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Abstract

In two-sided markets an intermediary brings together two distinct customer populations, such as buyers and sellers on an e-commerce platform. In these markets the growth process of customer populations depends on network effects both within and between buyers and sellers. Thus, assigning IT investments to customer populations and quantifying the monetary value of these investments is complex. We show that measuring the intermediary's platform value may provide a remedy, and make IT investments in two-sided markets accountable. Thereby, we develop a model for the platform value and the growth process of customer populations accounting for network effects in two-sided market. We apply our model to an e-commerce platform. Our results highlight a significant contribution of buyers to the platform value. Analysing former IT investments we find further evidence to rather invest in buyers than sellers, and to promote investments that increase buyers' trust in products, intermediary and trading partners (sellers).

Keywords

Two-Sided Markets, Network Effects, Electronic Commerce, IT Success, Business Value of IT

INTRODUCTION

In two-sided markets such as online auctions, an intermediary provides the platform for linking together two customer populations (Rochet and Tirole 2006). For instance, eBay provides the infrastructure as well as the rules to enable transactions between two customer populations:[1] on one side of the market eBay serves sellers with a platform to offer their products, on the other side it provides buyers with a way to buy second-hand and new products. Two-sided markets are not an entirely new phenomenon. In mediaeval times, a city council provided the market place as a platform for farmers to offer their products to citizens. Yet, two-sided markets have become more prevalent with what Shapiro and Varian (1999) labelled the "Network Economy". The Internet has created new industries such as online auction houses and digital marketplaces (Porter 2001). In 2009, eBay earned more than 3.5 billion Euros in revenues by transactions via its platforms (eBay 2010).

In two-sided markets, both customer populations – in case of eBay the number of buyers and the number of sellers interacting on the platform – are crucial to the intermediary. If the number of sellers offering products on eBay is high, more buyers are attracted to the platform. Vice versa, if the number of buyers on the platform is high, more sellers join the platform. Thus, network effects are present in two-sided markets. Network effects exist, if a customer's utility derived from a service is affected by the number of other customers using the same service (e.g. Katz and Shapiro 1985; Shapiro and Varian 1999).

Thus, buyers are attracted to eBay if the number of sellers increases and vice versa. These effects are frequently referred to as cross-side network effects: a customer's utility derived from a service is affected by the customer

[1] Please note that the term customer population is different from customer segment, with the latter being part of the former, as sellers might be segmented into professional versus private sellers.

population on the other market side using the same service. Typically, cross-side network effects are positive as in case of eBay. Besides, same-side network effects exist, if a customer's utility derived from a service is affected by the customer population on the same market side using the same service. For example, eBay tends to be less attractive for sellers the more sellers compete with each other for buyers. Typically, same-side network effects are negative. Yet, same-side network effects can also be positive. In the video game industry, gamers are attracted by other gamers, since there are more prospective participants in multiplayer games. Figure 1 illustrates cross-side and same-side network effects in two-sided markets.

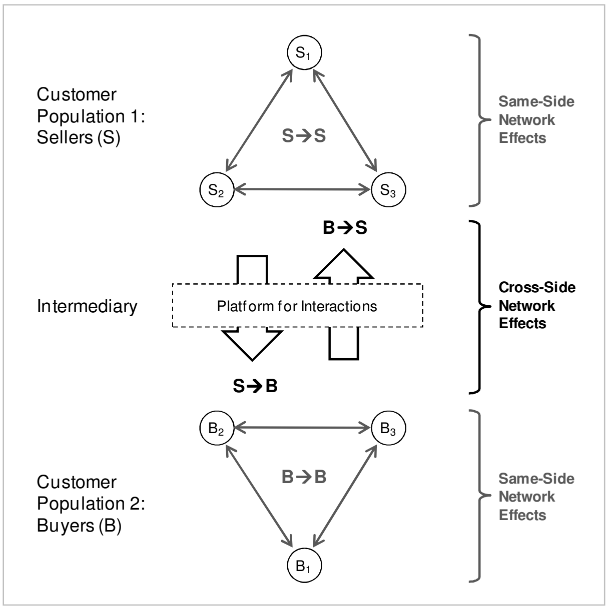

Figure 1: Network Effects in Two-Sided Markets

Intuitively, managerial actions in two-sided markets should aim for the retention of existing customers and the acquisition of new customers, because the customer populations are crucial to the intermediary. Yet, the growth process of customer populations is complex due to positive and negative network effects, since a new customer can have a positive effect on the cross-side customer population and a negative effect on the same-side customer population. Thus, it is difficult to assign IT investments to the customer populations and to quantify the monetary value of these investments. Measuring the intermediary's platform value as an adequate metric in two-sided markets may provide a remedy; i.e. the platform value could be used to measure the impact of the intermediary's IT investments. For intermediaries it is also crucial to know the value of the customer populations to have an upper limit for acquisition costs for new customers. As a consequence, it would be possible to determine for which customer population IT investments are more successful. Finally, further implications could be derived by analysing the nature of the most successful IT investments, in order to provide guidance for future IT investments.

By now, managers might at best apply heuristics to cope with these challenges. For example, they might assign potential investments to the customer population that provides the revenues, which would be sellers constituting the paying customer population in case of eBay. However, sellers just pay because of the "free customers", i.e. the buyers (Gupta et al. 2009). Thus, managers might misleadingly ignore one customer population. Moreover, managers are tempted to apply a rule of thumb, such as to split IT investments 50:50 across customer populations. Consequently, they ignore the relative size of customer populations as well as cross-side and same-side network effects.

The aim of our paper is twofold: We first introduce the platform value which captures the value of the customer populations that populate the platform in a two-sided market, and provides a proxy for the intermediary's shareholder value. We differentiate between cross-side and same-side network effects and examine their impact on new and existing customers. Second, we show how IT investments contribute to the platform value. By quantifying the contribution of IT investments, the IT department is able to calculate the return on specific investments and improves the overall accountability of IT investments. By applying appropriate methods, that have also been used to make marketing decisions accountable, it might be possible to show that IT is rather a driver of shareholder value than a simple cost factor.

LITERATURE REVIEW

Two-Sided Markets

Two-sided markets are defined as markets in which one or several intermediaries enable interactions between two customer populations, and try to get the two sides "on board" by appropriately charging each side (Rochet and Tirole 2006). The platform consists of an architecture, i.e. products, services and infrastructure, and a set of rules, which is further specified as protocols, rights and pricing (Eisenmann et al. 2006). It is important to note that both customer populations are distinct (Evans and Schmalensee 2005).

The concept of two-sided markets first arose in economics (e.g. Economides 1996; Rochet and Tirole 2006). Mainly, economists were concerned about the pricing structure in two-sided markets, i.e. should both customer populations be charged for the intermediary's service, or should just one customer population provide the revenues? If so, which customer population should be "free customers"? The intuition is that, the more "free customers" are attracted to the platform, the more "fee customers" will pay to reach them. For instance, in the case of eBay buyers are "free customers" that attract sellers which pay the intermediary for the service, and therefore subsidise buyers.

Two-sided markets are different from normal one-sided markets. In one-sided markets both parties (e.g. buyers and sellers) directly interact with each other since there is no third party involved, i.e. no intermediary provides a platform for interactions. Therefore, in traditional value chains the value moves from left to right (Eisenmann et al. 2006): a company has costs for suppliers (left side) and creates value from customers (right side). However, in two-sided markets the intermediary incurs costs and collects revenues in serving both customer populations.

A significant number of industries can be characterised as two-sided markets. For instance, Google.com's revolutionary business model is based on a two-sided market: the search engine provides a platform for companies to place text advertising, targeting a large number of search engine users. In the credit cards industry, intermediaries such as MasterCard, Visa and American Express provide a platform for payment transactions between merchants and consumers. Further online and offline examples encompass real estate brokerage (lessors and tenants), dating services (men and women), Yellow Pages (consumers and advertisers such as small companies), video game industry (players and software developers), operating systems (users and software developers), and job search (job seekers and employers). Parker and Van Alstyne (2005) provide a comprehensive overview over both online and offline two-sided markets.

Return on IT Investments

Worldwide IT investments in 2010 amount to over one trillion Euros (IDC 2010). However, Verner et al. (2006) found that only 62% of all software projects can be characterised as successful. Thus, there is a coincidence of high investment volumes with a moderate success of IT investments. IT departments are under pressure to make informed decisions on IT investments planned – based on quantitative measures (Barua et al. 1995). In addition, IT departments improve the accountability of past IT investments (Mukhopadhyay et al. 1995). Therefore, measuring the success of IT investments, i.e. the return on IT investments, gained attention in IS science and practice (Devaraj and Kohli 2003).

Research on the success of IT investments was initiated by the so-called productivity paradox (e.g. David 1990; Lucas 1999; Soh and Markus 1995). Economists found in empirical studies that IT investments do not result in a higher productivity, neither on an aggregate level (economy level) nor on an individual level (company level). First qualitative-oriented definitions from IS research concerning the success of IT investments can be found in Mason (1978) and Keen (1981). The DeLone-McLean Model (DeLone and McLean 1992) and its enhancements (e.g. Barua et al. 2004; DeLone and McLean 2003; Melville et al. 2004) gained high popularity for empirical studies focusing on the success of IT investments. The classical DeLone-McLean Model incorporates qualitative measures – such as system quality and information quality, use and user satisfaction, and individual impact and organizational impact – in a structural equation model.

Yet, scepticism towards the success of IT investments continues. For example, Carr (2003) claims that IT should be considered as an infrastructure technology such as electricity and railways, since it is no longer possible to gain competitive advantages through IT investments. In consequence, IT investments are considered simply as a cost factor which should be minimised. Therefore, the number of publications on the success of IT investments is still high. The success of IT investments can be measured quantitatively (e.g. revenues, profits) or qualitatively as in the DeLone-McLean Model (e.g. quality, satisfaction). A recent meta analysis on the success of IT investments literature proves the high popularity of qualitative success measures (Urbach et al. 2009).

However, there are only few approaches available to measure the quantitative return on IT investments (Kumar 2004), because simple and objective methods are missing in this field (Tallon and Kraemer 2007). Theoretical papers on the basis of analytical models (e.g. Barua et al. 1991; Thatcher and Pingry 2004) can be a starting point. Further implications for the quantitative success of IT investments have been derived from calculations of net present value (Anandarajan and Wen 1999) and from option pricing models (Benaroch and Kauffman 1999; Taudes et al. 2000). Finally, regression analysis on dependent variables such as revenues, profits or stock prices have been applied (e.g. Mukhopadhyay et al. 1995). For instance, Devaraj and Kohli (2000) conduct a longitudinal study in eight hospitals, in order to analyse cost reductions through business process re-engineering. They choose dependent variables such as revenues per patient, the mortality rate or patients' satisfaction.

In summary, the existing literature on the success of IT investments sets four major research priorities. First, mainly qualitative methods are used to measure the success of IT investments. The second focus is on organizational IT investments, e.g. specific Enterprise Resource Planning systems, and theoretically grounded in the Resource-based View (Prahalad and Hamel 1990). Thus, the emphasis is on the company level (Melville et al. 2004) and does not consider the success of customer-oriented IT investments. Third, the existing literature is based on an input-oriented perspective, i.e. the minimisation of IT costs such as less full-time equivalents necessary to complete a job or a higher capacity utilisation. Finally, existing empirical studies focus on user surveys to measure the success of IT investments through structural equation models: 22 out of 28 studies, recently published in leading journals, are based on the DeLone-McLean Model (Urbach et al. 2009).

In addition to the existing literature on the success of IT investments, we focus on quantitative methods to measure the success of IT investments. An explicit aim is to measure the success of IT investments in monetary terms in the following sense: "IT investment X contributed 100.000 Euro to the platform value". Second, we concentrate on customer-oriented IT investments, e.g. in the frontend. Third, we develop an output-oriented perspective by measuring the monetary value of IT investments. Finally, we choose actual transaction data for our empirical study.

The monetary value of IT investments can be measured by additional profits from existing customers and new customers, which stay at the platform, respectively join the platform, because of the IT investments. To model the platform value and the success of customer-oriented IT investments, we draw on the extensive literature on Customer Equity (CE) and Customer Lifetime Value (CLV), measuring current and future customer margins from a long-term perspective (e.g. Berger and Nasr 1998; Gupta et al. 2004; Rust et al. 2004; Wiesel et al. 2008).

Return on IT Investments in Two-Sided Markets

Existing models in the field of CE and CLV for markets with network effects (Hogan et al. 2004; Libai et al. 2009) base upon the Generalised Bass Model (e.g. Bass et al. 1994) and conduct their analysis on an industry level. In addition, some researchers have already specifically addressed the platform value in two-sided markets (Gupta et al. 2009, Sridhar et al. 2010). Gupta, Mela and Vidal-Sanz (2009) develop their model in a monopoly context and further extend the Generalised Bass Model to incorporate cross-side network effects by adding additional imitation coefficients. At first, they calculate the value of one additional buyer and one additional seller for an online auction house. Further, the authors include a link to shareholder value, but explain only one third of the intermediary's market capitalisation.

However, existing models applied for the diffusion process in two-sided markets entail two limitations: first, as the market potential in the Generalised Bass Model accounts for the whole industry, company level analysis can only be completed if the intermediary is a monopolist. This assumption does not apply to most settings. Second, there is no differentiation of network effects on existing versus new buyers (sellers), because acquisition and retention rates are proportional to the total number of buyers (sellers). Since our empirical setting is non-monopolistic, and as we expect network effects on existing versus new buyers (sellers) to be different, we develop a distinct model for the growth process of customer populations in two-sided markets.

By now, academics and business practice lack a comprehensive metric to measure the success of IT investments in two-sided markets, and encounter difficulties to assign IT investments to customer populations in two-sided markets (Bakos and Katsamakas 2008). The platform value could help researchers and managers to improve decisions on assigning IT investments to customer populations. Furthermore, the platform value could support the evaluation of managerial actions. For IS research, our results may promote measuring the quantitative success of IT investments. Moreover, our research may encourage a paradigm shift: caused by the productivity paradox, the value contribution of IT investments is still questioned. By making IT investments accountable as demanded by Mukhopadhyay et al. (1995), we may support a way to consider their value contribution and promote a positive attitude towards IT investments.

MODELLING THE PLATFORM VALUE

Platform Value Model

We first develop a model for the platform value. In order to derive the platform value, we take an aggregated perspective on current and future margins provided by all customers, based on the CE literature. Yet, we show later that we are also able to calculate the value of each customer population. We define the platform value as the net present value of all margins provided by current and future customers in a long-term perspective. In the following, we introduce the terms buyers and sellers indicating two distinct customer populations, as this fits our empirical example of an e-commerce platform, on which sellers provide the intermediary with margins. However, our model can be generalised to any two-sided market. The platform value (PV) can be modelled as follows:

$$\text{PV} = \sum_{t=0}^{T} \frac{N_t^S \cdot m^S}{(1+k)^t} \tag{1}$$

Where t=0 denotes the starting period for which the platform value should be calculated, m^S the average margin provided by one seller per time period, k the discount rate and N^S_t the total number of sellers in time period t. N^S_t is the sum of the total number of sellers in t-1, plus the new sellers in t, minus the lost sellers in t. Same-side and cross-side network effects as described above can influence the platform value through the acquisition of new sellers (Villanueva et al. 2008) and the prevention of the loss of existing sellers (Mohr et al. 2009). Our model assumes that sellers pay in the beginning of a period, because margins from the first period are not discounted. Furthermore, sellers churn at the end of a period, since they will stay at least for one period. Finally, T denotes the maximum time horizon which we restrict to T=10 years, since margins after this time period are strongly discounted and thus do not contribute to the net present value of the platform.

Growth Model

In order to capture the growth process of buyers and sellers, we estimate the number of new (New^B_t) and lost ($Lost^B_t$) buyers as well as the number of new (New^S_t) and lost ($Lost^S_t$) sellers via four regressions. New^B_t depends on (i) the total number of sellers in the last time period N^S_{t-1}, which captures cross-side network effects, (ii) the total number of buyers in the last time period N^B_{t-1}, which captures same-side network effects, and (iii) a set of dummy variables for IT investments $F_{i,t}$. $F_{i,t}$ thus captures the effect of IT investments in the software functionality of the platform which might change the behaviour, here the acquisition and the retention, of two distinct customer populations. Furthermore, we (iv) control for trend (T_t) and seasonality (S_t) effects. By applying a similar logic to the other dependent variables we arrive at the following model:

$$\text{New}_t^B = \alpha + \beta_1 \cdot N_{t-1}^S + \beta_2 \cdot N_{t-1}^B + \beta_3 \cdot T_t + \beta_4 \cdot S_t + \sum_{i=5}^{I+5} \beta_i \cdot F_{i,t} + \varepsilon_t \tag{2}$$

$$\text{Lost}_t^B = \alpha + \beta_1 \cdot N_{t-1}^S + \beta_2 \cdot N_{t-1}^B + \beta_3 \cdot T_t + \beta_4 \cdot S_t + \sum_{i=5}^{I+5} \beta_i \cdot F_{i,t} + \varepsilon_t \tag{3}$$

$$\text{New}_t^S = \alpha + \beta_1 \cdot N_{t-1}^S + \beta_2 \cdot N_{t-1}^B + \beta_3 \cdot T_t + \beta_4 \cdot S_t + \sum_{i=5}^{I+5} \beta_i \cdot F_{i,t} + \varepsilon_t \tag{4}$$

$$\text{Lost}_t^S = \alpha + \beta_1 \cdot N_{t-1}^S + \beta_2 \cdot N_{t-1}^B + \beta_3 \cdot T_t + \beta_4 \cdot S_t + \sum_{i=5}^{I+5} \beta_i \cdot F_{i,t} + \varepsilon_t \tag{5}$$

Utilising the growth model (2) - (5) we are able to forecast the total number of buyers (N^B_t) and sellers (N^S_t) in each time period t, based on the growth process of both customer populations. Inserting the total number of sellers for each N^S_t in (1), we can calculate the platform value for each starting period t=0. Since the equations (2) - (5) might have correlated error terms, it is suggested to estimate them simultaneously.

EMPIRICAL STUDY

We apply our model to an e-commerce platform, which we label Platform.com, since the intermediary's management does not want us to reveal their identity. On Platform.com, professional sellers offer their products – such as consumer electronics, household appliances, jewellery, watches and cosmetics – to buyers. The intermediary is a start-up company funded in three rounds. Investors include the High-Tech Entrepreneur Fond of the German Federal Ministry of Economics and Technology.

Data

Our study comprises daily data on all 78,180 transactions completed between buyers and sellers on Platform.com, ranging from the intermediary's launch in April 2005 to May 2009. Based on the transaction data, we calculate the number of total active buyers and total active sellers in all t=211 weeks via the P-Active model

(Reinartz and Kumar 2000). The P-Active model estimates the probability that a customer makes a transaction in a certain time period, based on his past behaviour and has been applied in a variety of noncontractual empirical settings. In t=211, 13,007 buyers and 126 sellers actively use Platform.com (figure 2).

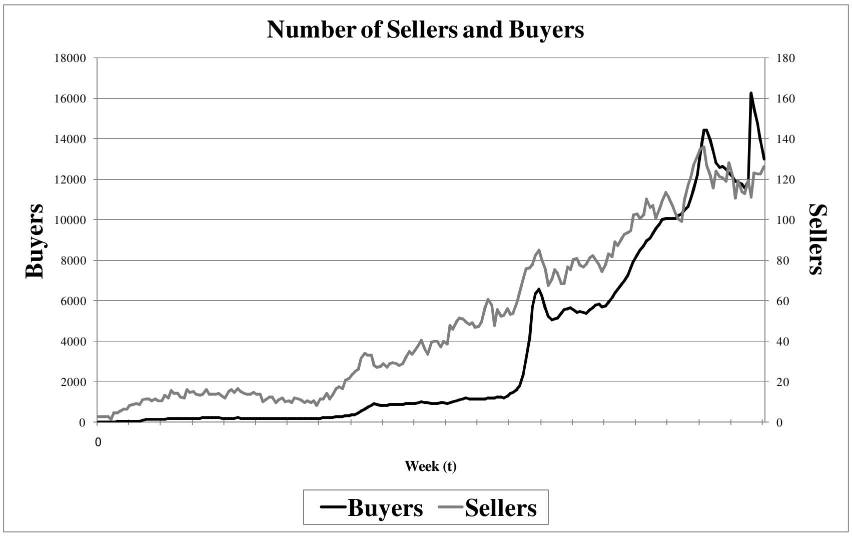

Figure 2: Number of Total Active Buyers and Sellers

Further, our data encompasses the number of new buyers and sellers in each week, as ID numbers were assigned to individual buyers and sellers when they made their first transaction. By knowing the number of total active buyers and sellers in each week as well as the number of new buyers and sellers, we can easily compute the number of lost buyers and sellers in each week.

The intermediary charges sellers with 3% of transaction volumes, while buyers can use the service of Platform.com for free. Platform.com already completed eight major software releases and thus IT investments, five of them directed to buyers and three of them directed to sellers. Advertising for Platform.com stems from word-of-mouth, since the intermediary has not been actively running any marketing activities. The average margin provided by one seller per week is m^S=31.25 Euros. We use a discount rate of k=0.27% per week (based on a discount rate of 15.00% per year).

Results

By estimating our model (2) - (5) simultaneously via Seemingly Unrelated Regressions (SUR), correcting for autocorrelation and heteroscedasticity, and inserting the total number of sellers N^S_t in (1), we derive three findings that we will explain in the following paragraphs: (i) cross-side and same-side network effects, (ii) the platform value, and (iii) the return on IT investments. Table 1 depicts the results related to (i) cross-side and same-side network effects.

Table 1. Cross-Side and Same-Side Network Effects

Dependent Variables	Intercept	Total Number Sellers in t-1	Total Number Buyers in t-1	Trend in t	Seasonality in t
New Buyers in t	-67.8933 *(p<0.05)*	+9.0069 *(p<0.10)*	-0.0951 *(p<0.01)*	n.s.	+191.3181 *(p<0.05)*
Lost Buyers in t	+103.4511 *(p<0.05)*	-6.3901 *(p<0.10)*	+0.1345 *(p<0.01)*	n.s.	n.s.
New Sellers in t	+0.5540 *(p<0.05)*	n.s.	-0.0004 *(p<0.01)*	n.s.	n.s.
Lost Sellers in t	-1.7343 *(p<0.01)*	+0.3055 *(p<0.01)*	-0.0007 *(p<0.10)*	-0.0303 (p<0.05)	-1.9997 *(p<0.05)*

We find positive cross-side network effects of +9.0069 from total number of sellers on new buyers, due to a higher attractiveness of Platform.com since more sellers offer their products to buyers. Furthermore, we find negative same-side network effects of -0.0951 from total number of buyers on new buyers. This can be attributed to the crowding effect, which describes the intensification of competition among buyers. Finally, we find a positive seasonal effect for the month of December of +191.3181 on new buyers because of the Christmas trade.

The results for the other three dependent variables can be explained on the same lines; overall our results demonstrate face validity.

We calculate (ii) the platform value of Platform.com by forecasting the number of buyers and sellers based on the significant parameters derived from the four regressions. In week t=211, the platform value amounts to 1.1 million Euros. Figure 3 also shows a steady growth pattern of the platform value in earlier time periods attributed to network effects.

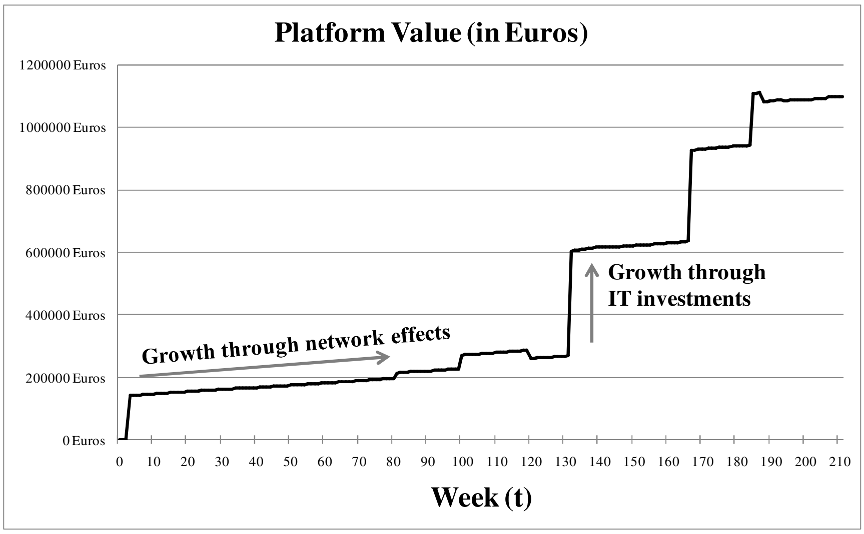

Figure 3: Development of Platform Value over Time

We define the customer population values of buyers (sellers) as the impact of adding one more buyer (seller) on the intermediary's platform value. At Platform.com, the value of one buyer is 1 Euro and the value of one seller is 76 Euros. Since the current buyer-to-seller ratio is 103:1, our results reveal that buyers actually contribute to a larger extent to the platform value. This is counter-intuitive in a sense that Platform.com receives all margins from sellers, and management could misleadingly assume a value of 0 Euro for a "free customer" (buyer).

Figure 3 further reveals jumps in the platform value due to IT investments. We derive (iii) the return on IT investments by calculating their impact on the platform value, i.e. the change in platform value compared to a scenario if they would not have been introduced (table 2).

Table 2. IT Investments in Buyers and Sellers

Investment	Customer Population	Intro-duction	New Buyers in t	Lost Buyers in t	New Sellers in t	Lost Sellers in t	Value (Euros)
Introduction Video	Buyers	t=79	n.s.	+164.7286 *(p<0.01)*	+1.21888 *(p<0.10)*	-2.0002 *(p<0.10)*	+16,630
Product News	Buyers	t=130	+599.2652 *(p<0.01)*	n.s.	+1.734401 *(p<0.01)*	-3.9015 *(p<0.10)*	+334,573
Seal "Trusted Shop"	Buyers	t=165	+422.8245 *(p<0.01)*	n.s.	+2.402498 *(p<0.01)*	-3.9318 *(p<0.05)*	+289,764
Evaluation System	Buyers	t=183	+275.0794 *(p<0.01)*	n.s.	+3.082383 *(p<0.01)*	n.s.	+164,859
Payment Methods	Buyers	t=186	n.s.	n.s.	-1.419041 *(p<0.05)*	n.s.	-32,319
New Tools	Sellers	t=89	n.s.	n.s.	n.s.	n.s.	+/-0
Platform.com-Button	Sellers	t=98	-94.2419 *(p<0.05)*	+71.9883 *(p<0.10)*	n.s.	-3.3143 *(p<0.01)*	+43,053
Automated Processing	Sellers	t=118	n.s.	+77.1709 *(p<0.10)*	n.s.	n.s.	-26,555

Table 2 depicts the regression results for the influence of IT investments on the dependent variables. For example, the investment *product news* provides buyers with more information about the products available at Platform.com and thus generated 599.3 new buyers. However, the investment also had a significant impact on the other market side: since the number of new buyers was increased, new sellers were acquired (new sellers: +1.7) and the retention of existing sellers improved (lost sellers: -3.9).

As shown in the last column in table 2, IT investments directed to buyers are more successful than IT investments directed to sellers, i.e. driven by *product news* (+334,573 Euros), *seal "trusted shop"* (+289,764 Euros) and *evaluation system* (+164,859 Euros). Analysing the nature of these IT investments, we find that the most successful IT investments reduce buyers' uncertainties in two-sided markets: the investment *product news* reduces uncertainty and information asymmetries regarding the products traded on Platform.com. Moreover, the *seal "trusted shop"* improves buyers' confidence in the intermediary, since an independent company approved a safe buying process when using Platform.com. Finally, the *evaluation system* gives buyers more information about sellers, because they can assess how other buyers rate reliability and speed of individual sellers. The three most successful IT investments are thus investments in the attenuation of information asymmetries and lead to an increase in buyers' trust in products, intermediary and trading partners (sellers).

SUMMARY

Our modelling approach takes the platform value model as starting point and integrates a model for the growth process of customer populations in two-sided markets. Thus, we quantify the intermediary's platform value and the value of IT investments under the consideration of network effects in two-sided markets. Our results yield the following implications: we find preliminary evidence rather not to go for the paying customer population, i.e. sellers, but to go for buyers, which considerably contribute to the intermediary's platform value. Based on our results, intermediaries might consider investing in increasing buyers' trust in products, intermediary and trading partners (sellers).

In our model, we do not include competition, which might be a limitation if our model is applied to a market leader rather than a start-up company. Further, we assume the sellers to be homogeneous and do not distinguish different seller segments as has been suggested by the CLV literature. Finally, we assume the network effects to be constant over time. However, if the empirical study would be about a market leader, network effects might decrease if the market potential is reached.

Thus, there are opportunities for further research. In some empirical settings, customer populations can take multiple roles, e.g. sellers can act as buyers and vice versa. This does not apply for our study as there are only professional sellers involved in the transactions on Platform.com, but might be more frequent in Consumer-to-Consumer markets, e.g. in online consumer credit marketplaces such as Prosper.com. Further, our research considers the value of past IT investments from which we derive guidance for future IT investments. However, intermediaries might also embrace a decision support system for future IT investments in two-sided markets.

REFERENCES

Anandarajan, A., and Wen, H.J. 1999. "Evaluation of Information Technology Investment," *Management Decision* (37:4), April, pp 329-339.

Bakos, Y., and Katsamakas, E. 2008. "Design and Ownership of Two-Sided Networks: Implications for Internet Platforms," *Journal of Management Information Systems* (25:2), pp 171-202.

Barua, A., Konana, P., Whinston, A.B., and Yin, F. 2004. "An Empirical Investigation of Net-Enabled Business Value," *MIS Quarterly* (28:4), December, pp 585-620.

Barua, A., Kriebel, C.H., and Mukhopadhyay, T. 1991. "An Economic Analysis of Strategic Information Technology Investments," *MIS Quarterly* (15:3), September, pp 313-331.

Barua, A., Kriebel, C.H., and Mukhopadhyay, T. 1995. "Information Technologies and Business Value: An Analytic and Empirical Investigation," *Information Systems Research* (6:1), March, pp 3-23.

Bass, F.M., Krishnan, T.V., and Jain, D.C. 1994. "Why the Bass Model Fits Without Decision Variables," *Marketing Science* (13:3), Summer, pp 203-224.

Benaroch, M., and Kauffman, R.J. 1999. "A Case for Using Real Options Pricing Analysis to Evaluate Information Technology Project Investments," *Information Systems Research* (10:1), March, pp 70-97.

Berger, P.D., and Nasr, N.L. 1998. "Customer Lifetime Value: Marketing Models and Applications," *Journal of Interactive Marketing* (12:1), March, pp 17-30.

Carr, N.G. 2003. "IT Doesn't Matter," *Harvard Business Review* (81:5), May, pp 41-49.

David, P.A. 1990. "The Dynamo and the Computer: An Historical Perspective on the Modern Productivity Paradox," *American Economic Review* (80:2), May, pp 355-361.

DeLone, W.H., and McLean, E.R. 1992. "Information Systems Success: The Quest for the Dependent Variable," *Information Systems Research* (3:1), March, pp 60-95.

DeLone, W.H., and McLean, E.R. 2003. "The DeLone and McLean Model of Information Systems Success: A Ten-Year Update," *Journal of Management Information Systems* (19:4), Spring, pp 9-30.

Devaraj, S., and Kohli, R. 2000. "Information Technology Payoff in the Health-Care Industry: A Longitudinal Study," *Journal of Management Information Systems* (16:4), Spring, pp 41-67.

Devaraj, S., and Kohli, R. 2003. "Performance Impacts of Information Technology: Is Actual Usage the Missing Link?," *Management Science* (49:3), March, pp 273-289.

eBay 2010. "Annual Report 2009." Retrieved 7-22-10, from http://files.shareholder.com/downloads/ebay/892843985x0x361552/b45137ee-aa41-4c2c-94ca-d72d5b0844be/eBay_77655_BANNERLESS.pdf

Economides, N. 1996. "The Economics of Networks," *International Journal of Industrial Organization* (16:4), October, pp 673-699.

Eisenmann, T., Parker, G., and Van Alstyne, M.W. 2006. "Strategies for Two-Sided Markets," *Harvard Business Review* (84:10), October, pp 92-101.

Evans, D.S., and Schmalensee, R. 2005. *Paying with Plastic: The Digital Revolution in Buying and Borrowing*. Cambridge: MIT Press.

Gupta, S., Lehmann, D.R., and Stuart, J.A. 2004. "Valuing Customers," *Journal of Marketing Research* (41:1), February, pp 7-18.

Gupta, S., Mela, C.F., and Vidal-Sanz, J.M. 2009. "The Value of a "Free" Customer." Retrieved 7-22-10, from http://e-archivo.uc3m.es/dspace/bitstream/10016/3883/1/wb092903.pdf

Hogan, J.E., Lemon, K.N., and Libai, B. 2004. "Quantifying the Ripple: Word-of-Mouth and Advertising Effectiveness," *Journal of Advertising Research* (44:3), September, pp 271-280.

IDC 2010. "Worldwide IT Spending to Grow 3% in 2010, According to IDC's Worldwide Black Book." Retrieved 7 July, 2010, from http://www.idc.com/getdoc.jsp?containerId=prUS22192510

Katz, M.L., and Shapiro, C. 1985. "Network Externalities, Competition, and Compatibility," *American Economic Review* (75:3), June, pp 424-440.

Keen, P.G.W. 1981. "Information Systems and Organizational Change," *Communications of the ACM* (24:1), January, pp 24-33.

Kumar, R.L. 2004. "A Framework for Assessing the Business Value of Information Technology Infrastructures," *Journal of Management Information Systems* (21:2), Fall, pp 11-32.

Libai, B., Muller, E., and Peres, R. 2009. "The Diffusion of Services," *Journal of Marketing Research* (46:2), April, pp 163-175.

Lucas, H.C. 1999. *Information Technology and the Productivity Paradox: Assessing the Value of the Investment in IT*. New York: Oxford University Press.

Mason, R.O. 1978. "Measuring Information Output: A Communication Systems Approach," *Information & Management* (1:4), pp 219-234.

Melville, N., Kraemer, K., and Gurbaxani, V. 2004. "Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value," *MIS Quarterly* (28:2), June, pp 283-322.

Mohr, J.J., Sengupta, S., and Slater, S. 2009. *Marketing of High-Technology Products and Innovations*. Upper Saddle River: Pearson Education.

Mukhopadhyay, T., Kekre, S., and Kalathur, S. 1995. "Business Value of Information Technology: A Study of Electronic Data Interchange," *MIS Quarterly* (19:2), June, pp 137-156.

Parker, G.G., and Van Alstyne, M.W. 2005. "A Theory of Information Product Design," *Management Science* (51:10), October, pp 1494-1504.

Porter, M.E. 2001. "Strategy and the Internet," *Harvard Business Review* (79:3), March, pp 64-78.

Prahalad, C.K., and Hamel, G. 1990. "The Core Competence of the Organization," *Harvard Business Review* (68:3), May, pp 79-91.

Reinartz, W.J., and Kumar, V. 2000. "On the Profitability of Long-Life Customers in a Noncontractual Setting: An Empirical Investigation and Implications for Marketing," *Journal of Marketing* (64:4), October, pp 17-35.

Rochet, J.C., and Tirole, J. 2006. "Two-Sided Markets: A Progress Report," *Rand Journal of Economics* (37:3), June, pp 645-667.

Rust, R.T., Lemon, K.N., and Zeithaml, V.A. 2004. "Return on Marketing: Using Customer Equity to Focus Marketing Strategy," *Journal of Marketing* (68:1), January, pp 109-127.

Shapiro, C., and Varian, H.R. 1999. *Information Rules: A Strategic Guide to the Network Economy*. Boston: Harvard Business School Press.

Soh, C., and Markus, M.L. "How IT Creates Business Value: A Process Theory Synthesis," *International Conference on Information Systems*, Society for Information Management, Amsterdam, 1995, pp 29-42.

Sridhar, S., Mantrala, M.K., Naik, P.A., and Thorson, E. 2010. "Dynamic Marketing Investment Strategies for Platform Firms," *Journal of Marketing*, forthcoming.

Tallon, P.P., and Kraemer, K.L. 2007. "Fact or Fiction? A Sensemaking Perspective on the Reality behind Executives' Perceptions of IT Business Value," *Journal of Management Information Systems* (24:1), Summer, pp 13-54.

Taudes, A., Feurstein, M., and Mild, A. 2000. "Options Analysis of Software Platform Decisions: A Case Study," *MIS Quarterly* (24:2), June, pp 227-243.

Thatcher, M.E., and Pingry, D.E. 2004. "Understanding the Business Value of Information Technology Investments: Theoretical Evidence from Alternative Market and Cost Structures," *Journal of Management Information Systems* (21:2), Fall, pp 61-85.

Urbach, N., Smolnik, S., and Riempp, G. 2009. "The State of Research on Information Systems Success," *Business & Information Systems Engineering* (1:4), August, pp 315-325.

Verner, J., Cox, K., and Bleistein, S.J. "Predicting Good Requirements For In-House Development Projects," *2006 International Symposium on Empirical Software Engineering*, ACM, Rio de Janeiro, 2006, pp 154-163.

Villanueva, J., Yoo, S., and Hanssens, D.M. 2008. "The Impact of Marketing-Induced versus Word-of-Mouth Customer Acquisition on Customer Equity Growth," *Journal of Marketing Research* (45:1), February, pp 48-59.

Wiesel, T., Skiera, B., and Villanueva, J. 2008. "Customer Equity - An Integral Part of Financial Reporting," *Journal of Marketing* (72:2), March, pp 1-14.

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