Research and Transport Policy
Lyon, 18-19 March 2010

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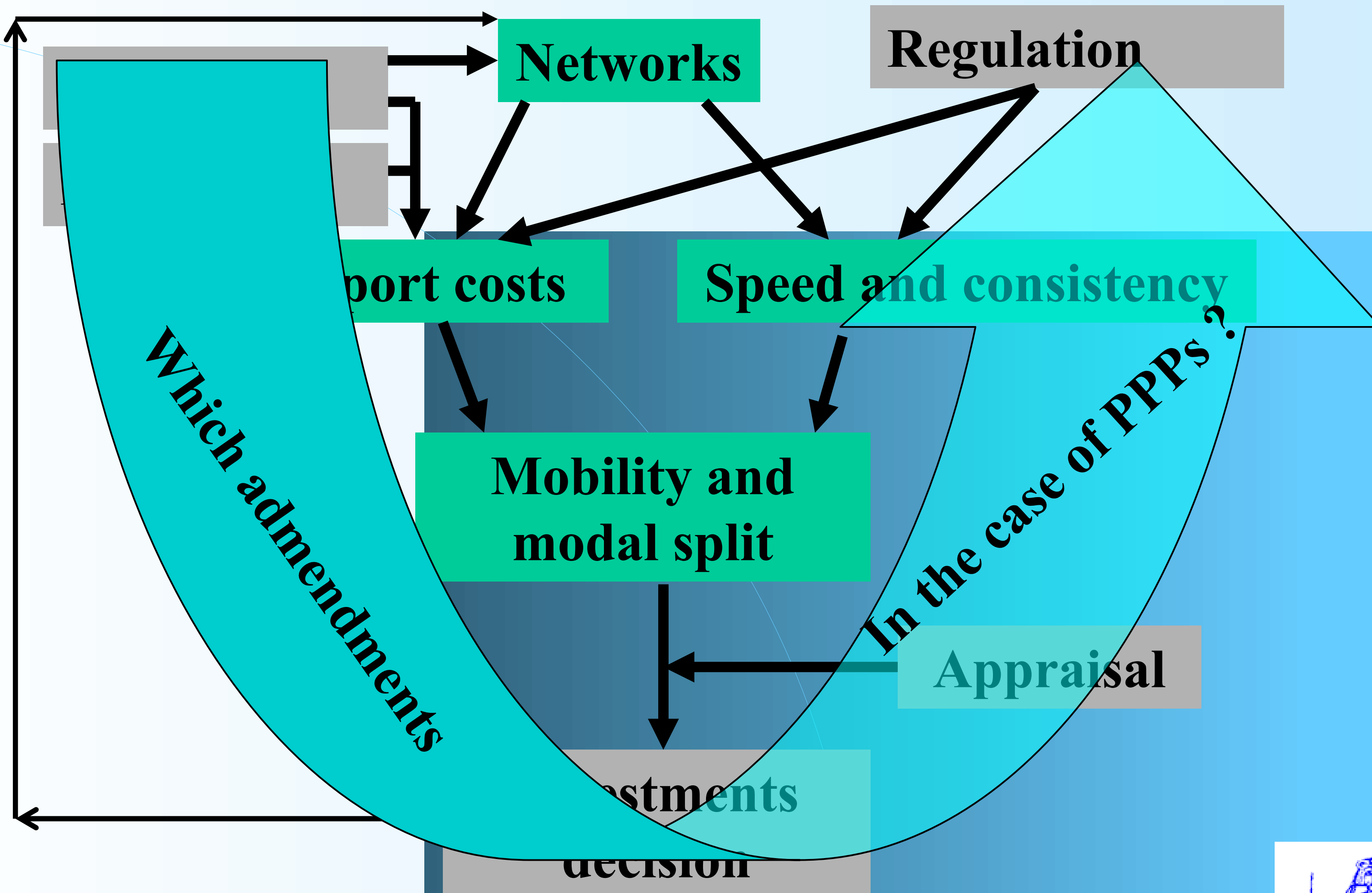
Which amendments to public economics ?

(In the case of PPPs)

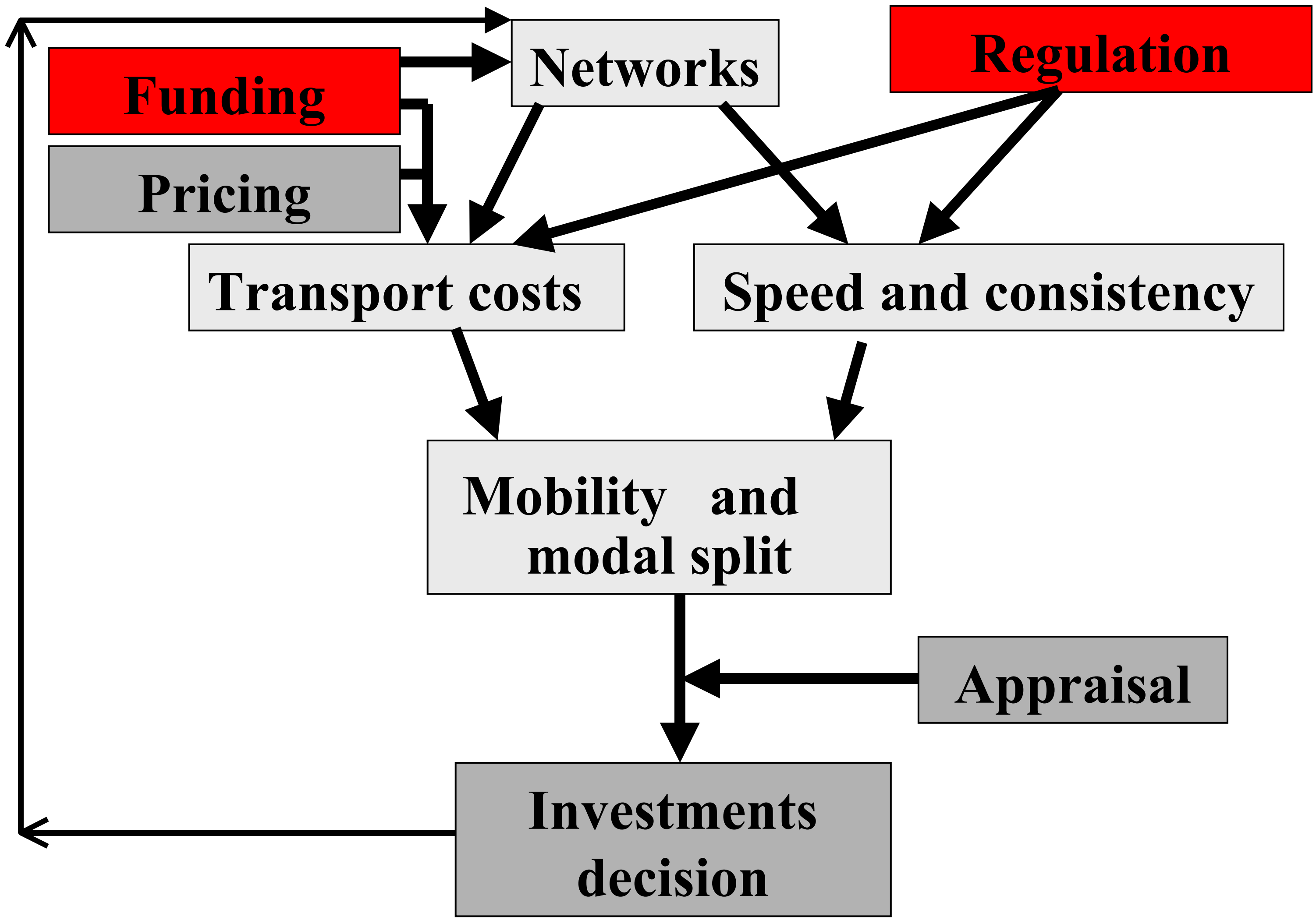
Alain Bonnafous

What are the means of transport policy?

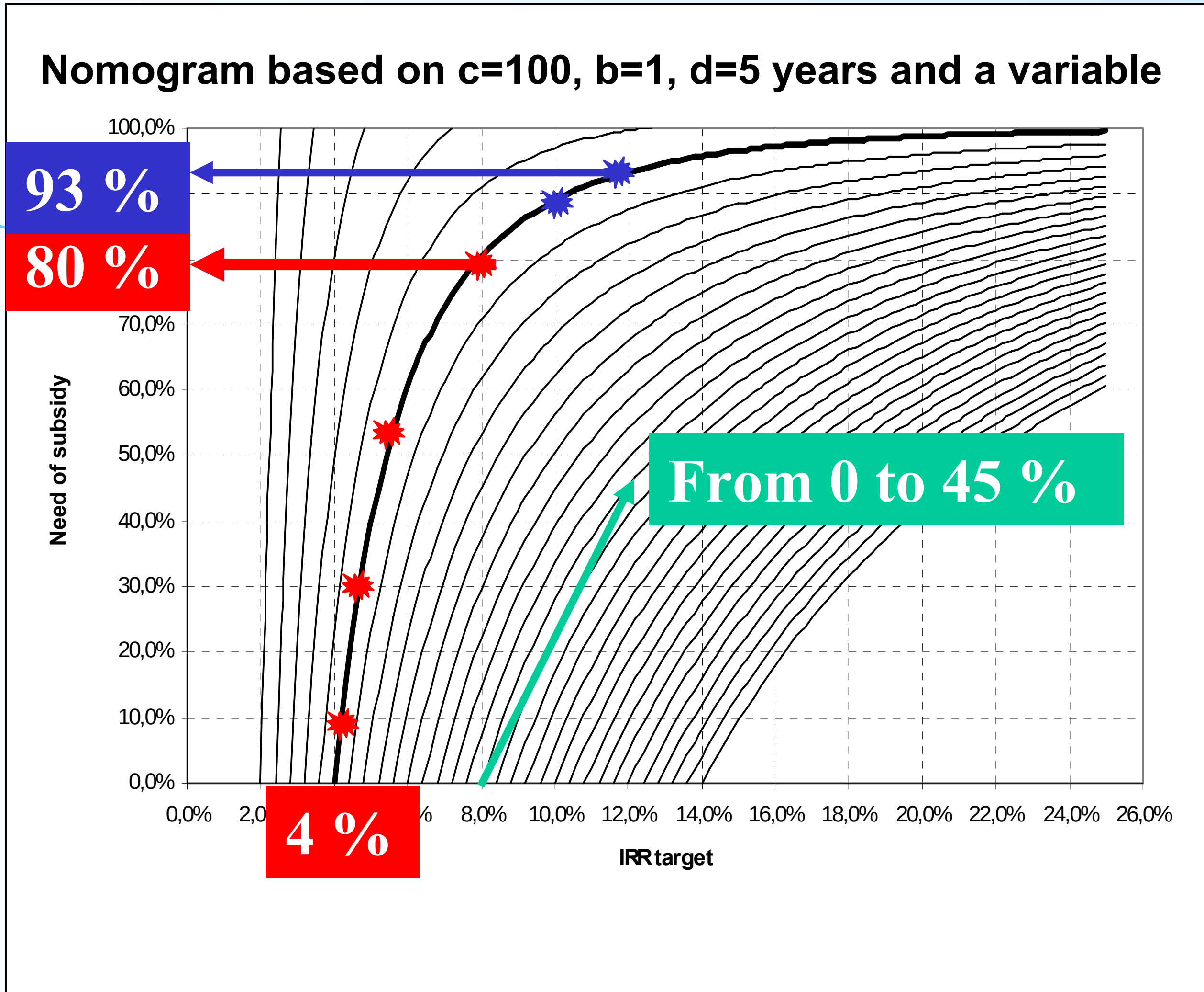
Government's controls over a transport system



Question 1 : To use or not to use PPPs ?

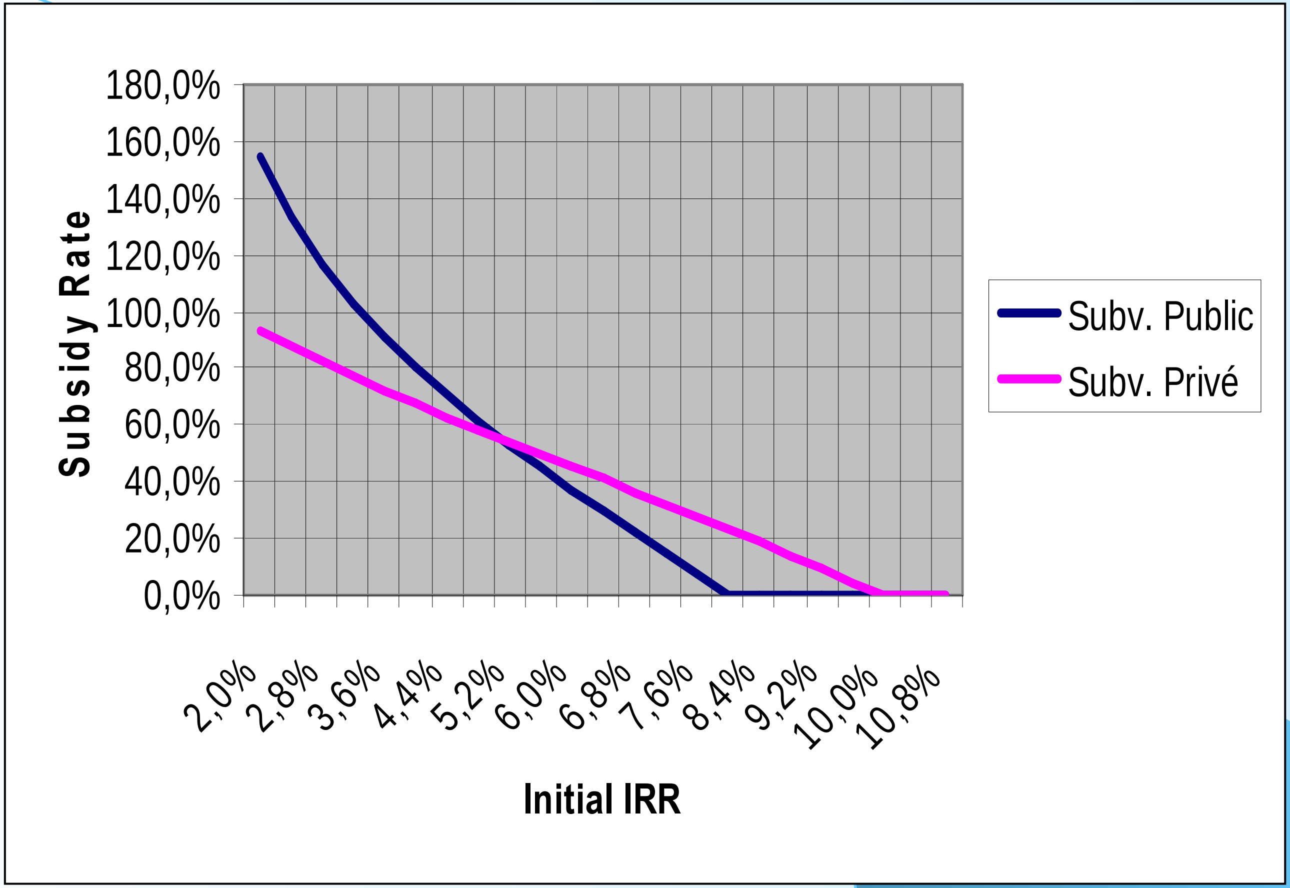


A profitability rate paradox

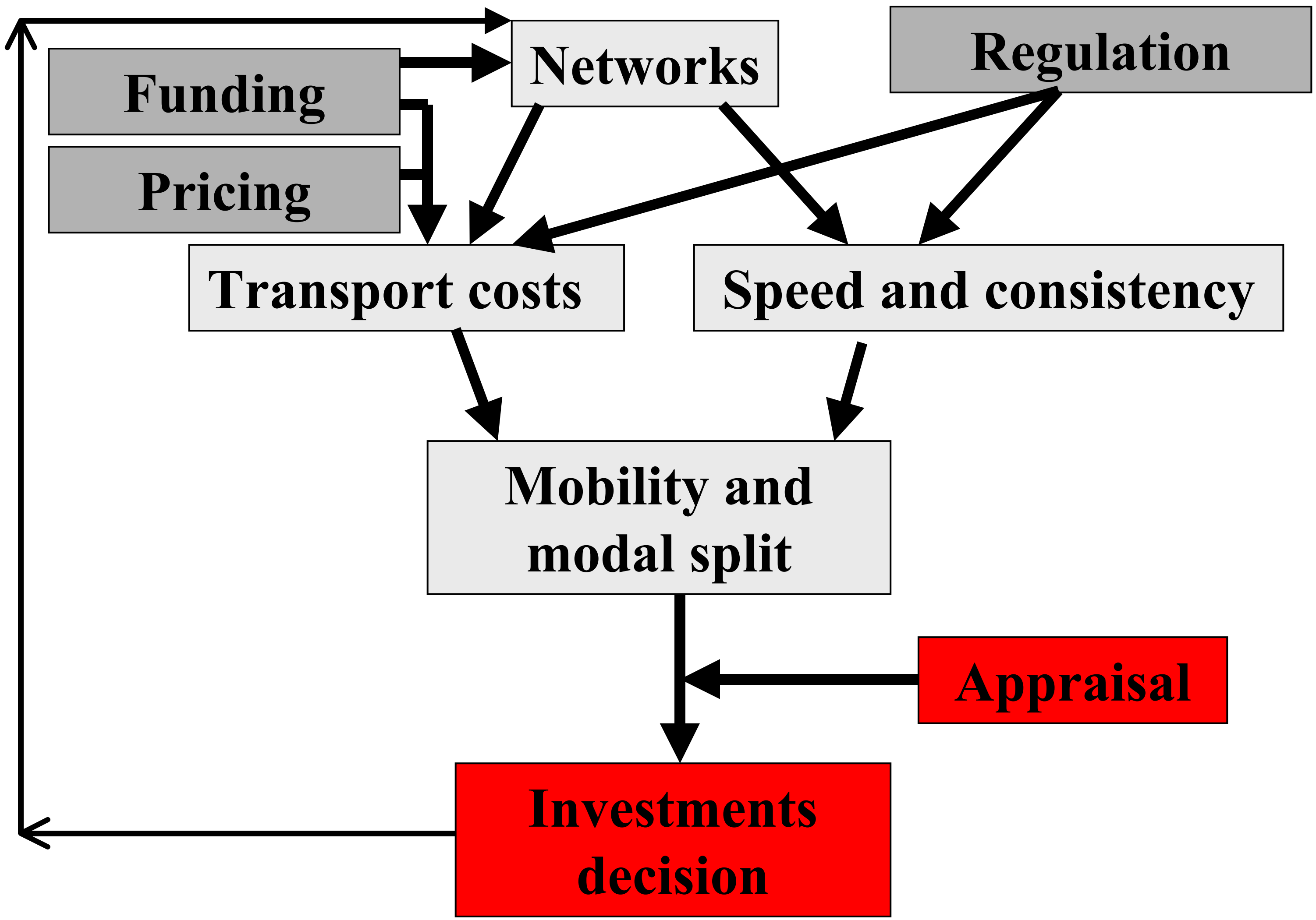


A profitability rate paradox when the private operator is more efficient

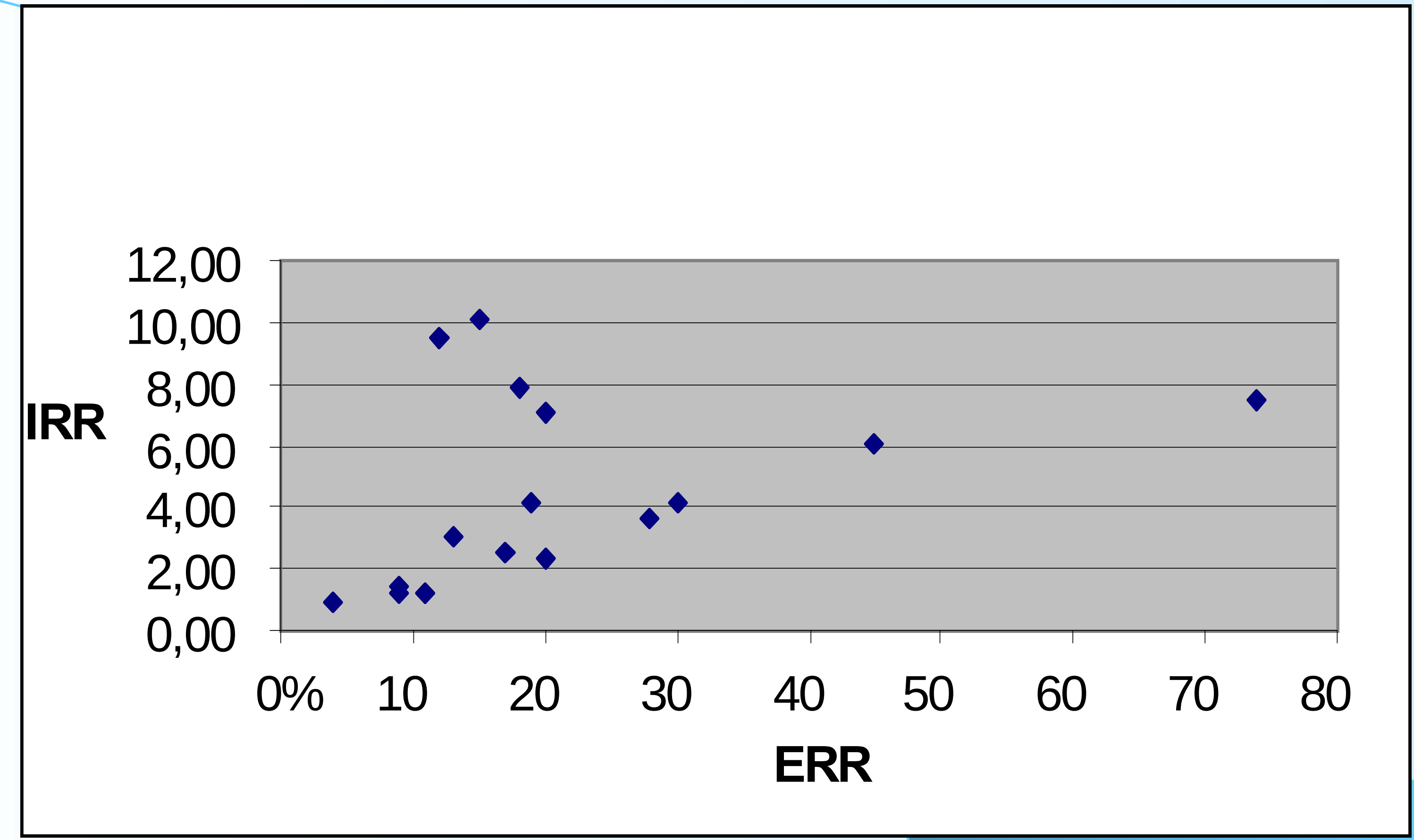
Target IRR of 8% for the public operator, and 12% for the private operator
Initial IRR with the private operator = Initial IRR with the public operator +2 %



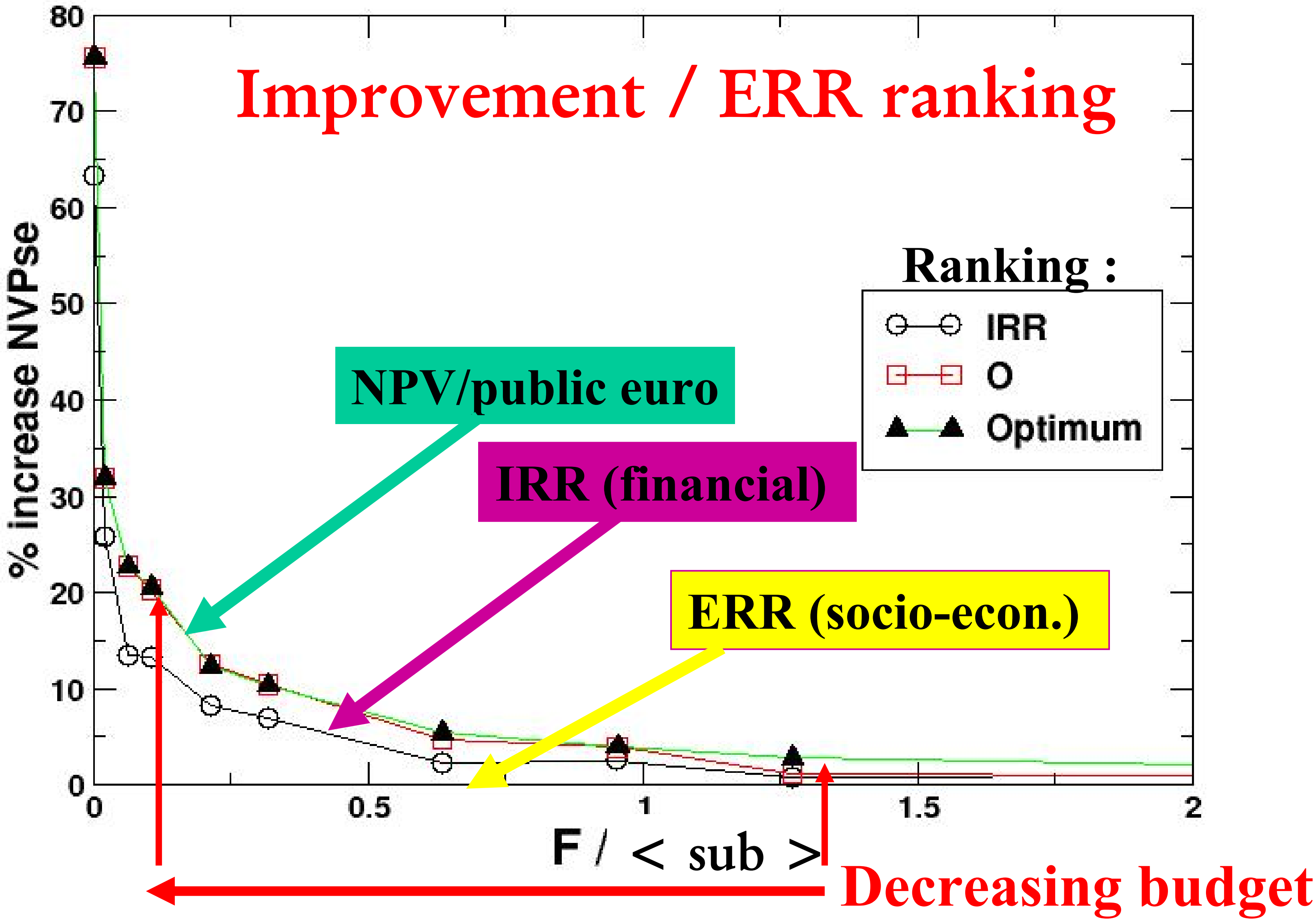
Question 2 : Which appraisal and investments decision ?



Socio-economic IRR (ERR) and financial IRR For 17 highway projects



Optimal ranking under budget constraint



OPTIMISATION OF THE WHOLE PROGRAMME

AND COEFFICIENT φ

$$\underset{x}{Max} \quad W(x) = \sum_{i=1}^{n} x_i NPV_i$$

$$s.c. \quad \begin{cases} \sum_{i=1}^{n} x_i S_i - B \leq 0 \\ -x_i \leq 0, \quad \forall i = 1,\dots,n \\ x_i - 1 \leq 0, \quad \forall i = 1,\dots,n \end{cases}$$

OPTIMISATION OF THE WHOLE PROGRAMME AND COEFFICIENT φ

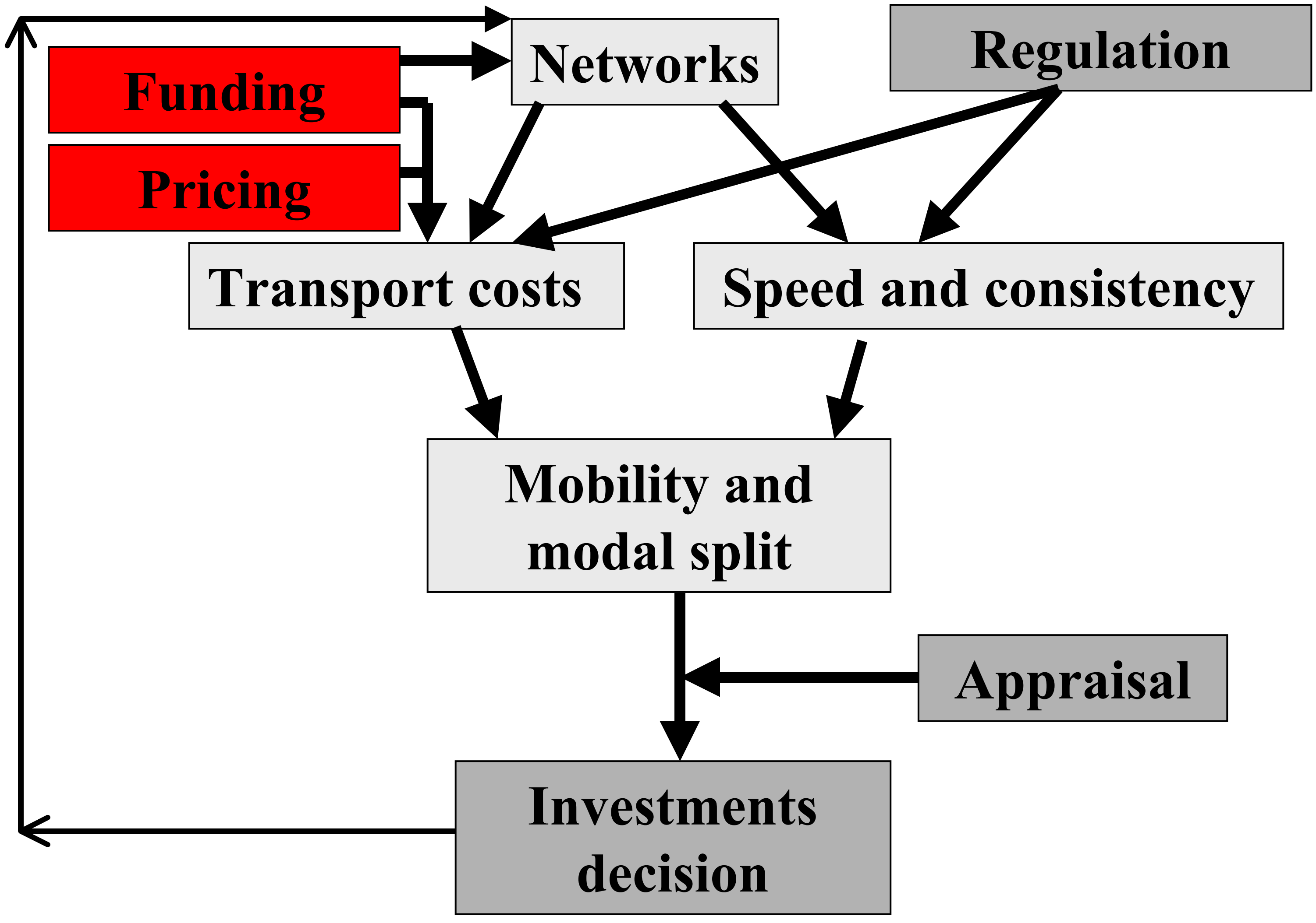
Optimal ranking

$$\frac{NPV_A}{S_A} > \varphi > \frac{NPV_R}{S_R}$$

A = Accepted projects

R = Rejected projects

Qustion 3 : What is the optimal pricing ?



For the whole programme, the IRR ranking provides more welfare gain than the ERR ranking (under the public financing constraint)

If the IRR is more efficient than the ERR for an optimisation of the whole programme, is the welfare oriented pricing more efficient than the profit oriented pricing?

The objective function

$$\Delta U = \underbrace{\Delta R - \Delta C}_{(\times\varphi)} + \Delta S$$

φ = scarcity coefficient of public funds

And the toll *p* as unknown variable

Demand, user surplus and operator revenue

Demand Function :

$$d = d_0 - \beta \cdot p \qquad (1)$$

User Surplus :

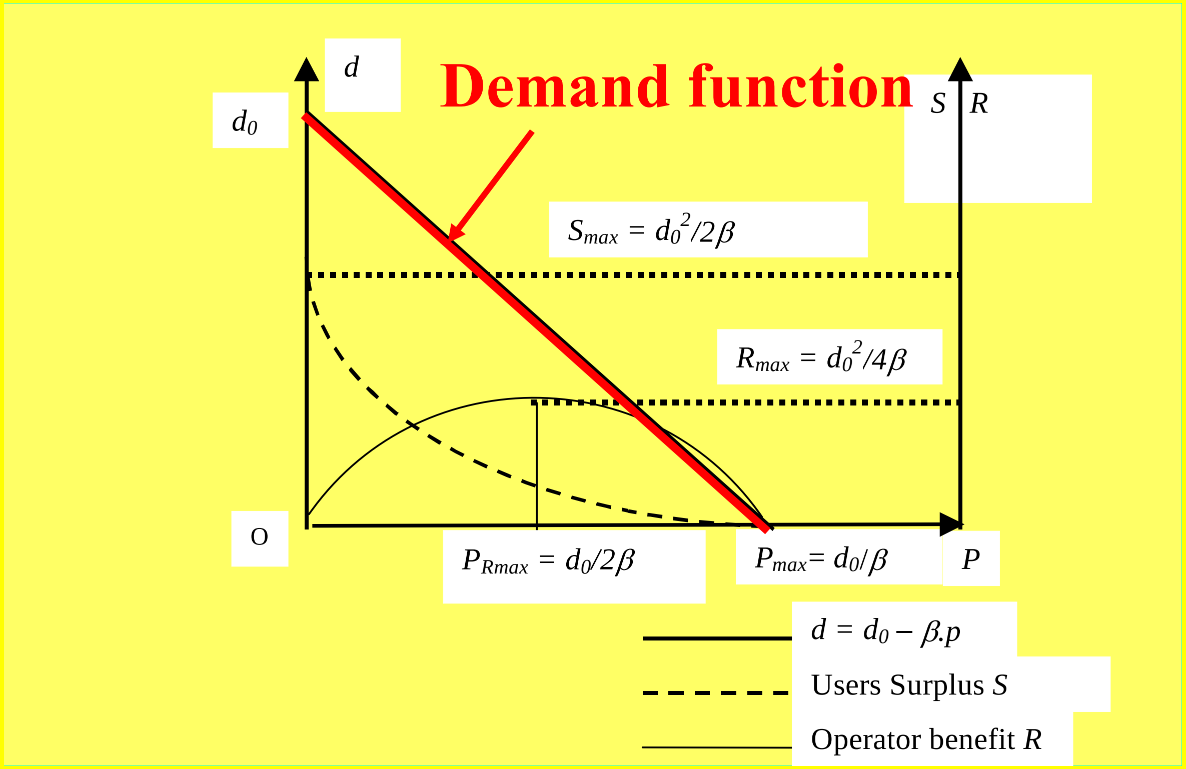
$$S = \frac{\beta}{2}\left(\frac{d_0}{\beta} - p\right)^2 \qquad (2)$$

Revenue :

$$R = d_0 \cdot p - \beta \cdot p^2 \qquad (3)$$

Maximising profit toll :

$$p_R = \frac{d_0}{2\beta} \qquad (4)$$



The two optimal tolls

Utility function :

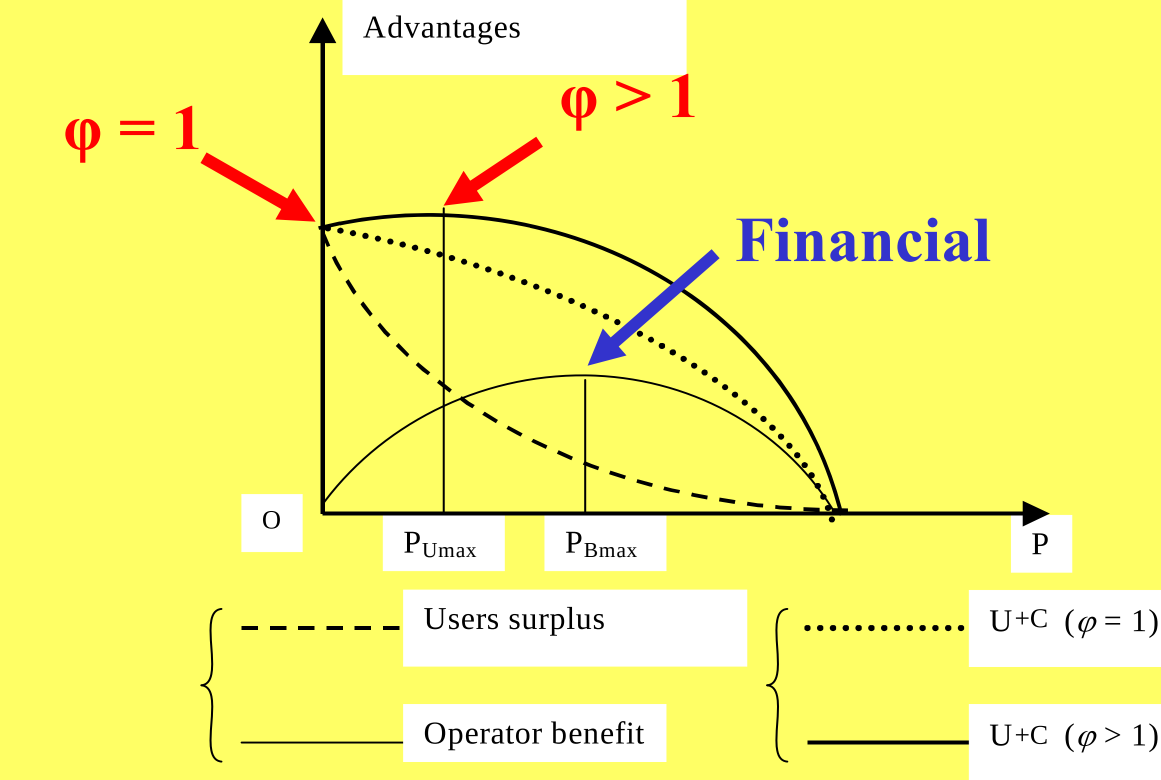
$$U = -\varphi . C + \frac{d_0^2}{2\beta} + (\varphi - 1) d_0 . p + \beta . p^2 (\frac{1}{2} - \varphi) \qquad (5)$$

Derivative :

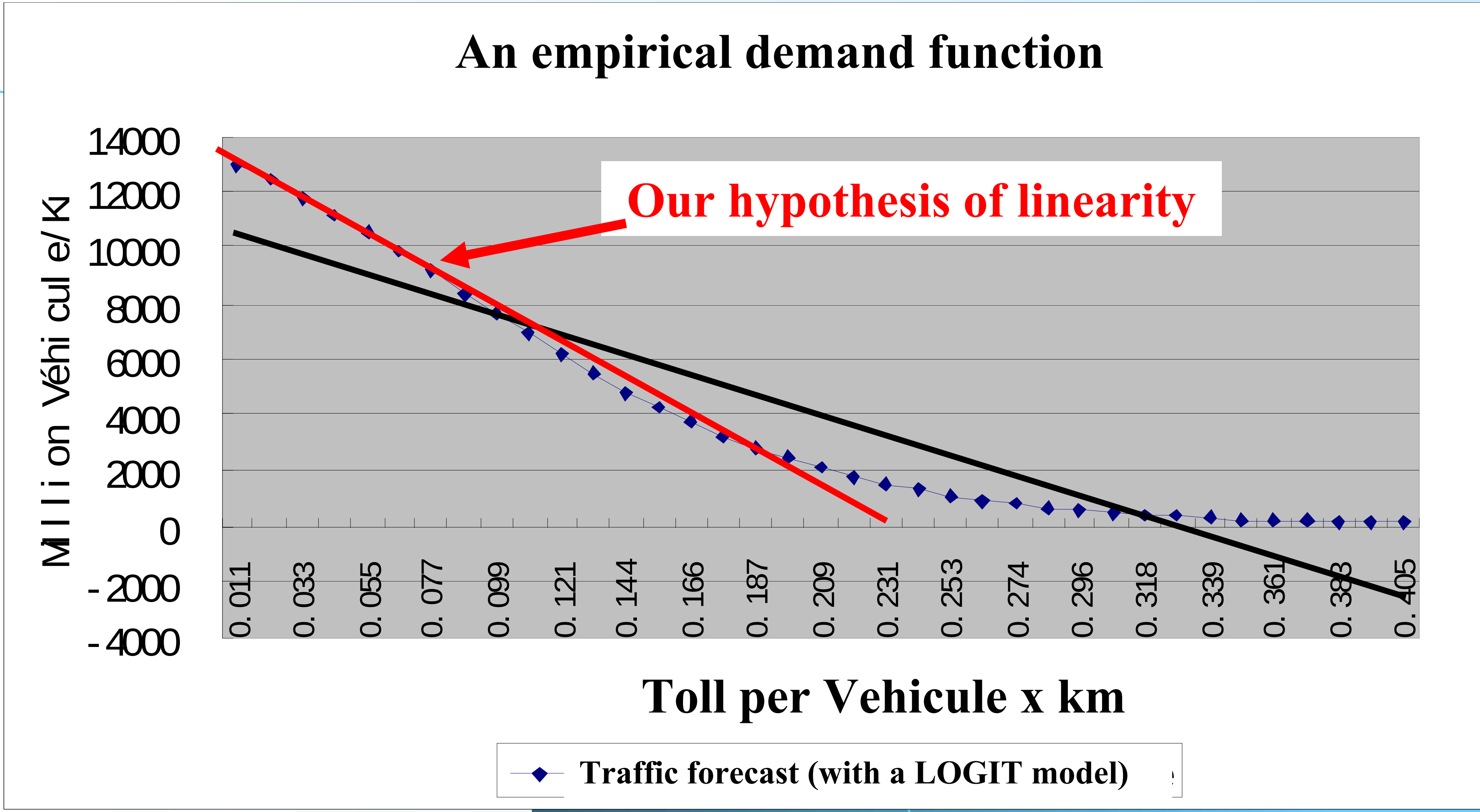
$$U' = (\varphi - 1) \cdot d_0 + 2\beta \cdot (\frac{1}{2} - \varphi) \cdot p$$

Toll maximising Utility :

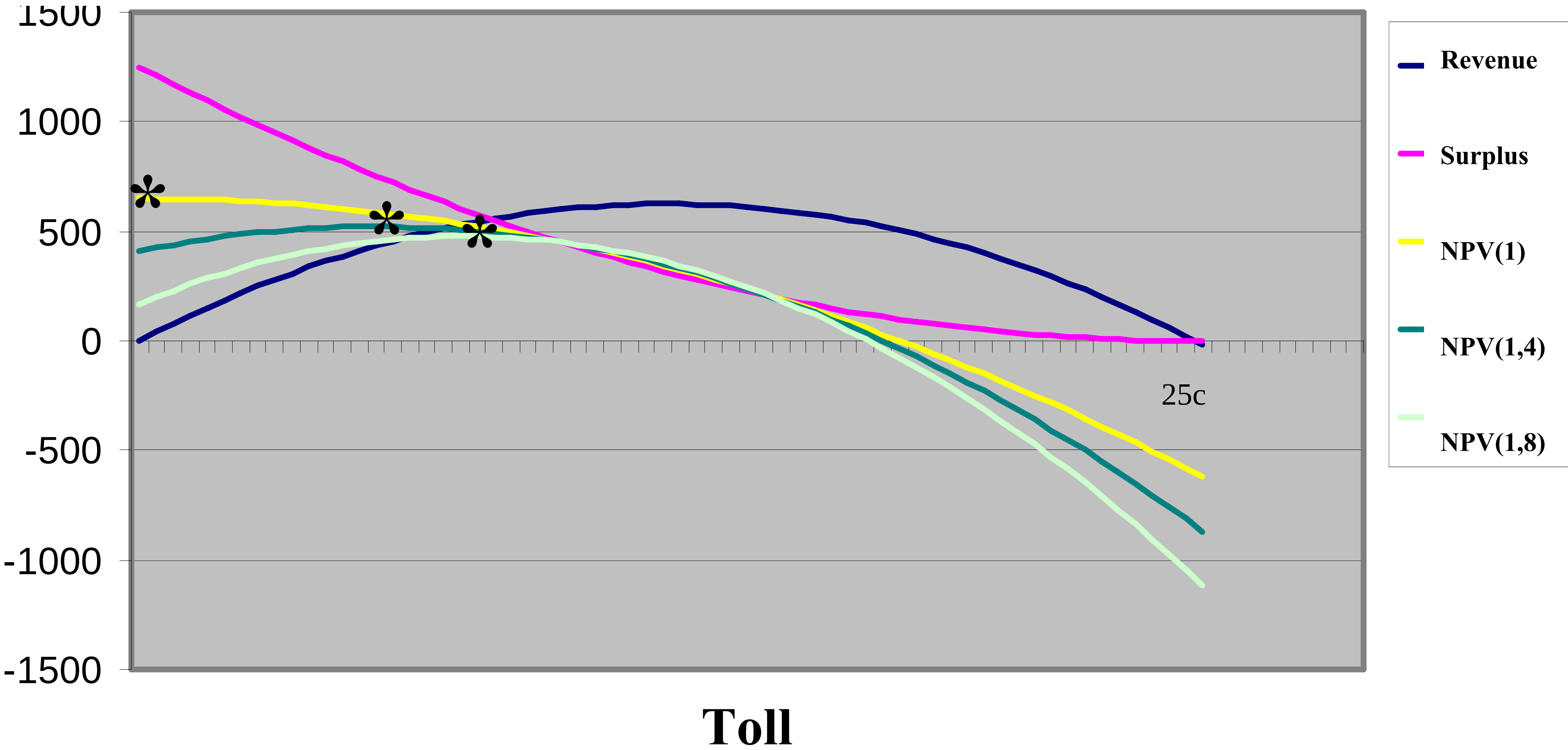
$$p_{Umax} = \frac{\varphi - 1}{\varphi - \frac{1}{2}} \times \frac{d_0}{2\beta} \qquad (8)$$

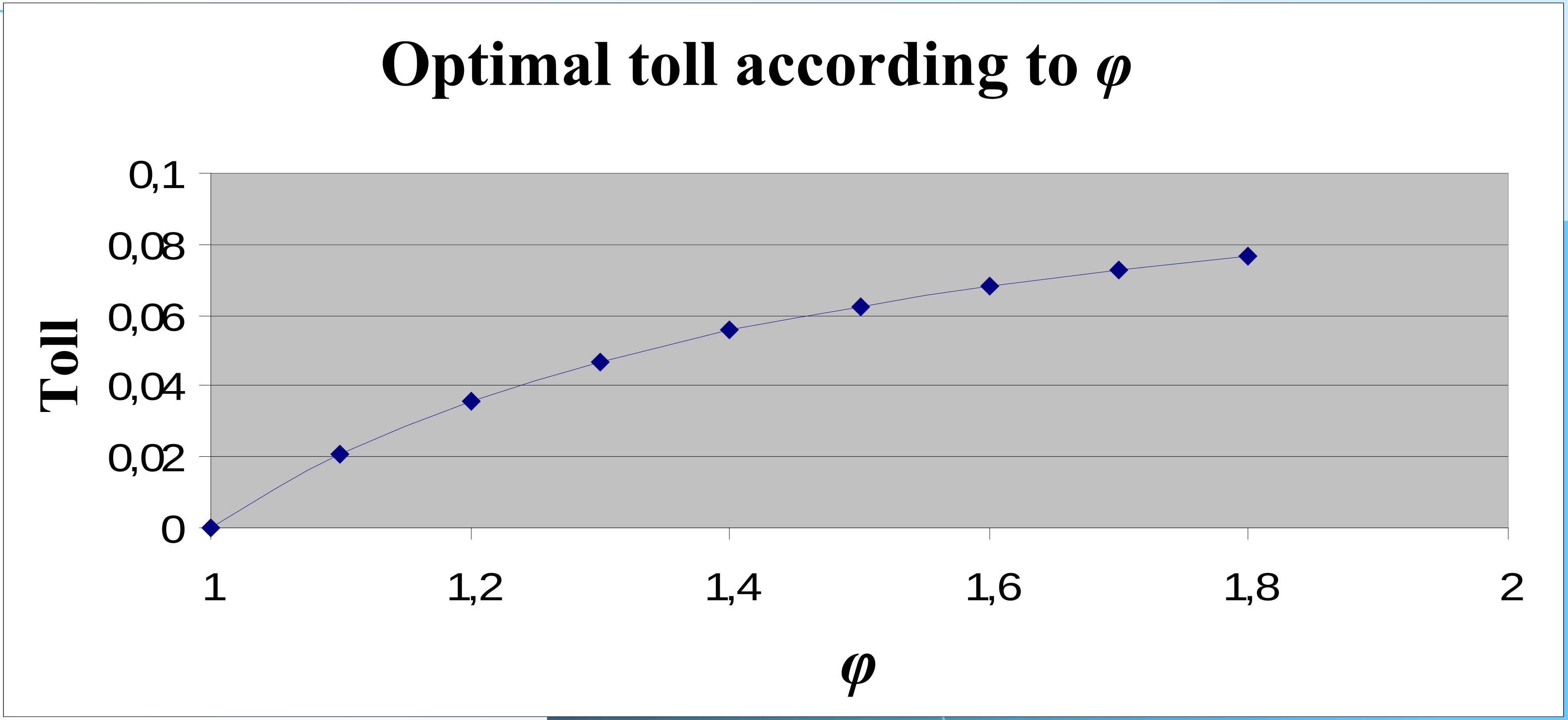


The concrete case of a real project of highway



Revenue, User surplus and NPV according to the toll and optimal toll* according to φ




Optimal toll according to φ
Toll
0,1
0,08
0,06
0,04
0,02
0
1
1,2
1,4
1,6
1,8
2
φ

Optimal toll for the whole programme

$$R = d_0 \cdot p - \beta \cdot p^2 \qquad (3)$$

$$U = -\varphi . C + \frac{d_0^{\,2}}{2\beta} + (\varphi - 1).d_0.p + \beta.p^2(\frac{1}{2} - \varphi) \qquad (5)$$

Subsidy :

$$Sub = C - R \qquad \textbf{(9)}$$

Programme NPV for a budget B :

$$U_{prog} = \frac{B}{Sub} U \qquad (10)$$

The equation (10) means that the objective function is in fact the ratio:

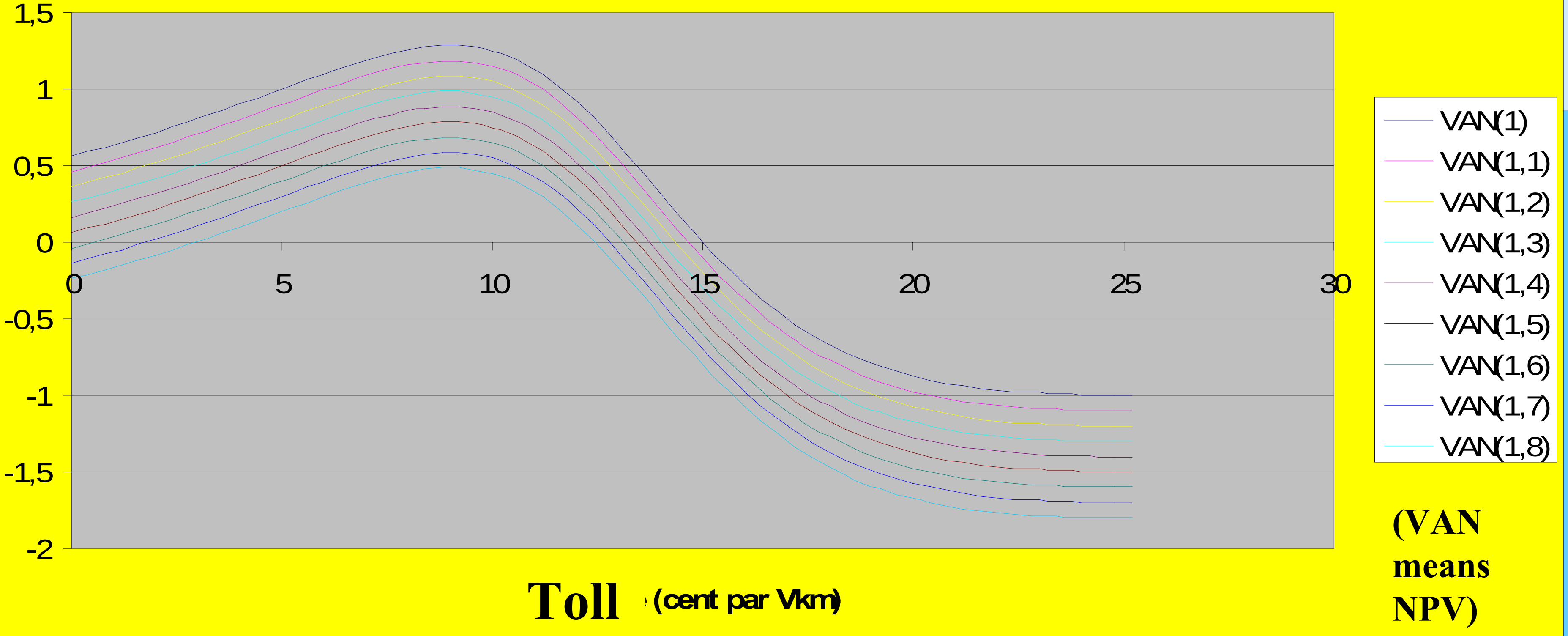
NPV/Sub

Optimal toll for the whole programme :

$$p_{prog} = \frac{d_0}{\beta}(1 - \frac{2\beta C}{d_0^{\,2}}) \qquad (11)$$

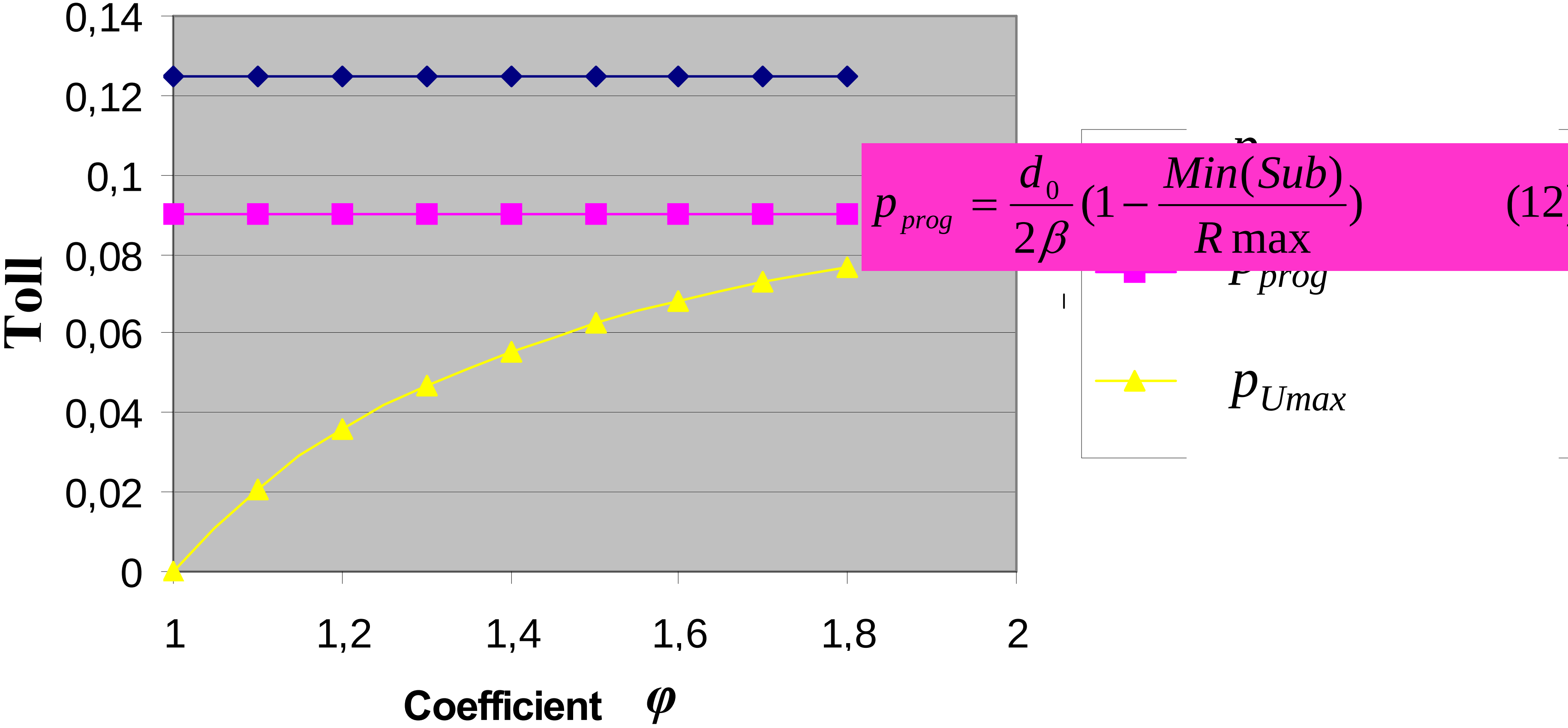
$$p_{prog} = \frac{d_0}{2\beta}(1 - \frac{Min(Sub)}{R\max}) \qquad (12)$$

Net Present Value of the whole programme under the budget constraint and according to φ



(VAN means NPV)

The three optimal tolls according to the scarcity coefficient of public funds



$$p_{prog} = \frac{d_0}{2\beta}\left(1 - \frac{Min(Sub)}{R\max}\right) \qquad (12)$$

$$p_{prog} = \frac{d_0}{2\beta}\left(1 - \frac{Min(Sub)}{R\max}\right)$$

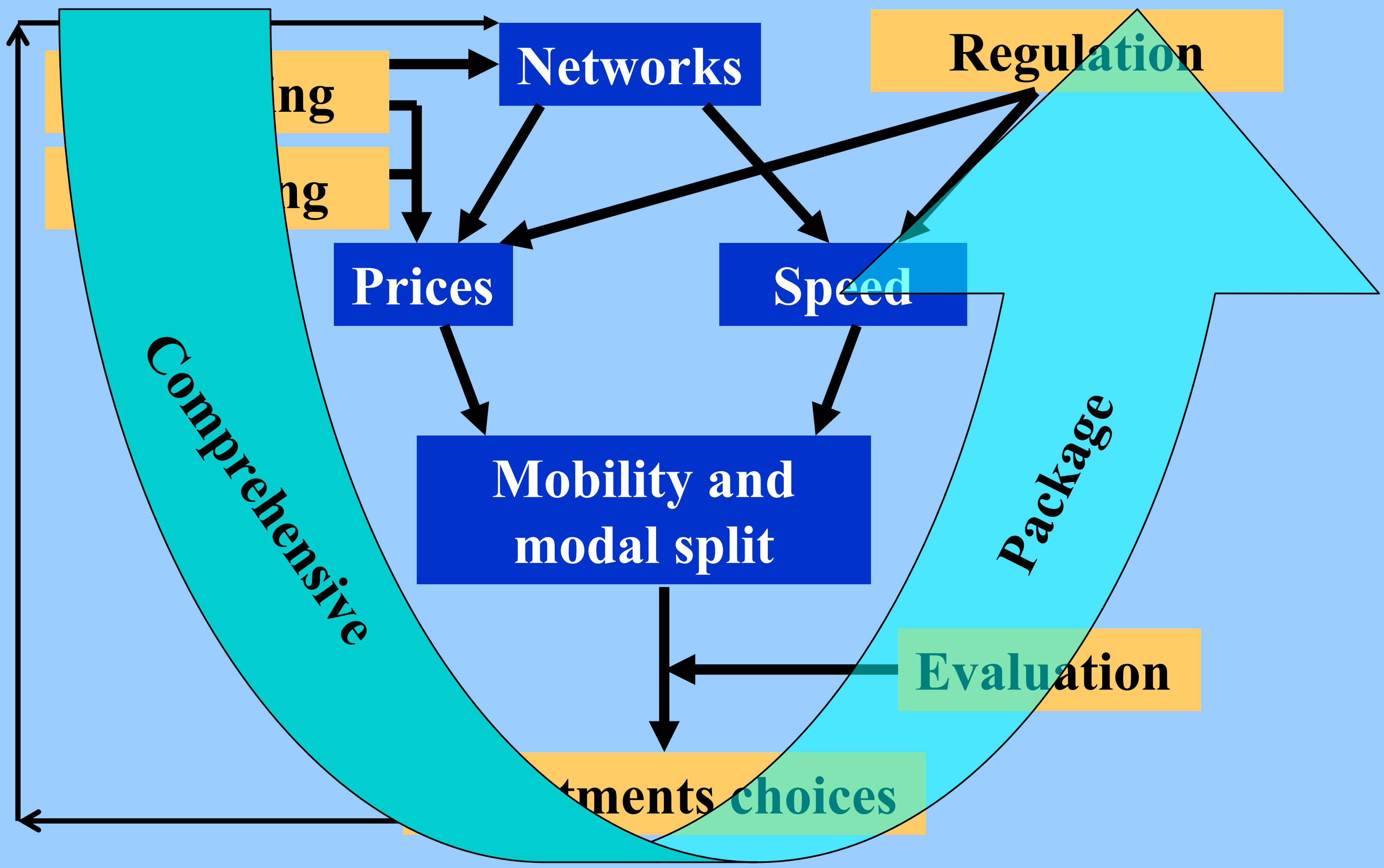
$Min(Sub) = 0 \Rightarrow P_{prog} = P_{Rmax}$

$Min(Sub) > R$**max** $\Rightarrow$ **Free road**

$0 < Min(Sub) < R$**max** $\Rightarrow$ **Regulated** P_{prog} **according to eq. 11**

Conclusion: 3 families of PPP dependant on IRR

How to coordonate the five means of control?



By maximising the ratio *Welfare gain/unit of subsidy*

MERCI