2, evidence from RPI ILD markets suggest that illiquidity premium can be of the order of 80 bps.

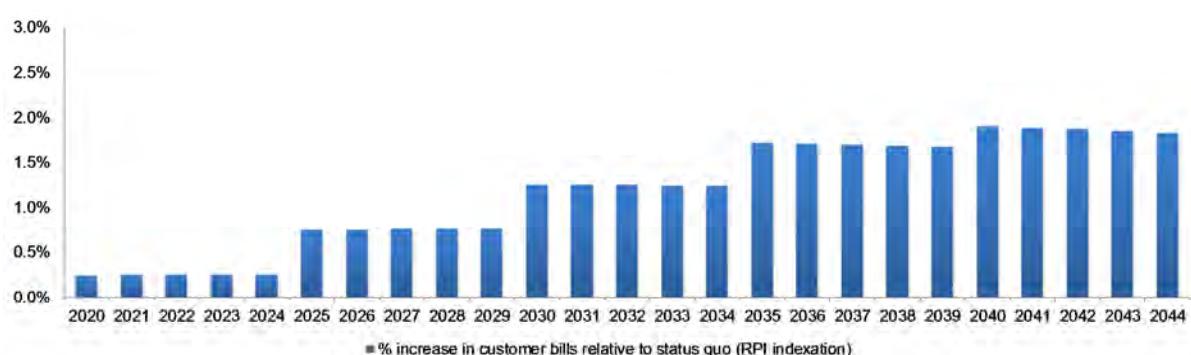
Alternatively, if companies are kept whole, our analysis suggests that customer bills could increase by around 2% (assuming a 50 bps increase in debt costs, modelled for a “typical” WaSC). We have calculated the increase in customer bills as follows:

- we assume cost of new debt post 2020 increases by 50bps based on evidence from RPI ILD markets that liquidity premium can increase by as much as 80 bps in times of market illiquidity (see section 6.2);
- we assumed an average tenor of issuance of 20 years such that all debt is refinanced by 2040;⁵⁰
- we assume the increase in debt costs is fully reflected in the allowed rate of return.

Based on the above assumptions, we calculate the increase in cost of new debt by 50bps post 2020 increases customer bills in the long run by 2 per cent (as shown in Figure 4.8).

Figure 4.8

Increase in Customer Bills for a “Typical” WaSC Assuming Cost of New Debt Post 2020 Increases by 50bps and Companies Adjust PAYG to Eliminate Bill Increase from CPI Switch



Source: NERA modelling

Another way the regulatory risk could affect companies’ financeability is through the rating agencies’ view of the riskiness of the regulatory framework.

As discussed in section 4.2.3, Ofwat proposes for companies to adjust other regulatory parameters (e.g. PAYG or depreciation lives) to mitigate the short-term bill increases implied by a switch to CPI indexation. As highlighted by Moody’s, if companies were required to fully offset the impact on bills of CPI indexation via e.g. reducing the PAYG ratio, this would effectively “undo” the transition to CPI and defer returns into the future. Moody’s further stated that such “*long term mandatory revenue deferrals would mean regulated companies are, in practice, unable to earn their “allowed” return for a sustained period, and would be inconsistent with our [Moody’s] current view of the GB regulatory frameworks*”⁵¹

4.3.2.2. External risk

In the previous section, we have discussed the impact of regulatory risk on financial metrics, where the risks considered meant that the switch to CPI indexation would not be revenue and

⁵⁰ In terms of profile, we assume share of new debt for PR19 of 12.5 per cent, for PR24 of 37.5 per cent, for PR29 of 62.5, for PR34 of 87.5 per cent and 100 per cent thereafter.

⁵¹ Moody’s (January 2016) op. cit., p.6.

value neutral in present value terms. A further material source of risk highlighted by stakeholders from switching to a CPI regime lies in breaking the natural hedge between the RPI indexation of the RCV and RPI index linked debt.

The existing regime of indexing the RCV with outturn RPI provides a natural hedge for companies financed with RPI index linked-debt, where both the allowed return and actual cost of debt grow in line with outturn RPI inflation, leaving equity returns unchanged. However, with a move to CPI indexation, this natural link will be broken. Even if investors are compensated for the expected difference between RPI and CPI inflation, variation in the outturn RPI-CPI wedge will expose companies to additional risks under the CPI regime, given that their revenues will be linked to one inflation measure (CPI) but their costs will be linked to another measure (RPI).

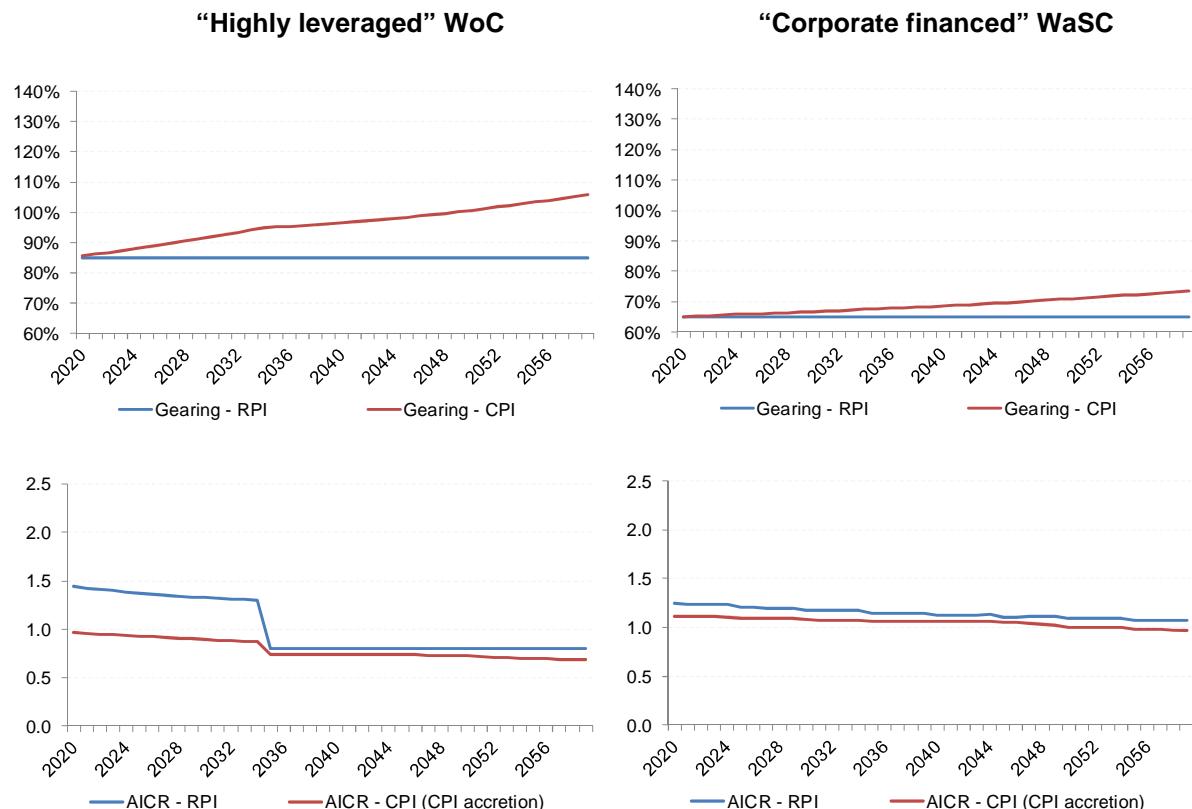
The impact on risk is illustrated in the following example:

- Assume Ofwat estimates at the review that CPI inflation will be 2 per cent and RPI inflation 3 per cent, allowing a 100bps increase in the real cost of capital to reflect the *expected wedge* between RPI and CPI inflation.
- Assume in reality, CPI increases to 2.5 per cent but RPI increases to 4 per cent, i.e. the *outturn wedge* is 150bps.
- Allowed revenues include an ex-ante allowance for the expected RPI - CPI wedge of 100 bps. Allowed revenues are also indexed with outturn CPI of 2.5 per cent. In total, allowed revenues therefore provide compensation for inflation of 3.5 per cent. This is lower than outturn RPI of 4 per cent, which reflects the company's increase in indexed-linked debt costs.
- The additional cost of index-linked debt due to the deviation of the outturn RPI – CPI wedge remains unfunded under the CPI indexation approach.

As we discuss in Appendix D, we have simulated the joint distributions of RPI and CPI as correlated random processes calibrated based on historical data. Our simulations show a relatively wide distribution for the RPI-CPI wedge. For example, our modelling shows that there is a sustained increase in the RPI-CPI outturn wedge of 85 bps (relative to 100 bps central assumption) for one in twenty simulations (i.e. for the 5th percentile).

In Figure 4.9 below, we show the impact on financial ratios assuming the CPI-RPI wedge increases in line with the 5th percentile, or 85 bps above allowance (Scenario 5). As in the previous scenarios, we also assume companies mitigate the impact of the switch to CPI on customer bills via PAYG adjustments, as we understand this represents the most likely scenario.

Figure 4.9
Scenario 5: Impact on Gearing and AICR, Assuming RPI – CPI Wedge Based on 5th Percentile (85 bps Above Allowance)



Source: NERA modelling

The impact of the increase in the RPI - CPI wedge above the ex-ante allowed wedge is similar to the regulatory risk scenario shown in Figure 4.9.

- There are additional costs associated with the switch which are not funded via allowed revenues (additional cost of index-linked debt arising from RPI - CPI wedge deviating above ex-ante allowance).
- These additional debt costs are covered via issuance of new debt which leads to a deterioration in gearing and AICR. As such gearing increases are not realistic in practice, companies would have to constrain dividends to cover the unfunded amounts, leading to value destruction for equity investors.
- The value lost is greater for companies financed with a greater proportion of RPI index linked debt (as demonstrated in Figure 4.9 by the more rapid deterioration in gearing for our stylised “highly leveraged” WoC with 90% ILD share in 2020 compared to the stylised “corporate financed” WaSC with 32% ILD share in 2020).

We note that Ofwat proposes to include true-up which would compensate companies for the outturn RPI – CPI wedge on an ex-post basis. However, even under a true-up the additional risk of RPI-CPI wedge deviations would still affect companies’ cash-flows and financial metrics within the regulatory period. It is also not clear whether Ofwat intends to include

such a true-up until stock of existing ILD matures (we note the last currently outstanding RPI index-linked water company bond matures after 2060).

4.3.2.3. Conclusion

Based on our modelling of risk under a switch to CPI indexation we draw the following conclusions:

- There is a perception among investors that any switch to CPI indexation may not be revenue or value neutral. Our modelling shows regulatory risk creates significant potential for value destruction.
- There is also significant risk that the RPI-CPI wedge deviates from the ex-ante allowance, creating risk for companies financed with high levels of ILD. Ofwat stated it intends to include a true-up to compensate for this risk, but companies would remain exposed to corresponding cash-flow risks within period. In addition, it is not clear whether Ofwat intends to include such a true-up until all existing RPI ILD matures (post 2060 based on current outstanding bonds).

5. Impact on Customer Bills, and Financial Ratios – Transition Options

In this section, we discuss the customer bill impact and financial ratios for different transition options of a gradual move to CPI indexation. As set out in section 2, the different transition options considered by Ofwat include:

- *Ofwat's proposals*: prices are indexed by CPI from April 2020, with 50% of RCV indexed by CPI and 50% by RPI for the 2020-2025 period, and Ofwat reducing the proportion of RCV indexed by RPI at each periodic review from PR24 onwards⁵².
- *Old RCV RPI linked, new RCV CPI linked*: prices are indexed by CPI from April 2020, existing RCV as at April 2020 is indexed by RPI, new RCV from April 2020 is indexed by CPI.

An additional option presented by Ofwat is *dual indexation*, where prices are indexed by CPI from April 2020 but the RCV continues to be indexed by RPI. However, this option yields broadly the same cash-flow profile as the current regime assuming the true-up is implemented correctly, although companies will face intra-period cash-flow risk prior to the true-up. We therefore do not present the cash-flows associated with this option in this section.

5.1. Modelling Results: Impact on Customer Bills

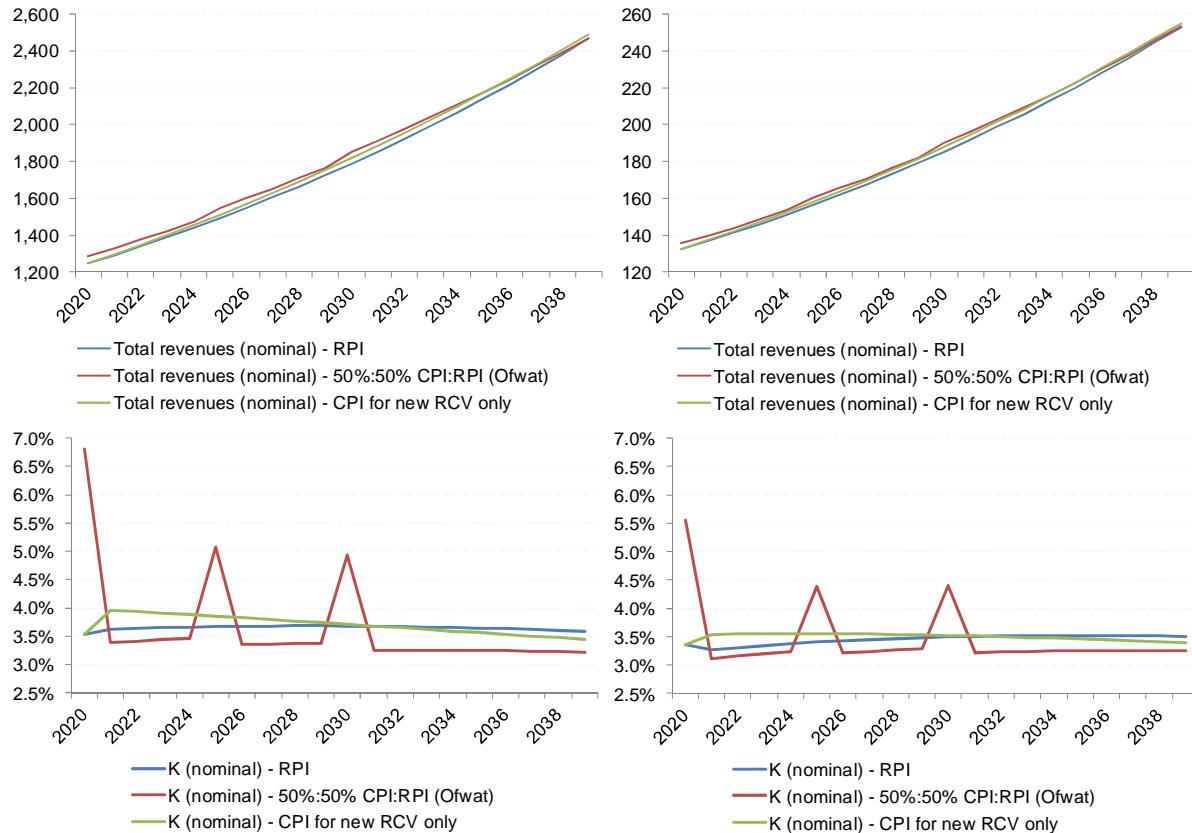
As in section 4.2, we first present the impact on customer bills of a revenue neutral switch under each transition option without any adjustments to other regulatory parameters to offset the associated bill impacts. We then consider the required adjustment to PAYG to mitigate the impact of the change in the indexation approach on customer bills.

5.1.1. Impact without mitigants

Figure 5.1 below shows the impact on nominal revenues and on k of a switch from RPI to CPI indexation under Ofwat's proposed transitional arrangements (50% RPI 50% CPI RCV indexation in PR19) as well as under the alternative scenario where only new RCV additions post 2020 are indexed with CPI, whereas old RCV remains indexed with RPI. As before, we measure k as the percentage change in nominal revenues, given that different regulatory options are associated with different inflation indices applied to “real” allowed revenues (RPI and CPI respectively).

⁵² Ofwat has made no explicit proposals in relation to its approach post 2024. In our modelling, we assume a 25% reduction in the RPI linked component of the RCV at each subsequent review.

Figure 5.1
Impact on Revenues and k (Nominal) of Transition Options
“Typical” WaSC **“Typical” WoC**



Source: NERA modelling

Ofwat's proposed transition scenario results in a one-off increase in bills in the first year following the switch (2020) of around 3.5 per cent for the “typical” WaSC and around 2 per cent for a “typical” WoC measured relative to the increase in k under RPI. This is followed by further step-change increases in customer bills of around 1.5 per cent for a “typical” WaSC and 1 per cent for a “typical” WoC in 2025 and in 2030. These additional step change bill increases reflect our assumption that the percentage of the RCV linked to RPI is reduced by 25 percentage points at each subsequent review, with full CPI indexation achieved in 2030.

The alternative scenario where only new RCV post 2020 is indexed with CPI but old RCV remains linked to RPI is associated with no bill increases relative to the RPI scenario in the year immediately following the switch. Over the short to medium term, k increases gradually relative to the RPI indexation scenario before falling below k under RPI indexation in mid-2030s.

As discussed in section 4.2, Ofwat expects companies to adjust other regulatory parameters to mitigate the impact of transition to CPI indexation on customer bills. We discuss the required adjustments under different transition options in the following section.

5.1.2. Implication for PAYG to mitigate increase

For each of the transition options, we calculate the required adjustment to PAYG to fully mitigate the impact on bills from transition to CPI indexation. We present results for a “typical” WaSC and a “typical” WoC for the four AMPs following the switch in 2020. The results are summarised in Table 5.1 and Table 5.2 below.

Table 5.1
Required Adjustment to PAYG to Offset Bill Impact of CPI Switch under Ofwat Proposals
(Relative to PR14 Value)

	PR19	PR24	PR29	PR34
“Typical” WaSC – water PAYG	-4%	-6%	-9%	-9%
“Typical” WaSC – sewerage PAYG	-5%	-8%	-11%	-11%
“Typical” WoC	-3%	-5%	-6%	-7%

Source: NERA calculations

Table 5.2
Required Adjustment to PAYG to Offset Bill Impact of CPI Switch Assuming Only New Post 2020 RCV Linked to CPI
(Relative to PR14 Value)

	PR19	PR24	PR29	PR34
“Typical” WaSC – water PAYG	-1%	-2%	-4%	-5%
“Typical” WaSC – sewerage PAYG	-1%	-3%	-5%	-6%
“Typical” WoC	-1%	-2%	-3%	-4%

Source: NERA calculations

Under Ofwat’s proposals, we calculate a required reduction of around 4 and 5 per cent in water and sewerage PAYG respectively for a “typical” WaSC to mitigate the impact on bills of CPI transition in PR19. The required adjustment approximately doubles over time, reflecting the need to further mitigate bill increases at the subsequent AMPs when the percentage of RCV linked to RPI reduces to zero. The equivalent required reduction in PAYG for a “typical” WOC is around 3 per cent in the first year, increasing to around double once full CPI indexation is achieved in 2030.

Under the alternative transition scenario where only new RCV post 2020 is linked to CPI, the required adjustments to PAYG are significantly lower compared to Ofwat’s transition scenario. This is because the profile of revenues under this transition option follows more closely the revenue profile under RPI indexation. The required reduction in PAYG for PR19 is around 1 per cent for both a “typical” WaSC and a “typical” WOC. The required adjustment increases over the subsequent AMPs, as the percentage of RCV linked to RPI falls.

5.1.3. Conclusions

Based on our modelling of a revenue neutral switch from RPI to CPI indexation under different transition options, we draw the following conclusions:

- The bill impact of transition options is greater the greater the proportion of RCV linked to CPI following the switch (absent adjustments to other regulatory parameters).
 - Ofwat’s proposals imply a one-off increase of around 3.5 per cent for a “typical” WASC and 2 per cent for a “typical” WOC in 2020 with further step-change increases of around 1 to 1.5 per cent in 2025 and 2030, as the proportion of RCV linked to RPI reduces to zero.
 - The alternative transition scenario where only new RCV post 2020 is linked to CPI matches the existing revenue profile under RPI indexation more closely. The impact on bills is minimal immediately following the switch, with k increasing gradually relative to the RPI indexation scenario before falling below k under RPI in the mid-2030s.
- The required PAYG adjustment to mitigate impact on bills is greater for the Ofwat proposed scenario, reflecting the greater impact of transition on customer bills under this option, compared to the transition option where only new RCV post 2020 is linked to CPI.

5.2. Modelling Results: Implications for Financeability

In this section, we set out the impact on financial metrics from implementing Ofwat’s proposals of linking 50% of the RCV to RPI and 50% to CPI at PR19 as well as a more gradual change where only new RCV post 2020 is linked to CPI whereas old RCV remains linked to RPI.

As in Section 4.3, we first present the impact on financial metrics of a revenue neutral switch under each transition option. We then consider the impact of risk. In all scenarios presented in this section, we assume companies mitigate the impact of the switch to CPI on customer bills via PAYG adjustments, as we understand this represents the most likely scenario.

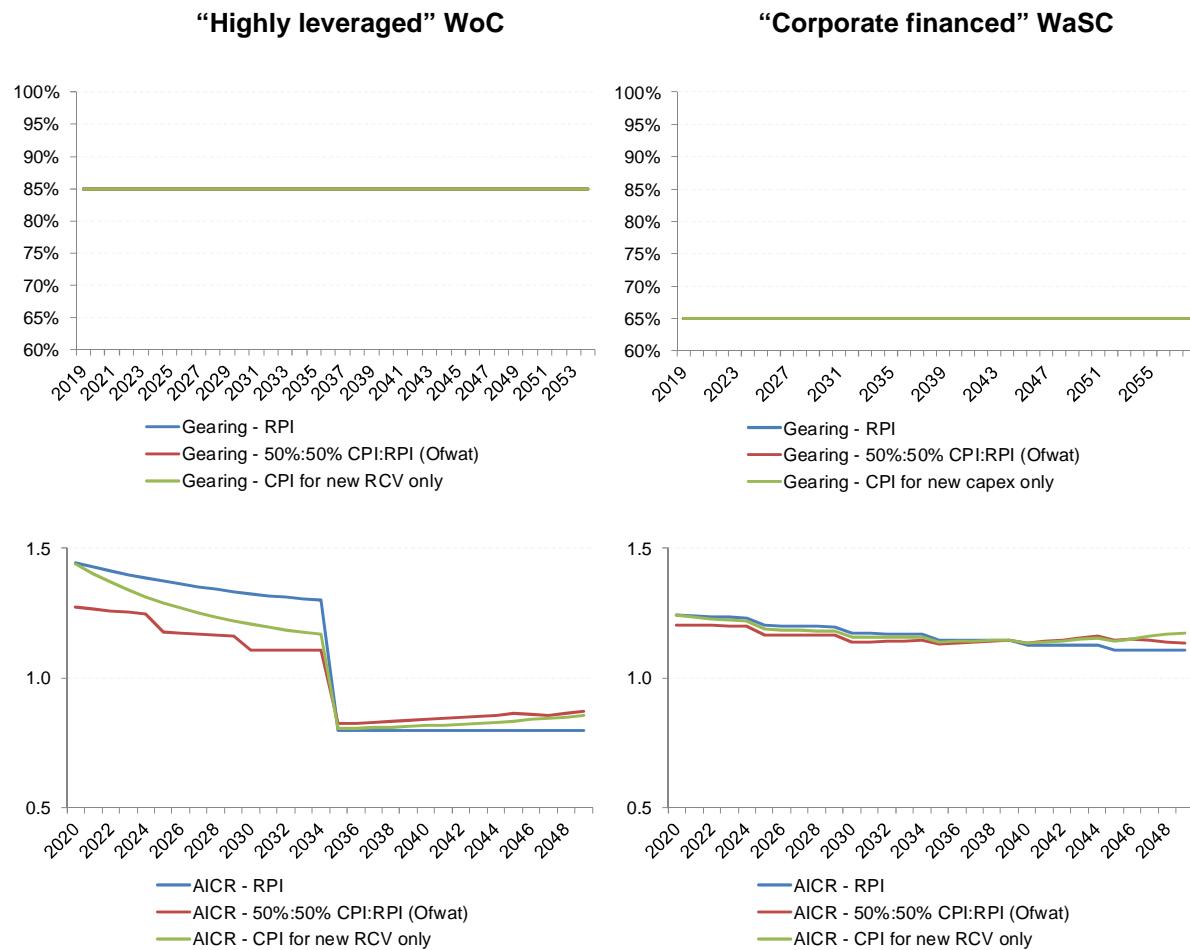
5.2.1. Base case impact on financeability

In this section, we present the financial metrics for our stylised “highly leveraged” WOC and “corporate financed” WaSC under the different transition options (see section 4.1 for definitions of our stylised companies).

As our base case, we assume a revenue neutral implementation of each transition scenario where Ofwat compensates companies for the expected difference between RPI and CPI inflation in the real allowed rate of return as well as in totex allowances (via real price effect adjustments). We further assume that companies mitigate the impact of the transition to CPI on customer bills via PAYG adjustments.

The impact on financial ratios under the different transition options is set out in Figure 5.2. The above assumptions are consistent with our modelling of the base case under Scenario 3 in section 4.3.1.

Figure 5.2
Scenario 3: Impact on Gearing and AICR under Transition Options, Assuming Companies Adjust PAYG to Eliminate Bill Increases from CPI Transition



Source: NERA modelling

As discussed in section 4.3, the PAYG adjustment used to mitigate bill impacts of the transition to CPI means revenues and cash flows are unchanged relative to the RPI framework. As explained in section 4.3, we have calculated AICR reflecting the true proportion of totex expensed within year, rather than the regulatory assumed PAYG (which has been artificially reduced to offset the effects of transition to CPI indexation).

The impact on financial ratios of different transition options can be summarised as follows:

- The AICR for our stylised “corporate-financed” WaSC deteriorates only marginally compared to the RPI framework. This reflects the fact that the PAYG adjustment restores the same revenues and cash-flow profile as under the original RPI framework (and our assumption to reflect the “true” PAYG when calculating AICR).
- The AICR for our stylised “highly leveraged” WOC (financed predominantly with ILD) deteriorates due to our approach of recognising the benefit of RPI accretion in the AICR only to the extent this is also matched by RCV linked to RPI. The deterioration is greater under Ofwat’s proposed scenario, as the proportion of RCV linked to RPI is lower compared to the option where only new RCV post 2020 is linked to CPI. The

“derecognised” benefit of total accretion is therefore greater under the Ofwat scenario which leads to a greater deterioration in the AICR.

In conclusion, even though cash-flows are unchanged relative to the RPI scenario, AICR can deteriorate for companies financed with high levels of index-linked debt, as our analysis shows.

In the next section, we discuss the impact on financial metrics under risk.

5.2.2. Risk analysis

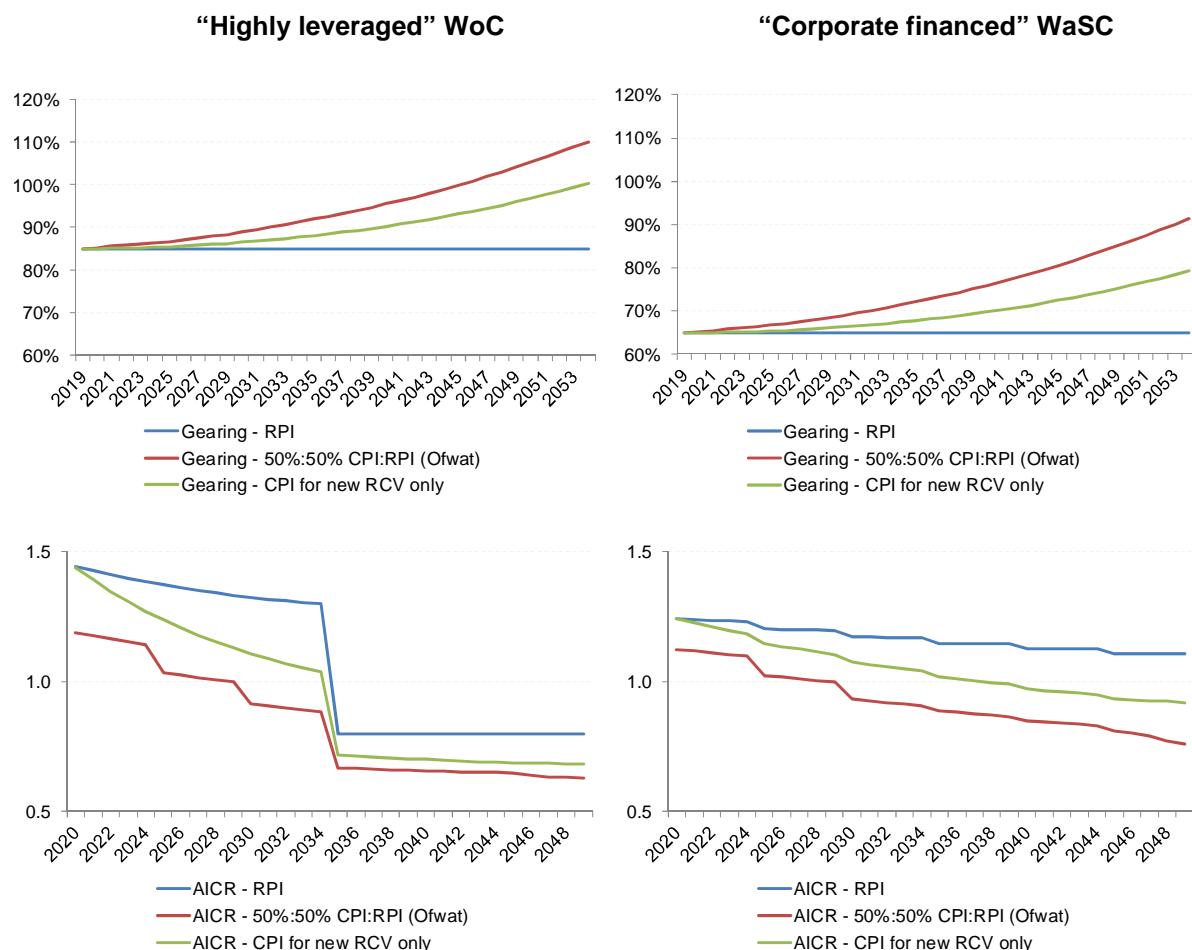
In this section, we present the impact on financial metrics of key risks highlighted by stakeholders as part of our interviews. As before, we divide key risks into two categories: regulatory and external risks.

Regulatory risk

As discussed in section 4.3.2, a number of investors highlighted regulatory risk as the key risk associated with the change in the indexation approach. Key sources of regulatory risk highlighted by stakeholders include pressure on Ofwat to alleviate bill impacts resulting in failure to recognise full difference between RPI and CPI in the real allowed rate of return (as well as totex allowances) and failure to allow recovery of additional costs arising as a result of the switch (for example additional hedging costs, and/ or the additional costs from issuing corporate CPI ILD in an illiquid market). In such an event, the switch to CPI indexation would no longer be revenue and value neutral in NPV terms as investors would no longer have the expectation to earn the same nominal WACC as under the RPI framework.

We model the impact on financial ratios under different transition options, but assuming Ofwat only allows 50% of the RPI-CPI wedge in the new real allowed rate of return, whereas actual dividends (and cost of debt) reflect the full wedge (corresponds to Scenario 4 presented in section 4.3.2). As with other scenarios, we also assume companies mitigate the impact of the transition to CPI on customer bills via PAYG adjustments. The results are shown in Figure 5.3 below.

Figure 5.3
Impact on Gearing and AICR, Assuming Ofwat Only Allows 50% of RPI-CPI Wedge and Companies Adjust PAYG to eliminate Bill Increases from CPI Transition



Source: NERA modelling

Ofwat not recognising the full wedge in the new real allowed rate of return under transition to CPI indexation would result in a rapid increase in gearing and deterioration in the AICR. (We assume dividends and cost of debt reflect the full wedge and therefore the unfunded amounts need to be covered via issuance of new debt.) As discussed in section 4.3.2, such gearing levels are not realistic in practice and companies would have to significantly reduce dividends early on to cover the unfunded amounts, leading to value destruction for equity investors.

The impact of regulatory risk of Ofwat not allowing the full RPI – CPI wedge is smaller the lower the percentage of RCV linked to the new real CPI WACC. As a result, the deterioration in credit metrics and gearing is greater for the Ofwat proposed transition scenario compared to the alternative where only new RCV post 2020 is linked to CPI.

In the next section, we discuss the impact on credit metrics of external risk.

External risk

In the previous section, we have discussed the impact of regulatory risk on financial metrics, where the risks considered meant that the switch to CPI indexation would not be revenue or value neutral in expectations. A further material source of risk highlighted by stakeholders from switching to a CPI regime lies in breaking the natural hedge between the RPI indexation of the RCV and RPI index linked debt. Even if investors are compensated for the expected difference between RPI and CPI inflation, variation in the outturn RPI-CPI wedge will expose companies to additional risks under the CPI regime, given that their revenues will be linked to one inflation measure (CPI) but their costs will be linked to another measure (RPI).

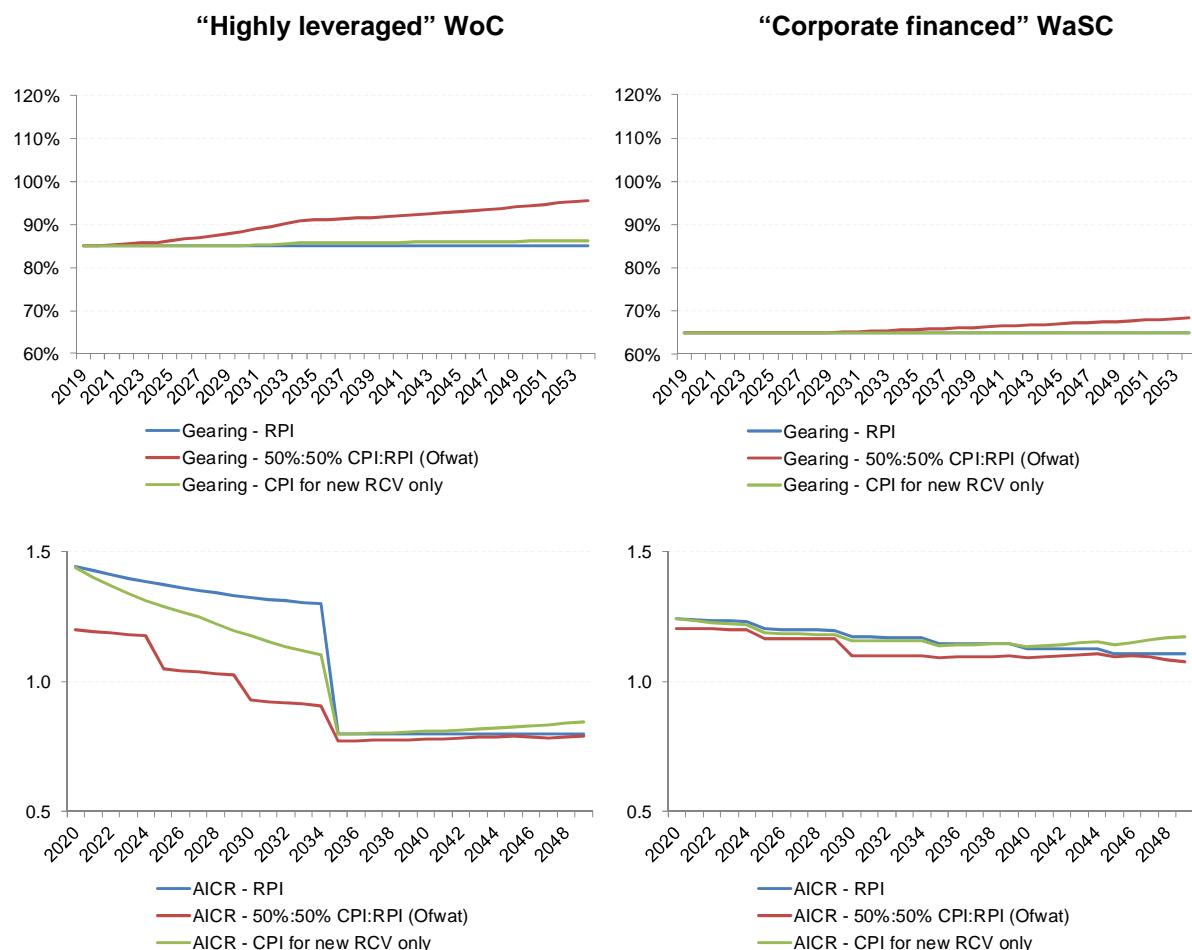
In Figure 4.9 below, we show the impact on financial ratios assuming the CPI-RPI wedge increases in line with the 5th percentile, or 85 bps above allowance (as per Scenario 5 in section 4.3.2). As before, we also assume companies mitigate the impact of CPI transition on customer bills via PAYG adjustments.

We model the impact of the increase in wedge, taking into account Ofwat's proposals to true-up for "*any deviation of the actual RPI/CPI differential from that forecast at the start of the regulatory period (for the RPI linked part of RCV)*"⁵³. Ofwat has not specified the method for trueing up ex-post deviations in the RPI-CPI wedge. For simplicity, we assume the 85bps increase in the wedge only affects companies to the extent where actual proportion of RCV financed with ILD exceeds the proportion of RCV linked to RPI in a given year. This effectively assumes an immediate true-up and may therefore overstate the benefit of Ofwat's intended protection, given that true-ups are likely to be implemented only at the review with companies exposed to intra-period cash-flow risk.

⁵³ Ofwat (December 2015), op. cit., p.127.

Figure 5.4

Scenario 5: Impact on Gearing and AICR, Assuming RPI – CPI Wedge Based on 5th Percentile (85 bps Above Allowance) and Companies Adjust PAYG to Eliminate Bill Increases from CPI Transition



Source: NERA modelling

Our modelling shows that the impact of outturn deviations in the RPI – CPI wedge on companies’ credit metrics depends significantly on the amount of ILD in the capital structure compared to the percentage of RCV linked to RPI under each transition option.

- The results for our stylised “corporate financed” WaSC with a relatively small share of ILD show that Ofwat’s proposed transition scenario leads to a moderate deterioration in AICR for the first two AMPs (assuming true-up is implemented correctly). There is a more significant deterioration following 2030, where we assume 0 per cent of the RCV is linked to RPI whereas the stylised company still continues to be financed with around 15% of ILD. The transition scenario where only new RCV post 2020 is linked to CPI provides a better hedge for the long-dated ILD and prevents a deterioration in the AICR even in the long-run.
- The results for the stylised “highly leveraged” WoC with a large proportion of ILD in its financial structure show that Ofwat’s proposals lead to a significant deterioration in the

AICR and gearing already from the first AMP, as the percentage of RCV linked to RPI (post true-up) is lower than the stylised company's share of RCV funded with ILD.

- The transition scenario where only new RCV post 2020 is linked to CPI provides a better hedge for companies funded with high proportion of ILD, as evident from only a small deterioration in gearing over time for our stylised “highly leveraged” WOC. The AICR under this scenario nevertheless worsens over time. This result is driven by our approach of recognising the benefit of RPI accretion in the AICR only to the extent this is also matched by RCV linked to RPI. The deterioration is therefore the result of a decreasing proportion of RCV linked to RPI over time and not an increase in gearing.

5.3. Conclusions

Our modelling shows that under the transitional options, customers' bills may increase by around 4-7% relative to RPI indexation over the next three AMPs. The increase in customer bills under where RCV additions are indexed by CPI is indiscernible relative to RPI change.

Companies' financial metrics may deteriorate slightly where the revenue impact from CPI indexation is offset by PAYG, and rating agencies recognise only CPI accretion in calculating cash-interest.

Companies' financial ratios may deteriorate sharply where Ofwat does not recognise the full RPI-CPI wedge, and/or additional financing costs, under its preferred scenario. There is also material risk where there is sustained increase in RPI-CPI wedge relative to expectations. In general, the risks are greater the greater the proportion of ILD. The risks are mitigated under the option where RCV additions from 2020 are indexed by CPI.

6. Evidence on Future Financing Costs Under CPI

6.1. Evidence on Development of CPI Gilts Market

The investors we interviewed told us that the prospects for the development of an efficient CPI ILD market for corporate debt issuance will depend in large part on UK government decisions over the issuance of CPI-linked sovereign debt. The UK Treasury has been the dominant issuer on the RPI-linked debt market,⁵⁴ with its issuance key to creating a pool that provides liquidity; ILG prices are typically used as a benchmark in pricing corporate RPI-linked debt.

In this section, we briefly consider the prospects for the development of a CPI gilts market, drawing on recent DMO publications and other evidence, as well as a discussion with the DMO as part of evidence-gathering for this study.

6.1.1. The DMO has made no firm decision

The Treasury has not set out any firm plans to issue any CPI (or CPIH)-linked sovereign debt. In 2011 the Treasury's Debt Management Office (DMO), following a public consultation, decided against moving towards issuance at that time, based on three concerns:⁵⁵

- 1) demand for CPI-linked gilts is not deep or sustainable enough;
- 2) the composition of the CPI index is subject to changes, which makes the valuation of any CPI-linked products difficult;
- 3) there is a non-trivial risk of lowered liquidity for both RPI and CPI-linked gilts caused by market fragmentation.

While the uncertainty around CPI composition is expected to resolve in early 2016⁵⁶, latest comments from the DMO and credit rating agencies suggest that the other concerns remain relevant factors.

Specifically, according to latest statements from the DMO office, CPI-linked gilts appear not to be on the current agenda. For example, in a 2014 interview the DMO chief executive said there would be no concrete plans for CPI-linked debt until the demand base became stronger.⁵⁷ Similarly, in minutes from the DMO's meeting in early 2015, DMO reports that

⁵⁴ UK Treasury accounts for more than 85% of outstanding RPI-linked debt.

⁵⁵ DMO (2011), CPI-linked gilts: response to consultation.

⁵⁶ Moody's (January 2016), Redefining real: adoption of CPI will transform index-linked debt market, raise risks for regulated sectors, p.5.

⁵⁷ See <http://www.ipe.com/countries/uk/uk-debt-management-office-concedes-growing-case-for-cpi-issuance/10006366.fullarticle>

growth of CPI linkage in pensions would increase the case for launching CPI-linked gilts, but investors see no pressing case.⁵⁸

The DMO has a primary objective of ensuring the long-term low cost of UK government financing. In contemplating the contribution that new CPI-linked instruments might make to this objective, we expect the DMO to be cautious until such time as the status of CPIH is clear along with the size of the associated demand for CPI-linked ILD. Both are necessary to allow the DMO to approach issuance in a systematic way, involving substantial issues repeated year by year linked to a measure that is not subject to change, to promote liquidity and lower risks for investors, with low financing costs for the government in turn.

At the time of writing, and as set out in section 2, there is still uncertainty about CPIH's status as an index and about its legal backing and its formal use as a headline inflation measure in the UK. This uncertainty may largely resolve over the next few years. We expect the DMO to wait until the UKSA has made its recommendations about inflation measures and until the government has considered these and decided on the appropriate roles for CPI and CPIH. At that stage it may be timely for the DMO to consider CPI- or CPIH- linked issuance more fully once again, following its own due process of consultation with investors and others for what could amount to a substantial change in its offerings.

6.1.2. The level of demand for CPI products is uncertain

In 2011, the DMO concluded that the demand for CPI related products was not sufficiently deep or sustainable. The DMO set out that the largest potential investor group for CPI-linked gilts is likely to come from the Liability-Driven-Investment made by Defined Benefit pension schemes, which seek to match the characteristics of their liabilities with specific investments. However the DMO estimated that only around one-third of scheme liabilities are linked to CPI while the remaining majority are still linked to RPI.⁵⁹

However, more recent estimates suggested that the demand for CPI related products might have increased since 2011. The Pension Protection Fund (PPF) concluded that 80% of schemes have adopted CPI for pre-retirement increases in benefits, and 30% for post-retirement increases, indicating greater potential demand.⁶⁰ Indeed, Moody's recently concluded that there was "significant unfulfilled demand for CPI-linked assets."⁶¹

6.1.3. There is a non-trivial risk of market fragmentation

The potential fragmentation of the index-linked market remains a concern that acts as a deterrent of the introduction of CPI-linked gilts. For example, Moody's shows in their latest

⁵⁸ DMO (January 2015), Minutes of meeting with gilt investors in Scotland on 23 January 2015. Link: <http://www.dmo.gov.uk/documentview.aspx?docName=/gilts/press/sa260115.pdf>

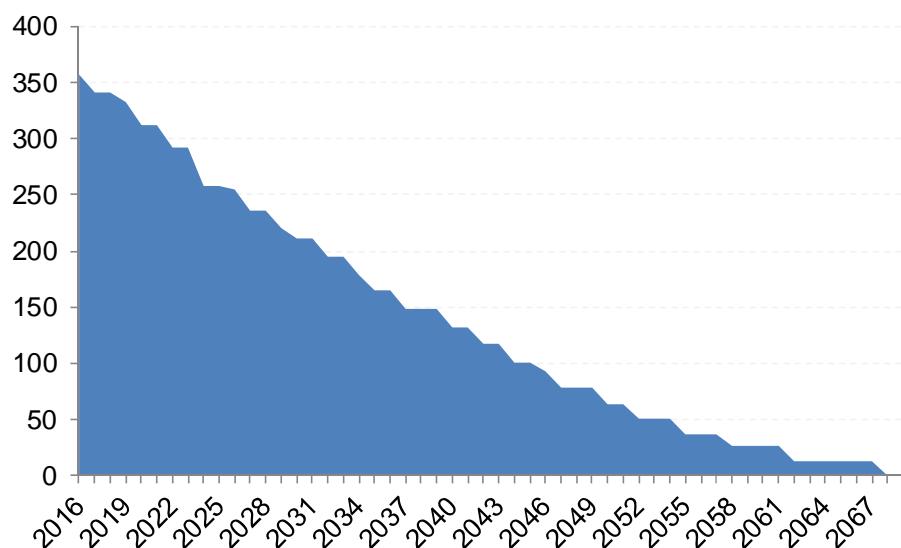
⁵⁹ DMO (2011), CPI-linked gilts: response to consultation, p. 9.

⁶⁰ Pension Protection Fund (October 2013), Long-Term Funding Strategy Update, p.14. Link: http://www.pensionprotectionfund.org.uk/DocumentLibrary/Documents/Funding_Strategy_Review_2013.pdf

⁶¹ Moody's (January 2016), Redefining real: adoption of CPI will transform index-linked debt market, raise risks for regulated sectors, p.4.

report that the existing stock in RPI-linked gilts will not fully mature until 2068 (see Figure 6.1).⁶² The evidence below suggests that even if a potential market for CPI-linked gilts were to develop, CPI-linked debt would compete with the alternative RPI –linked investment vehicles for decades (in the absence of a very unlikely wholesale swap of RPI for CPI). Thus, the development of CPI-linked assets would fragment the index related product market, cause potential illiquidity to both CPI and RPI products; and increase costs. Fragmentation remains a clear obstacle in any decision to issue CPI gilts.

Figure 6.1
Maturity Profile of RPI-linked Gilts (£ billion, current prices)



Source: NERA analysis of Debt Management Office data

6.1.4. We estimate it could take 20 years for CPI gilt market to fully develop

Our analysis of the DMO data shows that the weighted average maturity of existing RPI-linked gilt is c.19 years. This implies implies that if CPI IL gilts were issued from now on to refinance maturing RPI IL gilts, it will take around 20 years to reach 50% share of the overall IL gilt market, assuming no incremental issue or buy-back of RPI debt.

Historical evidence from the RPI IL gilt market indicates that it takes a long time for a new index-linked instrument to reach a high level of liquidity. A study from the DMO⁶³ shows the historical evolution of liquidity premium of RPI gilts (definition explained in more detail in section 6.2).⁶⁴

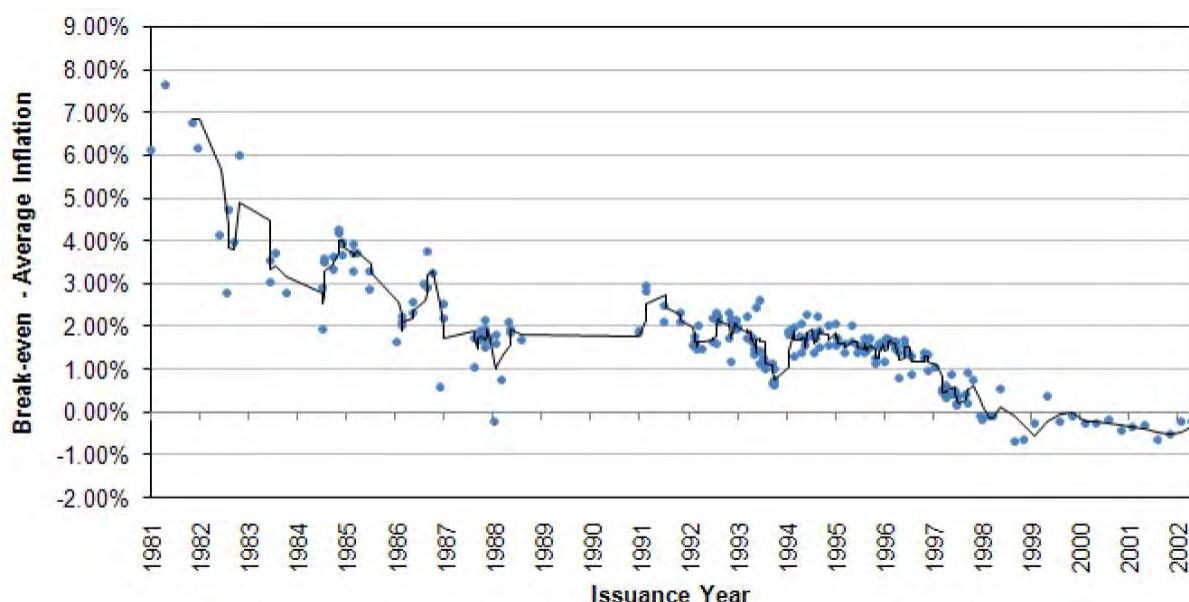
⁶² Moody's (January 2016), Redefining real: adoption of CPI will transform index-linked debt market, raise risks for regulated sectors, p.5.

⁶³ DMO (October 2012), Assessing the cost effectiveness of index-linked bond issuance, p.5. Link: <http://www.dmo.gov.uk/docs/research/IL%20Cost%20effectiveness.pdf>

⁶⁴ Theoretically, the difference is driven by the offsetting effects of two components – liquidity premium and inflation premium. In other words, assuming a constant inflation premium, the higher the liquidity premium, the higher the

As shown in the chart below, the illiquidity premium reduced significantly from 1981 (when RPI gilt was first introduced) to 1998 and remained relatively stable thereafter. This suggests that it took RPI-index gilt as long as 17 years to reach a high level of liquidity.

Figure 6.2
Spread Between Break-even Inflation at Issue and Average Inflation Over the Life of Each Tranche of Index-linked Gilt Issuance from 1981-2001



Source: DMO (October 2012), *Assessing the cost effectiveness of index-linked bond issuance*, p.5.

Based on the evidence above, we conclude that for CPI IL gilts to mature to the level observed in the RPI IL gilt market could take around 20 years from the time of a DMO decision to issue CPI IL gilts.

6.2. Evidence on Costs of Future CPI Corporate Issues

In this section, we consider the potential costs associated with any future CPI ILD issuance by water companies, and or CPI derivatives (e.g. a CPI-RPI swap). Potential illiquidity of the CPI-linked debt market would lead to higher financing costs for water companies, which plan to issue CPI-linked bonds to match their CPI-linked revenue profile.

It is well documented in the financial literature that investors require additional returns for investing in a security that cannot easily be turned into cash, referred to as the “liquidity premium”.⁶⁵ Although market evidence for the liquidity premium of CPI-linked debt is thin due to the limited number of issues in the UK, we produce indicative estimates drawing on other CPI-linked instruments.

difference between break-even and outturn inflation will be. See: DMO (October 2012), *Assessing the cost effectiveness of index-linked bond issuance*, <http://www.dmo.gov.uk/docs/research/IL%20Cost%20effectiveness.pdf>, p.3

⁶⁵ See for example, Brealey and Myers (2011), *Principles of Corporate Finance*.

Specifically, a 2011 report by Pension Insurance Corporation stated that although developing, liquidity in the CPI swap market is low and hence transaction costs are high.⁶⁶ It noted that bid-ask spreads quoted by banks on 20 and 30-year CPI swaps tend to be around 20 bps, compared to just 5 bps for RPI swaps of the same maturities, which implies a 15 bps liquidity premium for CPI swaps over RPI swaps. Other evidence suggests higher liquidity premia. For example, the Bank of England has calculated the historical evolution of liquidity premium of RPI-linked gilts relative to nominal gilts. As Figure 6.3 shows, although the premium was stable around 20-30 bps for the majority of the period since 2009, it escalated to 80 bps (10-year maturity) during the financial crisis, when liquidity for index-linked bonds dropped significantly due to funding constraints, flight-to-quality effects towards conventional gilts and the unwinding of derivative positions by institutional investors.⁶⁷ This implies that the liquidity premium of a less liquid index-linked market (e.g. RPI-linked debt market as in 2008) could be as high as 80 bps which may be indicative of potential liquidity premium of a nascent CPI-linked debt market.

Figure 6.3
Liquidity Premium for RPI-linked Gilts at 5 and 10 year Maturity



Source: Bank of England

Note: The figure shows the liquidity premium of nominal gilts over ILD, hence negative.

In addition to the liquidity premium, debt issuance costs could also be higher for illiquid instruments due to the lack of price transparency and difficulties in identifying and matching

⁶⁶ Pension Insurance Corporation (2011), UK final salary pension schemes: Inflation hedging and the change in indexation from RPI to CPI, p.10.

⁶⁷ Bank of England (2015), The informational content of market-based measures of inflation expectations derived from government bonds and inflation swaps in the United Kingdom, p.13.

counter-parties. For example, Damodaran found that investment banks normally charge higher fees to firms with less liquid offerings.⁶⁸

To conclude, the evidence on RPI-CPI swaps suggests a premium of around 15 bps, plus additional transaction costs. Evidence from RPI ILD market suggests illiquidity premium increased to around 80 bps during the financial crisis (when market liquidity declined), which may be reflective of a premium for an illiquid CPI market.

In addition, as identified through our discussions with investors, RPI-CPI swaps hedge CPI risk imperfectly, to the extent that:

1. RPI-CPI swaps have short tenors, which exposes companies to re-financing risk.
2. Swaps also typically include break clauses and accretion clauses, exposing companies to further risk.
3. Any derivative positions expose companies to counterparty risk, which has negative impact on credit rating.

⁶⁸ Damodaran (2011), Damodaran on Valuation: Security Analysis for Investment and Corporate Finance

7. Relative Merits of CPI and RPI in Compensating Companies for Cost Changes

In this section we assess how closely CPI and RPI indices track water companies' actual costs, and therefore whether CPI or RPI indexation provides better prospects for companies to recover costs.

In simulating water companies' costs, we have focused on the costs for three major input categories – labour, materials and construction. We have selected individual indices that likely provide the most robust estimation for the price of the three inputs, drawing on regulatory precedent from the UK water and energy industry. Specifically, we have selected:

- The ONS's "Private Sector Average Wage Earnings (AWE)" index as a proxy for labour costs. This index covers all industries within the private sector and has been widely used by GB regulators in setting RPE allowances as a measure of general wage costs.
- The BIS's "Resource Cost Index: Infrastructure Materials (FOCOS)" index as a proxy for materials costs. FOCOS index is used by the CMA, and Ofgem in setting RPE allowances as a measure of materials costs. We consider this index also relevant for water companies' materials costs.
- The ONS's "Construction Output Price Index: COPI" index as a proxy for construction costs. COPI had been used by Ofwat in indexing water companies' capital expenditure before Ofwat switched to use RPI to index both opex and capex (i.e. totex) in PR14.

We have calculated and compared the correlation between CPI and the three input price indices with that between RPI and the indices based on annual data from 2000 onwards. Table 7.1 shows that RPI has a higher correlation with each one of these indices than CPI, although both RPI and CPI have a negative correlation with COPI. In relation to labour wage growth, the analysis suggests that wage settlements continue to be more closely linked to RPI than CPI.

Overall, the analysis suggests that CPI indexation is less likely to match water companies' costs than RPI. The analysis suggests that the adoption of CPI indexation would require Ofwat to incorporate real price effects (RPEs) within totex forecasts, to ensure that companies were compensated for actual costs. Until now, Ofwat has not systematically allowed for RPE adjustments in determining totex forecasts and setting allowed revenues.

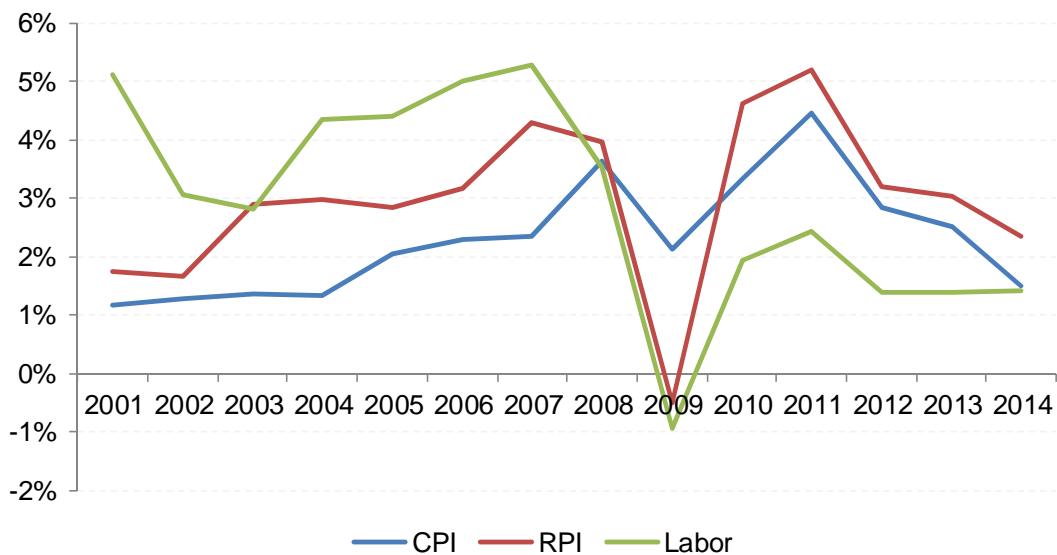
Table 7.1
Correlation between CPI/RPI and Water Companies' Input Costs

	Labour AWE index	Materials FOCOS index	Construction COPI index
CPI	-0.20	0.38	-0.55
RPI	0.37	0.59	-0.07

Source: NERA analysis of price indices published by the ONS and the BIS

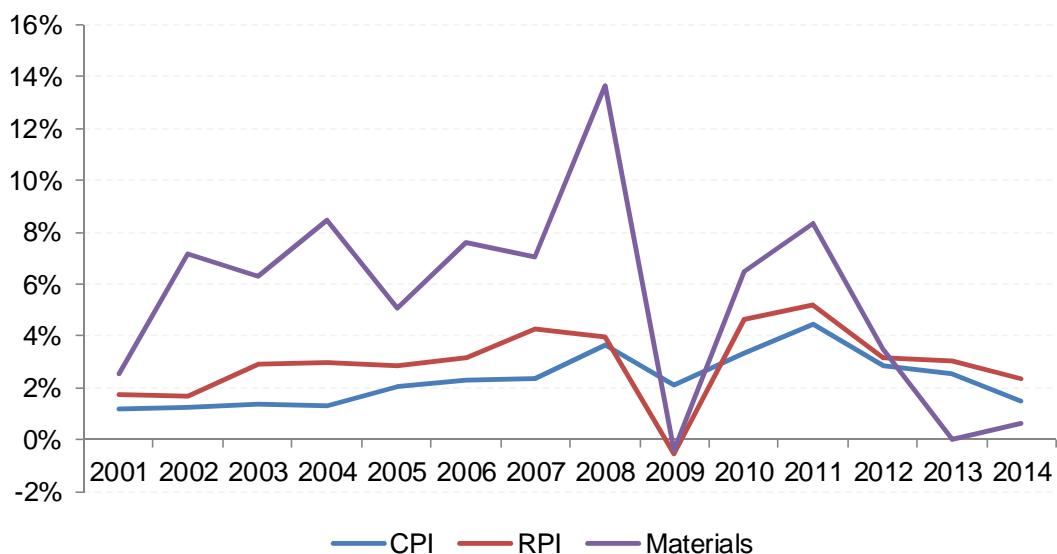
Figure 7.1, Figure 7.2 and Figure 7.3 show the historical changes in CPI/RPI index relative to individual input price indices. Consistent with the correlations above, the graphs show that RPI tends to track input prices more closely than CPI.

Figure 7.1
Annual Index Change - CPI, RPI and Labour index



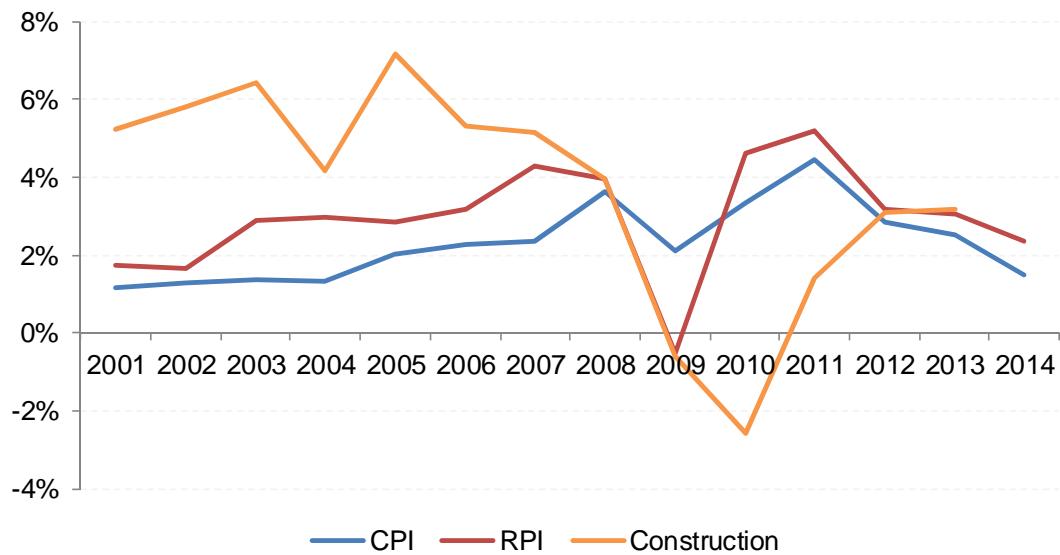
Source: NERA analysis of price indices published by the ONS and the BIS

Figure 7.2
Annual Index Change - CPI, RPI and Materials index



Source: NERA analysis of price indices published by the ONS and the BIS

Figure 7.3
Annual Index Change - CPI, RPI and Construction index



Source: NERA analysis of price indices published by the ONS and the BIS

8. Evaluation of Options

8.1. Evaluation

We evaluate the options from a customer's perspective against the following criteria: i) the overall impact on companies cost, and allowed revenues and bills; ii) incidence effects; iii) bill volatility; iv) inter-generational equity; and, v) legitimacy.

Companies are likely to face an increase in financing costs under a CPI framework

From our interviews with investors and our financial modelling, we have identified a number of pressures on companies' costs which will put upward pressure on allowed revenues and customers' bills. We expect companies with a material exposure to RPI ILD may need to hedge using CPI derivatives to offset basis risk, as established in our investor interviews, and acknowledged by Ofwat in its consultation. Our discussions with investors suggest that CPI related products provide an imperfect hedge, and the empirical research indicates a premium of around 15 bps (in addition to the hedge cost) for such products.

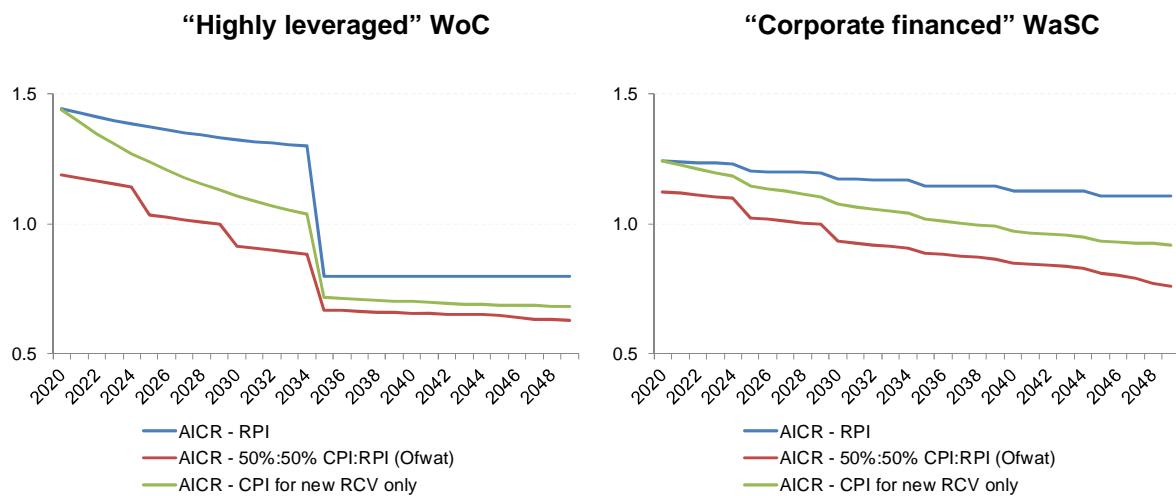
Our discussions with investors suggest that a liquid corporate CPI ILD market is unlikely to develop in the absence of the development of UK CPI ILD market, and the DMO reports investors see no pressing case. Companies may face higher debt costs where they continue to issue RPI ILD under a CPI regime given the basis risk, or issue less efficient CPI ILD. Empirical evidence suggests that any liquidity premium could be of the order of 80 bps, based on observed premium for RPI ILD where liquidity has been low.

Our modelling of financial ratios shows that there will be a deterioration in key credit metrics (e.g. AICR) where the revenue impact is offset through PAYG (as Ofwat intends), even if any change is implemented in a value neutral way. However, if Ofwat does not implement the change in a value neutral way, e.g. it fails to reflect the full RPI-CPI wedge in setting a CPI based allowed return, does not compensate companies for increased financing costs, and/or allow for higher CPI based totex allowances, financial ratios can deteriorate sharply.

These factors suggest that companies' financing costs will increase under CPI indexation. Alternatively, if companies are kept whole, our analysis suggests that customers' bills could increase by around 2% (based on an assumed 50 bps increase in debt costs).

Our analysis shows that the effects and risks are greatest under a full CPI switch (ranked worst), and material under Ofwat's proposed transitional arrangements. The effects and risks are moderated where new RCV additions are indexed to CPI, as the existing RCV indexed by RPI continues to provide a hedge for existing RPI ILD. There should be relatively low risk around option 2 – dual indexation – although there is risk around the conduct of the true-up. As a result, we rank option 2, and the least cost transitional option (CPI applied to RCV additions only), the same in our evaluation. The retention of the status quo implies the lowest cost risk, as we rank first under this criterion.

Figure 8.1
Of the Transitional Options, Companies Face Greater Risk (as Modelled Through Financial Ratios) under Ofwat's Preferred Option⁶⁹



Source: NERA modelling

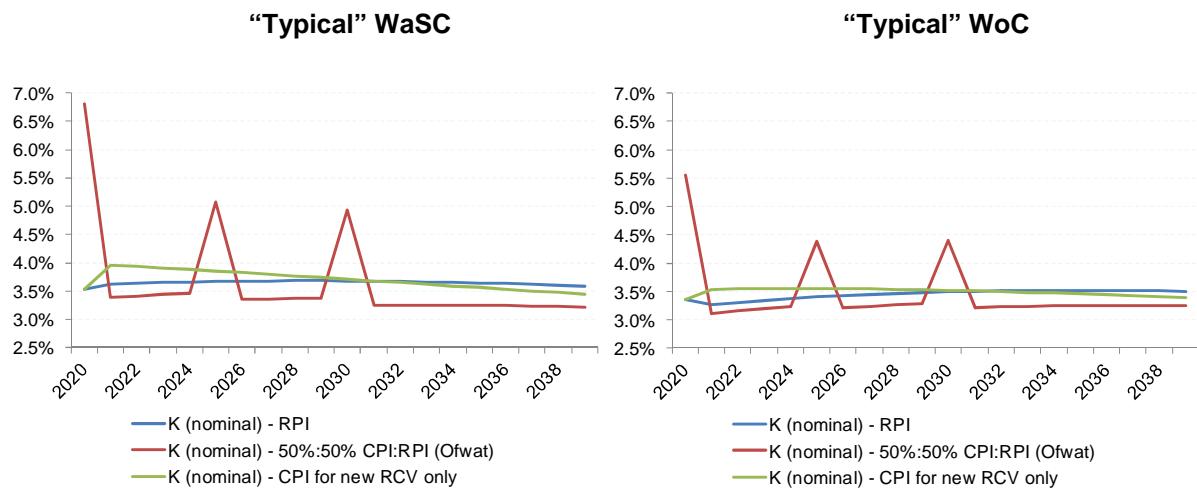
Incidence effects: bills will increase by around 4-7% under full CPI implementation

Our analysis shows that customer bills will increase by between 4 and 7 per cent under a full CPI switch at 2020 (which we therefore rank 5th), and by approximately this amount over the 15 year period under Ofwat's transitional arrangements. The effect is moderated where CPI indexation is applied to new RCV additions only and indiscernible from the status quo.

To offset these effects, Ofwat raises the prospect of adjusting companies' PAYG ratios. Our analysis shows that PAYG ratios would need to be reduced by around 8 to 10 per cent. However, this option is not necessarily costless: rating agencies have noted that pressure to offset bill increases could erode confidence in the regulatory framework, and increase financing costs. Investors have also noted that regulatory mechanisms that shift revenues over time and lead to mismatches between capitalisation rates and true proportions of opex and capex rates will likely increase perceptions of regulatory risk in the sector.

⁶⁹ Figure 8.1 shows the impact on financial ratios under different transition options assuming Ofwat only allows 50% of the RPI-CPI wedge in the new real allowed rate of return, whereas actual dividends (and cost of debt) reflect the full wedge. We also assume companies mitigate the impact of the transition to CPI on customer bills via PAYG adjustments, as we understand this represents the most likely scenario.

Figure 8.2
Impact on Revenues and k (Nominal) of Transition Options



Source: NERA modelling

Bill volatility will depend on implementation, e.g. around transition period, and PAYG

Bill volatility will depend on implementation of the proposals, the transition period and other adjustments to the regulatory methodology to accommodate this change e.g. how companies' PAYG ratios are adjusted.

In principle, there are two offsetting impacts of the shift to CPI on bill volatility. First, a shift to CPI (even with a transition period) will lead to immediate spikes in bills if applied without adjustments to PAYG ratios. Second, based on evidence that CPI is less volatile than RPI historically, indexation using CPI could reduce the volatility of customers' bills over the longer term. However, any reduction in bill volatility from a shift to CPI from RPI is likely to be relatively small, and could be achieved through other less costly means, e.g. within period smoothing mechanisms.

Based on the above, we therefore do not consider that there are clear grounds to distinguish these options based on bill volatility.

The impact on inter-generational equity is unclear

The ONS considers that CPI is an improved measure of general price inflation relative to RPI. On this basis, we may consider that indexation CPI results in greater fairness over time. However, intergenerational equity requires that costs are borne equitably over time, and our analysis suggests that RPI is a better measure of companies' costs relative to CPI. If Ofwat were to switch to a CPI regime, it would be necessary to incorporate real price effects (RPE) adjustments into forecast totex allowances to allow companies to recover expected nominal input prices. Therefore, it is not clear that CPI provides an advantage compared to RPI, and we rank the options identically on this criterion.

CPI is a more legitimate measure of inflation than RPI

As cited by Ofwat, UKSA's decision to cancel the designation of RPI as a national statistic, and a UKSA commissioned report that recommended that Government and regulators should work towards ending the use of RPI as soon as practicable given concerns about its robustness, implies that CPI has greater legitimacy than RPI.⁷⁰ Ofwat also considers that there is greater common acceptance of CPI relative to RPI in other areas, such as the Bank of England's Monetary Policy Committee target, and recent changes by some economic regulators to use CPI.

In terms of options, those that realise the transition to full CPI the earliest score best on legitimacy criterion. In relation to option 2 –dual indexation – on the face of it, the option addresses legitimacy by linking headline changes in prices to CPI but fundamentally relies on RPI. We therefore rank this option below the transitional options on this criterion.

8.2. Overall Evaluation

Table 8.1 summarises our evaluation.

As set out, based on our discussions with investors and modelling, we expect companies' risks and financing costs will increase under Ofwat's proposed switch to CPI, which could eventually feed into higher customers' bills. By contrast, the principal argument in support of any change is the greater legitimacy of CPI as a measure of general price inflation. Thus, any decision on the approach to indexation needs to strike a balance between the prospective costs and legitimacy of the index.

From an investor perspective, the investors we spoke to understand the changes could be designed to be *revenue* neutral for companies, but perceive that Ofwat will not compensate companies for any additional financing costs, and will therefore not be *value* neutrality. As a consequence, there is general support for the retention of current arrangements, at least until there is a clear understanding of the development of a liquid government led CPI IL gilts market which could take some time.⁷¹ The impetus is on the UK Treasury to lead any transition, and only then for Ofwat to follow once an efficient CPI gilt market is established.

If Ofwat proceeds with any change, Ofwat could seek to address concerns about financing costs by acknowledging differences in companies' capital structures to allow companies with high levels of RPI ILD to transition over an extended period, to minimise the mis-match between long-dated RPI ILD and CPI indexation, and to therefore minimise increases in costs. For similar reasons, many investors considered that any transition should involve indexing the 2020 RCV by RPI, with new RCV additions only subject to CPI. Investors also considered that Ofwat should provide a clear path, given the long-term nature of financing decisions.

⁷⁰ Johnson, P. (2015), UK Consumer Price Statistics: A review. Accessed here: https://www.statisticsauthority.gov.uk/wp-content/uploads/2015/12/images-ukconsumerpricestatisticsarevie_tcm97-44345.pdf

⁷¹ For example, our analysis of RPI ILD gilt market suggests that it took around twenty years to achieve volumes such that liquidity premium was negligible. (See section 6.2.)

Table 8.1
We Rank the Options Under the Different Criteria on a Scale of 1 to 5
(Where 1 is Best)

Option	Overall cost to companies/ customers	Incidence effects	Bill volatility	Intergen. equity	Legitimacy
Status Quo	1	1			5
Dual indexation	=2	=2			4
New RCV additions only	=2	=2	<i>We cannot clearly distinguish the options for these criteria</i>		3
Ofwat proposal (50:50)	4	4			2
Full CPI switch	5	5			1

Appendix A. Investor Survey Template

Water UK, the trade association for the water and sewerage service companies in England and Wales, has commissioned NERA Economic Consulting (NERA) to undertake an independent study of the implications of a change to the index used in setting price controls. It is intended that NERA's report will be published in Ofwat's "market place of ideas"⁷² as a contribution to Ofwat's Water 2020 programme. Under Water 2020, Ofwat is consulting on the regulatory framework for wholesale markets and the 2019 price control review, including the form of indexation of the price control.⁷³

As part of its investigation NERA is interviewing a number of water and sewerage companies and a number of parties from the investment community, of whom you are one. **All responses during our discussion will be kept confidential to NERA alone, unless the interviewee specifically authorises anonymous or attributed citation.**

The questions follow immediately. We provide Ofwat's Water 2020 consultation as an accompanying document for ease of reference.

- Q1. Date & location of interview.*
- Q2. Interviewees and NERA interviewers' names.*
- Q3. Code: Fully confidential only; Anonymous citation agreed; Attributed citation agreed.*

Ofwat's Proposals and Questions for Interviewees

Summary of Ofwat's proposals

In its recent December consultation, Ofwat proposed to change its approach to allowing for inflation in setting allowed revenues. In particular, it proposed to use CPI or alternatively CPIH, rather than RPI, for indexing both the RCV and allowed revenues (and therefore prices).

In its consultation, Ofwat sets out a number of policy options varying as to the extent of CPI indexation (whether applied to prices or to both prices and RCV), and any transitional arrangements. We describe the options in more detail below. Ofwat's preferred option is to apply a transition mechanism that applies CPI to allowed revenues, but allows for half of the RCV to be indexed by RPI for PR19 (i.e. from 2020-25) with the other half subject to CPI indexation. Ofwat explains that:⁷⁴ *Under our notional capital structure, this is equivalent to indexing all existing embedded debt by RPI with the remaining RCV accounted for by new debt and equity. This will provide time for existing RPI linked debt to unwind."*

⁷² Ofwat has encouraged a "market place of ideas" inviting views from companies and other stakeholders on how the sector should develop. See for example, Ofwat (July 2015) Towards 2020 – policy issues: promoting markets. Link: http://www.ofwat.gov.uk/wp-content/uploads/2015/11/pap_tec201507markets.pdf

⁷³ Ofwat (December 2015) Water 2020: Regulatory framework for wholesale markets and the 2019 price control review. Link: <http://www.ofwat.gov.uk/consultation/water-2020-consultation/>

⁷⁴ Ofwat (December 2015) op. cit., p.8

Beyond 2025, Ofwat states that its intention is to reduce the RPI indexation of the RCV (from the 50/50 RPI/CPI split in 2020-25) as the proportion of existing embedded debt reduces over time and taking account of the development of CPI linked debt markets.⁷⁵

Q4: How well aware were you of Ofwat's proposed change to indexation?

Implications for revenue profiles, and regulatory commitment to value neutrality

Ofwat sets allowed prices in the water sector by compensating investors for the effects of inflation through indexing the RCV by RPI, and consistent with this, setting an allowed return (based on WACC) on a real basis, deflated from observed nominal values using RPI. At review, Ofwat defines the annual price cap in real terms from which nominal charges are derived using RPI.

Ofwat has stated that if it were to use an alternative to RPI, such as CPI, as long as it used the same index in both indexing the RCV and deriving a real allowed return, and this index was applied to derive nominal charges, then the impact on customer bills and nominal company revenues should be neutral in the long run (in present value terms). Ofwat has stated that it will commit to the neutrality of any changes on company's nominal revenues.⁷⁶

As CPI is expected to be lower than RPI,⁷⁷ if Ofwat were to adopt CPI indexation, the real WACC calculated on a CPI basis would be higher than if Ofwat were to use RPI. By contrast, the growth in a CPI indexed RCV will be lower. Overall, the impact of a change to CPI would be to increase revenues and bills from 2020, but offset by reductions in revenues over the longer-term.

As well as Ofwat's proposed transition to CPI (through indexing half RCV by CPI from PR19), Ofwat has also suggested that the impact on cash-flows could be offset through adjustments to pay-as-you-go (PAYG) or RCV run-off rates.⁷⁸

As well as revenue implications, the change in index could have an impact on companies in terms of costs (e.g. to hedge existing RPI debt, as we discuss in section 0), as well as risk.

Q5: What are your views on the proposed change in indexation in terms of its neutrality in net present value terms to investors (i.e. considering implications for both revenue and any cost implications)?

*Q6: (a) How could Ofwat best support a commitment to neutrality in net present value terms?
(b) How could Ofwat demonstrate that any change was value neutral?*

⁷⁵ Ofwat (December 2015) op. cit., p.126

⁷⁶ Ofwat (December 2015) op. cit., p.123

⁷⁷ See for example, ONS (2011) The long-run difference between CPI and RPI. Link: <http://budgetresponsibility.org.uk/wordpress/docs/Working-paper-No2-The-long-run-difference-between-RPI-and-CPI-inflation.pdf>

⁷⁸ Ofwat (December 2015) op. cit., p.127

Q7: Do the proposed changes affect your view of risk of investing in the water sector?

Implications for financeability

Ofwat has calculated that RPI index linked debt comprises around one-third of water companies' RCV, although companies consider that this underestimates the effective position.⁷⁹ Ofwat has stated that any change from RPI to CPI will mean that companies will bear the risk that the growth in an RPI indexed RCV and allowed revenues change at a different rate to companies' debt costs, which may expose companies to additional risk, although Ofwat consider that the risk could be reduced for other reasons, such as the lower volatility of CPI compared to RPI.⁸⁰

Q8: What are your views on the implications for companies' financeability (considering both notional and actual company financing structures) from Ofwat's proposed change to CPI indexation?

Development of CPI related products

Ofwat has suggested that the mis-match between RPI index-linked debt and a CPI indexed RCV may be hedged, although it has noted that this would come at a cost. Ofwat also raises the prospect of companies issuing CPI indexed linked debt.

Q9: What are your views on companies' ability to manage the risk from CPI indexation of the RCV through hedging? What are your views on the likely costs?

Q10: What are your views on the prospects for the development of CPI related financial instruments, e.g. CPI index-linked debt market?

Q11: Would the absence of a natural RPI hedge change your view of the attractiveness of the sector?

Policy options, and overall change in risk

Ofwat has set out four different policy options in its consultation. In brief, these are:

- Option 1: Status quo (i.e. retain use of RPI to index both RCV and allowed revenues)
- Option 2: Apply CPI indexation to prices but not to RCV
- Option 3: Apply CPI indexation to both prices and RCV, but with a transition to RPI indexation. Ofwat has identified the following examples:
 - for the period 2020-25, 50% RCV indexed by RPI, and 50% indexed by CPI, with the expectation that the proportion of RCV indexed by RPI would decline over time (Ofwat's preferred option)

⁷⁹ Ofwat (December 2015) op. cit., p.125

⁸⁰ Ofwat (December 2015) op. cit., p.119

- From 2020, apply RPI to the existing RCV, and apply CPI only to new investments made from the start of PR19
 - Option 4: Apply CPI indexation to both allowed revenues and RCV with no transition
- The options are summarised in the Table below.

Figure A.1
Ofwat's Policy Options (Preferred Option = 3)⁸¹

Our policy options/ dimensions	1	2	3	4
Whether to change inflation measure	No, retain RPI		Yes, signal preferred move to CPI (subject to final UKSA recommendations)	
Full or partial implementation?	NA (no change)	Partial – only apply to prices	Full – apply to both prices and RCV (therefore allowed revenues)	
Immediate change, or with transition	NA (no change)	Immediate (linked to partial application)	With transition	immediate change
Form of transition	NA (no transition required)		CPI only applied to % of RCV	NA (no transition required)

Q12: Of the options set out by Ofwat, what is your preferred option and why?

Q13: If Ofwat implements its preferred policy option, to what extent (if any) does this change your view of the risk associated with investing in the water sector?

Concluding Remarks

Q14. Are there any other aspects of Ofwat's indexation proposals that you would like to discuss?

⁸¹ Ofwat (December 2015) op. cit., p.121

Appendix B. Detailed Description of Modelling

In this section, we describe in detail our modelling approach to calculating bill impacts and financeability impacts for different options of moving to CPI indexation. We first describe our modelling approach and then discuss our data sources and assumptions.

B.1. Modelling Allowed Revenues and Financial Metrics

We model allowed revenues for a typical WASC and a typical WOC, based on industry average cost and asset value inputs (see next section on data sources and assumptions). We calculate allowed revenues in line with Ofwat's PR14 approach for the two wholesale and retail controls. Specifically:

Wholesale allowed revenues are calculated as PAYG + depreciation + allowed return. Depreciation of pre-2015 RCV is based on a RCV run-off rate applied on a declining balance basis whereas post-2015 RCV additions are depreciated on a straight line basis in line with the new asset life assumptions.

Retailed allowed revenues are calculated by applying retail margin to wholesale + retail revenues.

For simplicity, we model allowed return on a pre-tax basis, using the expected statutory corporation tax rate.⁸² In our calculations of financial ratios we assume no out/underperformance on tax to avoid distortions to the results.

To simplify calculations for different transition options, we calculate allowed returns by applying the WACC to the opening rather than average RCV.

When modelling different indexation scenarios, we adjust the baseline real allowed WACC and totex allowances to reflect the expected difference between RPI and CPI(H) measures of inflation. This ensures any change in indexation approach is revenue neutral (i.e. it does not affect the present value of nominal revenues charged to customers).

For all options (other than status quo for RPI indexation), we follow Ofwat's guidance and express cost inputs for regulatory calculations as well as the RCV in real-CPI terms. For scenarios where the RCV is fully or partially linked to RPI, we include adjustments to the real CPI RCV and depreciation calculations to ensure the “effective” RPI indexation of the RCV is appropriately reflected. We also reflect the proportion of RCV linked to RPI accordingly in the real allowed rate of return.

We include functionality in the model to calculate the required adjustment to PAYG to offset the impact of change from RPI to (full or partial) CPI indexation on allowed revenues/bills.

⁸² Statutory corporation tax rates are forecast to fall to 19 per cent in 2017 with a further reduction to 18 per cent from 2020 onwards; Source: HMRC; <https://www.gov.uk/government/publications/corporation-tax-main-rate/corporation-tax-main-rate>. We note that using statutory tax rates may overstate companies' actual tax liabilities going forward. However, in our modelling we focus on the *difference* in allowed revenue under different indexation options (rather than the absolute level of revenues) and therefore consider the use of statutory corporation tax rates a reasonable approximation of the effects of switching between different indexation options.

We calculate financial metrics at the appointee level. We exclude retail allowed revenues and costs from the calculations of financial ratios. To ensure the allowed retail margin is appropriately reflected in our calculations, we remove Ofwat's 14bps downward adjustment to the appointee WACC, thus effectively including the allowed retail margin in wholesale revenues instead.⁸³

We model financial ratios for a stylised “corporate financed” and a “highly leveraged” financial structure for each of the WaSC and WoC, with data on opening financial arrangements derived from industry averages (see Section B.2 on data sources). We include assumptions on gearing, share of ILD and repayment schedules for each of our stylised companies. We assume any new debt issued in the model to refinance existing debt or to fund RCV growth is nominal debt. We assume the cost of debt is equal to the allowed cost of debt included in the WACC to avoid any distortions to the results from cost of debt out/underperformance.

In addition to calculating expected financial ratios based on forecast inflation, we also include functionality to model the impact of deviations in the outturn RPI - CPI wedge on credit metrics under the CPI framework.

B.2. Data Sources

We draw on opex, capital maintenance and capital enhancement projections as published in Ofwat PR14 FD models⁸⁴ for the 2015-2019 period.⁸⁵ We project opex post 2020 holding the 2019 figure constant in real (RPI) terms. We project capital maintenance and enhancement post 2020 based on average levels for PR14.

We include the opening RCV for 2015 in line with RCV data published in Ofwat's PR14 FD models. Key regulatory assumptions for PR14 (run-off rates, asset lives for new RCV additions, PAYG ratios) are sourced from Ofwat's PR14 FD models and held constant post 2020.

Retail inputs (retail costs to serve, allocation to HH and non-HH controls) are also sourced from Ofwat's published PR14 FD models. We project retail inputs post 2020 holding the 2019 figure constant in real terms.

We calculate industry averages for all the above inputs within the WaSC and WoC groups to define cost inputs for our “typical” WaSC and “typical” WoC stylised companies.

We assume a WACC in line with Ofwat's PR14 determination and hold it constant throughout the modelling period. We assume forecast CPI inflation of 2 per cent and RPI inflation of 3 per cent.

⁸³ This approach ensures that the allowed retail margin is always equal to 14bps on the WACC as per Ofwat's assumption and avoids any distortions created by the difference between 14bps assumption in the WACC and the allowed retail margin calculated bottom up from total wholesale and retail revenues.

⁸⁴ Ofwat FD models available at <http://webarchive.nationalarchives.gov.uk/20150624091829/> https://www.ofwat.gov.uk/pricereview/pr14/prs_web201405popfinancialmodel

⁸⁵ For Bristol water, we rely on data published in the CMA Final Determination instead of Ofwat's PR14 FD model.

We define generic assumptions on gearing levels, percentage of ILD and repayment schedules of ILD for our stylised corporate financed and highly leveraged WaSC and WoC, derived from industry average data sourced predominantly from companies' financial accounts. We discuss companies' financial structure in more detail in Appendix C.

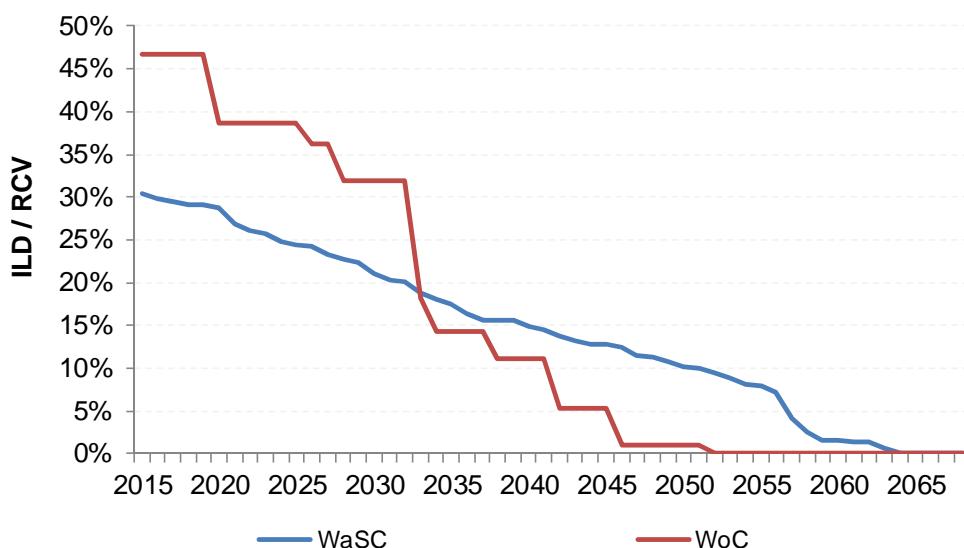
Appendix C. Analysis of Water Companies' Exposure to ILD

In this appendix we discuss water companies' exposure to RPI-linked debt both over time as well as companies' variation around the industry average. Our analysis shows that:

- 1) water companies face long-term RPI-linked liabilities which will not fully mature until 2067;
- 2)) there is great variation in water companies' exposure to RPI linked debt both in terms of volume and duration.

In carrying out this analysis we have collected data on individual water company bond issues from Bloomberg and/or company annual reports.⁸⁶ Figure C.1 shows the aggregate RPI debt position as a percentage of RCV for WaSCs and WoCs over time, assuming no new RPI linked debt issuance and a constant RCV going forward.

Figure C.1
Maturity Profile of RPI-linked Debt for WaSCs and WoCs (% RCV)



Source: NERA analysis of company annual report, Bloomberg and Ofwat data.

Consistent with Ofwat's estimate⁸⁷, our analysis shows that index-linked debt currently accounts for around 30 per cent of the aggregate RCV for WaSCs and 47 per cent for WoCs. We also observe the long-term feature of RPI-linked liabilities—WaSCs' RPI debt will not fully mature until 2067; WoCs not until 2051. Ofwat's proposals for the speed of transition to full CPI indexation should take the long-term aspect of companies' RPI linked liabilities into account to ensure adequate protection against RPI risk and/or avoid costly hedging.

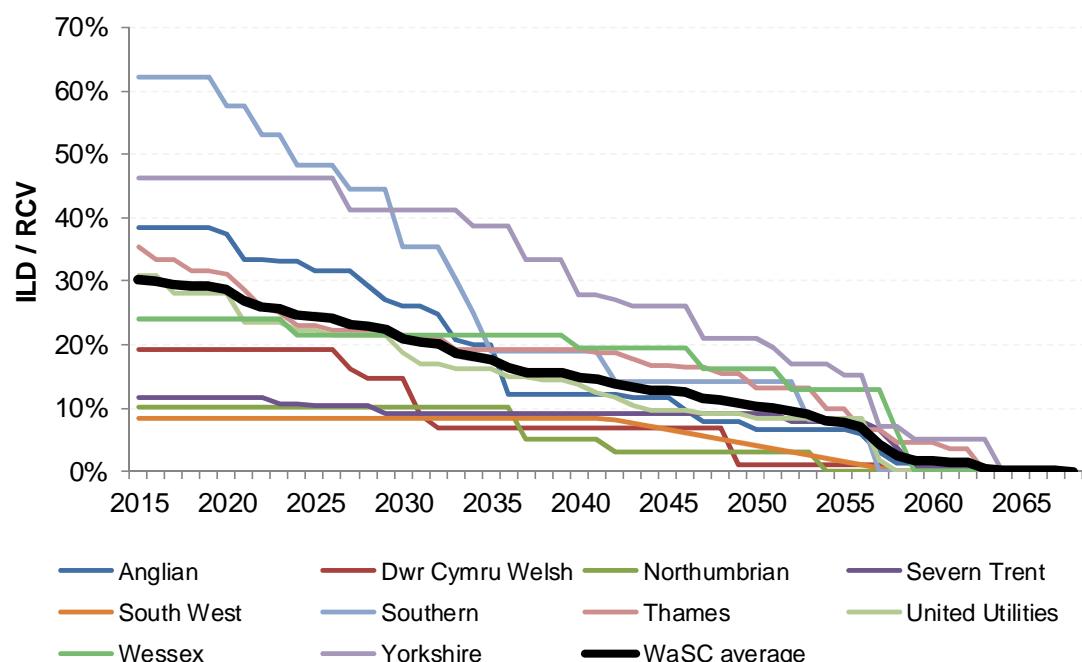
⁸⁶ Data is sourced predominantly from company annual reports. When bond maturities are not reported in annual reports, we source this data from Bloomberg.

⁸⁷ Ofwat (December 2015), "Water 2020: Regulatory framework for wholesale markets and the 2019 price control review", p.125

Furthermore, as shown in Figure C.2 and Figure C.3, there is great variation in individual water companies' RPI exposure, in terms of both volume and duration.

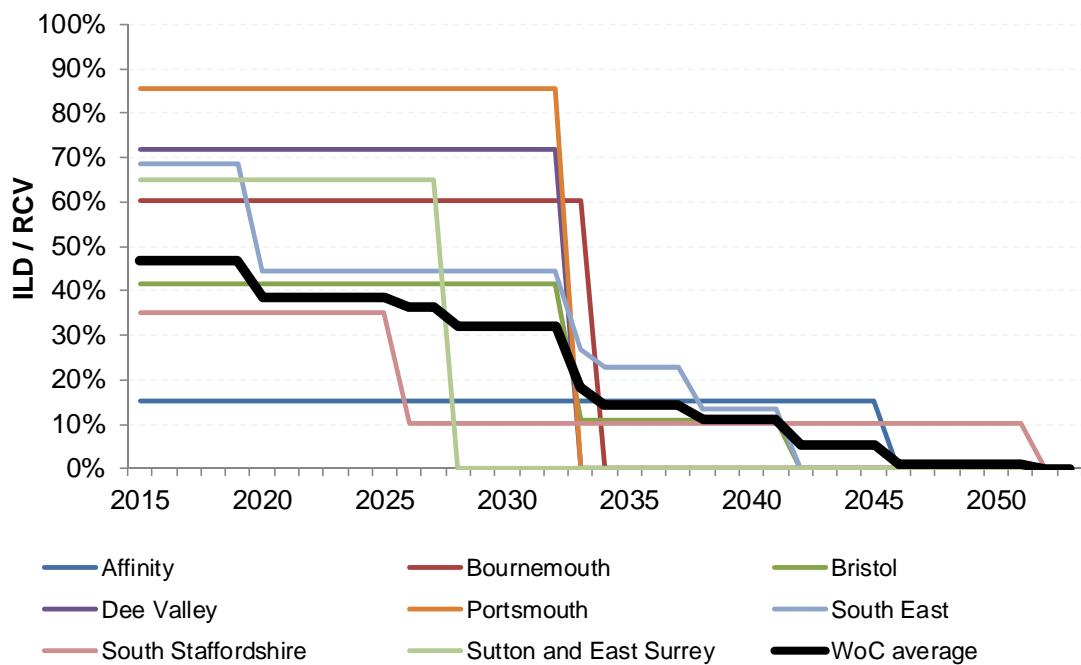
- For example, Southern Water has RPI-linked debt which accounts for 62 per cent of the RCV, well above WaSCs' average, while Yorkshire Water faces a considerable amount of RPI liabilities even after 2040.
- RPI risk is even greater for WoCs – Portsmouth Water has RPI liability as high as 86% of the RCV (through one single index-linked bond), which will not mature until 2033.

Figure C.2
Maturity Profile of RPI-linked Debt for WaSCs (% RCV)



Source: NERA analysis of company annual report, Bloomberg and Ofwat data.

Figure C.3
Maturity Profile of RPI-linked Debt for WoCs (% RCV)



Source: NERA analysis of company annual report, Bloomberg and Ofwat data.

Appendix D. Description of RPI, CPI, and CPIH

This appendix sets out the data, characteristics and our modelling approach to simulating RPI and CPI index changes. We draw on the simulations in this appendix to inform our analysis of the risks faced by water companies from a switch to CPI indexation, as set out in section 4 and 5 of our report.

D.1. RPI and CPI – Data and distributional characteristics

D.1.1. Data and assumptions

To assess the distributional characteristics of RPI and CPI indices, we use the following data from the Office of National Statistics:

1. We use the RPI Index series: *CHAW (RPI All items)*, consistent with what Ofwat has used at the last several reviews; and
2. We use the CPI Index series: *D7BT (CPI All times)*, as it offers a longer history compared to alternatives, e.g. the CPIH series which is available only from 2005.
3. We have not drawn on CPIH in our modelling of simulations, as there is more limited historical data. We have cross-referenced the CPI All Items with the CPIH index, and note that the indices exhibits strong correlation of 0.98.

For both indices we make the following assumptions:

- *Historic period of assessment*: we assess data starting from 1998, following which the Bank of England began targeting inflation at 2%, which represents a structural shift in inflation.
- *Granularity of returns*: We assess beginning of year changes (January – on – January) and annual average changes in the indices, for consistency with our financial modelling.

D.1.2. Historic distributional characteristics of RPI and CPI series

The characteristics of the RPI and CPI series are shown in the charts below:

Figure D.1
Historic RPI (CHAW)

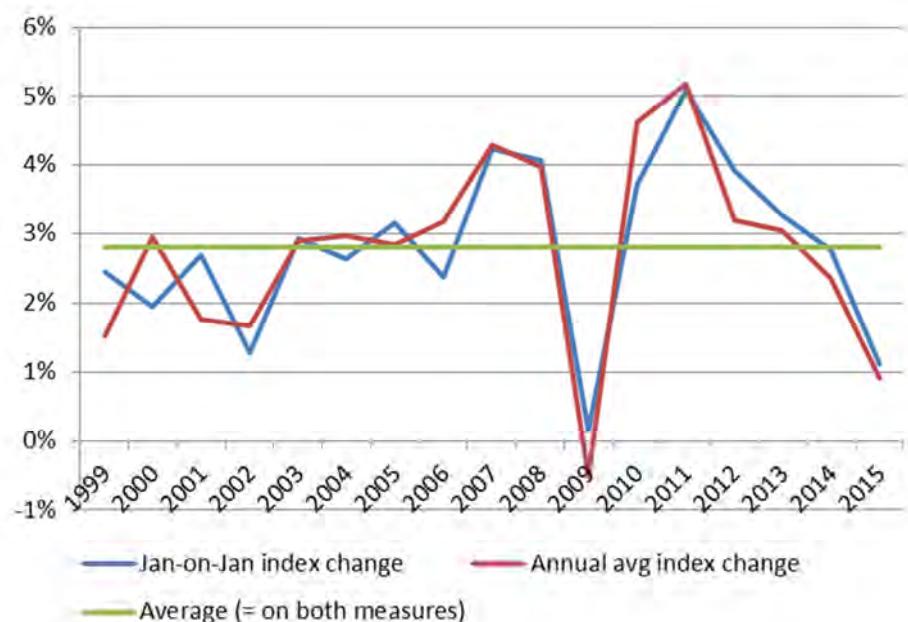


Figure D.2
Historic CPI (CPI All Items)

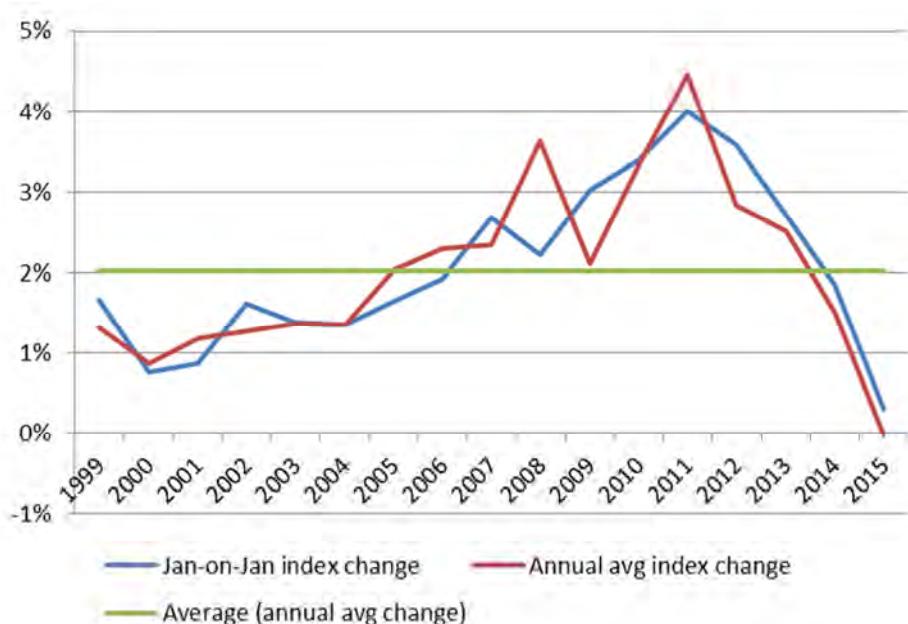


Figure D.3
CPI vs. RPI Comparison

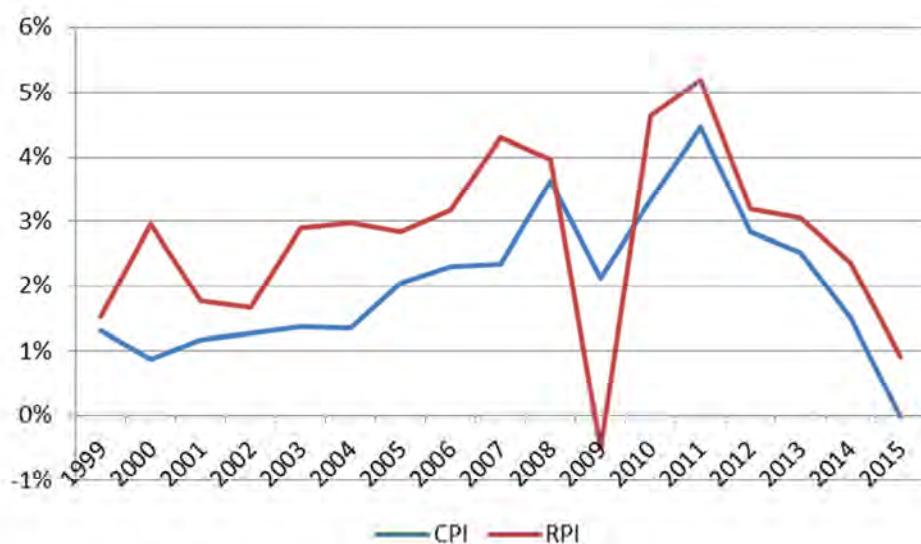
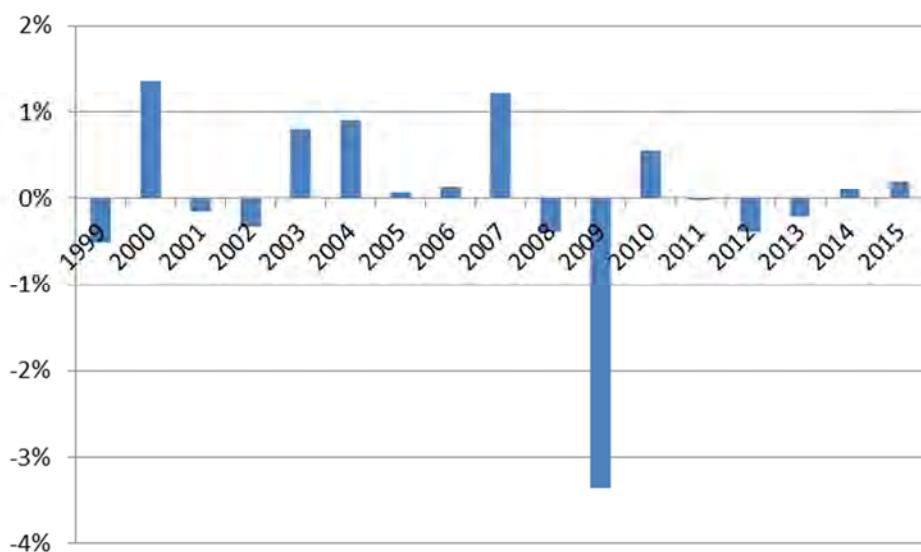


Figure D.4
Difference btw. CPI and RPI



Notes to Figures 2.1 – 2.4: (1) Distribution of annual differences shown taking out the average difference (of 0.73%); (2) 2015 average annual changes in RPI and CPI calculated based on 11 months excluding December.

Table D.1
Summary Statistics

	Mean	St Dev.	Correl (RPI, CPI)
CPI	2.03%	1.11%	0.68
RPI	2.76%	1.41%	0.68
Difference	0.73%	1.04%	

Source: NERA Analysis of ONS data.

In summary, over the historic period assessed for this review:

- the CPI and RPI series exhibited an average percentage growth of 2.03% and 2.76% respectively, with an average difference of 0.73%
- the RPI series is more volatile than the CPI series, with a standard deviation of 1.41%, compared to 1.11% for the CPI series; and
- the series exhibit correlation of 0.68.

D.2. Testing for persistence in the CPI and RPI series

The economic literature supported by empirical findings postulates that inflation metrics display a degree of persistence, i.e. the tendency for inflation rates to display a degree of (auto) correlation through time. To formally test the presence of time-dependence in the annual average inflation rates⁸⁸, we fit a simple autoregressive process (AR(1)), which explicitly accounts for persistence in the first lags of the CPI / RPI series respectively⁸⁹.

As shown in Tables 3.1 and 3.2 below, the historic CPI and RPI series do not exhibit the same trends. Specifically, the CPI series exhibits autocorrelation at the first lag (AR1) (but not in the second lag) while the RPI series does not exhibit any time dependence in the historic sample assessed above.

Table D.2
CPI AR(1) Fitted Model

	Coef	St dev	PVal
CPI _{t-1}	0.688	0.236	0.011
Constant	0.006	0.006	0.309

⁸⁸ We define the annual average inflation rate as $\Delta\text{CPI}_T = \text{CPI}_{\text{index average}, T} / \text{CPI}_{\text{index average}, T-1} - 1$, where the CPI Index Average is calculated as the average of the monthly index observations in each year T.

⁸⁹ We also tested for autocorrelation in the second lag by fitting an AR (2) process, but find no evidence for second lag autocorrelation in either of the series.

Table D.3
RPI AR (1) Fitted Model

	Coef	St dev	PVal
RPI _{t-1}	-0.030	0.276	0.916
Constant	0.029	0.009	0.005

D.3. CPI and RPI Forecasting

D.3.1. Forecasting CPI and RPI as correlated variables within a Monte Carlo framework

Given the persistence found in the CPI series, we simulate the CPI series as an AR(1) process, calibrated to fit the historic characteristics, as follows:

$$\Delta CPI_T = 0.6\% + 0.68 \times \Delta CPI_{T-1} + error_{CPI,T} \quad \text{Equation (1)}$$

$$\text{where } error_{CPI,T} \sim N(0, 0.9\%) \quad \text{Equation (2)}$$

The parameters in equations (1) and (2) are based on the historic AR(1) fit as shown in Table D.2 above.

Additionally, the starting point for the AR(1) process (i.e. the expected CPI change in 2020) is based on the unconditional distribution of CPI shown in Table D.1 above, with mean of 2% and standard deviation of 1.1%.

Given that the RPI series does not exhibit time-dependence, we simulate the RPI process as a random draw from a distribution displaying the historic RPI characteristics, i.e. an average change of 2.76%, with a standard deviation of 1.4%, as per Table D.1:

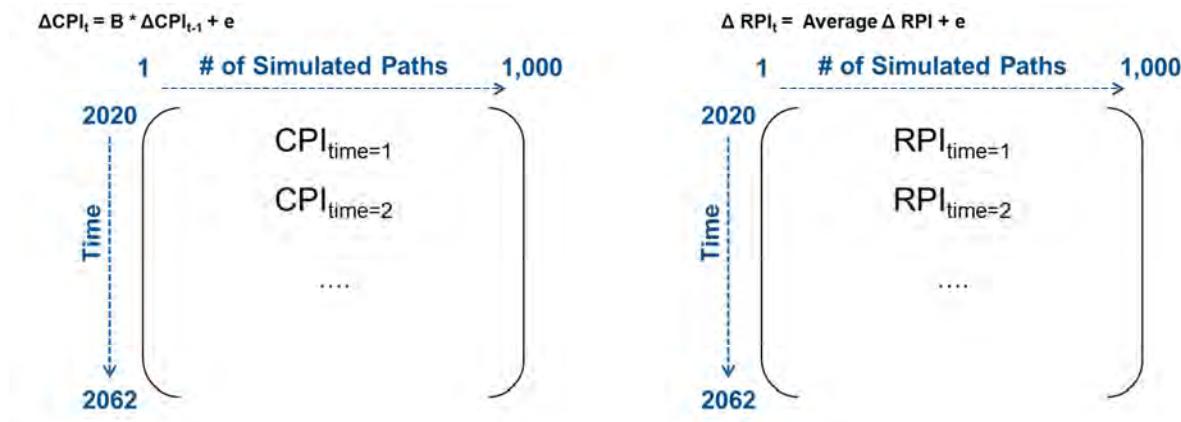
$$\Delta RPI_T = 2.8\% + error_{RPI,T} \quad \text{Equation (3)}$$

$$\text{where } error_{RPI,T} \sim N(0, 1.4\%) \quad \text{Equation (4)}$$

As per equations (1) and (3), the CPI and RPI simulations are driven by random noise processes. We impose the historic correlation between the noise process in equation (4) and the fitted residuals from the historic AR(1) process (corresponding to equation 2), of 0.76.

Schematically, the proposed simulations were structured as shown in Figure D.5 below.

Figure D.5
Structure of RPI - CPI Matrices



D.3.2. Simulation Results

The simulated results for CPI and RPI process are shown in Figure D.6 - Figure D.9.

The outturn distributional characteristics of the simulated series over the period closely resemble the distributional characteristics of the historic sample:

- CPI at the 50% percentile ranges between 1.8% -2.1% across the 43-year period run, and has a cross-sectional (within-period) standard deviation of 1.1% - 1.3% ;
- RPI at the 50% percentile ranges between 2.7% - 2.8% across the 45-year period, and has a cross-sectional standard deviation of 1.3% - 1.5%.
- The outturn correlation of the series is c.0.57 averaged across the runs approximately in line (i.e. slightly lower) than the observed unconditional correlation between the CPI and RPI variables.

Figure D.6
Simulated Expected % Change in CPI

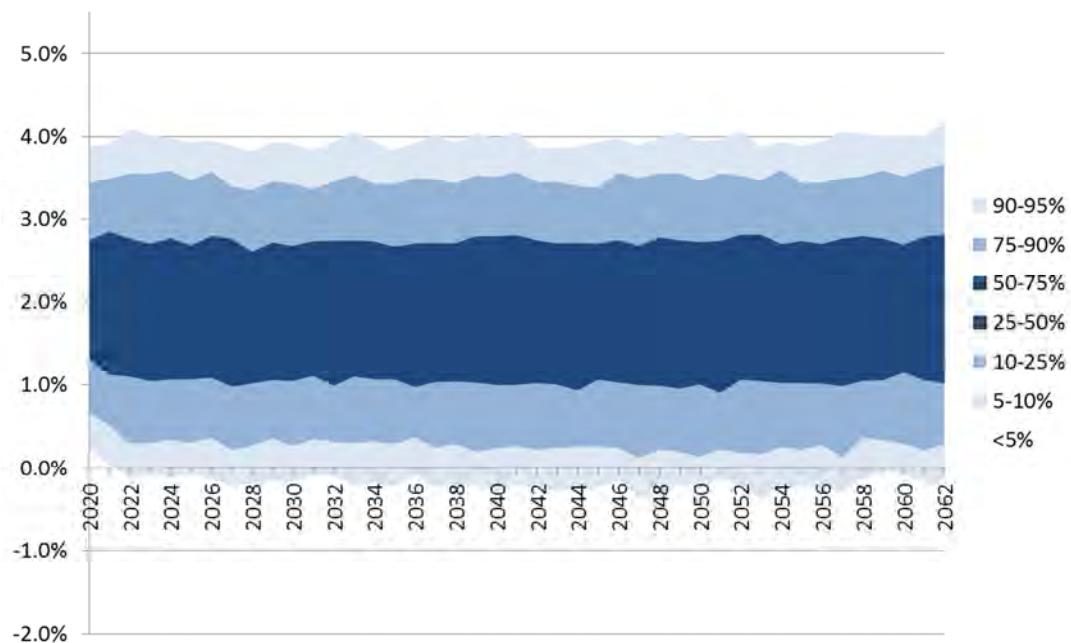


Figure D.7
Simulated CPI Index Level

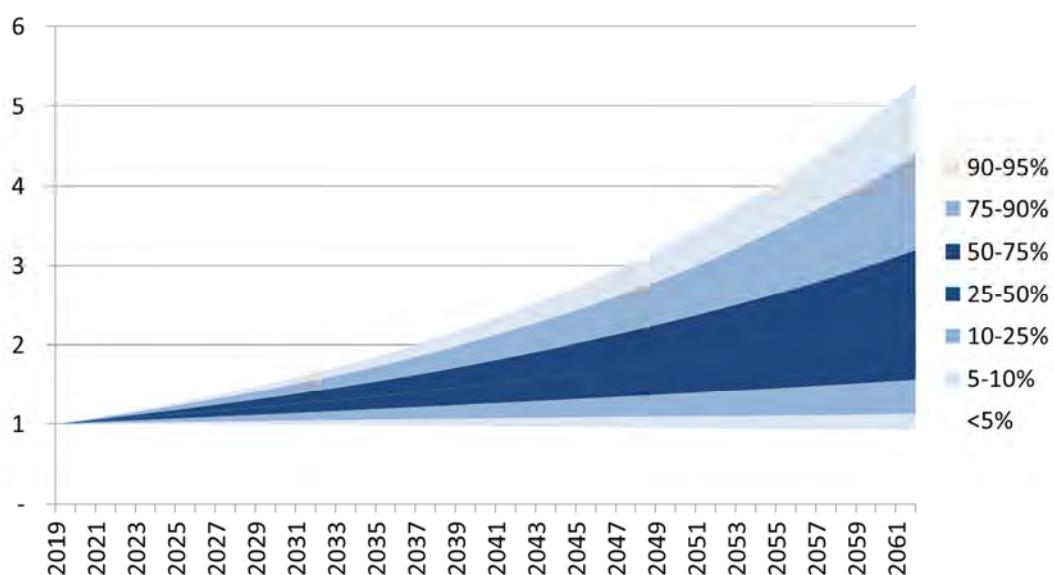


Figure D.8
Simulated Expected % Change in RPI

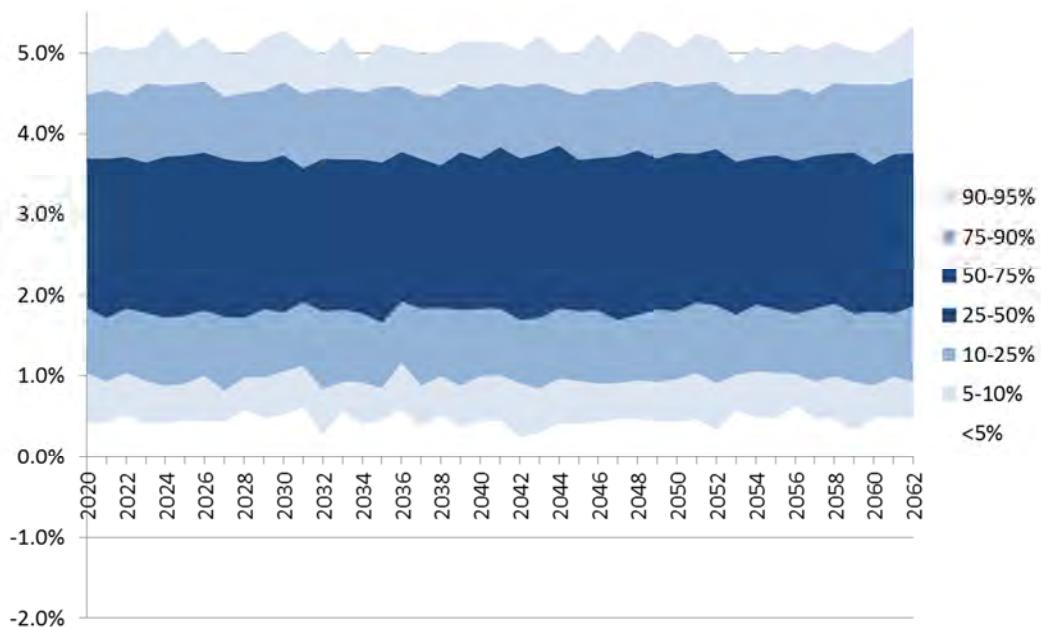
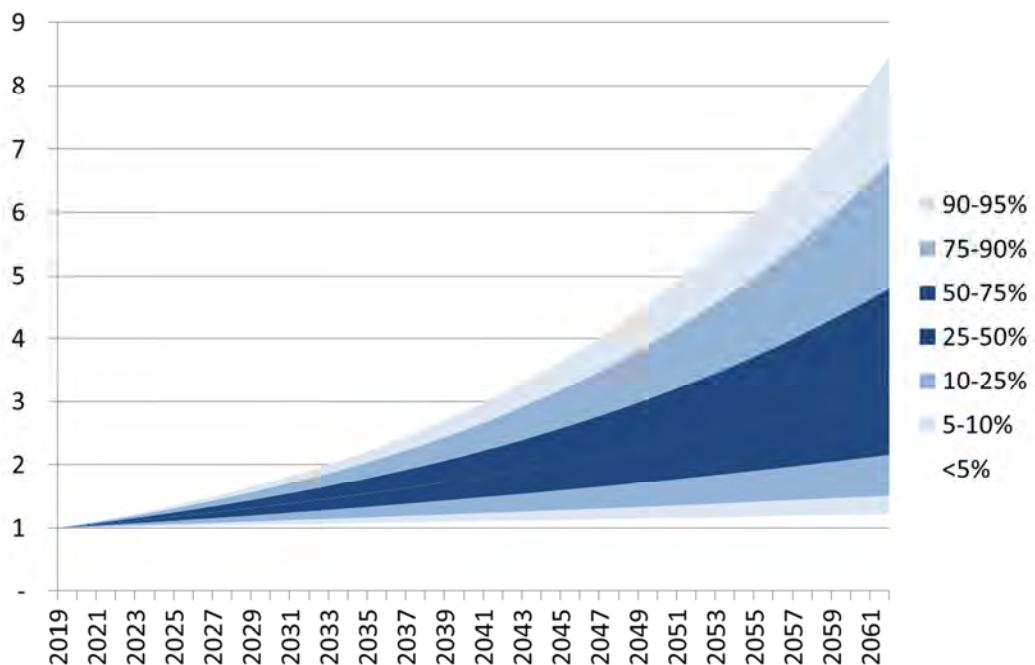


Figure D.9
Simulated RPI Index Level



The above simulated results characterise CPI and RPI as correlated random processes. To understand the likely CPI-RPI wedge going forward, we proxy the joint density of CPI and RPI according to the following process:

- 1) Within each period, we derive an ordered pairing of CPI and RPI such that CPI is ordered from smallest to largest, while RPI is ordered as the corresponding pair to the RPI;
- 2) Subsequently, we take the average CPI and RPI pairs within subsections of the distribution – i.e. in subsequent intervals (e.g. 0-100 observations, proxying the 5th percentile; 100 – 300 observations, proxying the 20th percentile etc.)

The procedure above produces a set of ordered CPI- RPI averages, where the average RPI is conditional on CPI being at given (approximate) percentiles of the CPI distribution. Taking the average produces the conditional differences between CPI and RPI, shown in Table D.4.

Notably, at the 50th percentile, the average expected CPI-RPI wedge stands at 0.9%, and is equivalent to unconditional difference between the expected CPI and RPI.

Table D.4 shows the conditional average difference between CPI and RPI across different CPI percentile levels, calculated as discussed above. As shown in Table D.4, the average difference between CPI and RPI conditional on CPI realizations at the 5th percentile was 1.7%, and decreases to 0.1% conditional on CPI being at the 95th percentile. Expressed relative to the expected difference at the 50th percentile, we find a 5% change that the conditional difference between CPI and RPI is as high as 0.9% under the above described characterization of the two series.

Table D.4
Conditional Differences between RPI and CPI

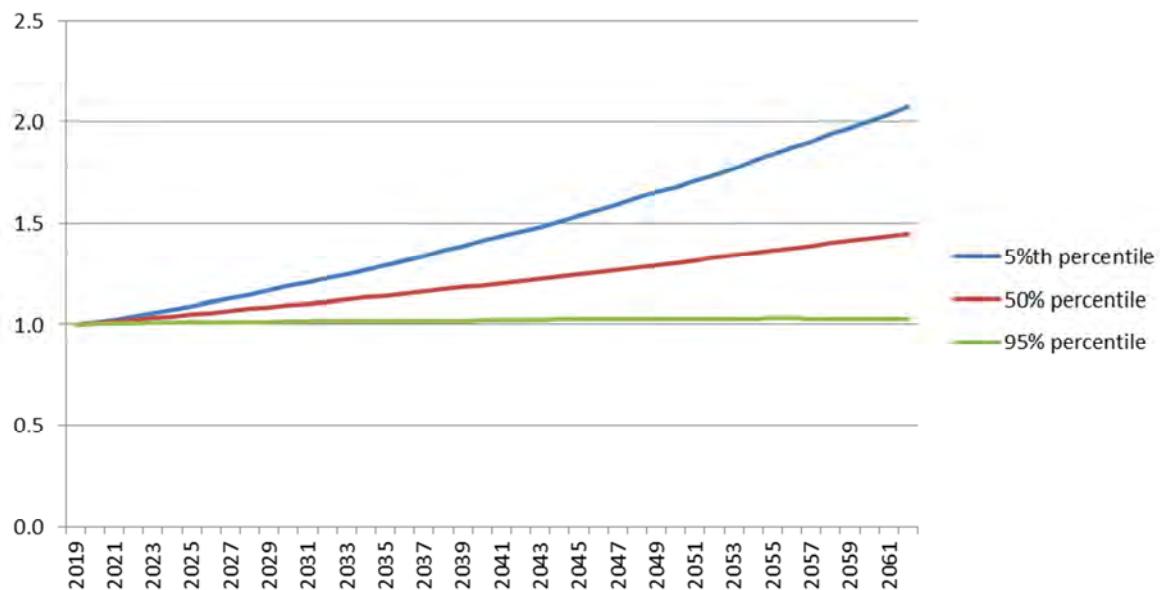
Percentiles	Average difference	Deviation from 50th Percentile
5%	1.7%	0.9%
10%	1.5%	0.6%
25%	1.2%	0.3%
50%	0.9%	0.0%
75%	0.6%	-0.3%
90%	0.3%	-0.6%
95%	0.1%	-0.8%

Source: NERA Analysis

Note: The above reports the average difference across the simulated period (2020-2062).

Figure D.10 shows the compound effect of the wedge across the percentiles, where the wedge differential ranges between annual average of 0.1% and 1.7% at the 95th and 5th percentiles respectively as discussed above.

Figure D.10
Conditional Expected (Compound) Differences btw. CPI and RPI



Source: NERA Analysis



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