Oxera

Compensation for inflation

Prepared for KPN

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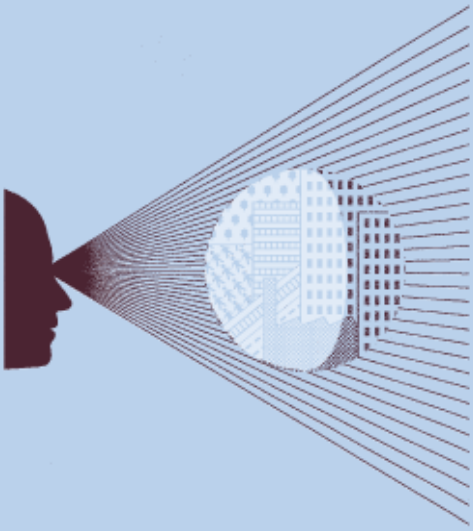

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1 Introduction

Oxera has been asked by KPN to undertake an independent analysis of the approach currently adopted by OPTA to calculating the wholesale price cap for KPN, and to examine whether it compensates KPN for inflation. This report presents the results of Oxera's analysis based on the discussions with KPN and the publicly available information available to Oxera.

The objective of the report is to conduct a robust and detailed assessment of the financial mechanics of the price-setting formula in the case of KPN, rather than to assess general principles in accordance with which regulated companies should be compensated for inflation. This is because the analysis of the appropriate compensation for inflation poses a number of significant challenges, and therefore needs to consider the detailed workings of each particular regulatory regime. The key conclusions from this analysis are set out below.

1.1 Key conclusions

– **Under-recovery in the case of KPN**. The wholesale price cap for KPN does not appear to include compensation for inflation. If appropriate compensation for inflation were provided, the price cap would be higher (lower), assuming that inflation, understood as the change in the price index for which the investor needs to be compensated, is positive (negative).

– This is evident from the fact that the outturn returns to KPN (pre-tax internal rate of return (IRR) over the lifetime of the assets), based on a stylised model, are equal to the *real* cost of capital, which is lower that the *nominal* cost of capital when changes in the general price index are positive. If the price cap appropriately compensated for inflation, investors would be allowed to earn the *nominal* cost of capital.

– **Application of the nominal cost of capital**. The under-recovery of inflation under KPN's current regulatory regime could be remedied by the application of the nominal cost of capital to calculating the price cap. This approach is adopted by other European telecoms regulators in key jurisdictions (eg, by Ofcom).

– The model based on the nominal cost of capital, as applied to other regulated telecoms companies (eg, in the UK), would provide appropriate compensation when the inflation is positive as well as when it is negative.

– **Application of the 'utilities-like' model for determining the price cap**. An alternative approach would be to move to the 'utilities model'—a model for setting the price cap typically used in the case of traditional, price-regulated, utilities (eg, water and electricity distribution in the UK)—where inflation is compensated for via annual indexation of assets. This method would require excluding the holding/gain loss on revaluation of assets (or any equivalent adjustment), and therefore from the cash flows.

– In order for the utilities model described above to allow investors to recover inflation, the inflation used to index assets has to equal inflation required by investors, in which case it would provide KPN with the same, appropriate, compensation for inflation.

– **Equivalence and practical application of the models**. From a conceptual perspective, both the telecoms and utilities models provide an appropriate compensation for inflation when inflation used to value assets under the utilities regime equals inflation assumed in the nominal allowed cost of capital under the telecoms regime. In the case of KPN it

may be more practical to adopt the telecoms model, given a significant number of precedents in Europe. In the event that the utilities model is adopted, it would be necessary to revisit the indices used for indexation of KPN's assets to ensure appropriate compensation for inflation.

1.2 Illustration and explanation of the key points

Table 1.1 compares outturn returns under different regulatory regimes, based on an illustrative, stylised model, and shows that the extent of under-recovery for different assumptions with respect to inflation. These results are based on simplified rather than actual models of different regulatory regimes.

Table 1.1 Returns to investors under different approaches for compensating inflation (stylised examples)

	Utilities model		Telecoms model		Model applied to KPN[3]	
Allowed WACC	Real		Nominal		Real	
Adjustment for holding gain/loss	No		Yes		Yes	
Inflation in nominal WACC (real WACC = 10%)[1]	**NPV (nominal, €)[2]**	**IRR (nominal, %)**	**NPV (nominal, €)**	**IRR (nominal, %)**	**NPV (nominal, €)**	**IRR (nominal, %)**
0% (nominal WACC = 10.0%)	7.5	13.3	0.0	10.0	0.0	10.0
3% (nominal WACC = 13.3%)	0.0	13.3	0.0	13.3	–6.8	10.0
–3% (nominal WACC = 6.7%)	16.6	13.3	0.0	6.7	8.3	10.0

Note: [1] Inflation used for asset indexation is 3% under all scenarios. [2] The allowed nominal cost of capital is assumed to equal the required nominal cost of capital. [3] The analysis is based on the assumption that the allowed (real) cost of capital is applied to opening assets excluding indexation for the period, similar to the telecoms regime.
Source: Oxera analysis.

– **Comparative returns under different regimes**. As can be seen from Table 1.1, under the utilities regime, the outturn return is the same under all scenarios (13.3%). This is because, under this regime, the allowed cash flows compensate investors for the level of inflation used for asset indexation (the same in all scenarios) and are unaffected by the general level of inflation in the nominal cost of capital.

– The net present value (NPV) of a hypothetical investment under the utilities regime varies with the level of inflation contained within the nominal cost of capital if the level of asset-specific inflation is kept constant. As a result, the NPV of cash flows under the utilities regime might be lower or higher than zero (ie, the investor will under- or over-recover) if the general price index (inflation) applicable to the cost of capital is different from the asset-specific inflation used to index the assets.

– Under the telecoms model, the NPV of a stylised investment over its lifetime is zero (ie, investors appropriately recover the nominal cost of capital) under all scenarios for the level of inflation contained in the nominal cost of capital. This is because, under this regime, cash flows recover inflation relevant to the nominal cost of capital rather than inflation used for asset indexation, as in the case of utilities. As a result, the outturn nominal return varies with the level of inflation such that it is always equal to the nominal cost of capital. The outturn return is *not* affected by the inflation used for asset indexation.

– **The model applied to the regulation of KPN.** Under the regime currently applicable to KPN, the outturn return appears the same under all scenarios. This is because under this regime the company is only allowed to recover the cash flows corresponding to the real cost of capital. Therefore, given that the real cost of capital is unchanged across all scenarios, the cash flows and the returns remain unchanged. The NPV varies by scenario because the investors need to recover different rates of return under different nominal costs of capital, while the cash flows remain unchanged.

– As can be seen from Table 1.1, under the current regulatory regime, KPN's investors recover only when the real cost of capital equals the nominal cost of capital (ie, inflation in the cost of capital is zero). When inflation in the cost of capital is positive (as is usually the case), investors under-recover under the KPN's regime.

This report is structured as follows.

– Section 2 discusses how inflation is compensated for under different regulatory regimes.

– Section 3 discusses how the regime is applied to KPN, and examines its implications for the recovery of inflation.

– Section 4 provides a stylised numerical example, which illustrates how inflation is recovered under different regimes.

– Appendix 1 shows the analytical derivation of the allowed cash flows under different regulatory regimes, and the extent of under-recovery for the KPN's regime.

2 Mechanics of calculating the compensation for inflation

This section discusses how inflation is compensated for under different regulatory regimes. Specifically, two types of regulatory regime that compensate for inflation differently are discussed: the regime typically applied to price-regulated utilities (eg, water, energy and transport companies), and the regime often applied to the telecoms companies. For illustration, the principles of recovery of inflation in the case of a fixed income security are discussed first and then compared with both regulatory models.

2.1 Fixed income securities

Fixed income securities (eg, bonds) provide a useful starting point for the analysis of how inflation is recovered in cash flows. In the case of a 'plain vanilla' bond, the periodic cash flows to investors comprise of the coupon payment and the repayment of principal. The coupon payment is calculated as the coupon rate applied to the amount of capital outstanding. The repayment of principal is determined by a pre-defined schedule and over the lifetime of a bond issued at par equals the value of the original investment.

Compensation for inflation in the case of a bond issued at par is included in the return on capital, which is calculated as the nominal required rate of return (ie, the coupon rate) applied to real capital employed (ie, unredeemed amount of capital). It is not included in the repayment of principal because, over the lifetime of a bond, the original amount of capital, unadjusted for inflation, is repaid.

This could be compared with the revenue allowance in the case of regulated companies, which also includes return on capital, provided in the form of an allowed return, and the redemption of capital, which is represented by the regulatory depreciation. Under different regulatory models, as discussed below, inflation could be either provided in the allowed return, as in the case of a bond, or in both the allowed regulatory depreciation and allowed return.

2.2 Regulated utilities

Traditional utilities and infrastructure companies are often regulated under the 'RAB/WACC' regime. The regime allows investors to earn a nominal return over the lifetime of the assets (assuming no out- or underperformance), where the inflation component of the nominal return corresponds to the inflation index used in asset valuation. This regime is applied to such companies as National Grid and Thames Water in the UK, ESB in Ireland, GDF in France and Snam Rete Gas in Italy.

Under the RAB/WACC regime the compensation for inflation is provided in the redemption of capital as well as in the return on capital. In order to understand the mechanism for how inflation is recovered in this case, it is important to consider three specific elements of the regime: approach to asset valuation, calculation of the allowed depreciation, and allowed return.

– **Asset valuation**. Assets of the regulated utilities are annually indexed (or re-valued) with inflation. The inflation index aims to reflect inflation assumed in the required returns (ie, the difference between the real and the nominal costs of capital). This ensures that the value of assets in every year reflects the evolution of the general price index (typically, RPI).

– **Depreciation**. Conceptually, in the regulated industries the allowed depreciation represents the redemption of capital. In the case of regulated utilities it is calculated on the basis of the indexed assets. Therefore, over the lifetime of the assets total allowed depreciation exceeds the value of the original capital expenditure by the amount of inflation indexation. The nominal component of the allowed depreciation represents one element of the total compensation for inflation that investors receive in the case of regulated utilities.

– **Allowed return**. Allowed return represents the return on capital. It is determined as the real allowed cost of capital applied to the indexed assets. Thus, the second component of the total compensation for inflation is the real return allowed on asset indexation.

Overall, in the case of regulated utilities, investors receive compensation for inflation in the form of inflation indexation, as part of the redemption of capital, and in the form of return on inflation indexation, as part of the return on capital.

This is different from a bond discussed above because compensation for inflation is split between the depreciation and allowed return. Effectively, in the case of utilities, the main component of inflation is provided as part of the redemption of capital, while the Fischer term is provided as part of the returns on capital.[1] This leads to a different profile of cash flows over the lifetime of the investment compared with a bond. In the case of a bond, cash flows are more front-loaded than cash flows implied by the regulatory regime applied to utilities.

The mechanics of this regime are such that investors are allowed to recover the rate of inflation used to index assets. Therefore, in order for investors to recover, the inflation used to index assets in the utilities regime has to equal the inflation assumed in the nominal cost of capital.

2.3 Regulated telecoms companies

The price cap for the telecoms companies is also often set on the basis of the allowed return and regulatory depreciation. The regime allows investors to recover the nominal allowed cost of capital over the lifetime of the assets. This regime is different from that of regulated utilities because the inflation that investors are allowed to recover is based on the inflation assumed in the nominal allowed cost of capital, rather than on the inflation used to index assets, as in the case of utilities. Such a regime is applied to telecoms companies such as BT in the UK, eircom in Ireland, Telefónica in Spain and France Telecom in France.[2]

It is useful to consider asset valuation and approaches to calculating the redemption of capital and cost of capital in order to understand the mechanism through which the inflation is recovered under this regime.

– **Asset valuation**. Under this regime the current cost asset valuation approach is typically adopted. The assets are re-valued to reflect changes in the underlying gross replacement cost value, which reflect general inflation, asset-specific inflation and technological developments. These changes could be significantly different from the changes implied by the general price inflation and from inflation assumed in the required returns; they could also lead to reductions in the gross book value over time.

[1] According to the Fischer formula, nominal return (n) exceeds real return (r) by the level of inflation (i) and the combined effect of inflation and real return (i*r). In the case of regulated utilities the (i) term is provided in the redemption of capital, while the real return and the Fischer term (i*r) is provided in the return on capital.

[2] Some telecoms companies in Europe are not regulated under this regime (eg, Swisscom in Switzerland).

– **Redemption of capital**. The total redemption of capital in the case of telecoms companies consists of two components: regulatory depreciation and holding gain/loss on revaluation of assets.[3]

– The regulatory depreciation is calculated on the re-valued assets; hence over the lifetime of the assets, total depreciation would differ from the original investment by the amount of revaluation over the lifetime of the assets. In the event that revaluation leads to a reduction in the gross book value of assets, total depreciation would be lower than the original investment.

– The holding gain/loss on the revaluation of assets is equal to the revaluation of assets over the period. Similar to depreciation, it represents a cash-flow component of the total revenue allowance for the telecoms companies.

– Over the lifetime of the assets, total redemption of capital (ie, the sum of depreciation and gain/loss on revaluation of assets) equals the value of the original investment. This is different from utilities, where the redemption of capital also includes compensation for inflation and hence exceeds the value of the original investment over the lifetime of the assets.

– **Allowed return**. Allowed return is determined as the nominal cost of capital applied to current cost assets. Compensation for inflation is provided as part of the allowed return. More specifically, both the rate of inflation (i) and the Fischer term (i*r) are compensated for through the allowed return.

Overall, in the case of the telecoms companies, inflation is compensated for in the allowed cost of capital. The redemption of capital does not include a compensation for inflation because the holding gain/loss on revaluation of assets reverses the nominal component of depreciation over the lifetime of the assets.[4]

The rate of inflation that investors are allowed to recover in the case of telecoms companies represents inflation assumed in the nominal cost of capital. In principle, over the lifetime of the assets, investors are indifferent with respect to which asset-specific inflation index is used for asset valuation, because its impact is reversed in the gain/loss on asset revaluation.

[3] This distinction is not always made. Sometimes, holding gain/loss on revaluation of asset is referred to as an element of the allowed depreciation.

[4] In this respect, this regime is similar to a bond. The main difference is in the profile of cash flows over the lifetime of the assets. In the case of telecoms companies, the profile of cash flows is the same as in the case of utilities, provided that the same level of inflation is assumed in the nominal allowed cost of capital in the case of telecoms companies, and is used for asset indexation in the case of utilities, and hence is more back-loaded compared with a bond.

3 Regime applied to KPN

This section discusses the regime applied to estimate the price cap in the case of KPN and examines whether it provides a conceptually appropriate compensation for inflation, given the way inflation is compensated for in the case of utilities and telecoms companies.

KPN has explained to Oxera how the current regime operates, and provided Oxera with stylised calculations that show approaches to asset valuation, and the calculation of depreciation and allowed return.

According to these calculations, the allowed return is based on the real allowed cost of capital. The assets are valued on a current cost basis as original acquisition costs, indexed with asset-specific inflation indices. The allowed regulatory depreciation for a period is calculated as the change in the value of the assets over this period. The change in the value of the assets is equal to the sum of the historical cost depreciation indexed with asset-specific inflation and a change in the gross book value of assets driven by revaluation carried out on the basis of asset-specific inflation indices.

The total redemption of capital provided under this regime seems similar to the regime applied in the case of the other telecoms companies, as described above, This is because over the lifetime of the assets total redemption of capital is equal to the value of the original investment and, as in the case of other telecoms companies, it comprises depreciation on re-valued assets and holding gain/loss on asset re-valuation.

Hence, the redemption of capital in the case of KPN does not include compensation for inflation given that holding gain/loss reverses the impact of inflation on depreciation on the re-valued assets (irrespective of whether asset-specific inflation is positive or negative).

This regime differs from that applied to other telecoms companies, as described above, in that a real allowed cost of capital is used to calculate the allowed returns. The combined effect of the holding gain/loss and depreciation on the value of assets in every period, and the application of the real allowed cost of capital, mean that compensation for inflation is not included in the allowed return.

Under the current regime, KPN seems to be allowed to earn the real allowed cost of capital, and hence under-recovers inflation required in nominal returns (or the difference between nominal and real allowed returns).

Application of a nominal cost of capital under KPN's current regulatory regime, everything else being equal, would allow KPN to recover inflation assumed in the nominal allowed cost of capital.

4 Stylised model of compensation for inflation under different regulatory regimes

This section employs a stylised model to numerically illustrate the methods used to compensate for inflation under two regulatory regimes—namely those applied to telecoms and to utilities—and to contrast these methods with the regime currently applied in the case of KPN.

4.1 Compensation for inflation assuming positive inflation used to value assets

The stylised model calculates the revenue allowance under a set of assumptions with respect to the useful life of an investment, allowed return and inflation, and shows which components of the allowed revenue provide compensation for inflation.

The example is based on a stylised asset with an acquisition cost of €100 and a five-year useful life. Table 4.1 shows the evolution of the value of this asset over its useful life. It shows the evolution of the real value as well as the indexed (CCA) asset value, assuming a rate of inflation of 3%. The same principles would hold for a different inflation index, as demonstrated in section 4.2 using the figure of –3%.

Table 4.1 Evolution of the value of the asset: real and indexed (CCA)

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Inflation used in asset valuation							
Rate	(a)	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Index	(b)	1.00	1.03	1.06	1.09	1.13	1.16
Real asset value							
Opening real asset value	(c)	–	100.0	80.0	60.0	40.0	20.0
CAPEX	(d)	100.0	–	–	–	–	–
Historical cost depreciation	(e)	–	(20.0)	(20.0)	(20.0)	(20.0)	(20.0)
Closing real asset value	(f) = (c + d + e)	100.0	80.0	60.0	40.0	20.0	–
Indexed asset value (CCA)							
Opening indexed asset value	(g)	–	100.0	82.4	63.7	43.7	22.5
CAPEX	= (d)	100.0	–	–	–	–	–
Historical cost depreciation	= (e)	–	(20.0)	(20.0)	(20.0)	(20.0)	(20.0)
Indexation of depreciation	(h) = (e) * (b – 1)	–	(0.6)	(1.2)	(1.9)	(2.5)	(3.2)
Indexation of assets (re-valuation)	(i) = (g) * (a)	–	3.0	2.5	1.9	1.3	0.7
Closing indexed asset value	(j) = (g + d + e + h + i)	100.0	82.4	63.7	43.7	22.5	0.0

Note: For presentational purposes, the opening value of the assets excludes indexation.
Source: Oxera calculations.

As can be seen from Table 4.1, changes in the indexed value of an asset (CCA, rows (g–j)) are driven by three factors (assuming no CAPEX beyond the original investment): historical cost depreciation, nominal component of depreciation (ie, depreciation on indexation) and indexation of assets (re-valuation). While the numbers used in the modelling may be different in different cases (eg, with respect to the inflation index used to re-value assets and calculate the nominal component of depreciation), the approach is similar for regulated utilities, typical telecoms companies and KPN.

4.1.1 Regulated utilities

Table 4.2 shows how the key components of the allowed revenue associated with the stylised asset are calculated (assuming no OPEX) for the regulated utilities and how the inflation is compensated for in this case.

The modelling is based on the illustrative assumption that the real allowed cost of capital is 8.2%. The corresponding nominal cost of capital is 11.4%, assuming the inflation of 3%.

The total compensation for inflation is provided through two components of the allowed revenue.

– Real allowed cost of capital applied to nominal components of indexed assets (provided as part of the return on capital). It is shown in row (a) of Table 4.2. For example, in year 1, this amount is equal to €0.2, or the real cost of capital (assumed to be 8.2%) multiplied by the holding gain of €3.0 (see row (i) of Table 4.1).

– Depreciation of asset indexation (provided as part of the redemption of capital), which is included in the total regulatory depreciation. It is calculated as inflation index applied to historical cost depreciation as shown in row (e) of Table 4.2.

Table 4.2 Illustrative example of compensation for inflation for regulated utilities

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Allowed return on capital	(a) = real allowed cost of capital * Table 4.1 (g+i)		**8.4**	**6.9**	**5.4**	**3.7**	**1.9**	**26.3**
Allowed redemption of capital	(b) = (c + f)		**20.6**	**21.2**	**21.9**	**22.5**	**23.2**	**109.4**
Regulatory depreciation	(c) = (d + e)		**20.6**	**21.2**	**21.9**	**22.5**	**23.2**	**109.4**
Historical cost depreciation	(d) = – Table 4.1 (e)		20.0	20.0	20.0	20.0	20.0	100.0
Indexation of depreciation	(e) = – Table 4.1 (h)		0.6	1.2	1.9	2.5	3.2	9.4
Holding loss/ (gain)	(f)		-	-	-	-	-	
Pre-tax cash flow	(g) = (h + i)	(100.0)	29.0	28.2	27.2	26.2	25.1	35.6
CAPEX	(h) = – Table 4.1 (d)	(100.0)	-	-	-	-	-	(100.0)
Allowed revenue	(i) = (a + b)		29.0	28.2	27.2	26.2	25.1	135.6

Note: Assumes useful asset life of five years. Assumes that assets are indexed at the inflation of 3%, as shown in Table 4.1. Assumes no outperformance.
Source: Oxera calculations.

In order for the regulatory regime to provide an appropriate compensation to investors for costs, including inflation, the outturn pre-tax IRR over the lifetime of an asset should be equal to the pre-tax cost of capital, assuming no out- or underperformance.

In the table above, the pre-tax IRR based on the pre-tax cash flow shown in line (g) is 11.4%. This is equal to pre-tax nominal allowed cost of capital of 11.4%, which is equivalent to the pre-tax real allowed cost of capital of 8.2%, as assumed in row (a), up-rated at the inflation of 3%, consistent with the inflation used to index assets, using the Fischer formula.

This demonstrates that investors recover inflation under the utilities regime assuming that inflation used to index assets (Table 4.1) equals inflation embedded in the required nominal returns (ie, inflation used to index assets shown in Table 4.1 is the same as inflation used to up-rate the real cost of capital). As shown in section 4.2, when inflation used to index assets is lower than inflation assumed in the nominal required returns, investors would under-recover under the utilities regime.

4.1.2 Telecoms companies

Table 4.3 shows a similar analysis for the telecoms companies. This example is based on the nominal allowed cost of capital of 11.4%, which is calculated as the real allowed cost of capital of 8.2% up-rated at the inflation of 3%.

Under the regime often applied to telecoms companies, investors receive compensation for inflation through the following component of the allowed revenue.

– Nominal allowed return on indexed asset base (provided as part of the return on capital), which is captured in row (a) of Table 4.3. For instance, in Year 1, this amount is equal to €3.0, or the inflation rate in the nominal cost of capital (3.0%) multiplied by the opening indexed asset value of €100 (see row (g) of Table 4.1).

The inflation indexation component, which partly compensated for inflation under the utilities regime, is now offset by the adjustment for holding loss/gains (see row (e) and (f) of Table 4.3, which both total €9.4 over the life of the asset, fully offsetting each other). However, the timing of these two opposite adjustment differs on a yearly basis (for instance, €0.6 compared to –€3.0 in Year 1). The fact that holding gain/loss on revaluation of assets is included in cash flows ensures that redemption of capital does not contain a compensation for inflation under the telecoms model.

It should be noted that application of the nominal allowed cost of capital to nominal assets (row (a) in Table 4.3) does not overcompensate for inflation, but rather ensures that inflation is compensated for according to the Fischer formula.

Table 4.3 Illustrative example of compensation for inflation for regulated telecoms

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Allowed return on capital	(a) = nominal allowed cost of capital * Table 4.1 (g)		**11.4**	**9.4**	**7.3**	**5.0**	**2.6**	**35.6**
Allowed redemption of capital	(b) = (c + f)		**17.6**	**18.7**	**19.9**	**21.2**	**22.5**	**100.0**
Regulatory depreciation	(c) = (d + e)		**20.6**	**21.2**	**21.9**	**22.5**	**23.2**	**109.4**
Historical cost depreciation	(d) = – Table 4.1 (e)		20.0	20.0	20.0	20.0	20.0	100.0
Indexation of depreciation	(e) = – Table 4.1 (h)		0.6	1.2	1.9	2.5	3.2	9.4
Holding loss / (gain)	(f) = – Table 4.1 (i)		**(3.0)**	**(2.5)**	**(1.9)**	**(1.3)**	**(0.7)**	**(9.4)**
Pre-tax cash flow	(g) = (h + i)	**(100.0)**	**29.0**	**28.2**	**27.2**	**26.2**	**25.1**	**35.6**
CAPEX	(h) = – Table 4.1 (d)	(100.0)	-	-	-	-	-	(100.0)
Allowed revenue	(i) = (a + b)		29.0	28.2	27.2	26.2	25.1	125.5

Note: Assumes useful asset life of five years. Assumes that assets are indexed at the inflation of 3%, as shown in Table 4.1 and that the nominal allowed cost of capital used in row (a) is based on the real allowed cost of capital and inflation of 3%. Assumes no outperformance.
Source: Oxera calculations.

Similar to the previous example, the lifetime pre-tax IRR under this regime is equal to 11.4% (row (g)), which is equal to the nominal allowed cost of capital, as used in row (a). This demonstrates that under the telecoms regime investors are allowed to earn the return that is equal to the nominal allowed cost of capital. As shown in section 4.2, investors' return over the lifetime of the assets is not affected by the rate of inflation used to index assets (row (a) in Figure 4.1).

4.1.3 Regime applied to KPN

Table 4.4 shows a similar calculation of the allowed revenue for KPN. Under the regime currently applied to KPN, the allowed return on capital is determined as the real cost of capital applied to indexed assets. This is shown in row (a) on the basis of a real cost of capital of 8.2%. The allowed redemption of capital for the period is equal to the change in the value of an asset over this period. This means that the redemption of capital is effectively composed of historical cost depreciation, depreciation on the revaluation of assets and holding gain/loss on asset revaluation. This is shown in row (b). The resulting pre-tax cash flows are calculated in row (g). The IRR over the lifetime of the asset under this regime is 8.2%, which is equal to the real pre-tax allowed cost of capital used in row (a).

Table 4.4 Regime currently applied to KPN

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Allowed return on capital	(a) = real allowed cost of capital * Table 4.1 (g)		**8.2**	**6.7**	**5.2**	**3.6**	**1.8**	**25.5**
Allowed redemption of capital	(b) = (c + f)		17.6	18.7	19.9	21.2	22.5	100.0
Regulatory depreciation	(c) = (d + e)		**20.6**	**21.2**	**21.9**	**22.5**	**23.2**	**109.4**
Historical cost depreciation	(d) = – Table 4.1 (e)		20.0	20.0	20.0	20.0	20.0	100.0
Indexation of depreciation	(e) = – Table 4.1 (h)		0.6	1.2	1.9	2.5	3.2	9.4
Holding loss / (gain)	(f) = – Table 4.1 (i)		**(3.0)**	**(2.5)**	**(1.9)**	**(1.3)**	**(0.7)**	**(9.4)**
Pre-tax cash flow	(g) = (h + i)	**(100.0)**	**25.8**	**25.5**	**25.1**	**24.8**	**24.3**	**25.5**
CAPEX	(h) = – Table 4.1 (d)	(100.0)	-	-	-	-	-	(100.0)
Allowed revenue	(i) = (a + b)		25.8	25.5	25.1	24.8	24.3	125.5

Note: Assumes general price inflation of 3.0% and asset-specific indexation of 3.0%. Assumes no outperformance. It should be also noted that the modelling presented above assumes that allowed return is estimated on the basis of the opening asset value (row (g) in Table 4.1) as in the case of the telecoms companies, rather than on the basis of the sum of opening asset value and indexation of assets (row (h) in Table 4.1) as in the case of utilities. If the allowed return was based on opening assets plus indexation then KPN would also under-recover, but the extent of under-recovery would be lower.
Source: Oxera calculations.

The outturn pre-tax IRR is equal to the *real* allowed cost of capital, rather than *nominal* as is the case with other methods applied to telecoms companies and utilities—this driven by the following.

– The allowed redemption of capital in the case of KPN (row (b)) is the same as in the case of telecoms and sums up to the acquisition value of an asset over its lifetime. This means that it does not contain a compensation for inflation.

– The allowed return on capital in the case of KPN is lower than in the case of telecoms companies (row (a)), because in the case of KPN a real cost of capital is applied to the same asset base, to which in the case of typical telecoms a nominal cost of capital is applied.

In the event that a nominal cost of capital (11.4% in this example) was applied under the KPN's regime, row (a) in Table 4.4 would be the same as row (a) in Table 4.3 and the lifetime IRR would be equal to the nominal cost of capital. This demonstrates that application of the nominal allowed cost of capital under the regime currently applied to KPN would allow investors to recover the inflation assumed in the nominal allowed cost of capital (3% in this example).

4.2 Compensation for inflation assuming a negative inflation used to value assets

This sub-section shows the return to investors under different regulatory regimes assuming that inflation used for asset indexation is negative, while inflation assumed in the nominal cost of capital (general level of price inflation) is positive. The objective of this analysis is to demonstrate that under these assumptions with respect to inflation KPN also under-recovers.

The inflation used to index the assets is assumed to be (–3.0%), while inflation in the cost of capital (assumed to equal to the inflation required by investors) is kept at the same level as in Section 4.1–ie, (+3%). The same real cost of capital of 8.2% (which corresponds to the nominal cost of capital of 11.4%) is used in this analysis.

Table 4.5 below shows the evolution of the value of assets under the assumption of negative inflation used for asset valuation.

Table 4.5 Evolution of the value of the asset assuming negative inflation used for asset valuation: real and indexed (CCA)

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Inflation used in asset valuation							
Rate	(a)	–3.0%	–3.0%	–3.0%	–3.0%	–3.0%	–3.0%
Index	(b)	1.00	0.97	0.94	0.91	0.89	0.86
Real asset value							
Opening real asset value	(c)		100.0	80.0	60.0	40.0	20.0
CAPEX	(d)	100.0					
Historical cost depreciation	(e)		(20.0)	(20.0)	(20.0)	(20.0)	(20.0)
Closing real asset value	(f) = (c + d + e)	100.0	80.0	60.0	40.0	20.0	
Indexed asset value (CCA)							
Opening indexed asset value	(g)		100.0	77.6	56.5	36.5	17.7
CAPEX	= (d)	100.0					
Historical cost depreciation	= (e)		(20.0)	(20.0)	(20.0)	(20.0)	(20.0)
Indexation of depreciation	(h) = (e) * (b – 1)		0.6	1.2	1.7	2.3	2.8
Holding gain/(loss)	(i) = (g) * (a)		(3.0)	(2.3)	(1.7)	(1.1)	(0.5)
Closing indexed asset value	(j) = (g + d + e + h + i)	100.0	77.6	56.5	36.5	17.7	(0.0)

Note: For presentational purposes, the opening value of the assets excludes indexation.
Source: Oxera calculations.

The impact of a negative inflation used for asset valuation can be seen from the comparison of the evolution of the CCA asset value over time in rows (j) of Tables 4.5 and 4.1. It can be seen that, as expected, the nominal asset value declines faster with a –3.0% (Table 4.5) index than at +3.0% (Table 4.1).

Table 4.6 shows the impact of these assumptions with respect to inflation on the allowed cash flow under different regimes, and compares pre-tax IRRs with the nominal cost of capital in order to examine whether investors recover inflation.

Table 4.6 Comparison of returns under different regulatory assuming negative inflation used for asset valuation

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Utilities								
Allowed return *on* capital	(a)		**7.9**	**6.2**	**4.5**	**2.9**	**1.4**	**22.8**
Allowed redemption *of* capital	(b) = (c + d)		**19.4**	**18.8**	**18.3**	**17.7**	**17.2**	**91.4**
Regulatory depreciation	(c)		19.4	18.8	18.3	17.7	17.2	91.4
Holding loss / (gain)	(d)							
Allowed revenue	(e) = (a + b)		**27.3**	**25.0**	**22.7**	**20.6**	**18.6**	**114.2**
Return (lifetime, pre-tax IRR)	**(f)**	**4.9%**	**Nominal cost of capital = 11.4%**					
Telecoms								
Allowed return *on* capital	(g)		**11.4**	**8.9**	**6.4**	**4.2**	**2.0**	**32.9**
Allowed redemption *of* capital	(h) = (i + j)		**22.4**	**21.1**	**19.9**	**18.8**	**17.7**	**100.0**
Regulatory depreciation	(i)		19.4	18.8	18.3	17.7	17.2	91.4
Holding loss / (gain)	(j)		3.0	2.3	1.7	1.1	0.5	8.6
Allowed revenue	(k) = (g + h)		**33.8**	**30.0**	**26.4**	**23.0**	**19.7**	**132.9**
Return (lifetime, pre-tax IRR)	**(l)**	**11.4%**	**Nominal cost of capital = 11.4%**					
KPN								
Allowed return *on* capital	(m)		**8.2**	**6.3**	**4.6**	**3.0**	**1.4**	**23.6**
Allowed redemption *of* capital	(n) = (o + p)		**22.4**	**21.1**	**19.9**	**18.8**	**17.7**	**100.0**
Regulatory depreciation	(o)		19.4	18.8	18.3	17.7	17.2	91.4
Holding loss / (gain)	(p)		3.0	2.3	1.7	1.1	0.5	8.6
Allowed revenue	(q) = (m + n)		**30.6**	**27.5**	**24.6**	**21.8**	**19.2**	**123.6**
Return (lifetime, pre-tax IRR)	**(r)**	**8.2%**	**Nominal cost of capital = 11.4%**					

Note: Assumes general price inflation of 3.0% and asset-specific indexation of –3.0%. Assumes no outperformance.
Source: Oxera calculations.

The key observations are as follows.

– **Utilities**. Under this regime if the rates of inflation assumed in the nominal cost of capital and used to index assets are equal, investors would recover (Table 4.2). However, when the rate of inflation used to index assets is lower than inflation assumed in nominal cost of capital (as it is the case in this example, Table 4.6), the outturn return would be lower than the nominal cost of capital (4.9% vs 11.4% in the example above).

– **Telecoms**. The outturn return under the telecoms regime corresponds to the nominal allowed cost of capital; it is unaffected by the rate of inflation assumed for asset indexation. This is consistent with the fact that compensation for inflation under that regime is captured by the cost of capital element of the allowed return, which is 3.0% in this example.

– **KPN**. Under the regime currently applied to KPN, the outturn return equals to the real allowed cost of capital. Similar to the regime applied to the telecoms companies, it is not affected by the rate of inflation used to index assets. Hence, in this case, KPN also under-recovers inflation.

A1 Analytical derivation of the allowed pre-tax cash flow under different regulatory regimes

Table A1.1 Description of variables

Variable	Description
V	Original investment (€)
i	Annual inflation (%). All three types of inflation (required by investors in the actual cost of capital, allowed in the nominal cost of capital under the telecoms regime and used for asset indexation) are assumed to be same
r	Real return (%). Allowed returns are assumed to actual return
n	Nominal return (%) calculated using the Fischer formula on the basis of the real return (r) and inflation (i) as follows: (1+r)*(1+i)-1

Source: Oxera.

Table A1.2 Asset valuation (€)

	Year 1	Year 2
Opening indexed asset value	**0**	**V**
CAPEX	V	0
Historical cost depreciation	0	–V
Indexation of depreciation	0	–V*(i)
Indexation of assets (re-valuation)	0	+V*i
Closing indexed asset value	**V**	**0**

Note: Based on the assumption of year-end cash flows.
Source: Oxera.

Table A1.3 Allowed pre-tax cash flows and returns

Investment = V	Utilities	Telecoms	KPN
			Scenario 1
Allowed pre-tax return (€)	(V+V*i)*r=V*(1+i)*r	V*n=V*[(1+r)*(1+i)-1]	V*r
Allowed redemption of capital (€)	V+V*i = V*(1+i)	V+V*I – V*i = V	V+V*I – V*i = V
Pre-tax cash flow (€)	V*(1+i)*r + V*(1+i) = V*(1+r)*(1+i)=**V*(1+n)**	V*[(1+r)*(1+i)-1]+V = V*(1+r)*(1+i)=**V*(1+n)**	V*r+V = **V*(1+r)**
Pre-tax return (%)	IRR [-V, V*(1+n)] = **(n)**	IRR [-V, V*(1+n)] = **(n)**	IRR [-V, V*(1+r)] = (r) = **(n – i - r*i)**
Under-recovery (€)	0	0	V*(1+n) – V*(1+r) = **V*(1+r)*i**

Note: Based on the assumption of year-end cash flows. Calculation of pre-tax cash flows for KPN assumes that the allowed cost of capital (r) is applied to the opening asset values net of indexation of assets, as in the case of telecoms. In this case KPN under-recovers the rate of inflation and the Fischer term (i+r*i). If the allowed cost of capital (r) were applied to the opening asset values gross of indexation of assets, as in the case of utilities, then KPN would under-recover only the rate of inflation (r).
Source: Oxera.

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