Competition between fixed and mobile broadband access
based on mobility and data volume

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Objective of the study

Question: Are fixed and mobile **broadband** markets
independent?

Answer: Today, authorities assume they are
independent in most countries except Austria in
Europe

Today, mobile BB is already more than an alternative to fixed in
emerging countries

In the future, development of LTE may lead to stronger F-M
competition whereas FTTH may reduce F-M substitution

Methodology: A microeconomic model is introduced as an
generic instrument to formally analyze the F-M
interdependence

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Context & motivation

- Regulators generally consider the fixed & mobile broadband markets as two independent markets by applying different control methods in each market: regulation of LLU prices for fixed, controlling the number of license and attribution of frequency bands for mobile.
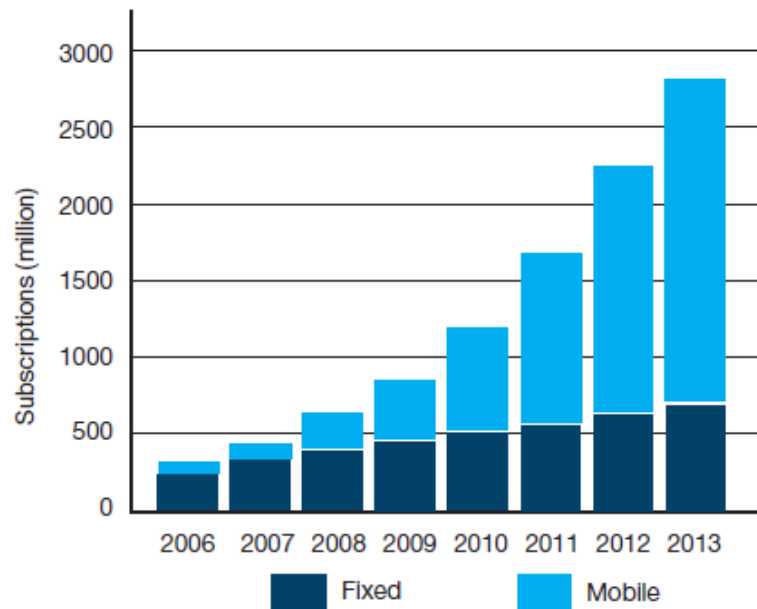
- Fixed penetration is low in emerging countries

- Mobile coverage is faster and less expensive than fixed

- Since mid-2007, China has lost 7% of its fixed lines per year. The increasing demand for BB access will be satisfied by 3G. Forecast: BB mobile occupies two thirds of the Chinese market in 2014

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Are fixed and mobile broadband markets independent ?

- In 26 out of 27 countries of the EU, current regulations assume that the fixed and mobile broadband markets are complementary & independent

- The Austrian case has a exceptional broadband market policy due to the fact that the European Commission admitted that ADSL, cable and broadband mobile belong to the same market in Austria.

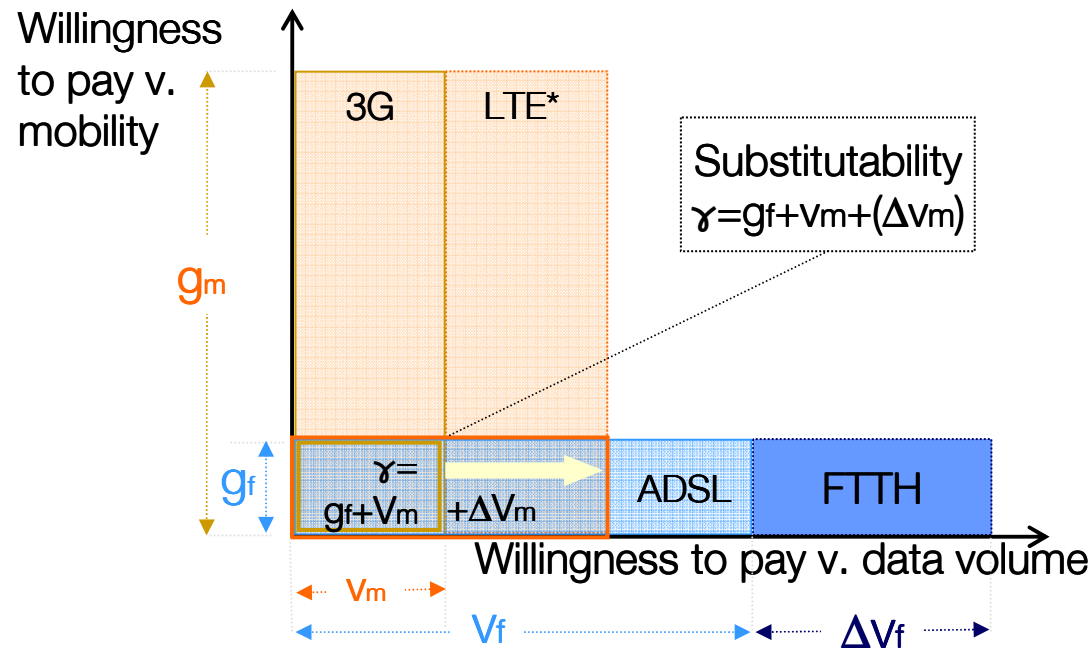- The model aims to show that fixed and mobile are highly interdependent even though they are not equivalent.
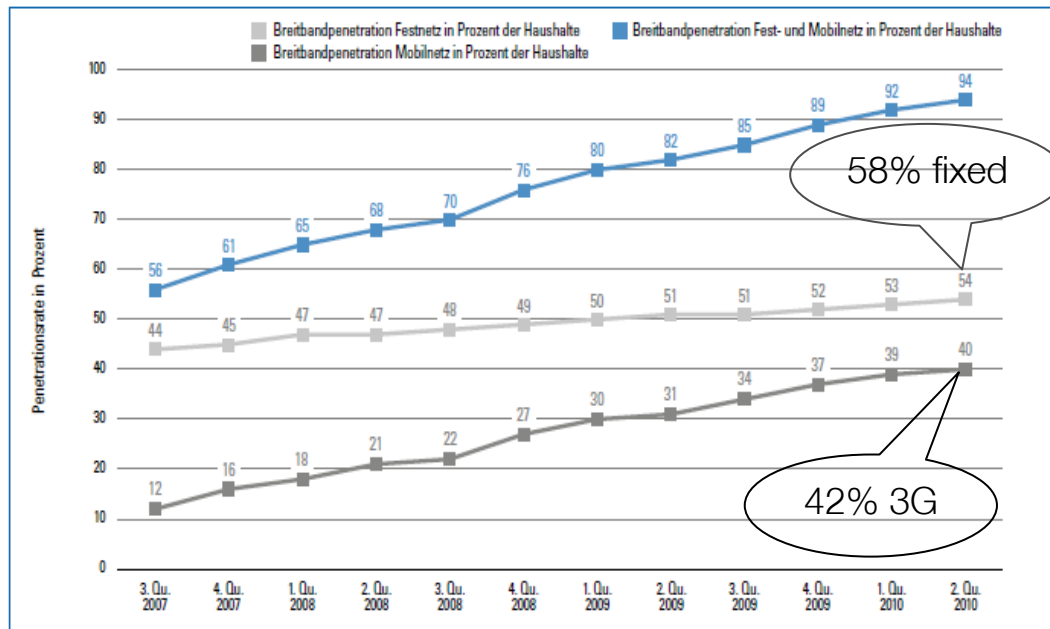
Source: RTR Austria telecom regulator

Austria broadband market:

- 42% of broadband subscription are 3G mobile

- Mobile BB price $\cong$ Fixed BB tarif.

- 94% population covered by one of 3G operators

- CAPEX on 3G in Austria is twice the European average: Austria has invested 68€ / capita / year since 2005 while the European average is 38 € / capita / year

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Methodology

Willingness to pay v. mobility (vertical axis)

3G | LTE*

Substitutability
$\gamma = g_f + v_m + (\Delta v_m)$

g_m

g_f

$\gamma = g_f + v_m$ | $+\Delta v_m$ | ADSL | FTTH

Willingness to pay v. data volume (horizontal axis)

v_m

v_f

Δv_f

Characteristics of fixed & mobile broadband access

- Fixed access offers high data volume but very reduced mobility. Mobile offers high mobility and low data volume

- Substitutability γ represented by shared elements of two access $(g_f + v_m)$

- Δv_m of LTE generates a higher substitutability

- v_f increases with FTTH, thus increasing the differentiation between fixed and mobile access

Microeconomic model

- Inspired by the oligopoly model of Shubik & Levitan

- The model is first carried out for two players with a fixed and a mobile firm, then for 4 players with 2 fixed and 2 mobile firms (taking into account the intra and inter-modal competitions)

- The results of interdependence for the Nash equilibrium are similar for the 2-player model and the 4-player model

*LTE: Long Term Evolution   France Télécom

A microeconomic model

The utility function is assumed to be quadratic and concave

(1) $$U = (g_f + v_f)D_f + (g_m + v_m)D_m - \frac{1}{2}(\beta D_f^2 + 2\gamma D_f D_m + \beta D_m^2) - (p_f D_f + p_m D_m)$$

Using Equation (1), inverse demands are given by

(2)
$$p_f = (g_f + v_f) - \beta D_f - \gamma D_m$$
$$p_m = (g_m + v_m) - \beta D_m - \gamma D_f$$
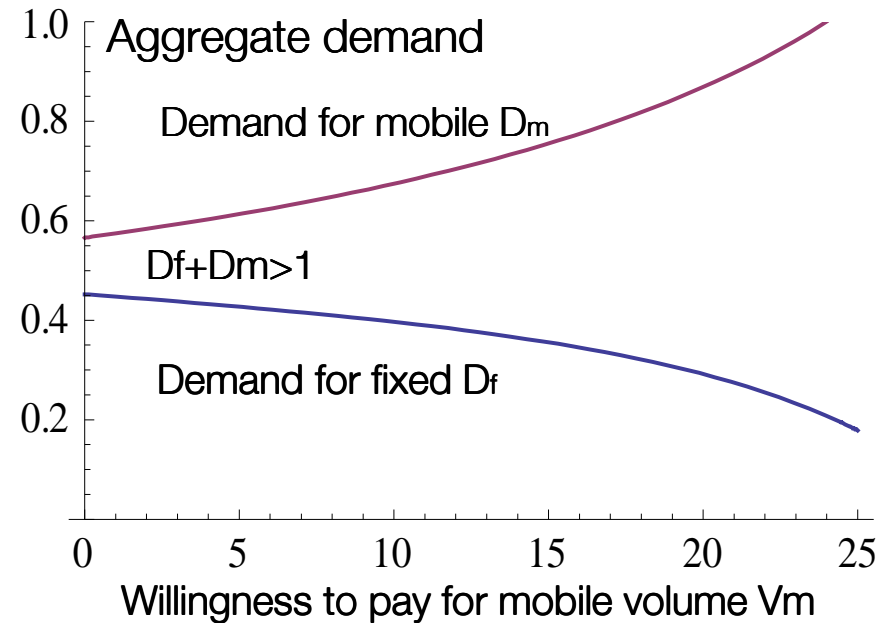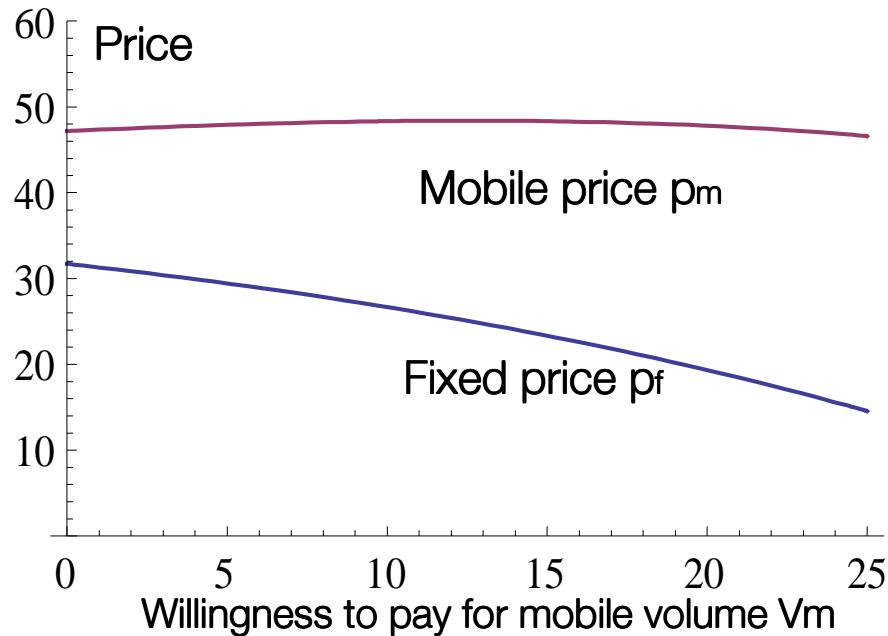
$\gamma = g_f + v_m$
f: fixed
m: Mobile

- g_f & g_m: willingness to pay for mobility

- v_f & v_m: willingness to pay for data volume

- p_f & p_m: fixed & mobile access price

- D_f & D_m: aggregate demand for fixed and mobile access

- $\gamma = g_f + v_m$ represents the shared elements (substitutable part) regarding fixed and mobile access (with $\gamma < \beta$).

- β represents the parameter of market

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Advantage & Assumptions of the model

- The model fits with a non saturated broadband market, allows to investigate oligopoly competition (>2 players).

- $v_f > v_m$: willingness to pay for data volume of fixed offer is higher than for mobile ($v_f = 50$, $v_m = 10$)

- $g_f < g_m$: willingness to pay for mobility of fixed offer is lower than for mobile ($g_f = 10$, $g_m = 80$)

- $\gamma = v_m + g_f$ and $\gamma < \beta$: fixed-mobile substitutability γ represents the shared elements (substitutable part). ($\beta = 50$, $\gamma = 20$)

- If $v_m = v_f$ & $g_f = g_m$, fixed and mobile broadband accesses are perfectly substitutable, but it's not realistic with fixed technology. Because the mobility of fixed WiFi technology is limited

- Mobile marginal cost c_m is assumed twice higher than the fixed c_f ($c_m = 20$, $c_f = 10$)

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Price and market share behavior

progress of mobile technology toward LTE → higher Vm → increased substitutability

Price

Mobile price p_m

Fixed price p_f

Willingness to pay for mobile volume Vm

Aggregate demand

Demand for mobile D_m

$D_f + D_m > 1$

Demand for fixed D_f

Willingness to pay for mobile volume Vm

- The mobile price at equilibrium remains stable with the willingness to pay for mobile data volume Vm
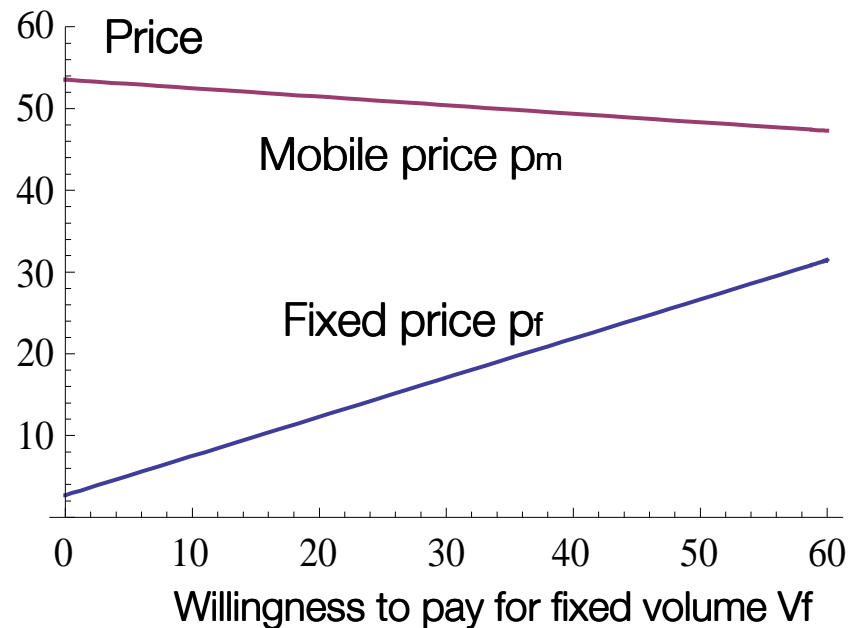
- The fixed price decreases with Vm

- The demand for fixed decreases with Vm

- The demand for mobile increases with Vm

- double subscription (F&M) is possible with Df+Dm>1

$(v_f = 50, v_m = 10, g_f = 10, g_m = 80, \beta = 50, \gamma = 20, c_m = 20, c_f = 10)$
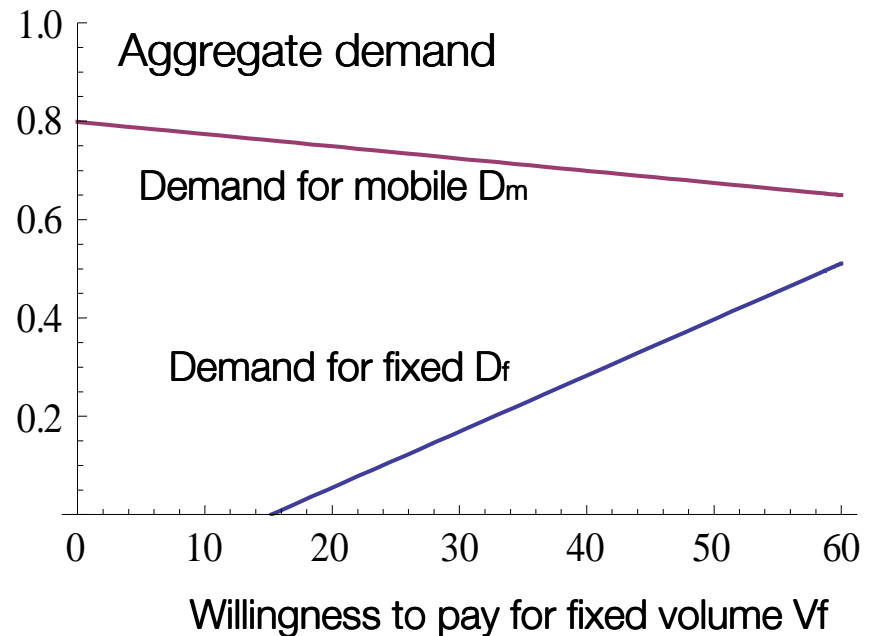
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Price and market share behavior

Progress of fixed data volume with FTTH
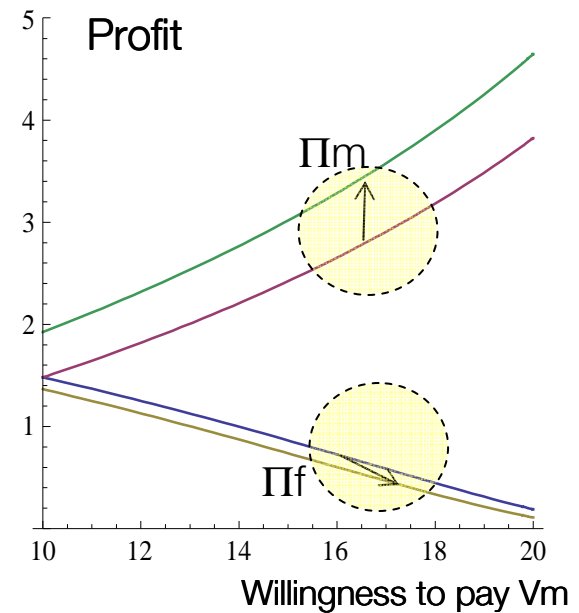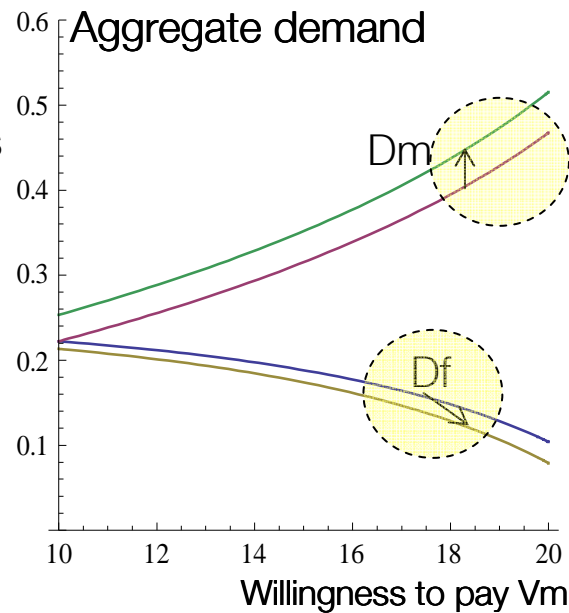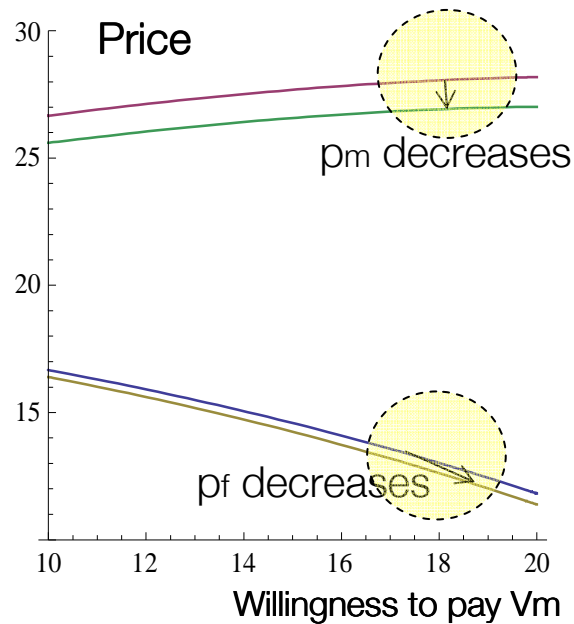→sustain fixed business (when there is no mobile technological progress)

- The mobile price at equilibrium decreases with willingness to pay for fixed data volume Vf

- The fixed price at equilibrium increases with willingness to pay Vf

- The demand for fixed increases with Vf

- The demand for mobile decreases with Vf

- A double subscription (F&M) is possible with Df+Dm>1

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Interdependence when marginal cost is lower

Lower mobile marginal cost with technological progress → higher mobile profit and lower fixed profit

Price — p_m decreases, p_f decreases (Willingness to pay V_m)

Aggregate demand — D_m, D_f (Willingness to pay V_m)

Profit — Π_m, Π_f (Willingness to pay V_m)

- The mobile equilibrium price decreases due to a lower marginal cost
- This leads to a decrease in the fixed price at equilibrium

- The demand for mobile increases due to a lower price
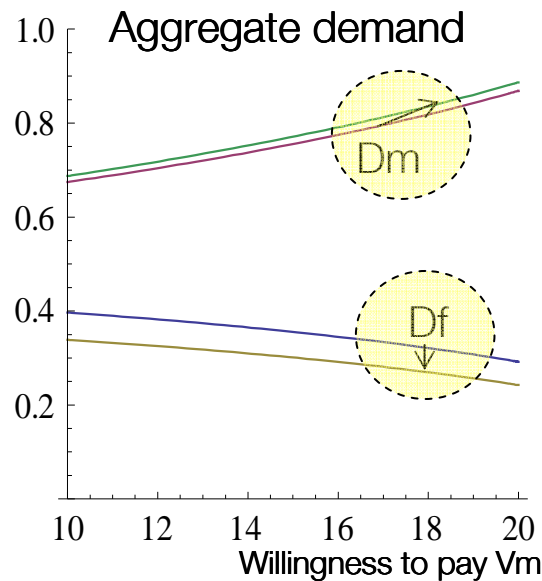- The fixed aggregate demand decreases

- The mobile profit increases
- The fixed profit decreases
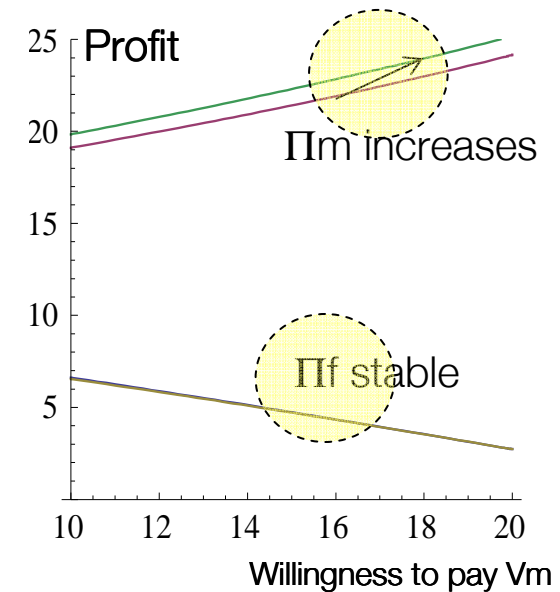
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Interdependence test of fixed & mobile markets

If the fixed price unilaterally increases by 10% → the demand for fixed decreases, the demand for mobile increases → mobile profit increases
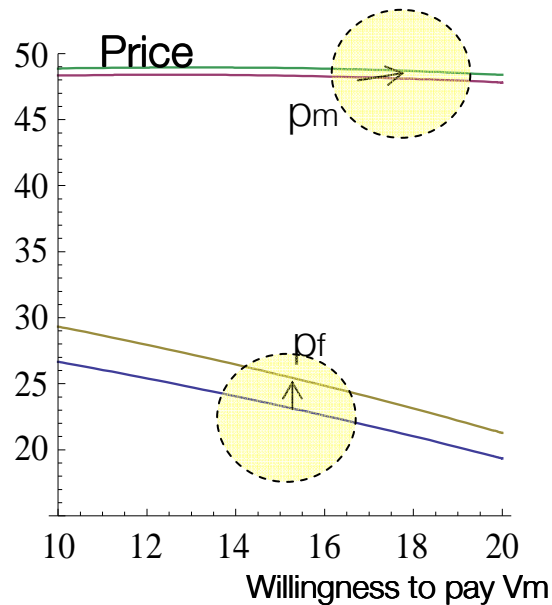
|		
- If fixed market decides unilaterally to increase its price by 10% vs. pf* - The mobile price increases slightly	- The demand for fixed decreases - The demand for mobile increases	- The fixed profit remains stable - The mobile profit increases

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A monopoly versus a more competitive market

## A monopolistic fixed market may be indirectly controlled by a more competitive mobile market
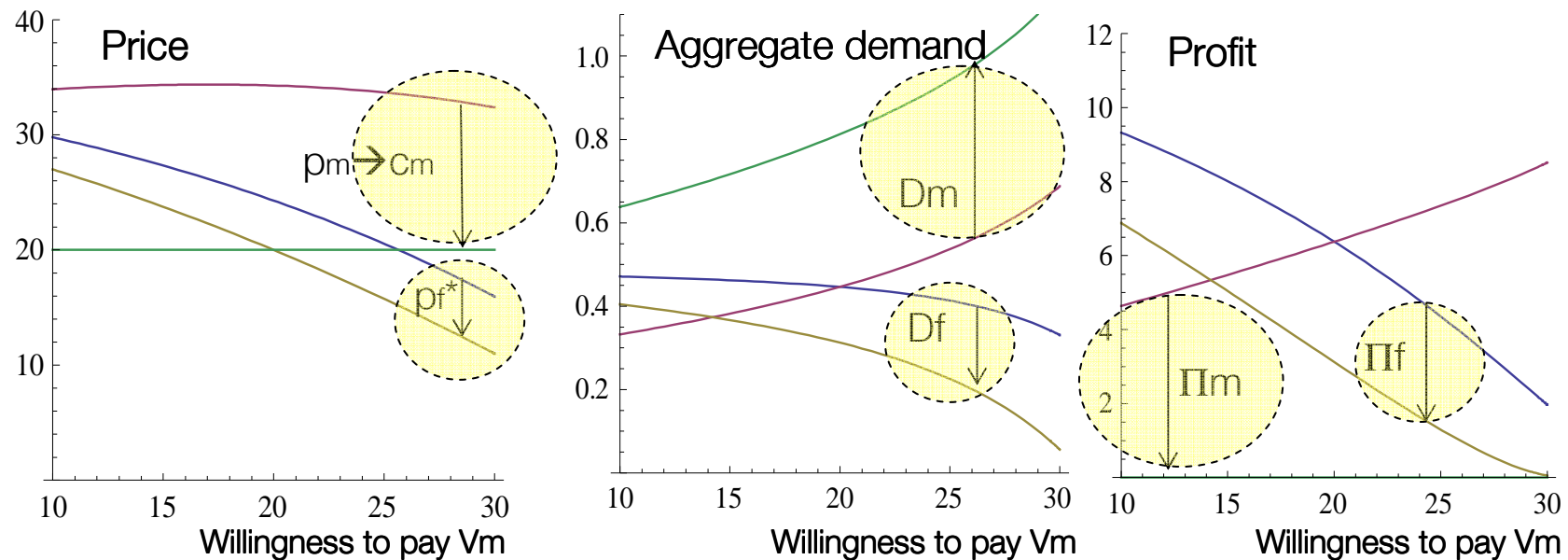
| The mobile price is moving to marginal cost

The fixed price at equilibrium (a monopoly) goes down | The demand for mobile increases due to the lowest mobile price

The demand for fixed decreases | The mobile profit is zero

The fixed profit decreases |

Impact of substitution on collusion

The partial fixed-mobile substitution can reduce the benefit of a possible collusion of two players in the same market
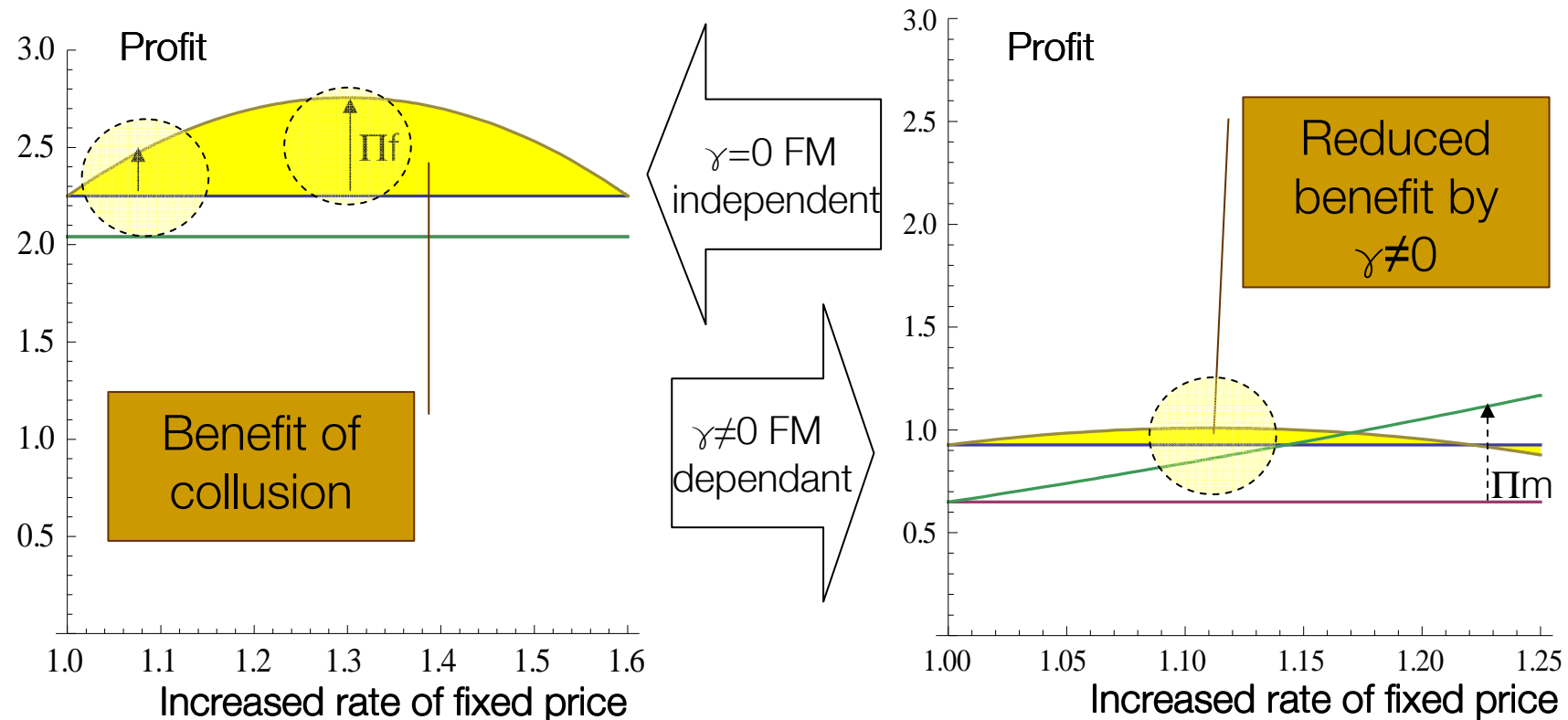
- When the fixed and mobile markets are independent ($\gamma = 0$), two players in the same market (e.g. fixed) collude, their profits increase.

- This benefit is significantly reduced in the presence of fixed-mobile substitution ($\gamma \neq 0$)

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Conclusion

- The model highlights interdependence between fixed and mobile markets:

  - A market increases its profit by lowering its marginal cost. Consequently, the profit of the other market decreases
  - A player unilaterally raises its price, it sees its market share reduced in favor of the other market
  - A monopolistic player in its market is indirectly controlled by the other market especially if it is competitive

- Mobile technological progress increases fixed-mobile substitution, whereas fixed technological progress reduces it:

  - With technological progress, mobile broadband access becomes more competitive when facing the fixed market. A partial fixed-mobile substitution will be observable worldwide in the future
  - The development of FTTH, to offer a differentiated product, seems necessary to sustain the fixed business

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