Regulatory methodologies

Incentive regulation for transport and distribution of electricity, French, Dutch and English examples

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Based on materials transmitted by the French energy regulator

Outline

1.1. Why incentive regulation?

1.2. Principles and risks

1.3. Different models

1.4. Economic Performance and quality of service

From theory to practice

The Laffont Tirole framework:

- Cost plus (ROR) versus price caps
- Information rents
- Need to minimise information rents while providing adequate incentives
- Depends on the relative productivity and nature of the service
  - examples of various activities:
    - Postal services
    - Telecommunications (RPI-X)
    - Health care (DRGs, pharmaceuticals)
    - Energy:
      - Generation (strategic aspects, energy mix)
      - Transmission/distribution

1.1.1. Key objectives of the regulation in the energy transmission/distribution

Access to networks

Facilitating **non discriminatory third party access** to the transmission and distribution networks, and ensuring fair and efficient competition

Pricing Structure

Providing incentives towards efficient use and development of the networks

Price levels

Regulating infrastructure monopolies

- ✓ Ensure continuity and quality of service while allowing financing of current and future activities
- ✓ control profits and/or minimise costs

1.1.2. Objective of incentive regulation

Price fixing in terms of cost-plus (ROR)

- Regulator fixes a price which allows the company to recoup its operating costs (including remuneration of capital)
- Prices are frequently adjusted to recoup excess gains or compensate excess losses)
  - ✓ Advantage: no « over profit » for the regulated entity
  - ✓ Drawback : **lack of incentives to minimise costs**

Incentive regulation

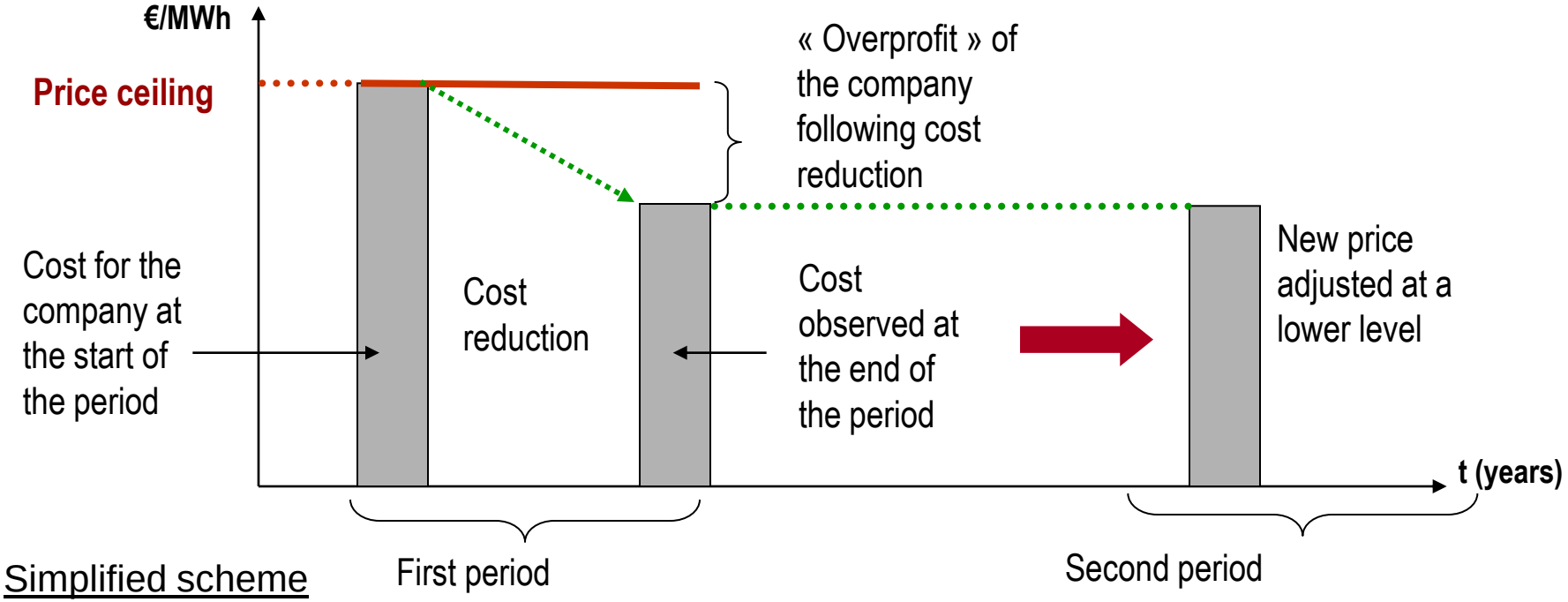
Facilitate price reduction through a methodology of price fixing which provides incentives for regulated entities to minimise their costs

Principles and Risks

1.2.1. a simple principle

« rewarding companies for their efforts in minimising costs»

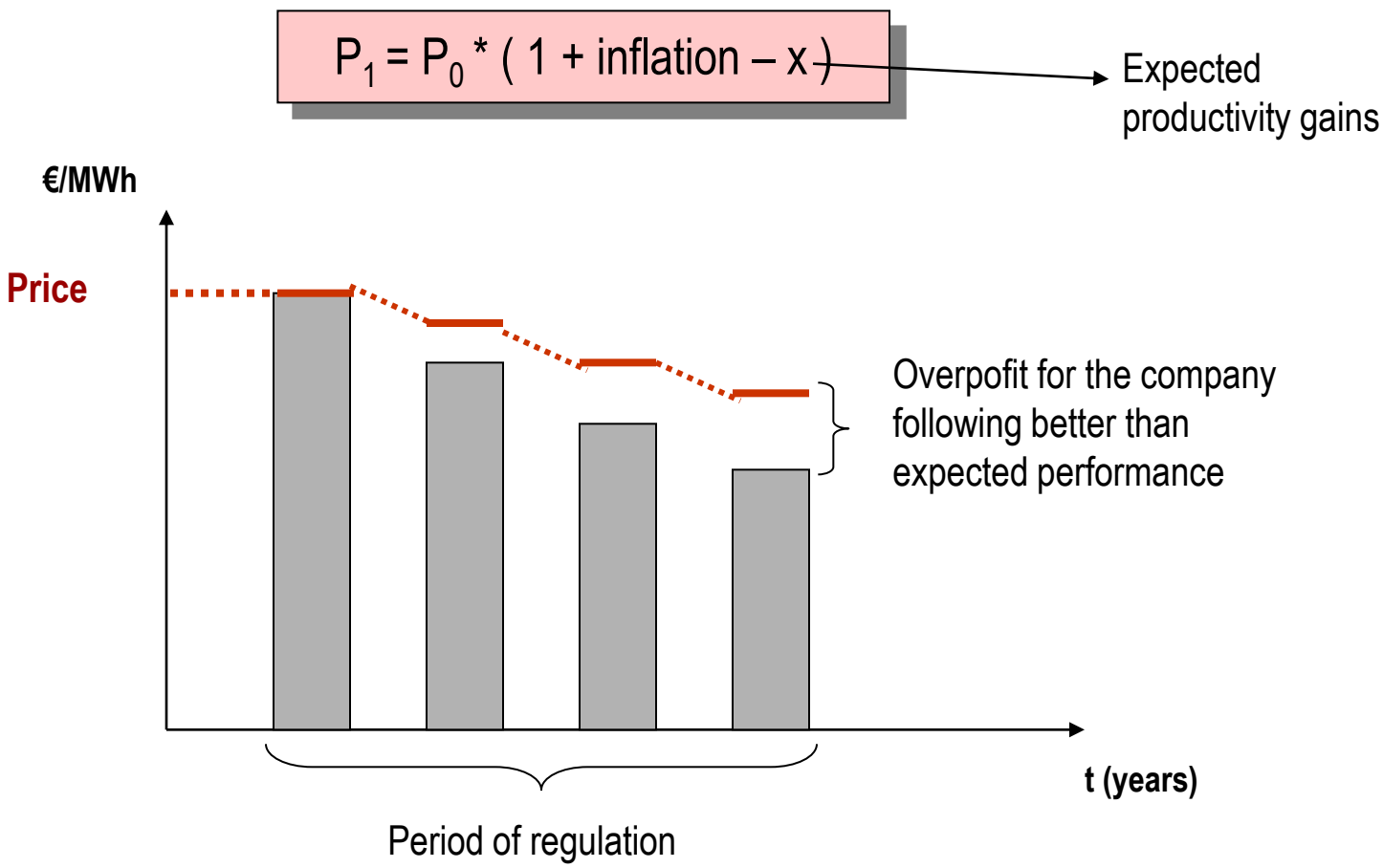
This reward is a form of « overprofit », which separates the ceiling in terms of prices or incomes, fixed a priori, and costs that are effectively incurred



Simplified scheme

- In practice, the price (or income) ceiling is adjusted ona yearly basis, taking into account inflation, productivity targets and possibly the technical performance of the Network Manager (Transmission Network Company/RTE)
- **Note**: *this supposes at least full accounting distinction between generating capacity, transmission and distribution (issues to obtain proper accounting /functional separation)*

1.2.2. The case of a Price Cap (RPI-X)



NB: In the case of an « income cap », the scheme is similar: the variables of total operating income and total costs are to be substituted for prices and unit costs.

1.2.3. Overprofit: a normal consequence of incentive regulation

- **Overprofit is necessary to provide adequate incentives towards cost reduction**
  - ✓ **Excessive overprofit** is the potential risk with which the regulator is faced with in the short term, and in terms of ***political acceptance***
  - ✓ Overprofit will be higher if the **information asymmetry** between the regulator and the regulated entity is significant
  - ✓ To obtain its overprofit, the network manager reveals to the regulator information on the amount of effort that he is able to invest to **reduce its costs**, as well as on the efficient level of costs
  - ✓ This information allows the regulator to **fix lower prices in the second period**
  - ✓ **The user** is always **winning** in the **long term** (if the overprofit results from cost cutting at constant quality level)

  Note: but it needs an ability to commit over several periods: independence of the regulators, stability of the macroeconomic framework.

1.2.3. Overprofit: a normal consequence of incentive regulation

Theoretical example :

2 periods of 5 years

Yearly X factor : -1% (productivity target)

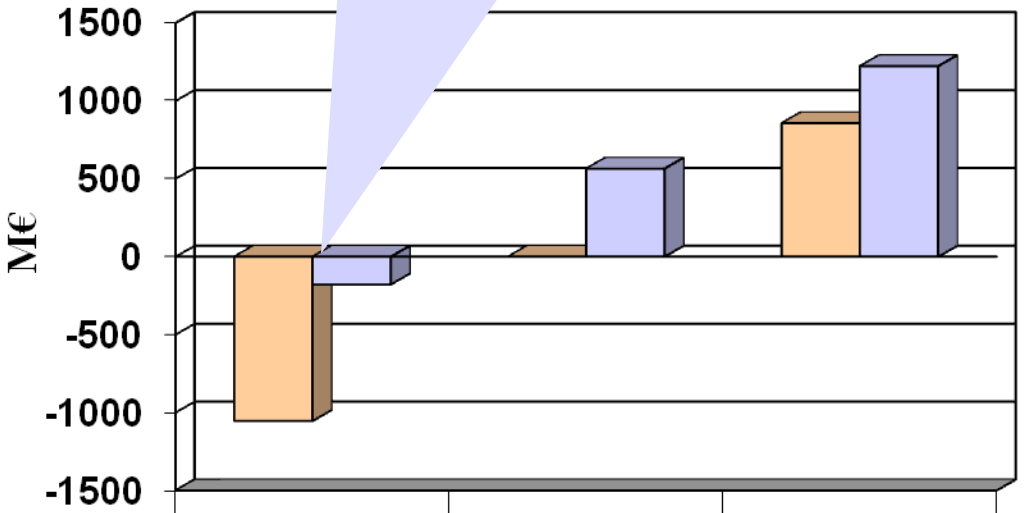
Controllable costs : 1500 M€

Discount rate o: 5,25%

Three cases depending on trends in observed costs

- ✓ H1: +2% /year
- ✓ H2: -1% /year
- ✓ H3: -4% /year

Results from trends in tariffs over 10years: X factor and price adjustment over the two periods



	2%	-1%	-4%
Overprofit	-1054	0	857
Savings for users	-178	565	1223

Even if significant overprofits occur, **the gain for network users is greater than for the company in the long term**

1.2.4. Paradox of information asymmetries

- The regulator implements **incentive regulation** as **it lacks information** over the level of efficient costs for the company
- This lack of information confronts the regulator with two types of **risks** :

  - ✓ Excessive gains of productivity required from the company => **financial risk for the company**
  - ✓ Excessive level of remuneration => **excessive overprofit**

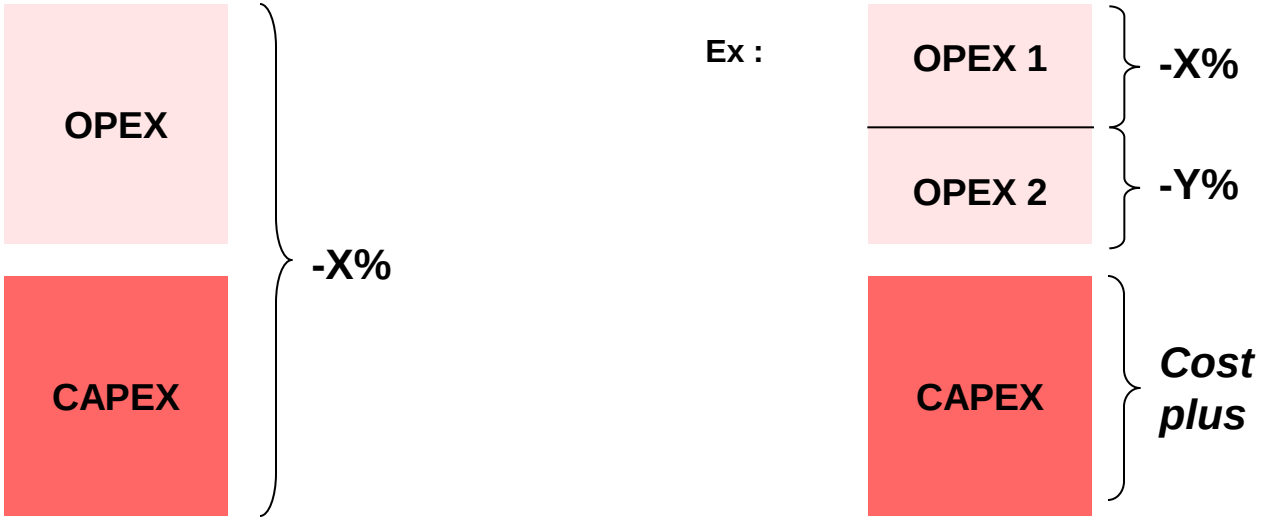
The regulated company can obtain **excessive overprofit** through :

- ✓ Overestimating future expenses
- ✓ Negotiating apparently ambitious targets of productivity which are in reality easy to reach
- ✓ Requiring a higher rate of profitability to compensate for greater financial risk

Different Approaches

1.3.1. How to determine productivity targets, global vs differentiated

GLOBAL PRODUCTIVITY TARGET **vs.** **DIFFERENTIATED PRODUCTIVITY TARGET**



Global Optimising of expenditure

Optimising expenditure item by item

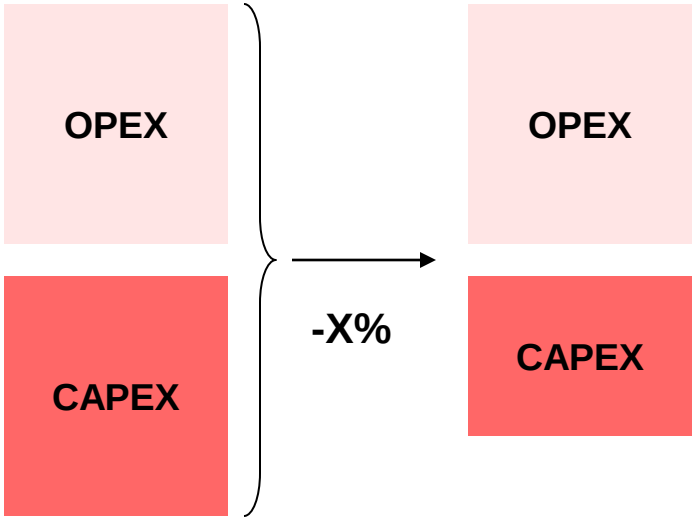
1.3.1. How to determine productivity targets?

Global productivity *vs* differentiated productivity

Chaque option présente des risques

GLOBAL PRODUCTIVITY TARGET :

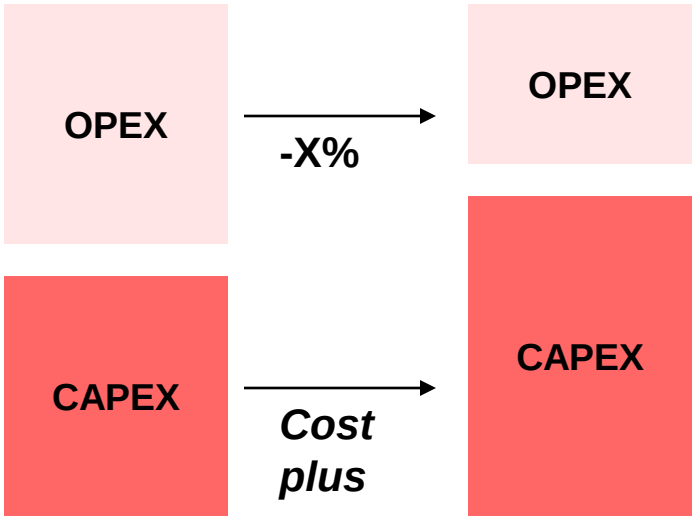
Risk of under-investment



=>The regulated entity is remunerated for overall cost reduction, including at the expense of quality

DIFFERENTICATED PRODUCTIVITY TARGET

Risk of substitution CAPEX / OPEX



=> The regulated entity is remunerated without a reduction in prices

Note: *This differs from traditional older notions in regulatory economics of utilities: ROR averch Johnson effects*

How to assess the productivity target ?

- Determine an « efficiency frontier », from a sample of companies
  - ✓ Econometric methods (OLS, Stochastic Frontiers)
  - ✓ Non parametric methods (DEA, data envelopment analysis).
  - ⇒ ***X* is the distance of the company to the efficiency frontier**
- Estimating the expected **average productivity in the industry**.
- Efficiency Audit
- Determine the costs of reference from a theoretical network: X estimated from **comparing these costs of reference and the actual observed costs of the regulated entity**

Imposing a target vs establishing a menu of possible contractual options

- The regulator can impose productivity targets or leave network managers choose their desired productivity target among a menu of options

⇒ This results in a **menu of contractual options**

- **MENU OF CONTRACTUAL OPTIONS**
  - ✓ The principle is to authorise higher overprofits for those companies which choose more demanding productivity targets, in order to provide incentives to companies for revealing information over their efficient cost level
  - ✓ The difficulty is to fix an authorised level of overprofit for each contract so that it is financially more interesting for the regulated entity to choose an ambitious contract
  - ✓ This option has been applied by the UK OFGEM in the case of investment in electricity distribution

The level of incentives of the chosen model

- The **level of incentive** depends primarily on the **duration** of the period of regulation
- The level of incentive can be diminished by mechanisms that may cap profits (but also losses) of the regulated entity during the period of regulation
- Such a mechanism may reduce the incentive power of the regulation but may also protect the regulator against excessive overprofit or against the risk of financial non viability of the regulated entity

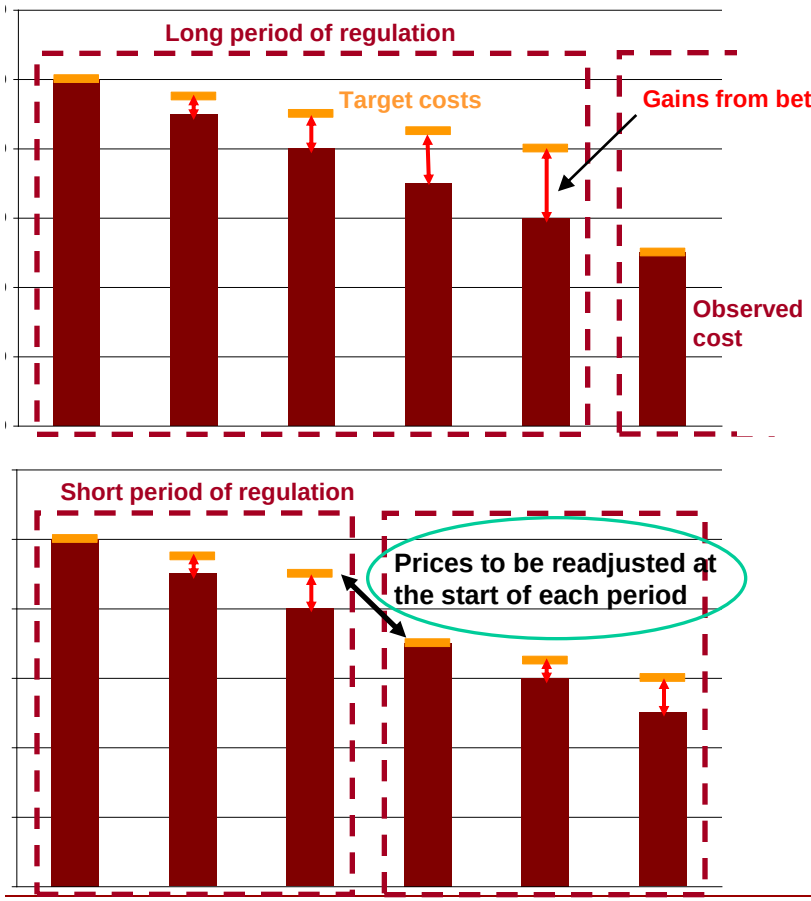
  Ex : a possibility is to **cap the rate of return** *ex-post.*

- The **level of incentive** depends on the credibility of the regulator and its **ability to make firm commitments** as concerns the rules that have been set *ex-ante*.

Note

- *Difficulty to commit over time periods (emerging countries)*
- *Macroeconomic stability*
- *Too short periods: equivalent to a ROR/Cost plus*

The power of the incentive regulation



Long period of regulation

Potentially higher gains for the regulated entity

Short period of regulation

Potentially lower gains for the regulated entity

The level of uncertainty faced by the network manager

❖ **Sources of uncertainty for network managers**

- ✓ Difficulty in forecasting future costs, or lack of control
- ✓ Difficulty of estimating future electricity consumption (in the case of a price cap rather than an income cap)
- ✓ Capacity of the network manager to reduce costs to reach the fixed productivity target

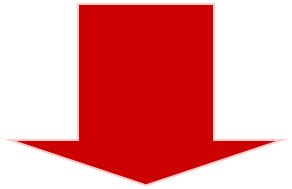
❖ **Productivity gains and level of remuneration of the company**

- ✓ As target productivity is imposed, perception of risk by the regulated entity may increase
- ✓ An increase in the level of remuneration is only warranted **if the productivity target is demanding**

Economic Performance vs service quality

.4.1. the risk of reduction in quality of service

- The network manager may be tempted to **reduce its costs at the expense of service quality**, reducing investments or expenses for maintenance and intervention
- This risk will be even more important if the regulatyor opts for a **global productivity target.**



Monitoring **investment policies**

Implementing **incentive regulation for quality**

Incentive regulation for quality

Two main approaches (1/2)

First approach : Fixing optimum quality standards and imposing penalties in case of non compliance

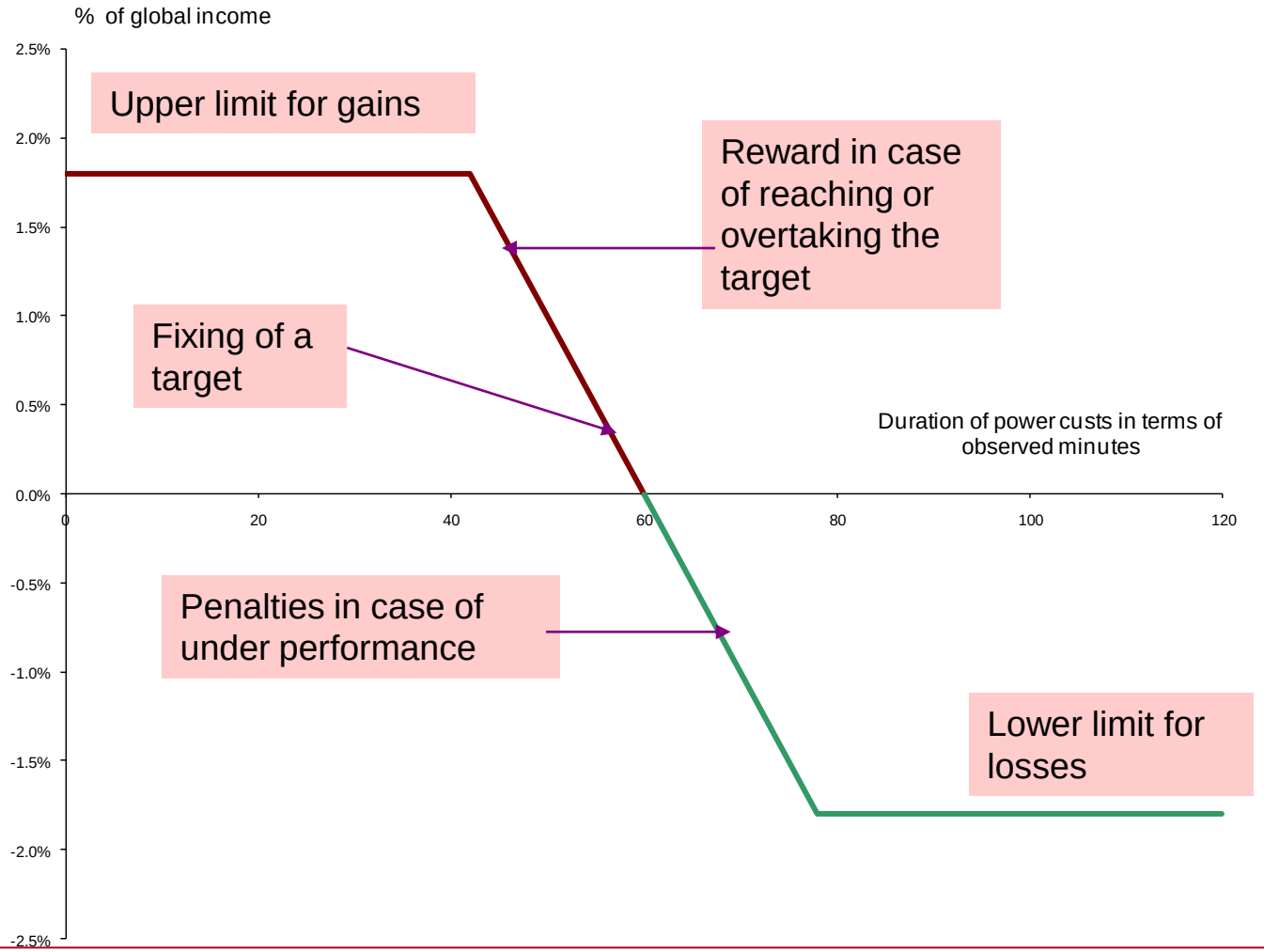
- The quality standard is determined through equalising at the margin :
  - ✓ The marginal production cost of quality by the network manager
  - ✓ The marginal cost of « non quality » for users of the network

- This marginal cost of non-quality for users is supposed to be constant and can be estimated from surveys

- Most often, the regulator does not have information on **the marginal costs for producing quality** (which would require thorough modelling of the whole network).

=> In practice, this approach is not applied frequently

Second approach : Setting up a system of rewards and penalties the level of which is determined solely by the level of the cost of « non quality » for users



This incentive mechanism provides incentives for network managers to offer an appropriate level of quality of service, without for the regulator to know the marginal cost of producing quality:

***Note**: emerging countries: case of Brazil, ANEEL sets very high level of fines to discipline the network, credibility of the fines.*

Additional options

Penalties/rewards can be applied globally (in terms of overall price variation), or for each affected user

- Incentives schemes which include only penalties may involve:
  - ✓ Direct compensations solely directed to the users impacted by the deterioration in quality
  - ✓ Or compensating all users through a reduction of prices

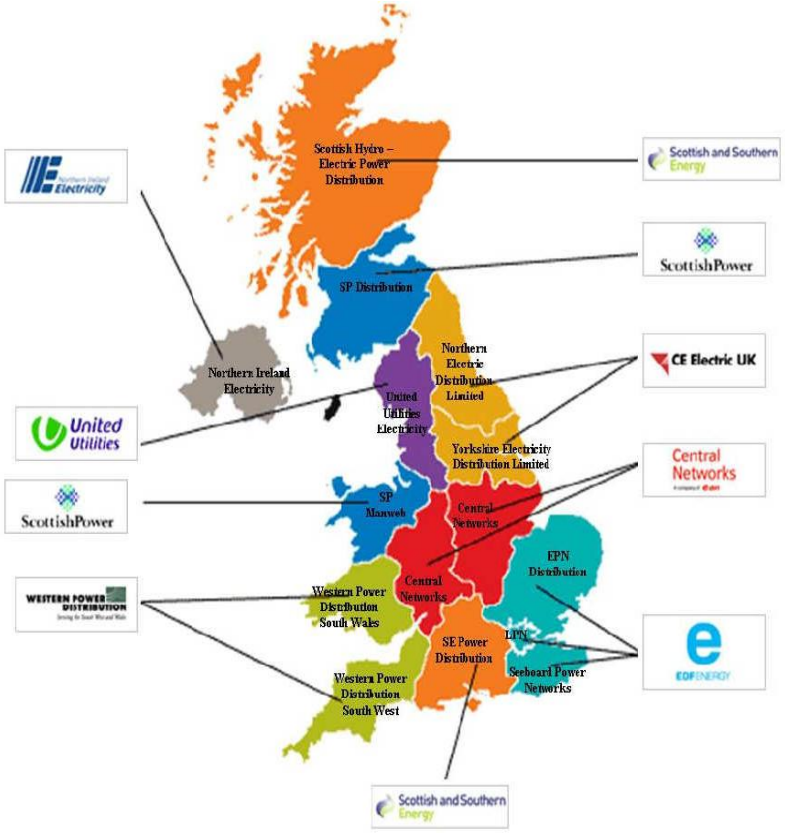
- Symmetric schemes with penalties and rewards involve price adjustment in the follow up period

THE UK EXAMPLE

Operators

DISTRIBUTION

15 Regional Electricity Companies



TRANSPORT

3 operators for the transport of electricity :

SHETL

SPTL

NGET (also in charge of **system management)**

Regulatory framework

- **Structure of prices for clients are fixed by the companies** (licences awarded by Ofgem fix main rules for the structure of prices)

- Pricniple of **incentive regulation established in legal Act** (Utility Act 2000).

- **OFGEM** (Office for Gas and Electricity Market) checks that incomes received by operators does not go over an authorised threshold for authorised annual income: ***income cap*** principle

Flows of income during the period of regulation

R_0: observed income for the last year of the previous period of regulation

$R_1 = \mathbf{R_0} * \mathbf{P_0}$

$R_2 = R_1 * (1+ \text{Inflation} + \mathbf{X})$

$R_3 = R_2 * (1+ \text{Inflation} + X)$

$R_4 = R_3 * (1+ \text{Inflation} + X)$

$R_5 = R_4 * (1+ \text{Inflation} + X)$

P_0: factor of variation for income during the first year of the period of regulation

X: factor of variation of income for the years 2,3, 4 et 5 of the period of regulation.

- The **amount of authorised yearly income** can be revised according to :
  - ✓ The difference between **observed demand** and **anticipated demand**
  - ✓ The variations of certain items of **expenses that are out of control** (taxes, transport access, fees)

Estimating authorised revenues and P_0

STEP 1

Estimating future charges to be covered during the 5 years of regulation

This results in a **global discounted amount** of income for the entire period

STEP 2

Annualising this discounted amount of income :

- ✓ Including trends in anticipated demand
- ✓ Fixing *ex-ante* then trend in income (**X factor**) for the years 2 to 5 of the period of regulation

The authorised amount of yearly income will not be uniform over the overall period of regulation

STEP 3

An initial level of income P_0 is obtained by dividing the yearly amount authorised for the 1st year of regulation by the amount of income for the last year of the previous period of regulation

Estimating authorised income and P_0

STEP 1

Previsional charges to be covered each year

✓Including productivity targets

STEP 2

Annualising the global discounted amount of authorised income

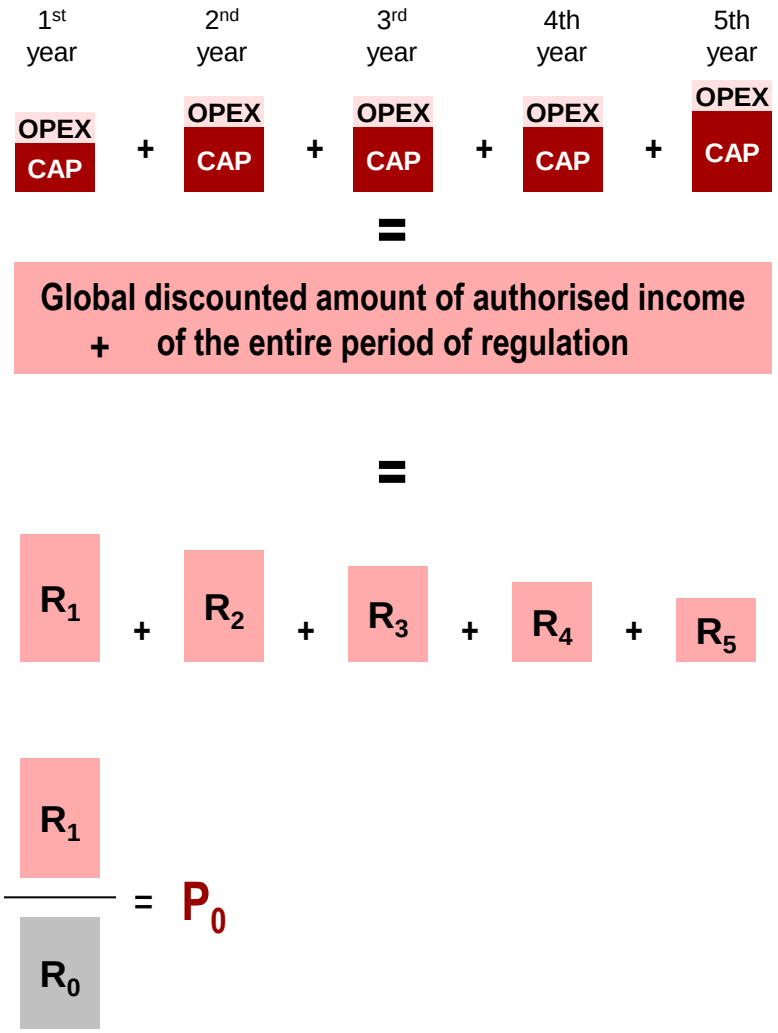
✓ Including variations in anticipated demand

✓ **X** = variation of annual income for the years 2-5 (determined *ex ante* by Ofgem)

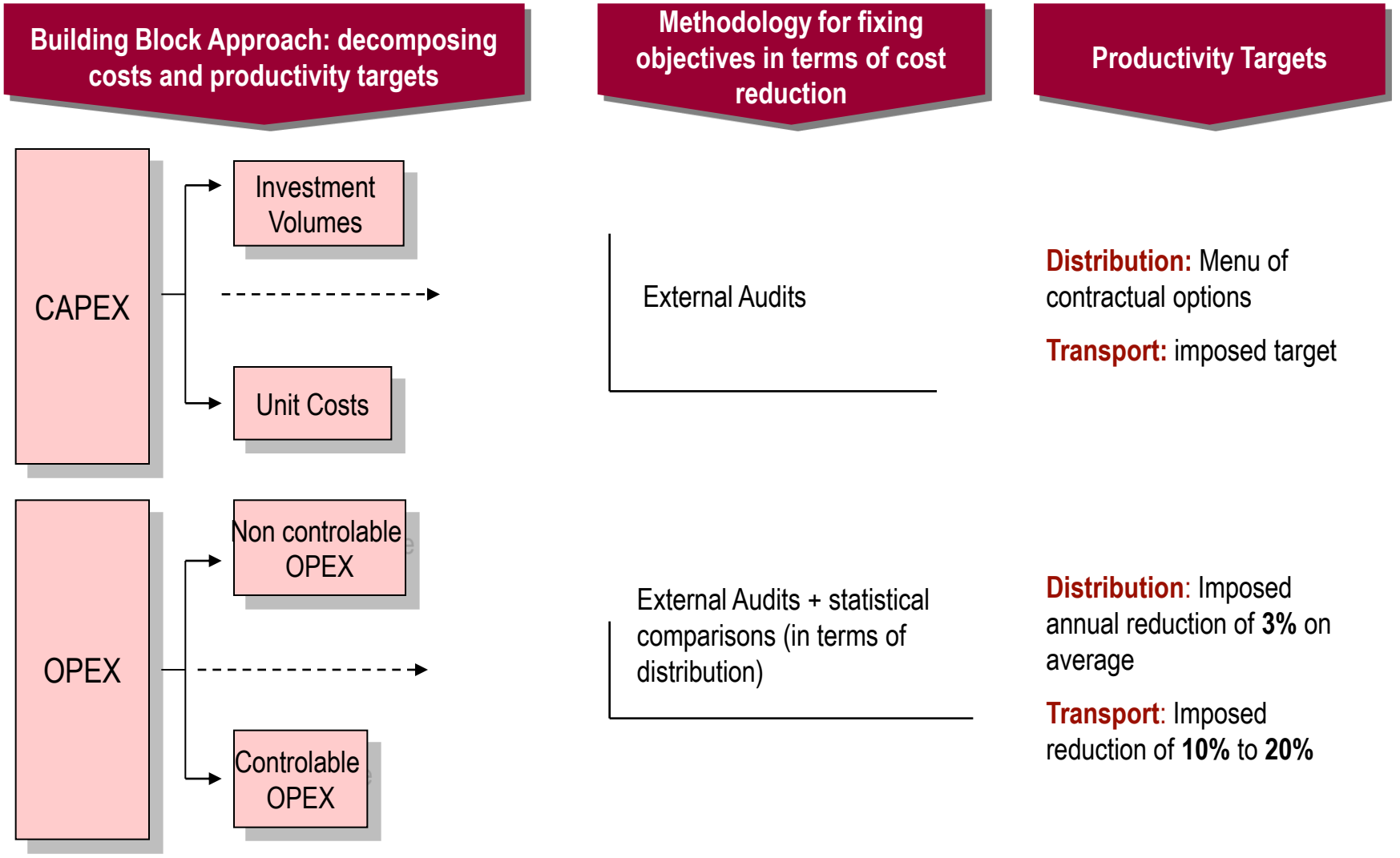
ETAPE 3

Estimating P_0

✓ R_0= Authorised income for the last year of the previous regulatory period



Productivity targets differentiated by category of expenses



A menu of contractual options for investment in distribution

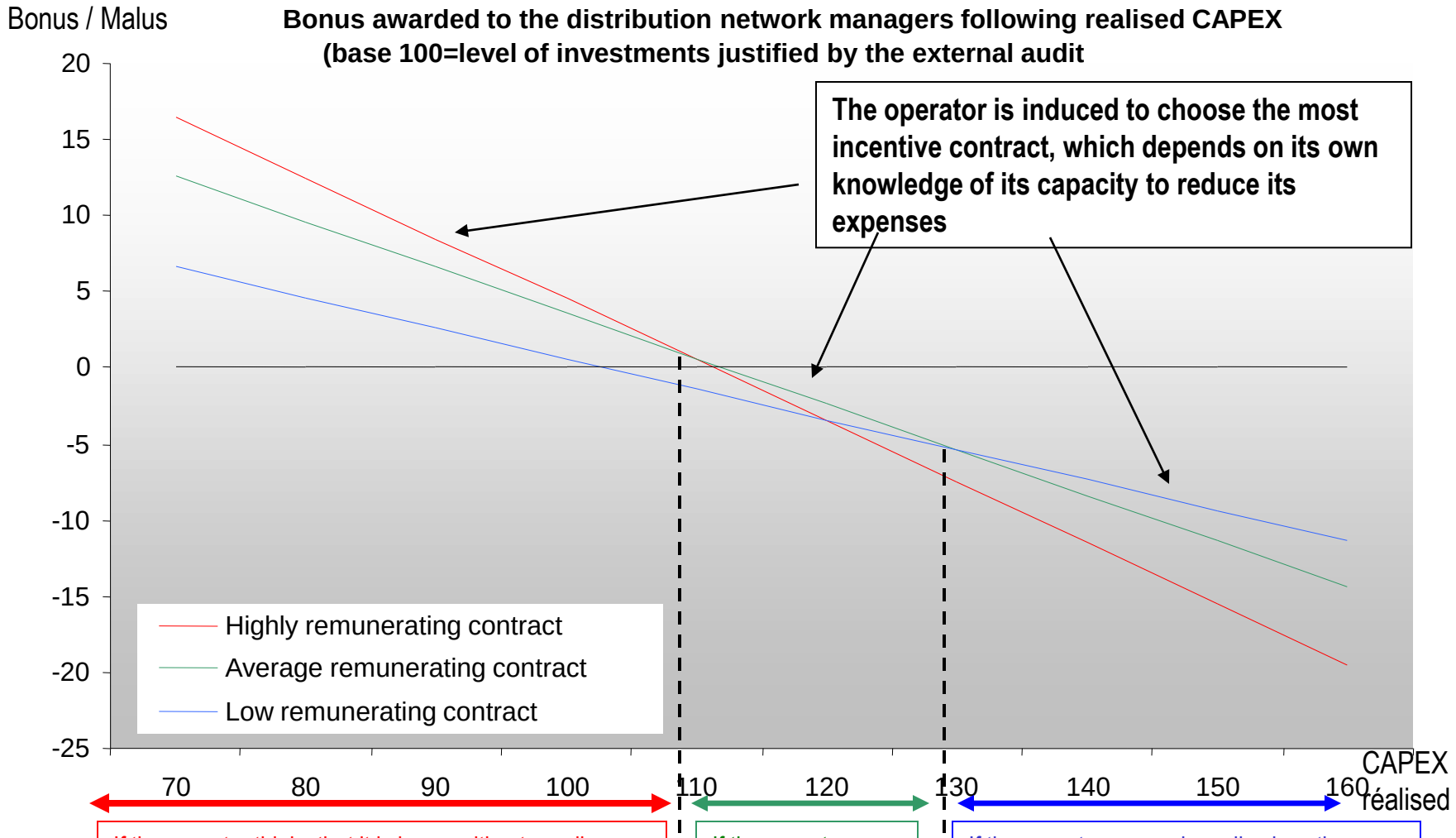
GREATER INFORMATION ASYMETRY BETWEEN THE REGULATOR AND THE REGULATED ENTITY

- Each distribution network manager presents **Investment Budgets for 5 years**
- An **external audit** is performed to assess the appropriate level of investment
- Often, a gap of up to **40%** between budgets by the network managers and the audit = source of conflict

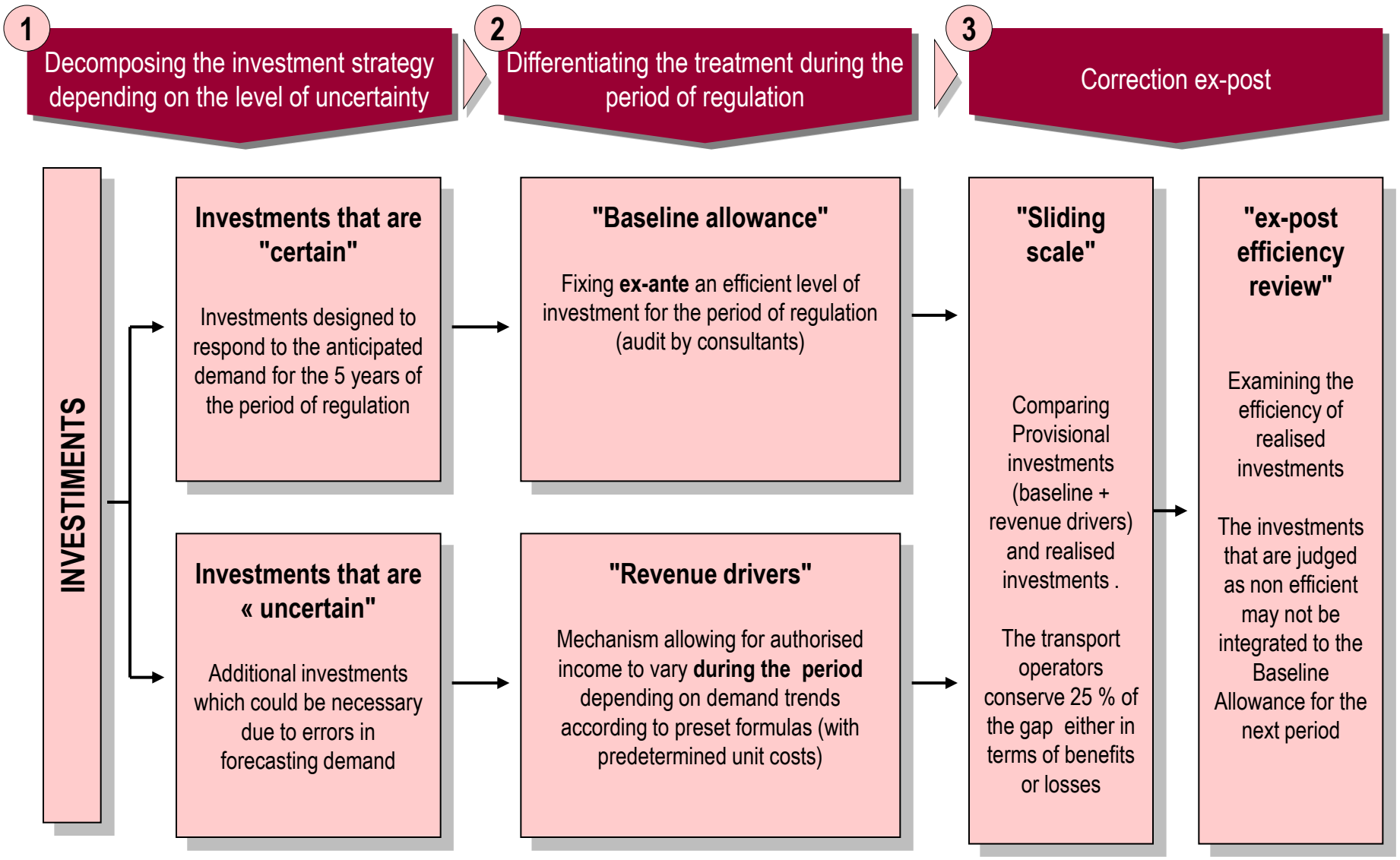
SOLUTION : A MENU OF INCENTIVE CONTRACTS

- The distribution network manager chooses a **target of investment** among a set of more or less incentive contracts
- The contracts that authorise a level of investment close to the one recommended by the external audit offer a higher remuneration in case of a reduction of expenses by the operator; in exchange, the losses are higher in case of budget overrun
- The distribution network manager is induced to choose the contract which best matches its profile, thus **revealing the level of its efficient costs**

A MENU OF CONTRACTUAL OPTIONS INDUCES THE DISTRIBUTION NETWORK MANAGER TO REVEAL ITS COSTS



Investment in transport: reconciling flexibility and incentives towards efficiency



The Regulation of Quality

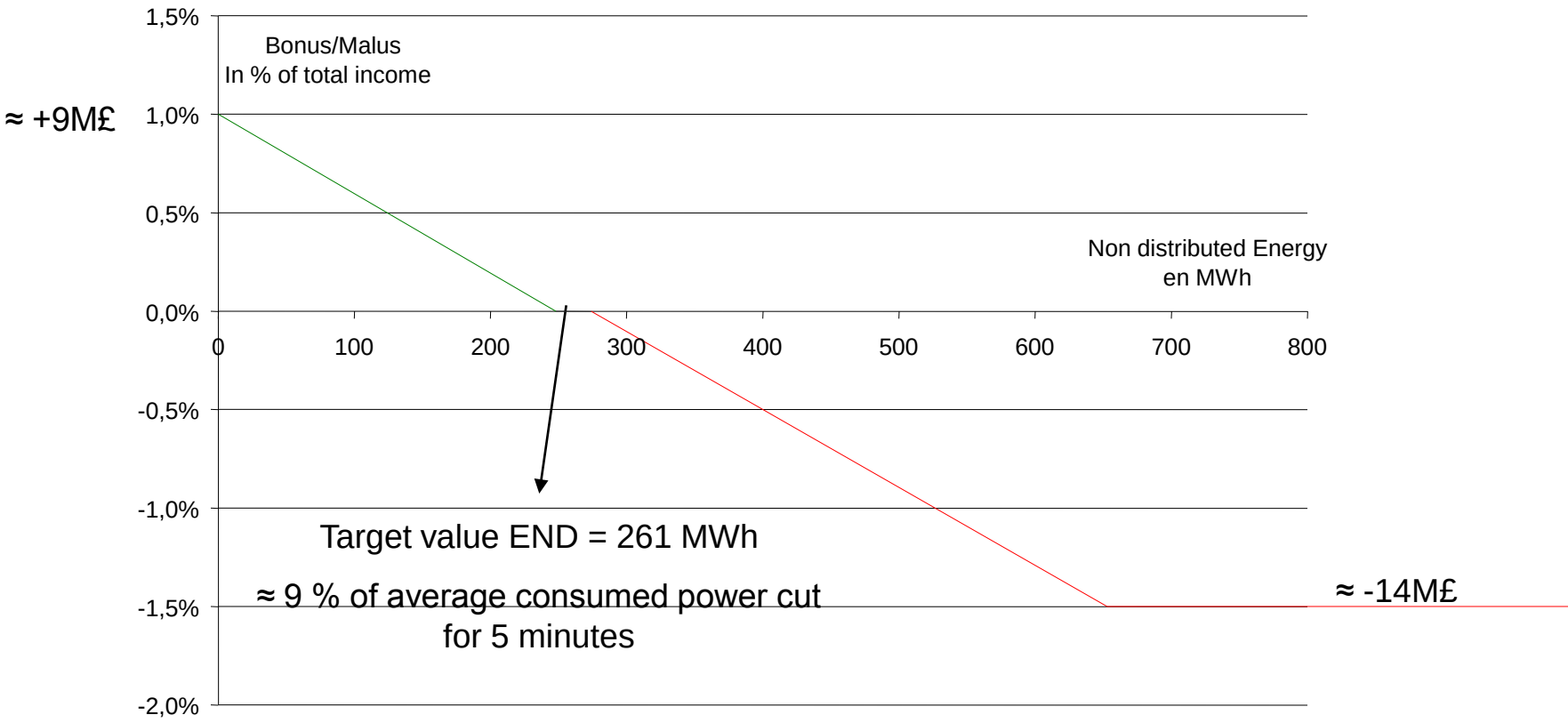
TWO MECHANISMS FOR DISTRIBUTION

- A **uniform quality standard which provides a minimum level of quality for each user**
  - ✓ Individual Compensation of **50£ for 18 consecutive hours** of power cut + 25£ by additional tranche of 6h
  - ✓ Specific regulations for exceptional climatic events

- A **scheme for incentive regulation of quality** which induces each manager of a distribution network to improve the average quality of supply
  - ✓ Targets in terms of the frequency and duration of the cuts, with a bonus or malus in terms of the level of quality realised
  - ✓ Financial risk capped at +/- 3% of annual income

TRANSPORT : A GLOBAL MECHANISMS OF INCENTIVES

NGET



TO SUM UP KEY CHARACTERISTICS OF THE UK APPROACH

❖ PRODUCTIVITY TARGETS

- ✓ Differentiated by category of expenses
- ✓ Determined based on information from external audits and in the case of distributors' OPEX of a national study of costs
- ✓ The UK regulator is the first and the only one up to now to have used a solution of a menu of contracts

❖ LEVEL OF INCENTIVES

- ✓ Incentive mechanisms cover both OPEX and CAPEX
- ✓ OPEX : period of regulation of 5 years
- ✓ CAPEX : the regulated entity keeps between **20%** et **40%** of its productivity gains

❖ FINANCIAL RISK

- ✓ Productivity targets may not be reached
- ✓ However, risks linked to the demand and to non controllable costs are compensated *ex post*

SIGNIFICANT GAINS IN TERMS OF COST REDUCTIONS

- ✓ The implementation of incentive regulation has led to substantial reduction of revenue of network operators

Distribution	P_0	X
1990-1995	-	1,3%
1995-2000	-25,5 %	- 3%
2000-2005	-24,5%	- 3%
2005-2010	1,3%	0%

Transport (NGET)	P_0	X
2001-2006	-5%	-1,3%
2007-2012	7%	2%

- ✓ However, the potential for future cost reductions tends to be reduced
- ✓ Given the need to increase investments, the last processes of price fixing have led to increases of income ceilings

Last pricing review	Authorised Investments (M£)	Variation / last pricing period
Transport (NGET)	2997	+106%
Total Distributors	5734	+48%

A COMPLEX FRAMEWORK WITH SIGNIFICANT RESSOURCES

- Each round of price fixing covers a **18 months period**
- A cycle of **5 successive consultations** before reaching a final decision in terms of prices
- A large number of documents published
  - ✓ For example, **80 documents** have been published during the last distribution pricing round
- **Many studies** performed by consultants
  - ✓ The *business plans* of the 14 distribution companies are subject to audit
  - ✓ Several external studies on the cost of capital and the productivity of companies

THE DUTCH EXAMPLE

- 15 network managers for distribution and one manager for transport (TenneT)
- The regulator DTe, fixes prices on an annual basis following proposals from the operators
- Since 1998, **incentive regulation is explicitly mentioned in legal acts** for transport and distribution
  - ✓ Period of regulation established legally between 3 and 5 years
  - ✓ In practice, the periods are for 3 years
- Three rounds of price fixing
  - ✓ 2001-2003
  - ✓ 2004-2006
  - ✓ 2007-2009 (2007-2010 for transport)

A methodology of price caps for distribution and of income ceilings for transport

- A differentiated treatment for distribution and transport**:**
  - ✓ **Distribution** : $P_{t+1} = (1 + \text{inflation} - X + Q) \cdot P_t$
  - ✓ **Transport** : $R_{t+1} = (1 + \text{inflation} - X) \cdot R_t$

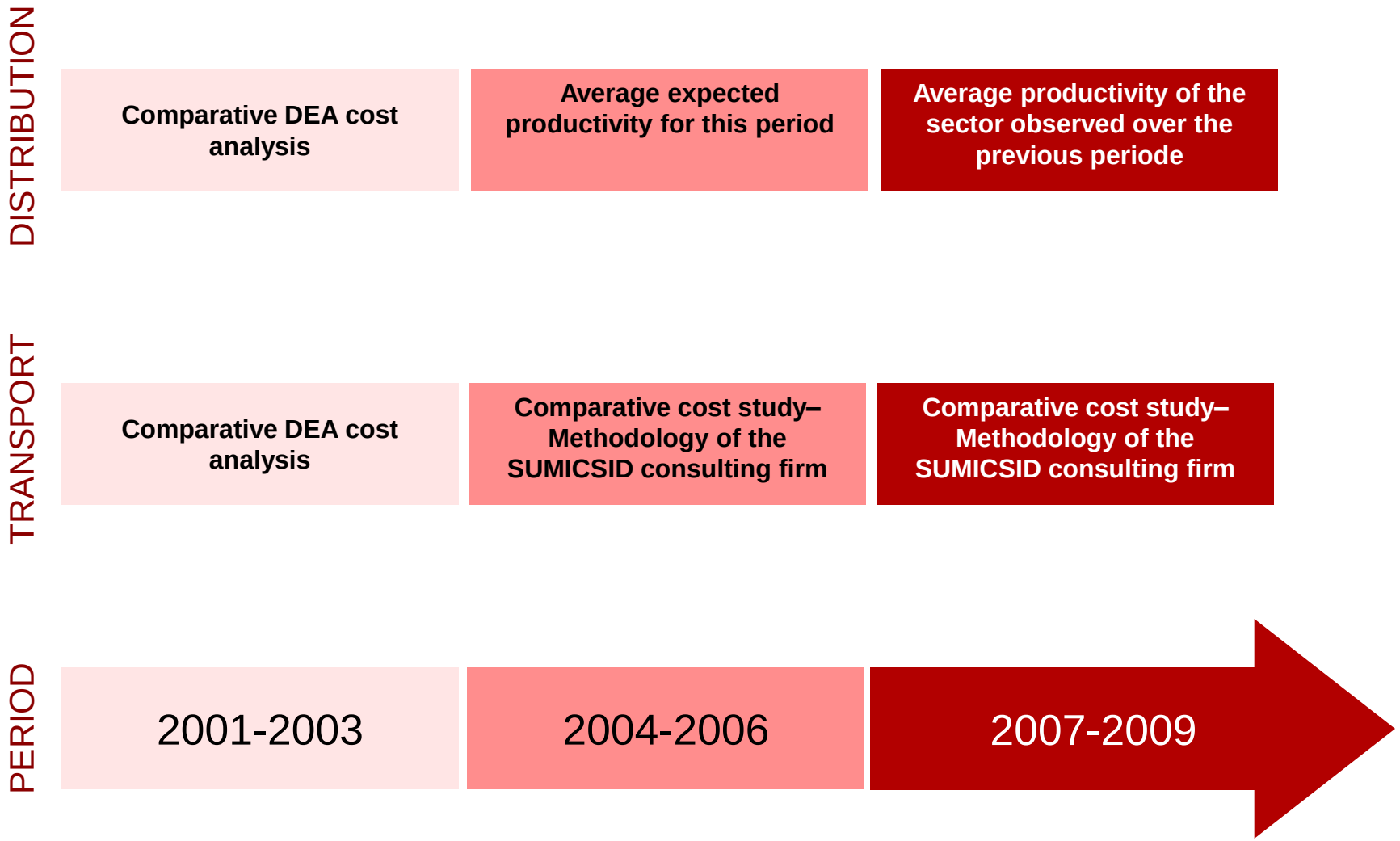
The X factor is estimated differently from OFGEM

X : **Global productivity factor**

Q : Adjustment factor in relation to the **quality of supply** (introduced en 2005)

- For transport, financial risk linked to future demand is covered by a compensation of price in the following year
- However, only **significant changes** in terms of volume of consumption from one period of regulation to the next can determine an adjustment in prices

The method for estimating the global productivity factor X has evolved over time



INCENTIVE REGULATION FOR DISTRIBUTION

PRINCIPLE

Price ceilings are augmented (or reduced) with a Q factor if quality of supply improved (deteriorated) over the previous period

ESTIMATING THE Q FACTOR

- ✓ Period of regulation 2007-2009 : Q calculated depending on the improvement of quality between 2000-2002 and 2003-2005
- ✓ Indicator of quality used : average duration of power cut
- ✓ The variation of technical performance is translated in economic terms by estimating marginal willingness of pay of consumers for one minute less of power cuts
- ✓ This value is differentiated by network manager and is expressed as a percentage of income
- ✓ Q is capped : –5%/+5%

TO SUM UP KEY CHARACTERISTICS OF THE DUTCH APPROACH

❖ PRODUCTIVITY TARGET

- ✓ Global productivity which leads to **trade offs between CAPEX and OPEX**
- ✓ Determined from a statistical approach

❖ LEVEL OF INCENTIVE

- ✓ The company is receiving incentives for all its categories of costs
- ✓ The period of regulation is only **3 years** for distribution

❖ FINANCIAL RISK

- ✓ The network managers are partly facing uncertainty in terms of future demand
- ✓ A strong hypothesis, according to which network managers will be able to obtain on average future productivity gains similar to those obtained during the previous period.

POSITIVE ACHIEVEMENTS IN TERMS OF PRICE REDUCTION

According to estimates by the Dutch regulator, incentive schemes implemented for pricing of distribution, have generated savings of up to a billion Euros over the period 2001-2006.

X Factor	Distribution	Transport
2001-2003	-3,2%	-8%
2004-2006	-2,8%	-7,2%
2007-2009	-1,1%	-1,4%

A TRANSPARENT AND NOT INTRUSIVE REGULATORY FRAMEWORK

The process goes over **8 months**

- A process of consultation is organised with network managers and users
- Several external studies are performed to determine :
  - ✓ The X factor (Tennet)
  - ✓ The cost of capital

- The regulatory approach is **not intrusive,** as it does not require efficiency audits company by company, but relies on statistical methods

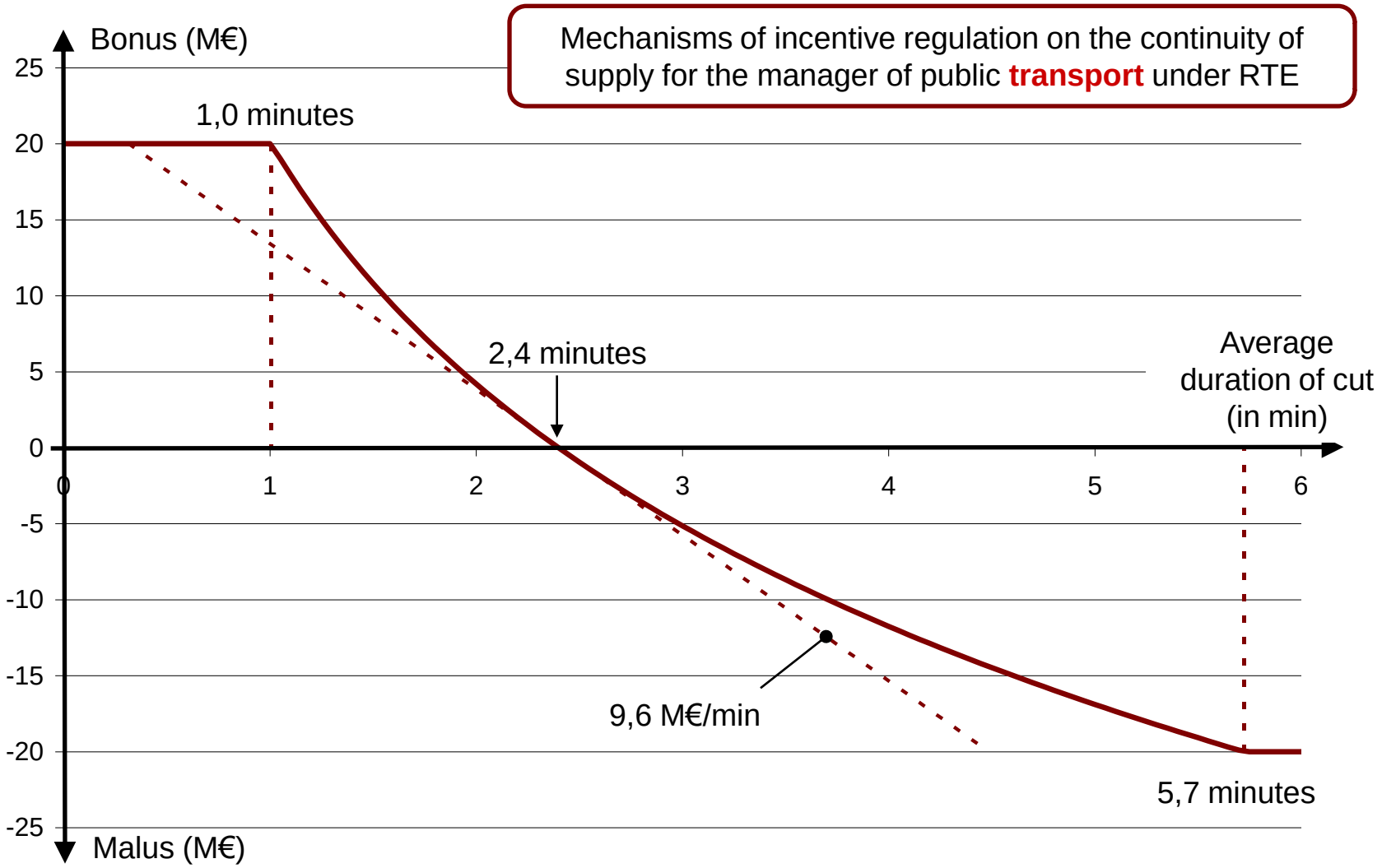
THE FRENCH EXAMPLE

- The third round of pricing for the use of public distribution and transport networks has been finalised with new prices in august 2009
- For the first time, these prices include some elements of incentive regulation
- The regulatory framework involves
  - ✓ A period of regulation of 4 years
  - ✓ An annual indexation of prices
    - Distribution : Inflation + 1,3 % + K
    - Transport : Inflation + 0,4 % + K'
    - The coefficients K et K' allow to compensate ex-post for certain charges that are deemed as non controllable (cost of network losses, and capital charges), the difference between real costs incurred by the operator and provisional costs included in the elaboration of prices
  - ✓ Incentive mechanisms
    - OPEX that can be controlled
    - Continuity of supply
    - Quality of service

Incentives for OPEX that can be controlled

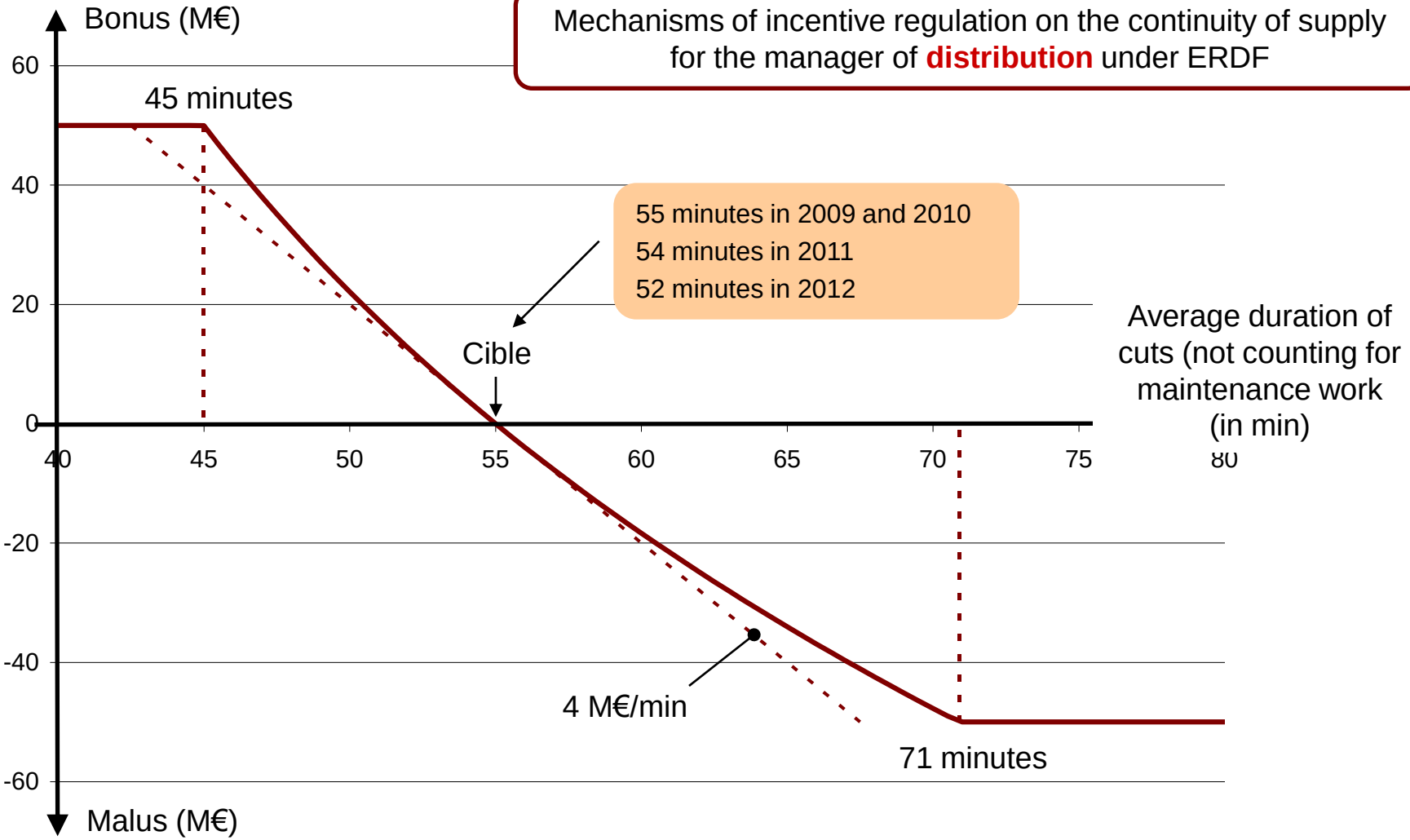
- If the OPEX that can be controlled are inferior to the amount defined *ex-ante* by the regulator, the operator keeps 50 % of the difference defined in constant Euros 2009
- About 1 billion Euros per year for RTE (transport manager) and 4 Billion Euros per year for ERDF (distribution manager, significant reduction in recent years)

Incentive mechanisms on the continuity of supply, TRANSPORT



Incentive mechanisms on the continuity of supply, DISTRIBUTION

Mechanisms of incentive regulation on the continuity of supply for the manager of **distribution** under ERDF



Incentive Mechanism for the quality of service

- The incentive mechanism for the quality of service includes two types of indicators :
  - ✓ Indicators subject to monitoring by the French regulator CRE and financial incentives in case of non compliance, or in case of reaching pre-agreed targets. These financial incentives involve a system of bonus/malus, imputed on prices, or of financial compensation for clients that require them.
  - ✓ The indicators are only monitored by CRE
  - ✓ Among the indicators subject to financial incentives:
    - Number of complaints following scheduled appointments not respected by ERDF
    - Rate of response to complaints within 30 days
    - Number of connection proposals that have not been sent within agreed timetable

Reflection of the French experience

- Gradual transition (slower than in some EU countries), EDF to be split with ERDF, RTE and the generating capacity unit, separation from gas company: decade long evaluation, preceded with management contracts for the company to provide increased managerial autonomy
- The regulator only “proposes” prices: minister can only accept, or reject, and has to publicly motivate reason for rejection (limited discretion). (Future EU regulation: pricing full responsibility of regulators, similar trends for telecoms).
- Political acceptance: mainly ROR cost plus scheme as concerns about the possibility of “over profits”
- Elements of success: last round of pricing generally understood and well accepted (supported by all parties)
- Need to clarify the functions of the state : shareholder function (French treasury and finance), representation for the interest of consumers (Minister for Energy and sustainable development). (Healthier to clarify the functions of the state)

OVERALL CONCLUSIONS

- Need for pragmatic approach (E.g. gradual understanding of the cost function by the regulator took up to 8 years in France, to obtain a full and comprehensive understanding)
- E.g. Swedish example: theoretical network approach, 10 years of legal trials, gaps with actual network
- UK model very advanced, impressive gains in the first period, but requires a stable environment, need to assess real usefulness of all the regulatory methodology features, less potential for the current period, UK only with choice among a menu of contractual option (but need to provide high premium to induce operators to take the risk, costly).
- Adapt to an emerging country condition: lack of visibility, higher macroeconomic instability: shorter periods,
- Incentive regulation less conflictual: more autonomy for the companies.
- Need to find a model that suits technical conditions in the country, level of political consensus,
- Need capacity and institution building with the regulator