Return on Marketing Investments in Two-Sided Markets

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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, assigning investments to customer populations and quantifying their impact on the customer base is complex. We show that measuring the value of the customer base may provide a remedy. Thereby, we develop a model for Customer Equity and the growth process of customer populations in two-sided markets, and apply our model to an e-commerce platform. Our results highlight a significant contribution of buyers to the intermediary's Customer Equity. Analysing former investments we find further evidence to rather invest in buyers than sellers and to promote investments that reduce buyers' uncertainties concerning products, intermediary and sellers.

Keywords: Two-Sided Markets, Network Effects, Customer Equity, Customer Lifetime Value

Introduction

In two-sided markets such as online job search, an intermediary provides the platform for linking together two customer populations (Rochet and Tirole, 2006). For instance, Monster.com provides the infrastructure as well as the rules to enable transactions between two distinct customer populations:[i] on one side of the market Monster.com serves job seekers with a job search engine, on the other side it provides employers with a way to promote their vacancies to job seekers. These two-sided markets are not an entirely new phenomenon. In medieval 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 as the "Network Economy". The Internet has created new industries such as online auction houses and digital marketplaces (Porter, 2001). A prominent example is the auction house eBay.com, which earned more than 3.5 billion Euros in revenues in 2009 by transactions via its platforms (eBay, 2010). Amazon.com followed this trend and integrated sellers, actually competing with its own offers, in its platform. Further examples include online real estate brokerage, payment and dating services. Parker and Van Alstyne (2005) provide a comprehensive overview over both online and offline two-sided markets.

In two-sided markets, both populations of the customer base – in case of Monster.com the number of employers and job seekers interacting on the platform – are crucial to the intermediary. If the number of employers offering jobs on Monster.com is high, more job seekers are attracted to the platform. Vice versa, if the number of job seekers on the platform is high, more employers are attracted to 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; Srinivasan, Lilien and Rangaswamy, 2004). Job seekers are attracted to Monster.com if the number of employers 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 population on the other market side using the same service. Typically, cross-side network effects are positive as in case of Monster.com. 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, Monster.com tends to be less attractive for employers the more employers compete with each other for job seekers. 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.

For intermediaries it is crucial to know the value of the customer populations to have an upper limit for acquisition costs. The determination of customer valuations in two-sided markets is not trivial, 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. The value of the customer base could be used to measure the impact of the intermediary's investments. As a consequence, it would be possible to determine for which customer population investments are more successful. Finally, further implications could be derived by analysing the nature of the investments. At best, managers might 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 employers constituting the paying customer population in case of Monster.com. However, employers just pay because of the "free customers", i.e. the job seekers (Gupta, Mela and Vidal-Sanz, 2009). Thus, managers might misleadingly ignore one customer population. Moreover, managers are tempted to apply a rule of thumb, such as to split 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.

In academics, a first attempt to model the value of the customer base in two-sided markets was made by Gupta, Mela and Vidal-Sanz (2009). 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 company's market capitalisation. They apply a diffusion model assuming that the online auction house is a monopolist; however, this assumption is not justified in most settings. Finally, as we argue below, their model does not allow for a differentiation of network effects on newly acquired versus lost customers. By now, academics and business practice lack a comprehensive metric to measure and forecast the impact of investments in two-sided markets.

The aim of our paper is to measure the value of the customer base in two-sided markets. In particular, we measure cross-side and same-side network effects and calculate the total value of the customer base, i.e. the Customer Equity (CE), as well as the Customer Lifetime Values (CLVs) for each customer population. Applying the CE as a metric, we quantify the impact of investments in buyers and sellers. Therefore, the remainder of this work is organised as follows: we first develop a model for the value of the customer base in two-sided markets while accounting for network effects. Then we implement our model in an empirical study, present our results and discuss the implications.

Modelling the Value of the Customer Base in Two-Sided Markets

Customer Equity Model

The monetary value of 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 investments. To model the platform value and the success of investments, we draw on the extensive literature on CE and CLV measuring current and future customer margins from a long-term perspective (e.g. Berger and Nasr, 1998; Gupta, Lehmann and Stuart, 2004; Rust, Lemon and Zeithaml, 2004; Wiesel and Skiera, 2007; Wiesel, Skiera and Villanueva, 2008). In order to derive the value of the customer base, we take an aggregated perspective on current and future margins provided by all customers, i.e. the CE. Yet, we show later that we are also able to calculate the CLVs of each customer population. We define the CE as the net present value of all margins provided by current and future customers. 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 revenues. However, our model can be generalised to any two-sided market. The CE can be modelled as follows:

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

Where t=0 denotes the starting period for which the CE should be calculated, m^S the average margin provided by one seller per time period, k the discount factor 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 CE through the acquisition of new sellers (Villanueva, Yoo and Hanssens, 2008) and the prevention of the loss of existing sellers (Mohr, Sengupta and Slater, 2009). Finally, T denotes the maximum time horizon which we restrict to T=10 years, since margins after this time period are strongly discounted.

Growth Model

Existing growth models accounting for same-side network effects in the field of CE and CLV (Hogan, Lemon and Libai, 2004; Libai, Muller and Peres, 2009) base upon the Generalised Bass Model (e.g. Bass, Krishnan and Jain, 1994) and conduct their analysis on an industry level. 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. 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, a company level analysis can only be completed if the company is a monopolist. This assumption does not apply to most settings. Second, there is no differentiation of network effects on new versus lost 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 new versus lost buyers (sellers) to be different, we develop a distinct model for the growth process of customer populations in two-sided markets.

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 investments $F_{i,t}$. 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:

(2) $$New^B_t = \alpha + \beta_1 \cdot N^S_{t-1} + \beta_2 \cdot N^B_{t-1} + \beta_3 \cdot T_t + \beta_4 \cdot S_t + \sum_{i=5}^{I+5} \beta_i \cdot F_{i,t} + \varepsilon_t$$

(3) $$Lost^B_t = \alpha + \beta_1 \cdot N^S_{t-1} + \beta_2 \cdot N^B_{t-1} + \beta_3 \cdot T_t + \beta_4 \cdot S_t + \sum_{i=5}^{I+5} \beta_i \cdot F_{i,t} + \varepsilon_t$$

(4) $$New^S_t = \alpha + \beta_1 \cdot N^S_{t-1} + \beta_2 \cdot N^B_{t-1} + \beta_3 \cdot T_t + \beta_4 \cdot S_t + \sum_{i=5}^{I+5} \beta_i \cdot F_{i,t} + \varepsilon_t$$

(5) $$Lost^S_t = \alpha + \beta_1 \cdot N^S_{t-1} + \beta_2 \cdot N^B_{t-1} + \beta_3 \cdot T_t + \beta_4 \cdot S_t + \sum_{i=5}^{I+5} \beta_i \cdot F_{i,t} + \varepsilon_t$$

Empirical Study

We apply our model to a professional B-to-C e-commerce platform operating in Germany, which we label Platform.com. 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 transactions, 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). In t=211, 13,007 buyers and 126 sellers actively use Platform.com. The intermediary provides professional sellers with a platform to sell new products to buyers, while charging sellers with 3% of transaction volumes. Platform.com already completed eight investments. The average margin provided by one seller per week is 31.25 Euros. We insert a discount factor of k=0.27% per week (k=15.00% per year).

Results

By estimating our model (2) - (5) via Seemingly Unrelated Regressions (SUR) and correcting for autocorrelation and heteroscedasticity, we derive three findings that we will explain in the following paragraphs: (i) cross-side and same-side network effects, (ii) the value of the customer base, and (iii) the values of investments.

Table 1 depicts the results related to (i) network effects. 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 for buyers. Furthermore, we find negative same-side network effects of -0.0951 from total number of buyers on new buyers, since the competition between buyers increases. 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.

Table 1: 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 calculate (ii) the CE 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 CE of Platform.com amounts to 1.1 million Euros. Figure 1 also shows a steady growth pattern of CE in earlier time periods attributed to network effects. Concerning the customer populations' values, we define the CLV of a buyer (seller) as the impact of adding one more buyer (seller) on the intermediary's CE. At Platform.com, the CLV of one buyer is 1 Euro and the CLV 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 CE of Platform.com. This is counter-intuitive in a sense that Platform.com receives all revenues from sellers.

Figure 1: Customer Equity

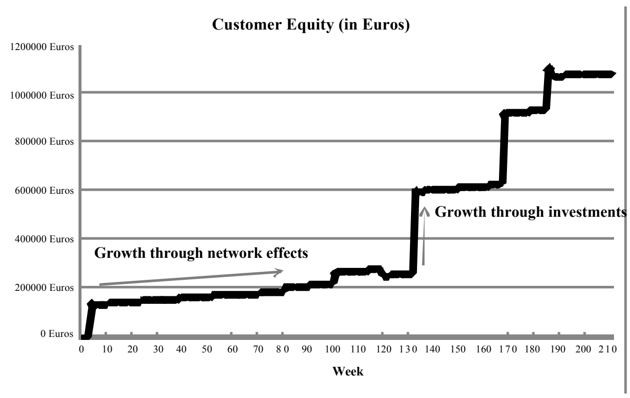

Figure 1 further reveals jumps in CE due to investments. We derive (iii) the values of investments by calculating their impact on CE. As shown table 2, investments directed to buyers are more successful than investments directed to sellers. Analysing the nature of these investments, we find that the most successful investments reduce buyers' uncertainties in two-sided markets: the investment *product news* (+334,573 Euros) provides buyers with more information about the products available at Platform.com and thus reduces uncertainty and information asymmetries regarding the products. Moreover, the *seal "trusted shop"* (+289,764 Euros) improves buyers' confidence in the intermediary, since an independent company approved a safe buying process using Platform.com. Finally, the *evaluation system* (+164,859 Euros) gives buyers more information about sellers, because they can assess how other buyers rate reliability and speed of individual sellers. The three most successful 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).

Table 2: Investments in Buyers and Sellers

Investments in Buyers	Introduction	Value (Euros)	**Investments in Sellers**	Introduction	Value (Euros)
Introduction Video	t=79	+16,630	New Tools	t=89	+/-0 (n.s.)
Product News	t=130	+334,573	Platform.com-Button	t=98	+43,053
Seal "Trusted Shop"	t=165	+289,764	Automated Processing	t=118	-26,555
Evaluation System	t=183	+164,859			
Payment Methods	t=186	-32,319			

Implications and Conclusion

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 CE. Based on our results, intermediaries might consider investing in reducing the uncertainty of buyers in two-sided markets concerning products, intermediary and trading partners (sellers). The value of the customer base could help researchers and managers to improve decisions on assigning investments to customer populations. Furthermore, the value of the customer base could support the evaluation of managerial actions. From a marketer's perspective, measuring the value of the customer base as a metric enhances the accountability of marketing actions, and can get marketing back to the boardroom as demanded by Verhoef and Leeflang (2009). The value of the customer base as an adequate metric could ultimately lead to a paradigm shift, from considering investments as costs to measuring their value contribution (Doyle, 2000).

[i] Please note that the term customer population differs from the term customer segment, with the latter being part of the former, as employers might be segmented into large, medium-sized and small companies.

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