

Jeanjean, François

## Conference Paper

# High correlation between net promoter score and the development of consumers' willingness to pay (Empirical evidence from European mobile markets)

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**22<sup>nd</sup> European Regional ITS Conference  
Budapest, 18-21 September, 2011**

**François Jeanjean**

**High Correlation between Net Promoter Score and  
the Development of Consumers' Willingness to Pay  
(Empirical Evidence from European Mobile Markets)**

**Abstract**

This paper shows that the correlation between the Net Promoter Score and consumers' Willingness To Pay in five European mobile markets is very strong. The Net Promoter Score is provided by a survey and the Willingness To Pay is calculated using the “Spokes Model” which is an economic model based on horizontal differentiation among firms. The model input data (firms’ revenues, number of subscribers and profits) are provided by Merrill Lynch, Bank of America. The well-known correlation between Net Promoter Score and Revenues is weaker and arises from the previous correlation. The same is true of the correlation between Net Promoter Score and Profits.

**JEL codes:** D11, D43, L13, L96, M31

**Keywords:** Net Promoter Score, recommend intention, customer satisfaction, consumer's Willingness to Pay

**François Jeanjean: France Telecom Orange<sup>1</sup>  
e-mail: francois.jeanjean@Orange-ftgroup.com**

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<sup>1</sup> This paper represents the analysis of the author and not necessarily a position of France Telecom

# 1 Introduction

Measuring customer satisfaction and Willingness To Pay, or “WTP,” is a major strategic objective for managers and marketers, and the best method for doing so has been hotly debated for years. In recent years, the arrival of the "Net Promoter Score" (NPS) indicator: created a small revolution. While it not always the most accurate indicator, it is probably the easiest to use, since it requires only one question: “*How likely is that you would recommend us to a friend or a colleague?*” The people who answer most positively are called “promoters”, while; those that respond less favourably are called “detractors”. The NPS calculates the difference between promoters and detractors. This ease of implementation has prompted managers widely to adopt this new metric.

In his paper (Reichheld, 2003), “The One Number You Need to Grow”, Fred Reichheld highlighted the strong correlation between a company's growth rate and its Net Promoter Score in most competitive industries. A second paper, (Reichheld, 2006), “The Microeconomics of Customers Relationship”, sought to offer a rational explanation of the success of NPS. He suggests that promoters have a good customer experience meaning that they are more loyal and more likely to repurchase. Promoters spend more than detractors; their lifetime with a company is longer because of their loyalty. Consequently, acquisition costs are amortized over a longer period and thus become cheaper. Promoters are less price-sensitive than detractors because they believe they are getting a good value overall from the company. Moreover, promoters help to recruit newcomers by recommending their provider to friends (Word of Mouth). A good NPS tends to increase both market share and sale price and therefore revenues.

NPS has, however, been criticized by other authors. (Morgan & Rego, 2006), as well as (Keiningham, Cooil, Andreassen, & Aksoy, 2007) (Keiningham, Aksoy, Cooil, Andreassen, & Williams, 2008) have pointed out that NPS was not always the best indicator for predicting corporate revenue growth, and results varied by industry.. Empirical evidence has emphasized the NPS' relevance in the telecommunications industry.

This paper shows that in the European mobile markets, the link between the NPS and Willingness To Pay is very strong and is even stronger than the correlation between NPS and corporate revenue growth.

NPS appears to be proportional to the rate of development of WTP and could represent a good proxy for it. When choosing their provider, all customers had a preference for it without being either promoters or detractors. Promoters are those who have maintained or increased this preference over time, while detractors are those who have been disappointed and have changed it. NPS is a clear sign of consumers' changing opinions over a given period of time as compared to their initial choice. Some time later, detractors of the previous period will have probably changed their provider, provided that the market is sufficiently competitive, (switching costs are not too high and commitments are not too long-term) and promoters will have

helped recruit new customers. Promoters in the new period are those who have maintained or increased their preference from one period to the next, and detractors in the new period are those who were disappointed during the previous period, since former detractors have already cancelled their service. The NPS for the new period thus represents customers' changing opinions from one period to another. More generally, NPS indicates consumers' changing opinions over time. A positive NPS means that promoters outnumber detractors and thus that customers' opinions are changing positively. Similarly, a negative NPS means that customers' opinions are changing negatively.

When the market is not competitive enough, customers tend to be captive and cannot change providers as they wish. In this case, there is a significant gap between customers' actual behaviour and their wishes; NPS therefore does not accurately reflect the financial results. A strong correlation between NPS and financial performances is thus the sign of effective competition, while an uncorrelated NPS implies an impediment to customers' desires. Reichheld (Reichheld, 2006) has shown that NPS did not apply for monopolies.

This paper consists of 6 sections. Section 2 presents a theoretical model of competition in order to determine the relationship between WTP and financial performance (prices, revenues and profits). Section 3 describes the data used for the empirical evidence, including both financial data and survey data (NPS). Section 4 compares the two sets of data and highlights the strong correlation between them. Section 5 compares this correlation to the correlation between NPS and corporate revenue growth or between NPS and corporate profit growth and shows that it is much stronger. The difference stems from the fact that WTP depends essentially on customer choices while revenues and profits also depend on other parameters and particularly on marginal costs. Improving customer satisfaction has a cost; we found that firms which increase NPS the most are often also those which increase their marginal costs the most. Section 6 is the conclusion.

## 2 The Spokes Model

The spokes model, as described by (Chen & Riordan, 2007) is a version of the Hotelling model for more than two firms.

The market is represented by a spoke wheel where consumers are uniformly distributed. Each firm is located at the end of a spoke. The wheel diameter is normalized to 1; the length of each spoke is thus 1/2. The size of the market is also normalized to 1. Each consumer located within a spoke compares the utility to purchase the offer by the firm located at the end of the spoke and the offer he prefers from among the other firms. Like all the spokes converge at the centre of the wheel, the comparison can be made in pairs between all firms. If there are  $N$  firms, there will be  $\frac{N(N-1)}{2}$  comparisons. Each firm is involved in  $(N-1)$  comparisons.

We assume  $V_i$  and  $p_i$  are respectively the consumer's willingness to pay and the price of firm  $i$ 's offer. We will focus on the comparison between firms  $i$  and  $j$ . The length of the two joined spokes is 1. A consumer located at a distance  $x$  from firm  $i$  is located at a distance  $(1-x)$  from the firm  $j$ . His utilities of purchasing firm  $i$ 's and firm  $j$ 's offer are respectively:

$$U_i = V_i - p_i - tx$$

$$U_j = V_j - p_j - t(1-x)$$

With  $t$ , the coefficient of differentiation. The indifferent consumer between  $i$  and  $j$  is

$$\text{located at } x_{ij} = \frac{V_i - V_j + p_j - p_i + t}{2t}$$

Firm  $i$ 's market share is written:

$$\sigma_i = \frac{2}{N(N-1)} \sum_{j \neq i} x_{ij}$$

We assume that firm  $i$  incurs a marginal cost  $c_i$ . The profit of firm  $i$  is:

$$\pi_i = n\sigma_i(p_i - c_i)$$

$n$  represents the total number of customers.

The first order condition allows us to determine  $p_i$ :

$$p_i = t + \frac{Nc_i + \sum_{j \neq i} c_j + (N-1)V_i - \sum_{j \neq i} V_j}{(2N-1)} \quad (1)$$

and hence:

$$\sigma_i = \frac{1}{N} \left( 1 + \frac{(N-1)V_i - \sum_{j \neq i} V_j - ((N-1)c_i - \sum_{j \neq i} c_j)}{(2N-1)t} \right) \quad (2)$$

Let us denote:  $c_i^* = c_i - \frac{1}{N} \sum_{j=1}^N c_j$ , the relative marginal cost, which is the deviation of firm  $i$ 's marginal cost from the average marginal cost.

In the same way,  $V_i^* = V_i - \frac{1}{N} \sum_{i=1}^N V_i$  represents the relative consumer willingness to pay. Firm  $i$ 's market share can be rewritten:

$$\sigma_i = \frac{1}{N} + \frac{V_i^* - c_i^*}{(2N-1)t}$$

Let us note that  $\sigma_i^* = \sigma_i - \frac{1}{N}$  the difference between firm  $i$ 's market share and the average market share  $\frac{1}{N}$ .

Therefore, firm  $i$ 's relative Willingness To Pay is:

$$V_i^* = (2N-1)t\sigma_i^* + c_i^* \quad (3)$$

## 3 Data and methodology

### 3.1 Availability of data:

Five countries were studied from Q1 2008 to Q3 2010: Belgium (3 firms), France (3 firms), Spain (4 firms), Switzerland (3 firms) and the United Kingdom (5 firms). (Data for Switzerland and United Kingdom is given using their national currency and required quarterly exchange rates to be converted into €, the exchange rates used are given in appendix 7.1), for a total of 9 variations quarter by quarter for 18 firms, or 162 observations.

However, some observations are not relevant and must be excluded. In Spain, the NPS for the fourth operator Yoigo is only available from Q4 2009, so we must reject all the previous quarters. In United Kingdom, the merger between Orange and T-Mobile makes data irrelevant from Q2 2010. A total of 30 observations must be rejected, leaving 132 relevant observations.

### 3.2 Hypothesis

We are seeking to verify the hypothesis formulated in the introduction: NPS is proportional to the speed of the development of WTP. The speed of the development of WTP is the derivative of WTP with respect to time  $\tau$ .

$$\frac{dV}{d\tau} = \beta NPS$$

If we take into account the relative WTP of firm  $i$ , the hypothesis can be written:

$$\frac{dV_i^*}{d\tau} = \beta NPS_i^* \quad (4)$$

In order to test our hypothesis, we will compare the relative NPS,  $NPS_i^*$ , to the changes in the relative WTP,  $V_i^*$ , calculated using the spokes model, for each firm in all of the countries studied.

### 3.3 Calculating WTP from the database using the Spokes Model

The “Bank of America, Merrill Lynch” database provides us with the following quarterly data for each firm in each country:

- Number of subscribers,  $q_i$ .
- Revenues,  $R_i$
- Ebitda,  $\pi_i$

The GfK “Customer Experience Tracker” provides us the quarterly NPS for each firm in each country.

The total number of subscribers in a country is  $n = \sum_{i=1}^N q_i$

Firm  $i$ 's market share is:  $\sigma_i = \frac{q_i}{n}$

(Average) price of firm  $i$ :  $p_i = \frac{R_i}{q_i}$

(Average) marginal cost of firm  $i$ :  $c_i = \frac{\pi_i - R_i}{q_i}$

Equation (1) can be rewritten:

$p_i = t + c_i + \frac{N(V_i^* - c_i^*)}{2N - 1}$  which allows us to calculate the sum of the firms' prices:

$\sum_{j=1}^N p_j = Nt + \sum_{j=1}^N c_j$  and thus to determine the coefficient of differentiation  $t$ :

$$t = \frac{\sum_{j=1}^N (p_j - c_j)}{N}$$

This data provides everything we need for to calculate the relative willingness to pay for each firm,  $V_i^*$ , using equation (3).

## 4 Empirical evidence

### 4.1 First model: Significant correlation but low accuracy

As we did in section 2, we will denote  $NPS_i^* = NPS_i - \frac{1}{N} \sum_{j=1}^N NPS_j$ , the relative NPS of firm  $i$ .

We will denote  $(NPS_i^*)_Q$ , the relative NPS of firm  $i$  for quarter  $Q$  and  $\Delta_{Q1}^{Q2}(V_i^*) = (V_i^*)_{Q2} - (V_i^*)_{Q1}$ , the variations of relative willingness to pay between Q1 and Q2.

From equation (4),  $\Delta_{Q1}^{Q2}(V_i^*) = \beta \int_Q^{Q+1} NPS_i^*(\tau) d\tau$ . Because NPS is measured quarterly,

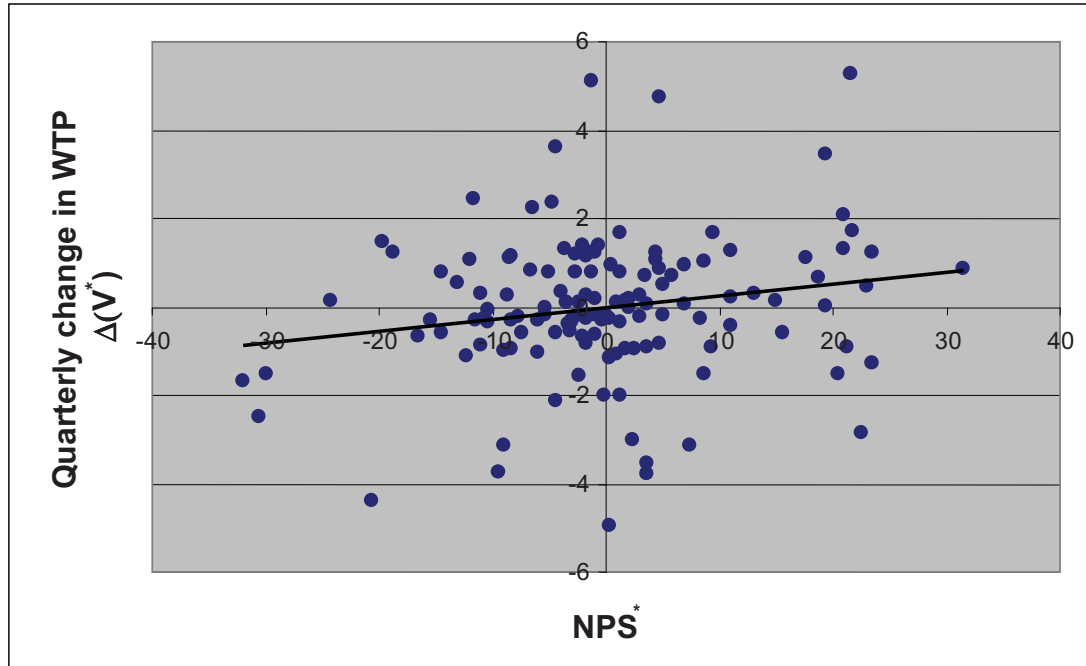
we assume that the NPS is steady during a quarter and  $(NPS_i^*)_{Q+1}$  represents the NPS for all of quarter  $Q+1$  from the end of quarter  $Q$  to the end of quarter  $Q+1$ . Thus

during this time  $NPS_i^*(\tau) = (NPS_i^*)_{Q+1}$ , so  $\int_Q^{Q+1} NPS_i^*(\tau) d\tau = (NPS_i^*)_{Q+1}$  and the equation to be tested is:

$$\Delta_Q^{Q+1}(V_i^*) = \beta(NPS_i^*)_{Q+1} + (\varepsilon_i)_{Q+1} \quad (5)$$

$\beta$  is the proportionality ratio and  $(\varepsilon_i)_{Q+1}$  the error term.

The coefficient of correlation between  $\Delta_Q^{Q+1}(V_i^*)$  and  $(NPS_i^*)_{Q+1}$  is 0.190 for 132 observations. It is significant in the table of critical values for the Pearson correlation, and the hypothesis of correlation can be accepted with an error risk lower than 5%. However, the results are not very accurate. The mean of both series is equal to zero because each value is the deviation from the mean. The standard deviation for  $\Delta_Q^{Q+1}(V_i^*)$  is 1.61 while the standard error is 1.59. The useful signal is buried in the noise, which is why the correlation coefficient is not higher. The graph below (fig.1) represents the scatter plot:



(fig.1)

This raises the question of whether the error results from a lack of correlation between sets or if it is simply a residual error which is independent of the correlation. In the latter case, the correlation coefficient is low because the WTP has not had enough time to sufficiently exceed the error level.

#### 4.2 Second model: Higher and increasing accuracy

The only way to answer this, letting WTP evolve over a longer period, using several quarters instead of a single quarter. The standard deviation of  $V_i^*$  should increase over



time, and if the standard error does not increase in the same proportions, the correlation should improve and the coefficient of correlation should increase.

We will compare the evolution of relative NPS to that of relative WTP,  $V_i^*$  over a period of time of  $k \geq 1$  quarters.

In this case, because NPS is steady during a quarter:

$$\Delta_Q^{Q+k}(V_i^*) = \beta \int_Q^{Q+k} NPS_i^*(\tau) d\tau = \beta \sum_{j=1}^k \left( \int_{Q+j-1}^{Q+j} NPS_i^*(\tau) d\tau \right) = \beta \sum_{j=1}^k (NPS_i^*)_{Q+j}$$

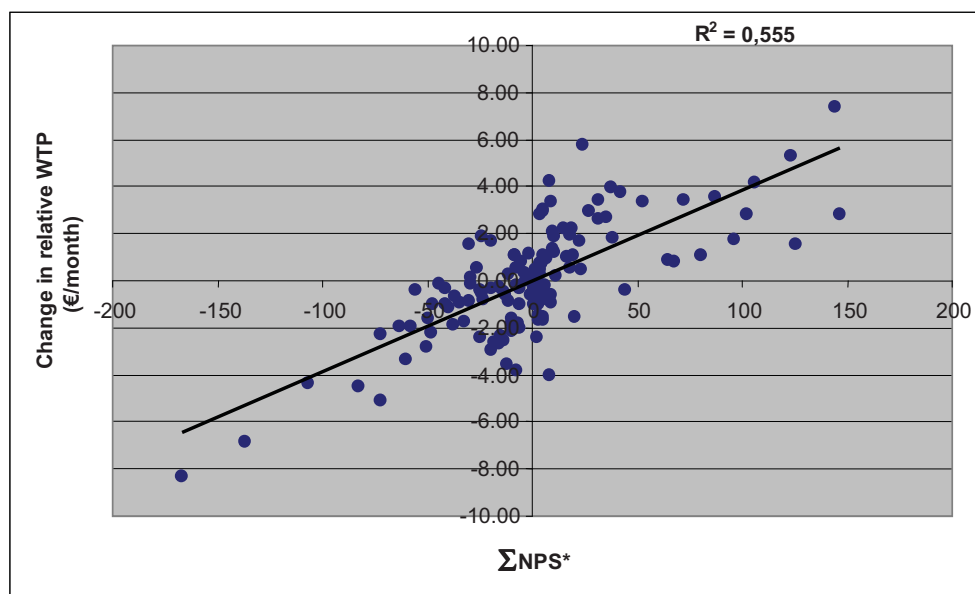
As a result, we will test the following expression:

$$\Delta_Q^{Q+k}(V_i^*) = \beta \sum_{j=1}^k (NPS_i^*)_{Q+j} + (\varepsilon_i)_{Q+k} \quad (6)$$

Data for Spain was available for only 4 quarters (from Q4 2009 to Q3 2010) and data for the UK for only 7 quarters (from Q3 2008 to Q3 2010). There are thus 18 available observations for each value of  $k$  when  $k \leq 4$ , for a total of 72 observations. For  $4 < k \leq 7$ , the Spanish data is not available and there are 14 available observations for each value of  $k$ , for a total of 42 observations. For  $7 < k \leq 9$ , the British data is not available and there are 9 available observations for each value of  $k$ , for a total of 18 observations. We thus have a total of 132 available observations. For all countries with the exception of Spain, the value of  $Q$  in equation (6) is the second quarter of 2008:  $Q = Q2$  2008. For Spain,  $Q$  is the third quarter of 2009:  $Q = Q3$  2009 (See appendix 7.2).

The coefficient of correlation is now 0.745, which is highly significant.

The standard deviation for the set of 132  $V_i^*$  observed has reached 2.35, as opposed to 1.61 in the previous model, while the standard error has remained almost steady at 1.58. The graph below (fig.2) represents the scatter plot for the second model:



(fig.2)

The increase in the duration of the evolution of WTP has dramatically improved the correlation, which suggests that the standard error does not stem from a poor correlation but from a residual error which is independent of the correlation.

### 4.3 Test of increasing correlation

In order to confirm this, we will weigh each NPS value with the number of quarters,  $k$ . We will then perform the following linear regression:

$$\Delta_Q^{Q+k}(V_i^*) = (\beta_1 + k\beta_2) \sum_{j=1}^k (NPS_i^*)_{Q+j} + (\varepsilon_i)_{Q+k}$$

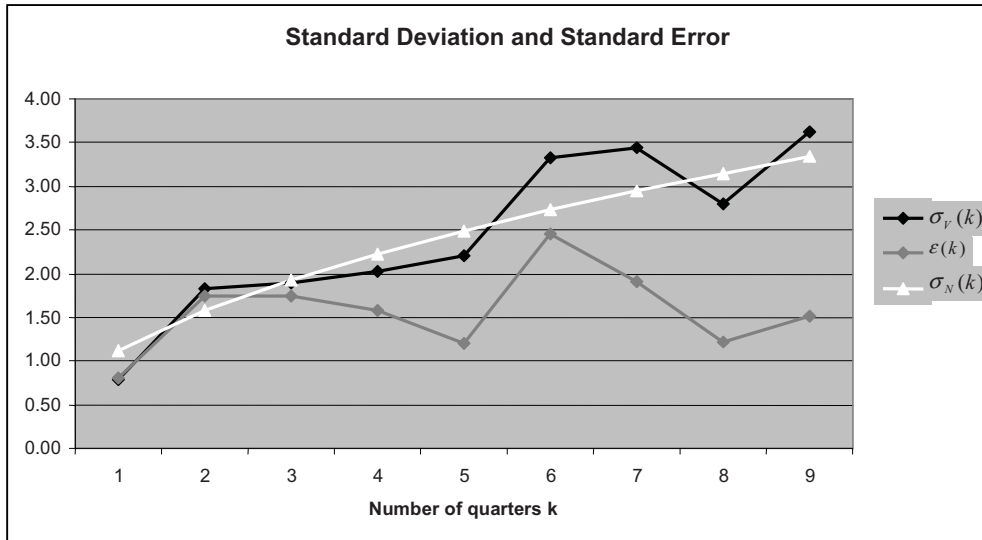
The regression provides a positive and significant value for  $\beta_2$  (see appendix 7.3) which means that the correlation is increasing.

### 4.4 A useful signal emerges from the noise

The mean of the series  $\Delta_Q^{Q+k}(V_i^*)$  and  $\sum_{j=1}^k (NPS_i^*)_{Q+j}$  is equal to zero because  $V_i^*$  and

$NPS_i^*$  are the deviation of each firm from the national average. However, when the number of quarters  $k$  increases, the standard deviation of the series also increases, while the standard error between the two series remains roughly steady, despite fluctuations quarter by quarter. It is worth noting that standard deviation of both series seems evolve almost like a standard normal distribution whose standard deviation is  $\sigma = 1.11$ .

Indeed, each additional quarter amounts to add such standard normal distribution to the previous one. After  $k$  quarters, the standard deviation of the sum of  $k$  such standard normal distributions is  $\sqrt{k} \sigma$ . The figure below (fig.3) represents the evolution of the standard deviation of  $\Delta_Q^{Q+k}(V_i^*)$ ,  $\sigma_V(k)$  (black curve), the evolution of the standard deviation of a standard normal distribution,  $\sigma_N(k)$  (gray curve), and the standard error  $\varepsilon(k)$ , (white curve) according to  $k$ . This suggests that the distribution of the values of  $\Delta_Q^{Q+k}(V_i^*)$  around the mean are almost randomly distributed.

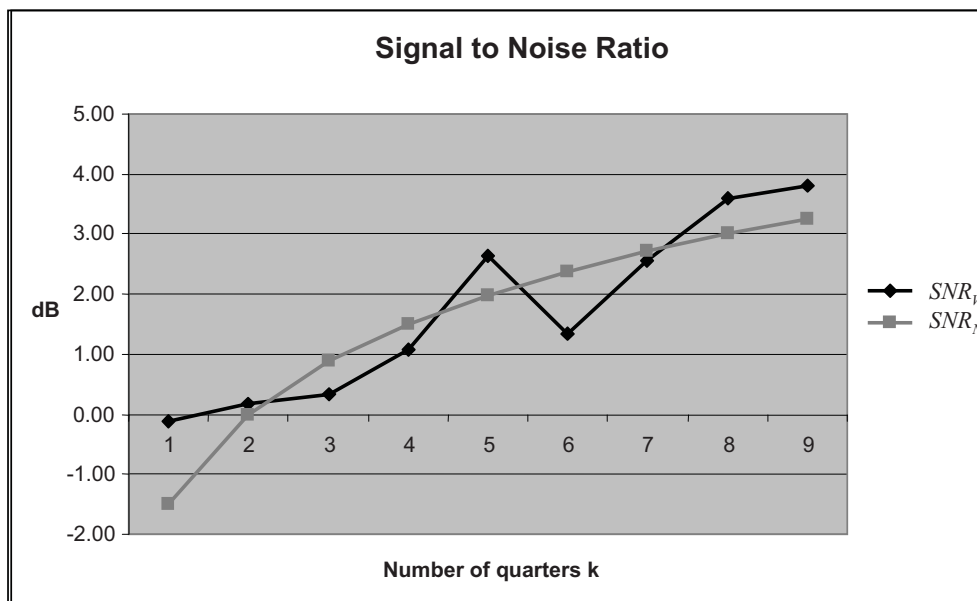


(fig.3)

The increase in standard deviation means that the absolute values of the series increase and as a result, the correlation increases too. The ratio Standard deviation on Standard error can be interpreted as a signal to noise ratio. The figure below (fig.4) represents the Signal to Noise Ratio (in decibel),  $SNR_V(k) = 10 \log\left(\frac{\sigma_v(k)}{\epsilon(k)}\right)$ , (black

curve) and  $\sigma_N(k) SNR_N(k) = 10 \log\left(\frac{\sigma_N(k)}{\mu}\right)$ , (gray curve), with  $\mu = \frac{\sum_{k=1}^9 \epsilon(k)}{9}$ , the mean of  $\epsilon(k)$  on the 9 quarters.

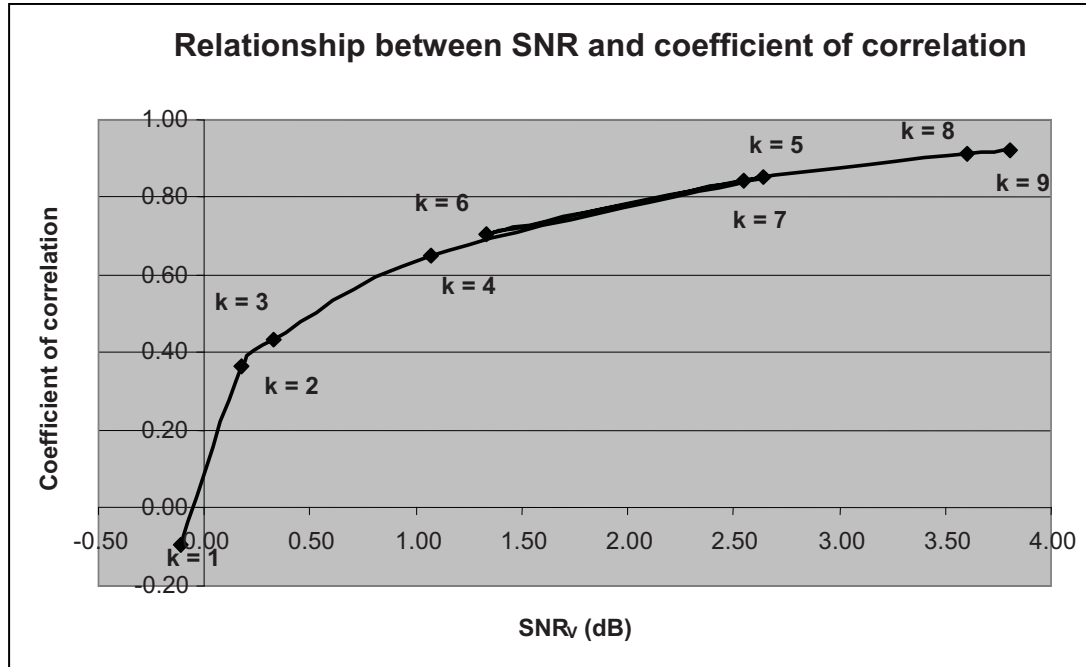
One can notice the strong increase in standard error for  $k=2$  and  $k=6$ . This corresponds to the Q4 2008 and Q4 2009 for Belgium, France, Switzerland and UK. (Not for Spain where  $k=2$  corresponds to Q1 2010 and where  $k \leq 4$ ). 4<sup>th</sup> quarters seem to generate more errors than other. This is probably the effect of Christmas season when many promotions are offered to customers.



(fig.4)

An increase in SNR improves the correlation. The figure below (fig.5) illustrates the relationship between  $SNR_V(k)$  and the coefficient of correlation between the two

series  $\Delta_Q^{Q+k}(V_i^*)$  and  $\sum_{j=1}^k (NPS_i^*)_{Q+j}$ .

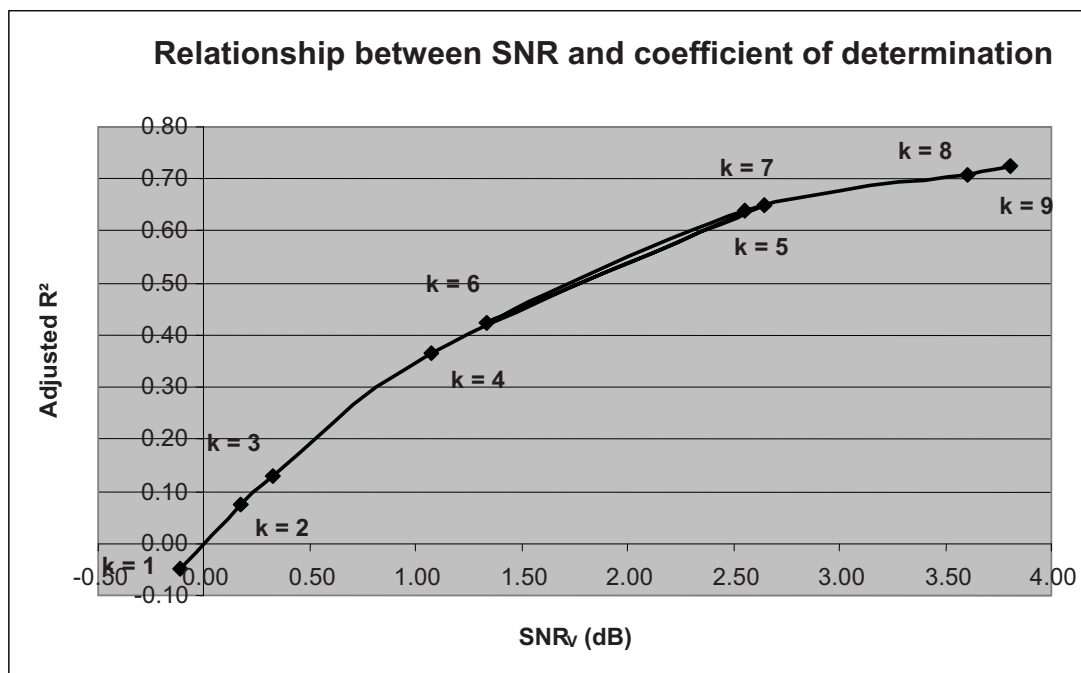


(fig.5)

One can notice that for  $SNR_V(k) = 0$ , the coefficient of correlation is close to zero, in such a case, the level of noise is equal to the level of signal. When  $k$  increases,  $SNR_V(k)$  tends to increase and the coefficient of correlation increases as well (excepted for  $k=6$ . For  $k=2$ , despite the slight improvement of the SNR, the coefficient of correlation increases anyway because of the very strong slope of the curve here). When  $k$  is great, the coefficient of correlation tends toward 1. In this study, for  $k = 9$ , the coefficient of correlation attains 0.92.

The useful signal which is buried in the noise for the low values of  $k$ , emerges from the noise when  $k$  increases and consequently, the correlation becomes stronger and stronger.

Likewise the coefficient of correlation, the coefficient of determination  $R^2$  increases with the SNR and hence tends to increase with  $k$ . For  $k=9$ , adjusted  $R^2 = 0.72$ , NPS explains more than 72% of the Willingness to Pay. The following graph (fig.6) represents the evolution of the adjusted  $R^2$  according to  $SNR_V(k)$



(fig.6)

This increasing correlation confirms the hypothesis  $\frac{dV}{d\tau} = \beta NPS$  and allows us to estimate parameter  $\beta$ .

#### 4.5 Estimation of parameter $\beta$

The accuracy of the estimation increases like the correlation with the number of quarters,  $k$ . Therefore the most accurate estimation is given for  $k=9$ . In such a case, the estimation leads to  $\beta = 5$  cent €/month with a 15% standard error. That means that  $\beta$  has a probability of 50% to be in the range: 4.3 to 5.8 cent €/month or a probability of 95% to be in the range: 3.3 to 6.8 cent €/month.

$\beta = 5$  cent €/month means that a 10-point NPS per quarter corresponds to a 0.5 €/month increase in consumer Willingness To Pay. The NPS is measured each quarter and the results are cumulated over time. In other words, a 5-point NPS per quarter during a year corresponds to 1€/month increase in Willingness To Pay. However, if all firms have the same NPS, their relative NPS will remain unchanged and therefore also their relative Willingness To Pay. This does not mean their individual Willingness To Pay does not increase; only that it increases identically for all firms. In such a case, all things being equal, revenues and profits remains steady. Firms can benefit from the increase of Willingness To Pay of their customers, only when it is higher than that of their competitors.

There are no significant differences between countries, adding a dummy country does not provide additional information.

A comparison of the relative evolution of WTP,  $V_i^*$  and  $\beta NPS$  using the coefficient  $\beta$  we have estimated and a simulation of the evolution of the relative WTP by country are available in the appendices (Appendix 7.4).

Firms that have the greatest changes are often also those that give the most accurate results because they deviate more from the margin of error for example: Swisscom (Switzerland); Hutchinson 3 (UK); Bouygues (France) or Yoigo (Spain).

## 5 Correlation between NPS, revenues and profits

The correlation between NPS, revenues and profits has already been clearly indicated by (Reichheld, 2003). We aim to show that this correlation is much weaker than for WTP. WTP depends essentially on customers' choices and thus on their satisfaction which can be measured by NPS, while revenues and profits, while they heavily depend on NPS, are also subject to other factors which are independent of customers, including marginal cost, coefficient of differentiation  $t$  and total market size  $n$ .

Equation 1 can be rewritten:

$$p_i = c_i + t + \frac{N(V_i^* - c_i^*)}{(2N - 1)}$$

Revenues and profit of firm  $i$  can be written:

$$R_i = \frac{nN}{t} \left( \left( \frac{t}{N} + \frac{V_i^* - c_i^*}{(2N - 1)} \right)^2 + \frac{c_i}{N} \left( \frac{t}{N} + \frac{V_i^* - c_i^*}{(2N - 1)} \right) \right) \quad (7)$$

$$\pi_i = \frac{nN}{t} \left( \frac{t}{N} + \frac{V_i^* - c_i^*}{(2N - 1)} \right)^2 \quad (8)$$

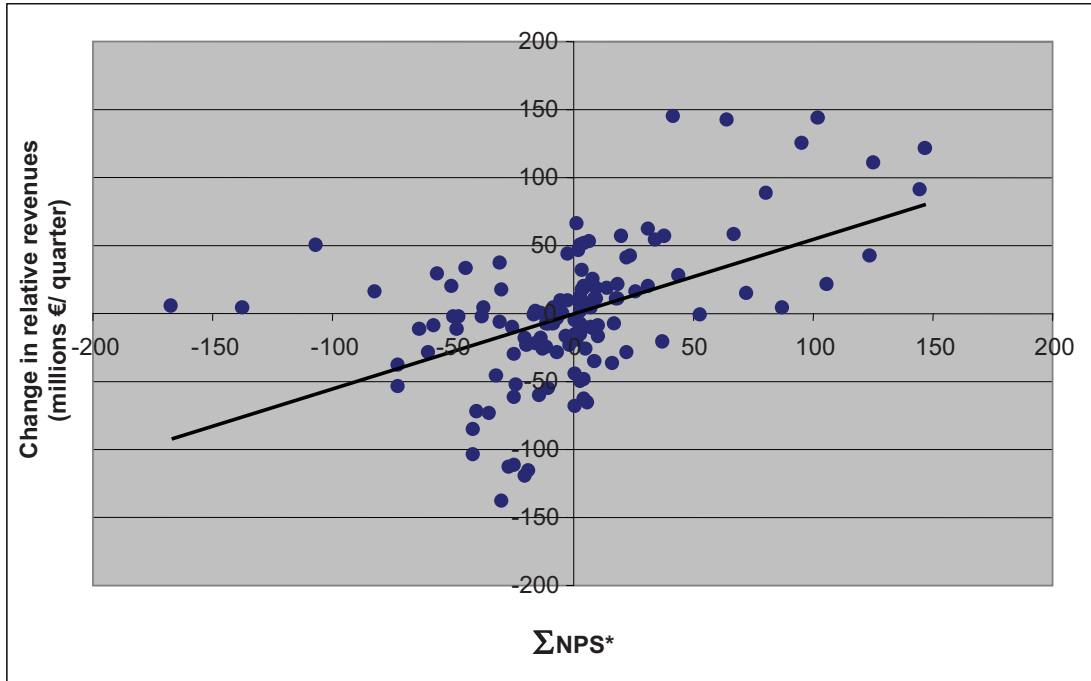
Equations 7 and 8 show that revenues and profit will evolve quadratically with the development of relative Willingness To Pay  $V_i^*$ , and thus with the relative NPS. This fulfils the second generalization of (Gupta & Zeithaml, 2006) “*The link between satisfaction and profitability is asymmetric and non-linear*”

However, Revenues and Profit are also very sensitive to variations in efficiency,  $c_i^*$ , differentiation  $t$ , or the total market size  $n$ .

Equation (6) illustrates the relationship between WTP and NPS. We can write the similar relationship between the evolution of Revenues and NPS:

$$\Delta_Q^{Q+k}(R_i) = \beta \sum_{j=1}^k (NPS_i^*)_{Q+j} + (\varepsilon_i)_{Q+k} \quad (9)$$

The coefficient of correlation is 0.503 for 132 observations. It is still significant but weaker than the correlation between WTP and NPS (coefficient of correlation 0.745). The graph below represents the corresponding scatter plot (fig.7)

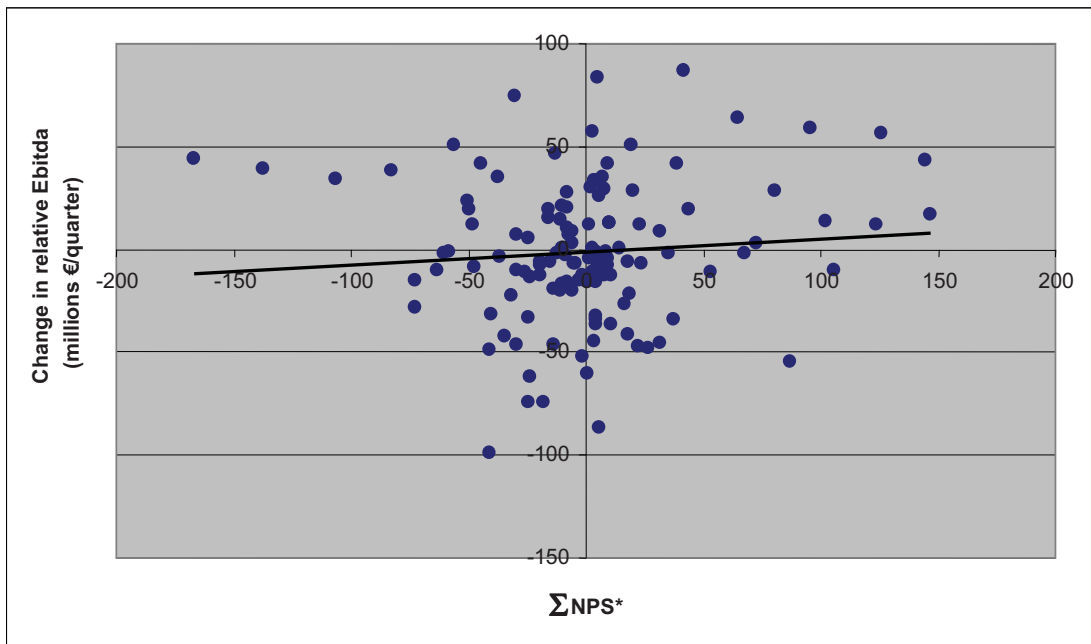


(fig.7)

In the same way, the relationship between the development of profits and NPS can be written:

$$\Delta_Q^{Q+k}(\pi_i^*) = \beta \sum_{j=1}^k (NPS_i^*)_{Q+j} + (\varepsilon_i)_{Q+k} \quad (10)$$

The coefficient of correlation is 0.085, which is too low to be significant. The graph below (fig.8) represents the corresponding scatter plot.



(fig.8)

Equation (8) indicates that profits are very sensitive to marginal costs. Let us add marginal costs to the regression.

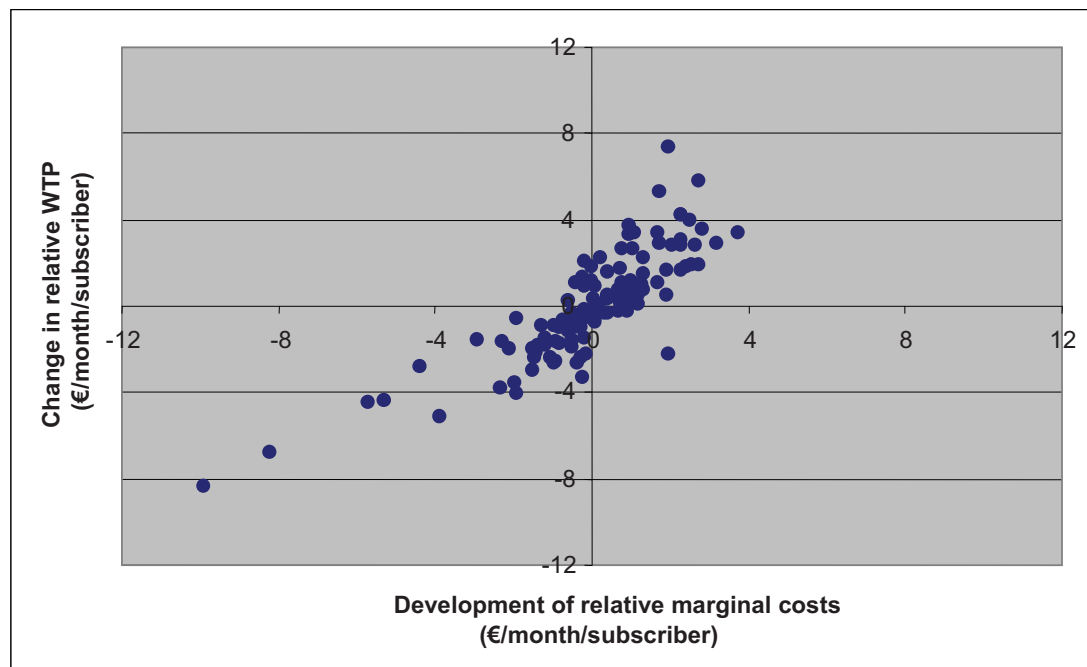
$$\Delta_Q^{Q+k}(\pi_i^*) = \beta_1 \sum_{j=1}^k (NPS_i^*)_{Q+j} + \beta_2 \sum_{j=1}^N (c_i^*)_{Q+j} + (\varepsilon_i)_{Q+k} \quad (11)$$

$\beta_1$  and  $\beta_2$  are both quite significant:  $\beta_1 = 0.379^{***}$  and  $\beta_2 = -11.44^{***}$ . The opposite signs of  $\beta_1$  and  $\beta_2$  suggest that firms with a high NPS which increase their consumers' WTP the most quickly are also generally those which increase their marginal costs the most. In other words, this suggests that the increase in WTP and marginal costs are correlated. The correlation coefficient is 0.838 for 132 observations, which indicates a strong correlation. This explains why the correlation between profit development and NPS is so weak. The increase in NPS often requires an increase in quality for consumers. This tends to increase marginal costs and reduces the benefits provided by consumers' satisfaction. In equation 7, the increase of marginal costs reduces the term  $V_i^* - c_i^*$  but it is compensated by the term  $\frac{c_i}{N}$ . In

equation 8 the term  $\frac{c_i}{N}$  disappears and can no longer compensate for the reduced efficiency.

Moreover, the coefficient of correlation between evolution of profits and  $(V_i^* - c_i^*)$  is 0.500 for 132 observations, which is quite significant.

The graph below (fig.9) represents the scatter plot between WTP and marginal costs.



(fig.9)



## 6 Conclusion

The correlation between NPS and WTP is very strong in the European mobile markets which we studied. It explains most of the variations in WTP. It is clearly the sign of competitive markets where customers can switch providers at will without much hindrance.

The standard error does not vary significantly with the duration of observation, while NPS tends to increase; therefore, the relative error decreases and causes the increase in the correlation between NPS and WTP. We can consider that the NPS faithfully reflects changes in WTP. A 5-point NPS per quarter over a year corresponds to about 1€/month increase in Willingness To Pay.

The correlation between NPS and Revenues exists but is less pronounced due to the fact that WTP depends entirely on consumers while Revenues also depend on strategic interactions among firms.

The correlation between NPS and profits is even lower because profits are very sensitive to variations in marginal costs and firms which increase their customers' WTP the most are also often those which increase marginal costs the most.

As part of further research, it might be relevant to find out how NPS could be used as an indicator of the competitiveness of a market, looking at the correlation coefficient between WTP and NPS.

This would distinguish what comes from the merits of the firms that manage to differentiate themselves from their competitors and what comes from an abusive customer retention.

### Acknowledgments

The author thanks Bruno Julien and Wilfried Sand-Zantman for their helpful tips and his colleagues at France telecom Orange for their remarks and comments, especially Mihasonirina Andrianaivo and Diane Filipini as well as Marie Claire Lampaert who provided the data.

## 7 Appendices

### 7.1 Exchange rate

	Q2 2008	Q3 2008	Q4 2008	Q1 2009	Q2 2009	Q3 2009	Q4 2009	Q1 2010	Q2 2010	Q3 2010
CHF->€	0,620	0,621	0,656	0,667	0,661	0,658	0,662	0,684	0,708	0,751
GBP->€	1,261	1,259	1,191	1,099	1,136	1,149	1,105	1,127	1,170	1,201

Source : Fxtop.com

### 7.2 Calculated values of $\Delta_Q^{Q+k}(V_i^*)$ and $\sum_{j=1}^k (NPS_i^*)_{Q+j}$ :

$$\Delta_Q^{Q+k}(V_i^*)$$

Country	€/month	Q3 2008	Q4 2008	Q1 2009	Q2 2009	Q3 2009	Q4 2009	Q1 2010	Q2 2010	Q3 2010
Belgium	k	1	2	3	4	5	6	7	8	9
	firm 1	-1,01	0,06	-2,05	-1,84	-2,13	-2,53	-3,59	-2,38	-2,95
	firm 2	0,78	0,55	-0,98	-0,99	-0,81	0,44	0,25	1,04	0,75
	firm 3	0,23	-0,60	3,03	2,83	2,94	2,09	3,33	1,34	2,20
France	k	1	2	3	4	5	6	7	8	9
	firm 1	1,14	-2,42	-0,72	-1,69	-0,28	-4,05	-1,68	-1,55	-1,45
	firm 2	-0,21	-1,78	-0,45	-0,52	-0,77	-1,74	-0,95	-1,13	-0,33
	firm 3	-0,92	4,20	1,17	2,22	1,06	5,79	2,64	2,68	1,78
Spain	k						1	2	3	4
	firm 1						1,10	-2,63	-0,37	-1,03
	firm 2						0,72	-0,23	-0,42	-0,31
	firm 3						-0,30	-0,88	-0,11	-0,42
	firm 4						-1,52	3,75	0,90	1,77
Switzerland	k	1	2	3	4	5	6	7	8	9
	firm 1	0,94	0,51	3,97	3,38	3,39	3,52	4,18	5,30	7,37
	firm 2	-0,32	1,09	-3,84	-2,69	-2,42	-1,88	-2,23	-3,33	-2,27
	firm 3	-0,62	-1,60	-0,13	-0,70	-0,97	-1,64	-1,95	-1,96	-5,10
UK	k	1	2	3	4	5	6	7		
	firm 1	-0,23	-0,50	0,45	0,72	0,20	1,86	1,93		
	firm 2	0,46	-0,43	0,80	1,10	2,80	1,52	2,83		
	firm 3	0,33	-0,01	-0,28	0,99	1,68	2,92	3,42		
	firm 4	-0,85	-0,59	1,86	1,69	-0,32	0,52	0,16		
	firm 5	0,29	1,53	-2,83	-4,50	-4,36	-6,82	-8,35		

Author's calculation using Bank of America Merrill Lynch data

$$\sum_{j=1}^k (NPS_i^*)_{Q+j}$$

Country		Q3 2008	Q4 2008	Q1 2009	Q2 2009	Q3 2009	Q4 2009	Q1 2010	Q2 2010	Q3 2010
Belgium	k	1	2	3	4	5	6	7	8	9
	firm 1	-6,00	-1,67	-6,00	-7,00	-10,00	-13,33	-12,33	-15,00	-19,33
	firm 2	-5,00	-7,67	1,00	3,00	5,00	3,67	3,67	5,00	4,67
	firm 3	11,00	9,33	5,00	4,00	5,00	9,67	8,67	10,00	14,67
France	k	1	2	3	4	5	6	7	8	9
	firm 1	-1,67	2,00	3,33	5,00	4,33	8,00	3,33	5,00	2,67
	firm 2	-7,67	-10,00	-13,67	-24,00	-23,67	-32,00	-34,67	-40,00	-41,33
	firm 3	9,33	8,00	10,33	19,00	19,33	24,00	31,33	35,00	38,67
Spain	k						1	2	3	4
	firm 1						-8,50	-18,00	-24,50	-41,00
	firm 2						3,50	6,00	4,50	1,00
	firm 3						-15,50	-30,00	-44,50	-56,00
	firm 4						20,50	42,00	64,50	96,00
Switzerland	k	1	2	3	4	5	6	7	8	9
	firm 1	7,00	18,00	37,33	53,00	72,33	87,33	106,00	123,67	144,67
	firm 2	-6,00	-8,00	-7,67	-16,00	-24,67	-37,67	-48,00	-60,33	-72,33
	firm 3	-1,00	-10,00	-29,67	-37,00	-47,67	-49,67	-58,00	-63,33	-72,33
UK	k	1	2	3	4	5	6	7		
	firm 1	3,00	1,20	1,60	4,60	1,40	10,80	17,80		
	firm 2	23,00	44,20	67,60	80,60	102,40	125,80	146,80		
	firm 3	-4,00	-2,80	5,60	16,60	22,40	26,80	31,80		
	firm 4	-11,00	-12,80	-24,40	-19,40	-19,60	-26,20	-29,20		
	firm 5	-11,00	-29,80	-50,40	-82,40	-106,60	-137,20	-167,20		

Author's calculation using GfK data

### 7.3 Test of increasing correlation:

Regression Statistics	
Multiple R	0,75621969
R Square	0,57186822
Adjusted R Sc	0,56088259
Standard Error	1,54668713
Observations	132

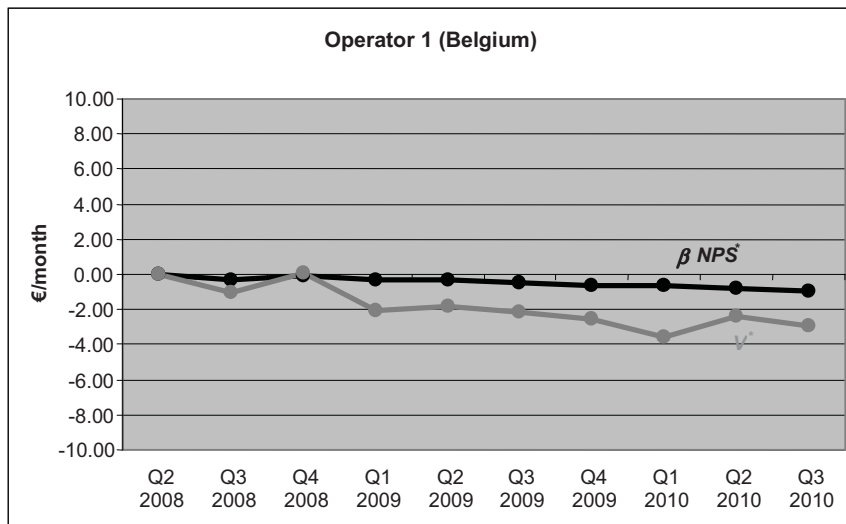
ANOVA					
	df	SS	MS	F	Significance F
Regression	2	415,40029	207,700145	86,8224138	1,2967E-24
Residual	130	310,991341	2,39224108		
Total	132	726,391631			

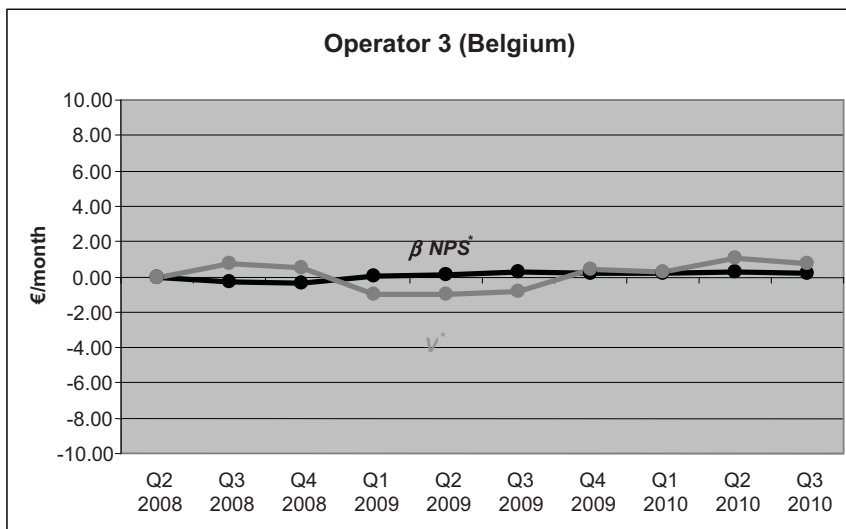
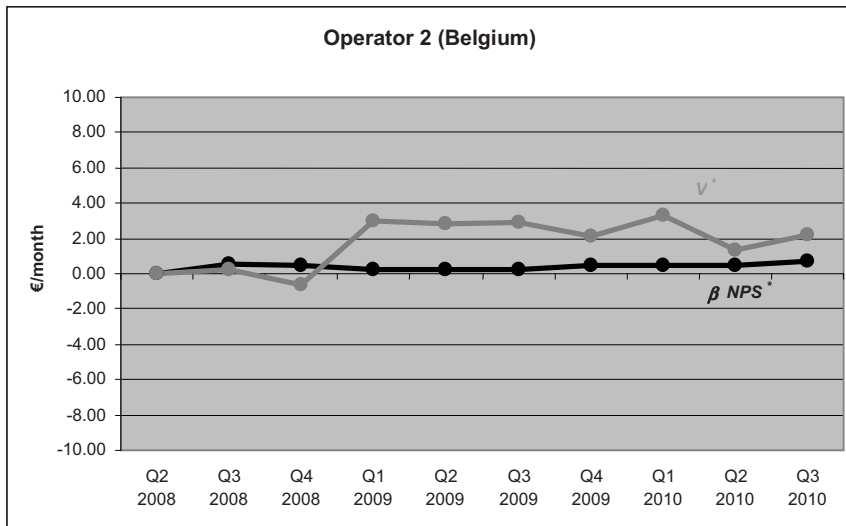
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
$\beta_1$	0,01620873	0,01012488	1,600881	0,11183062	-0,00382214	0,0362396
$\beta_2$	0,00360506	0,00157422	2,29005987	0,0236287	0,00049065	0,00671947

### 7.4 Firm by firm comparison of NPS and development of WTP

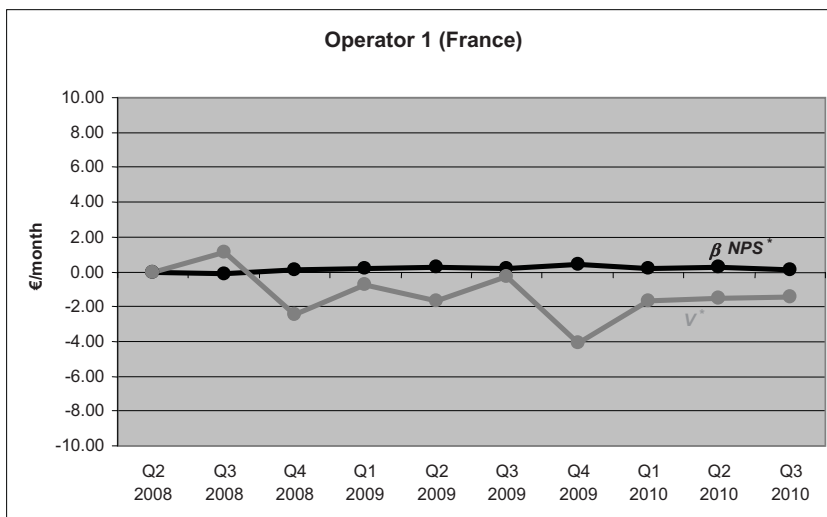
Let us compare the variations of relative WTP and  $\beta$  NPS using the coefficient  $\beta$  we estimated.

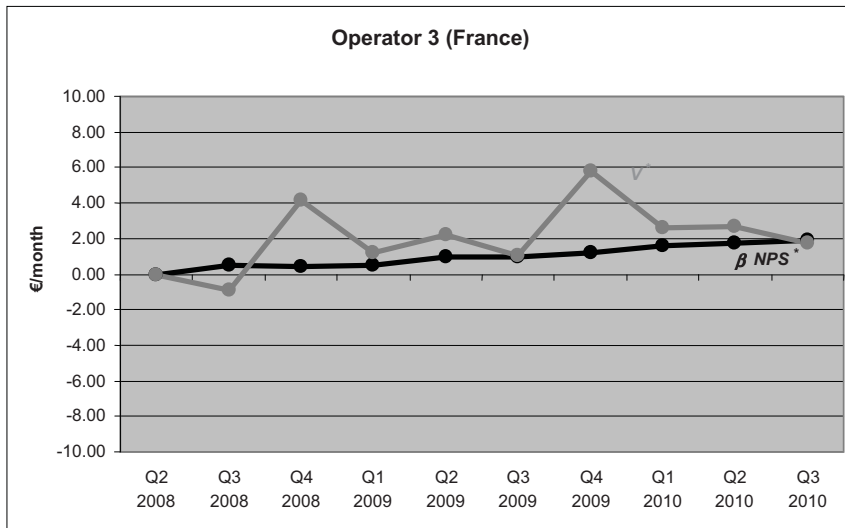
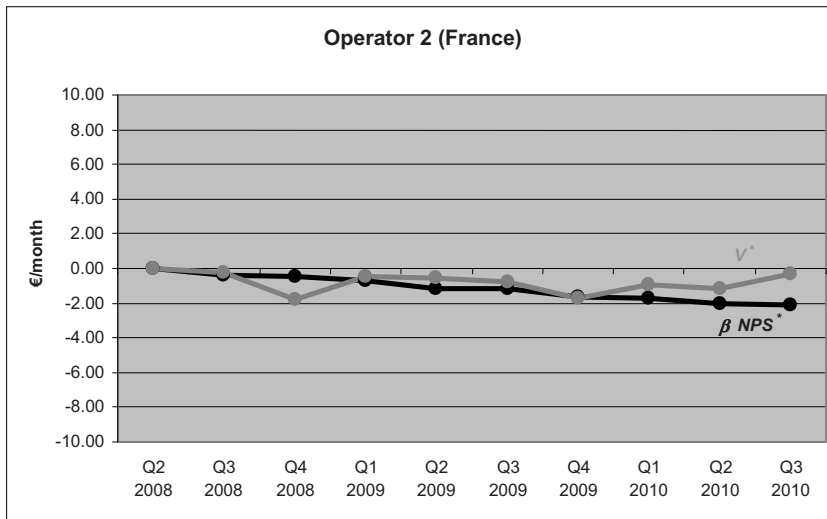
#### 7.4.1 Belgium



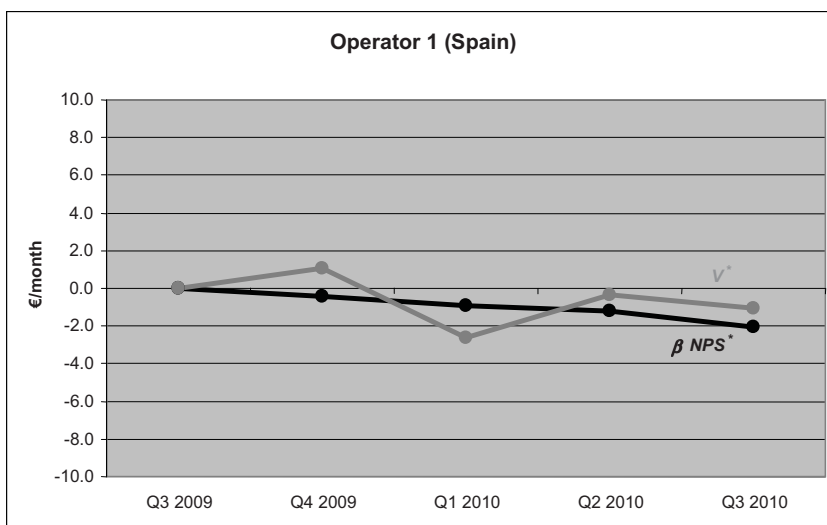


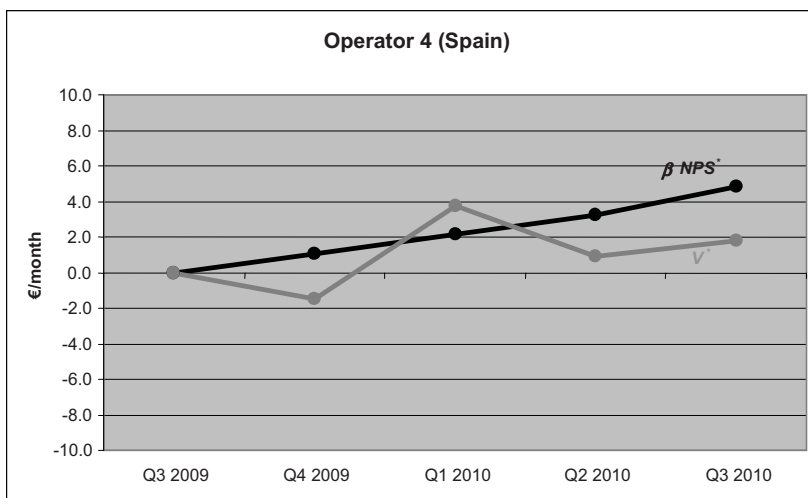
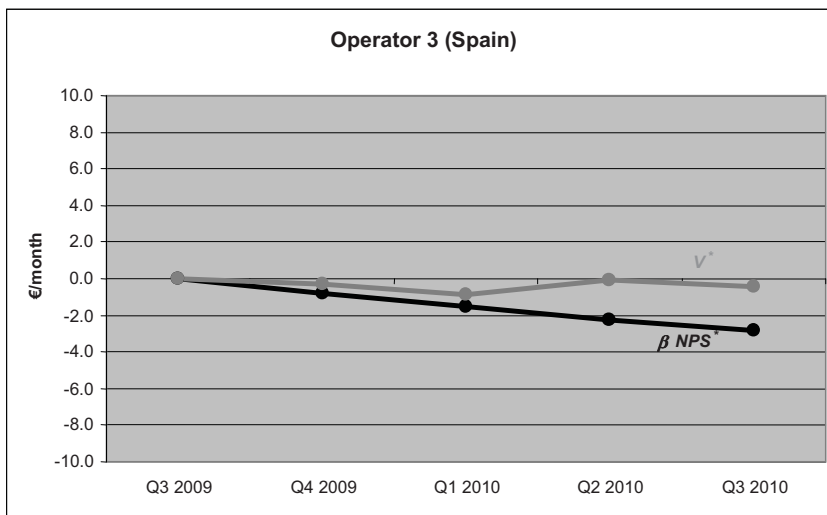
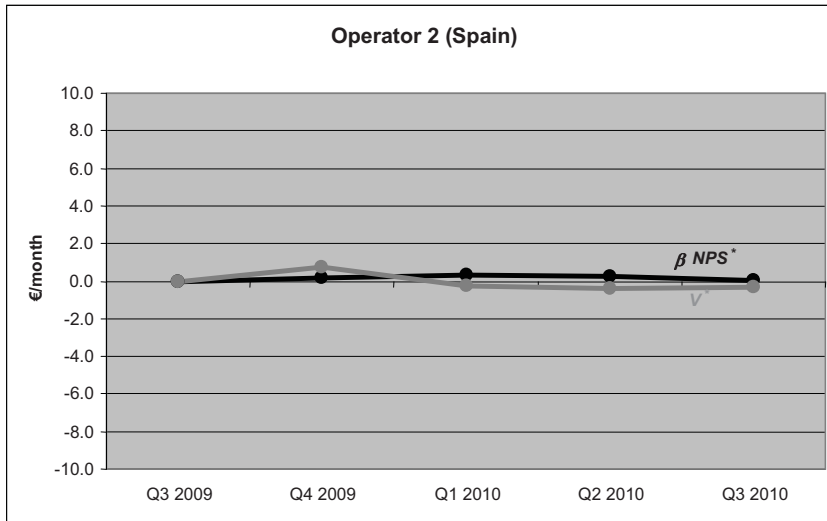
## 7.4.2 France



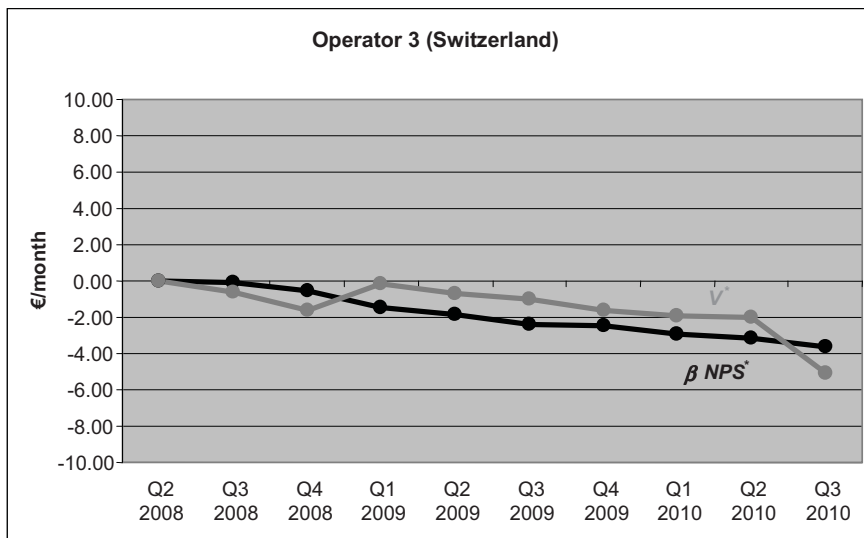
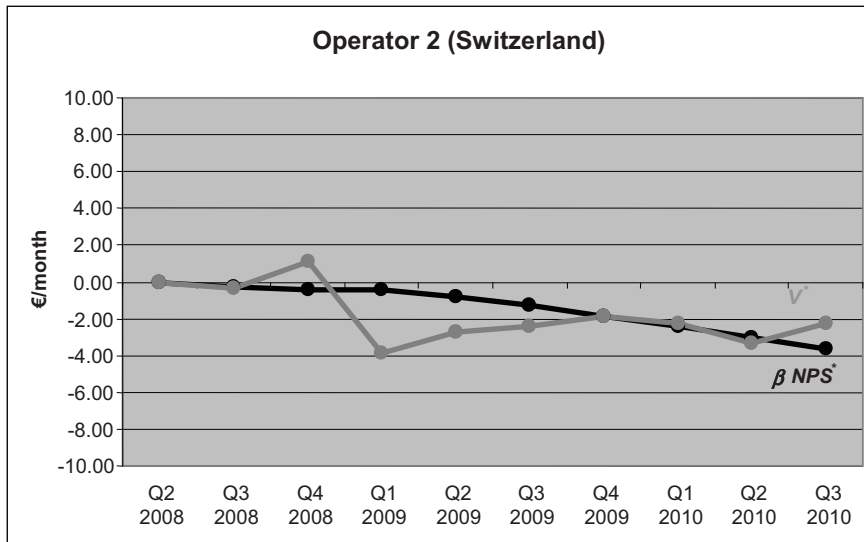
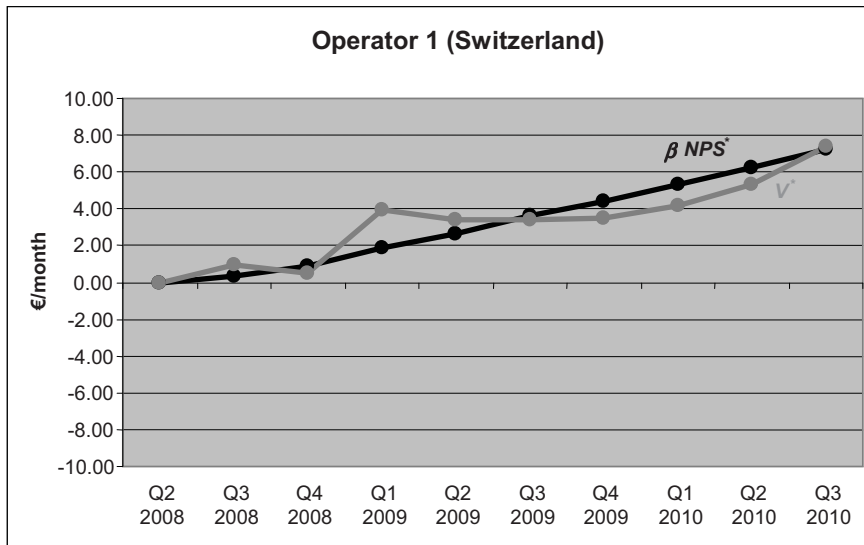


### 7.4.3 Spain

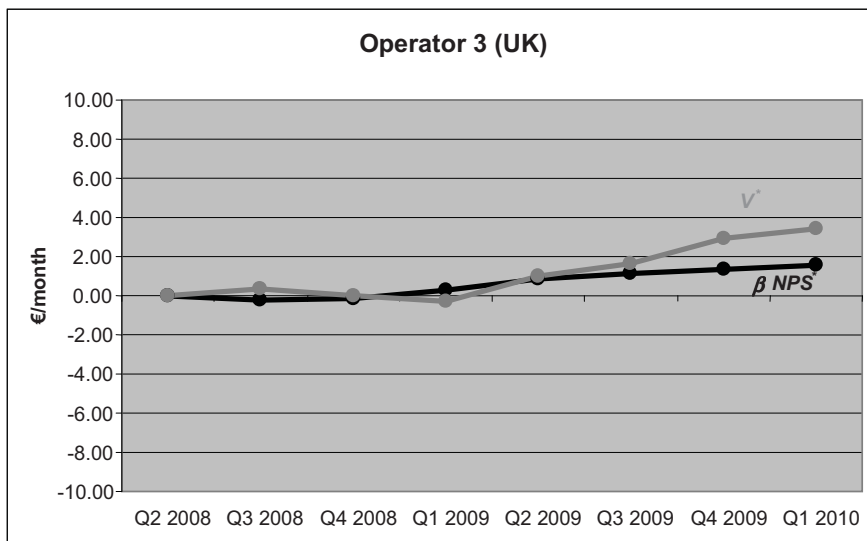
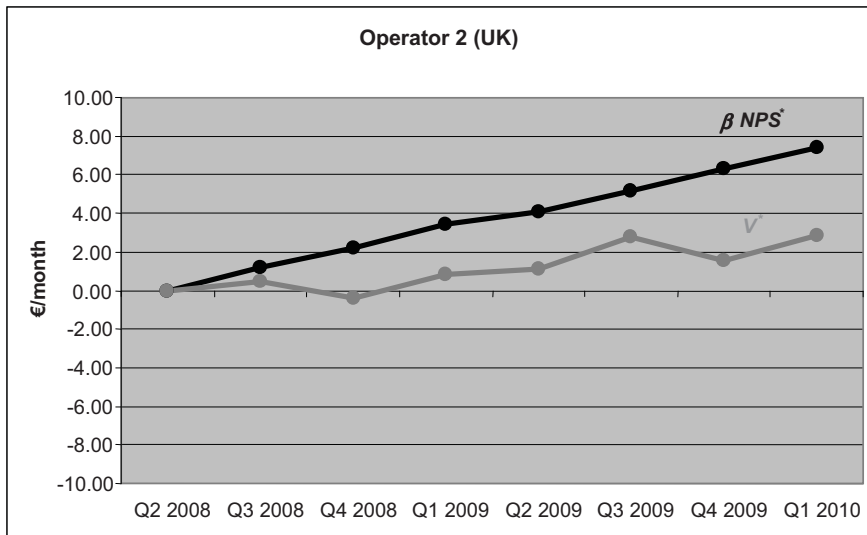
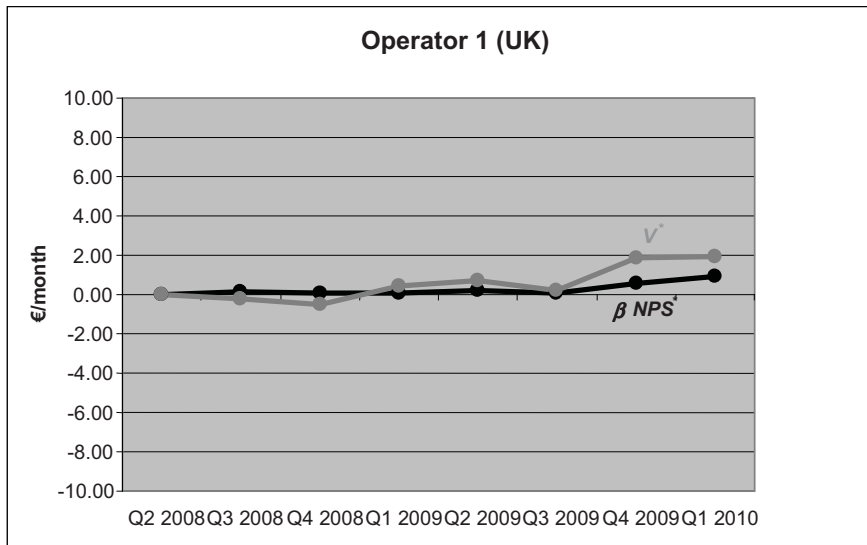




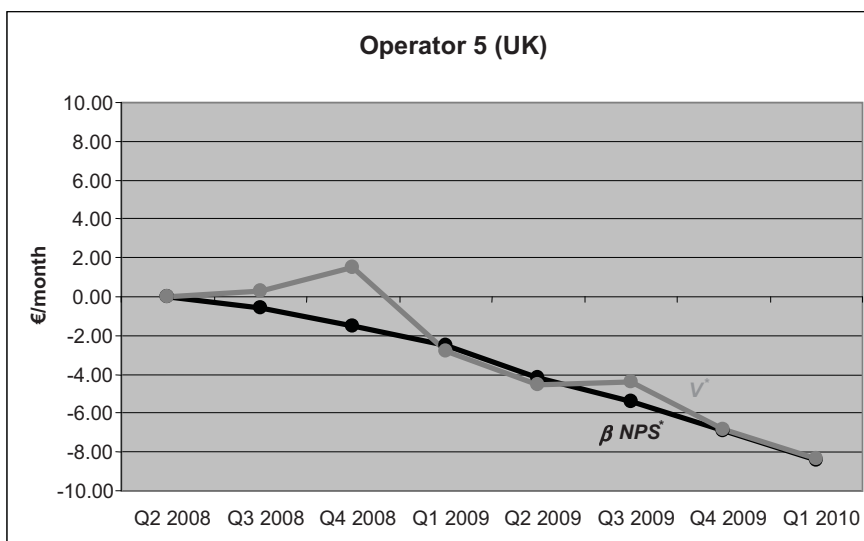
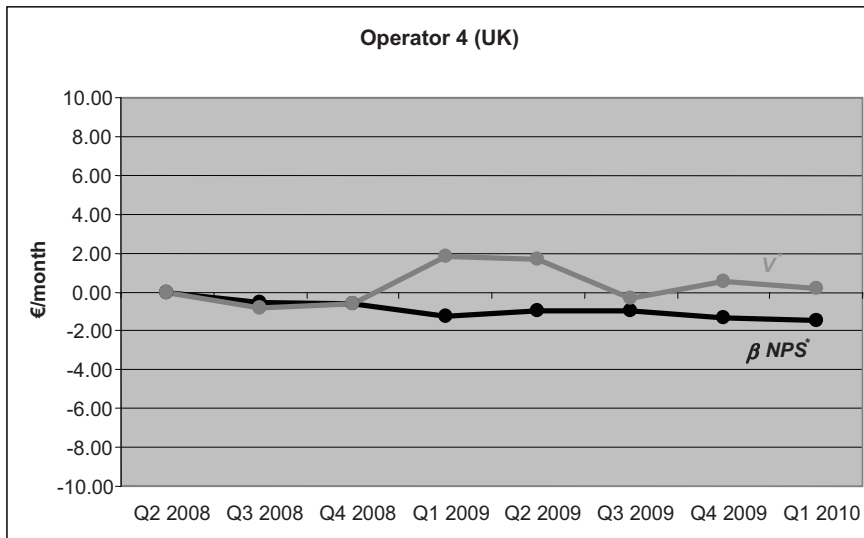
## 7.4.4 Switzerland



## 7.4.5 United Kingdom







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