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Asymmetric Information as a Cause for Market Failure – Application Service Providing (ASP) in Austria

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Abstract

The worldwide ASP market has not developed according to the forecasts of many market researchers. Asymmetric information, also known as quality uncertainty, has hardly been made the subject of discussion in the literature as a potential drawback for the successful development of the ASP market. Therefore, in this paper a theoretical framework is presented, showing three market situations with a varying amount of quality information on the customers' side and the resulting effects on the market situation and market development. Furthermore, the paper reports on empirical findings that show the existence of quality uncertainty on the Austrian ASP market.

Keywords. Application Service Providing (ASP), ASP quality, ASP market, asymmetric information, quality uncertainty, adverse selection, attribute-based service quality measurement, web-based questionnaire, quality characteristics.

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1 Introduction

Outsourcing has developed as a key topic for both Information Systems (IS) practitioners and academics. As outsourcing converges with the Internet, a new type of service provider, the so-called Application Service Provider (ASP), has been emerging. According to Gillan et al. (1999) ASPs provide a contractual service offering to deploy, host, manage, and rent access to an application from a centrally managed facility. ASP services are designed to be one-to-many offerings, thus there is minimal or no customization.

In 1999 a majority of market researchers forecasted double-digit annual growth rates for ASP revenues, according to Ovum (2000) worldwide ASP spending was to reach € 136 billion by 2006. The predominant optimism at that time was based on studies by renowned analysts identifying the enabling, technical and business drivers facilitating the ASP concept. In 2000 skepticism arose in North America later shifting to Europe. In March 2000 a decline of share prices of ASPs has begun, which has been much higher than the average loss at NASDAQ. Figure 1 shows the price development of three large ASPs – USinternetworking, Inc.; Interliant, Inc.; and Corio, Inc. – in the form of a capital-weighted ASP index compared to the development of the NASDAQ-100 index. It is evident, that the ASP index has declined much more than the NASDAQ-100 index. From this we conclude that special ASP-inherent reasons are responsible for the negative development of the branch.[1]

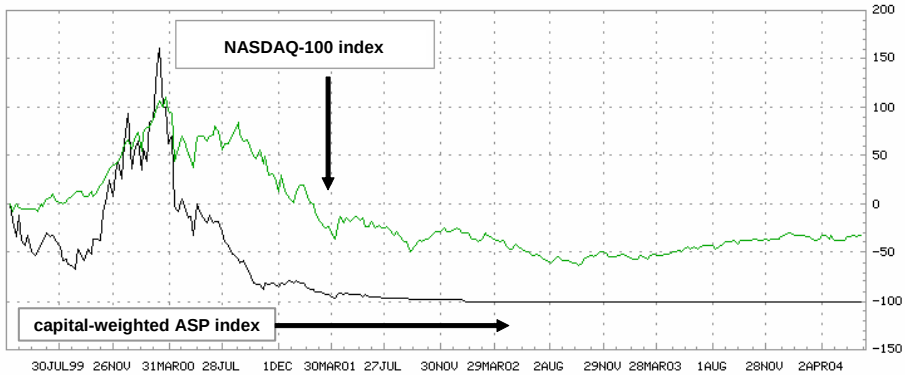

Fig. 1. Share price development, Schoellerbank (2004)

[1] In 2003 EINSTEINet – one of the largest German ASPs – had to declare bankruptcy.

Jayatilaka et al. (2003: 211) summarize the situation on the ASP market as follows: "While the optimistic projections vary in their potential dollar market, the actual adoption rate of ASP services is relatively low. The ASP Industry Consortium, an advocacy group for the industry, recently found that only 8 % of firms surveyed worldwide are currently using an ASP."

Up to now many empirical studies[2] have identified the major causes responsible for the slow market development. A study by The Information Technology Association of America (2000) isolated the following causes: security issues, loss of control, problems with integrating the ASP offering with existing applications, and concerns about the ASP's stability and longevity.

Quality uncertainty, the inability of potential customers to discern quality before purchase, has hardly been made the subject of discussion in ASP-related papers; exceptions are Bhargava & Sundaresan (2002) and Tamm (2003), although quality uncertainty is well known to exist for experience goods such as ASP. Hence, asymmetrically distributed service quality information is likely to be a potential hindrance for the flourishing development of the ASP market.

In this paper we develop a theoretical model showing that quality uncertainty is a potential cause for the slow market development (section 2). Section 3 reports on empirical findings about the existence of quality uncertainty on the Austrian ASP market. Finally, we point at limitations of the study and future directions of research (section 4).

[2] E.g. Günther et al. (2001) or IFES (2002).

2 Theoretical Framework

2.1 ASP market without quality uncertainty and known quality ratio

Let us look at a model of the ASP market where service quality information is asymmetrically distributed in favour of the providers. Thus, prospective customers do not know whether any given provider offers high or low quality[3]. Consider a market with 100 providers and 100 customers. Everyone knows that 50 providers offer high service quality (ASP_{high}) and 50 providers offer low service quality (ASP_{low}) – hence, the quality ratio is known. ASP_{high} are willing to offer at a monthly service fee of € 200 and the ASP_{low} are willing to offer at a price of € 100. ASP customers are willing to pay € 240 for high and € 120 for low quality.

If it is easy to verify service quality before entering into the outsourcing contract, there will be two submarkets: Outsourcing contracts will be placed at some price between € 100 and € 120 for low service quality (market 1) and between € 200 and € 240 for high service quality (market 2), as depicted in figure 2.

Figure 2 shows that up to a price of € 99 no ASP offers services. At a price of € 100 50 ASPs offer services (market 1). The supply function (S) and the demand function (D) are horizontal. Another 50 ASPs offer services at a price of € 200 (market 2, the supply and the demand functions are again horizontal). Therefore, if both market sides are fully informed on service quality all possible market transactions will take place. Actual market prices will depend on the bargaining power of the parties which in turn is mainly determined by the relative size of the provider compared to the customer.

[3] We distinguish between high and low quality with low quality still being acceptable to some potential customers.

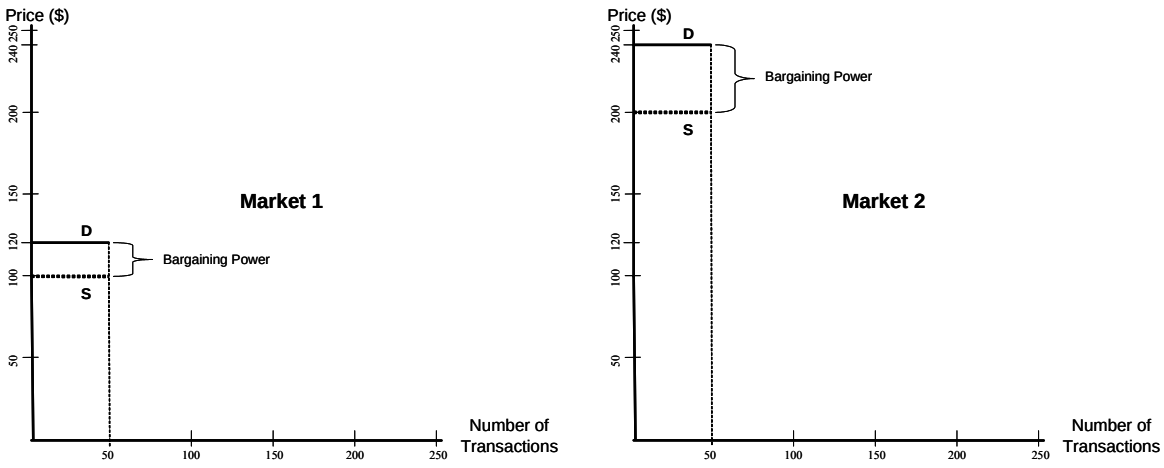

Fig. 2. ASP market without quality uncertainty and known quality ratio

2.2 ASP market with quality *uncertainty* and known quality ratio

What happens to the market if the customers cannot observe service quality? In this case customers have to guess about how much each service offering is worth. We assume that a service offering is equally likely to be of high or low quality. Then a typical customer would be willing to pay the expected value of the service offering. Using the above numbers this implies that each customer would be willing to pay € 180 (= € 120 • ½ + € 240 • ½).

But who would be willing to offer services at that price? The ASP_{low} certainly would, but the ASP_{high} would not be willing to offer services – by assumption they charge at least a fee of € 200. The price that the customers are willing to pay for an 'average' service offering is less than the price that ASP_{high} charge. At a price of € 180 only low quality service offerings are traded on the market (see the solid line D_{to} in figure 3).

But if the customer was certain that he contracts with an ASP_{low}, then he would not be willing to pay € 180. In fact, the equilibrium price in this market would have to be somewhere between € 100 and € 120 (see the solid line D_{t1} in figure 3). Again only ASP_{low} would offer their services, and therefore, customers would expect to get low service quality. In such a market, no ASP_{high} will ever place an outsourcing contract. ASP_{low} crowd ASP_{high} out of the market – according to Akerlof (1970) this effect is called *adverse selection*.

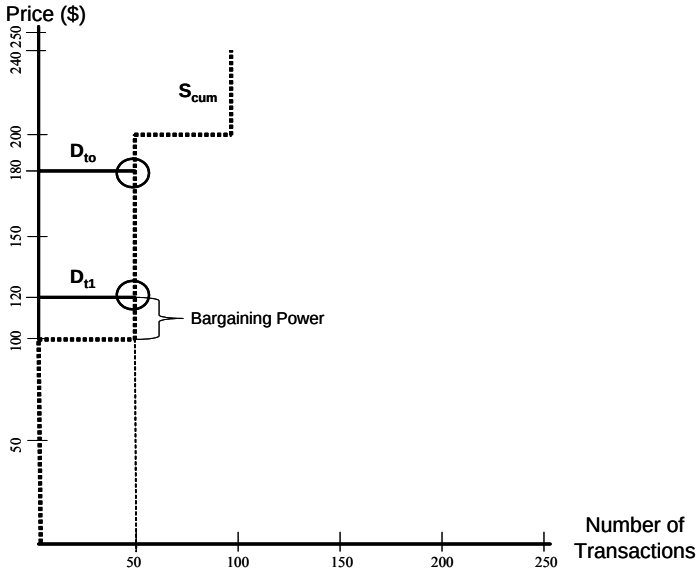

Fig. 3. ASP market with quality uncertainty and known quality ratio

It is worth analyzing the source of this market failure. The problem is that there is an externality between the ASP_{high} and ASP_{low}. When an ASP_{low} tries to place contracts, he affects the customers' quality perceptions of the 'average' service offering on the market. This lowers the price that they are willing to pay for the 'average' service offering, and thus hurts the ASP_{high}. According to Varian (2003) it is this externality that creates the market failure. Akerlof (1970:495) especially emphasizes the negative economic effect of adverse selection, namely the so-called 'Cost of Dishonesty': "There may be potential buyers of good quality products and there may be potential sellers of such products in the appropriate price range; however, the presence of people who wish to pawn bad wares as good wares tends to drive out the legitimate business. The cost of dishonesty, therefore, lies not only in the amount by which the purchaser is cheated; the cost also must include the loss incurred from driving legitimate business out of existence."

2.3 ASP market with quality uncertainty and *unknown* quality ratio

Until now we assumed that customers are perfectly informed about the ratio between ASP_{high} and ASP_{low}. Since this is not very close to reality we make the following modification: Every customer subjectively appraises the ratio between ASP_{high} and ASP_{low} – hence, we get different expected values for different customers. For the following illustration we assume that all

ratios between ASP_{high} and ASP_{low} are equally likely, the expected values for the customers are uniformly distributed. Such a distribution arises from the following appraisal: $customer_1$: $ASP_{high} = 0$ and $ASP_{low} = 100$ | $customer_2$: $ASP_{high} = 1$ and $ASP_{low} = 99$ … | $customer_{99}$: $ASP_{high} = 98$ and $ASP_{low} = 2$ | $customer_{100}$: $ASP_{high} = 99$ and $ASP_{low} = 1$.

In this case there will also be transactions on the high quality market segment, which corresponds to empirical findings from Günther et al. (2001) that there are not only ASP_{low} on the market. Only those customers who appraise the ratio between ASP_{high} and ASP_{low} with 2 to 1 are willing to pay at least € 200 (= € 240 • ⅔ + € 120 • ⅓), the minimum price charged by ASP_{high}. As visualized in figure 4 in such a case only one third of the 100 transactions will take place (see the intersection between the solid line D and S_{cum} in figure 4). Other assumptions about the distribution of the expected values (e.g. normally distributed values) do not change the qualitative result – not all ASP_{high} are crowded out from the market by ASP_{low}, what we call 'imperfect adverse selection'.

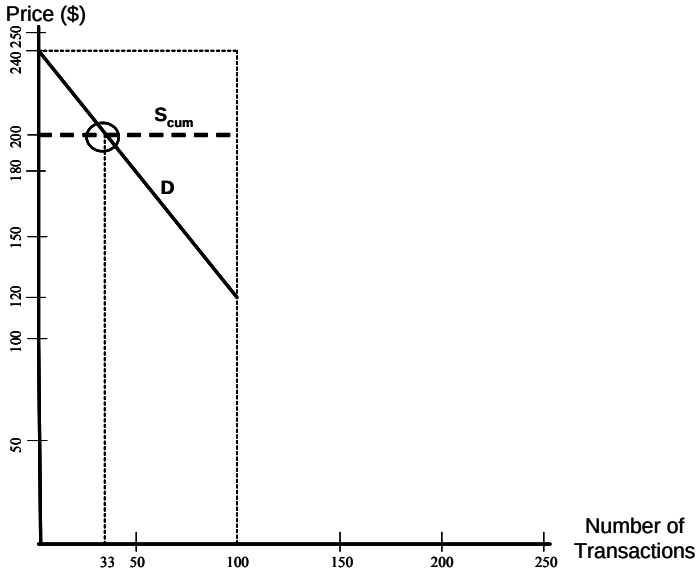

Fig. 4. ASP market with quality uncertainty and unknown quality ratio

Let us now take a look at the development of such a market in the long run. In the first round of contracting one half of the customers will meet with ASP_{high}. Their payment (between € 200 and € 240) will correspond to the service quality. Contracts will be renewed. The other half of the customers will receive low service quality but will have to pay the same high prices. They will renegotiate their contracts and pay the lower prices (between € 100 and

€ 120) receiving the corresponding service quality. Thus, the total number of transactions (⅓) will remain unchanged in the long run, with equal market shares of ASP_{high} and ASP_{low}.

The market situation visualized in figure 5 starts with the result from the market situation described in figure 4: One third of the 100 market transactions will take place. If we now assume that there are also two types of customers, those who demand high service quality (C_{high}) and those who demand low service quality (C_{low}), there are four possible combinations: Path 1 = C_{high} meets ASP_{high} | Path 2 = C_{low} meets ASP_{high} | Path 3 = C_{high} meets ASP_{low} | Path 4 = C_{low} meets ASP_{low}.

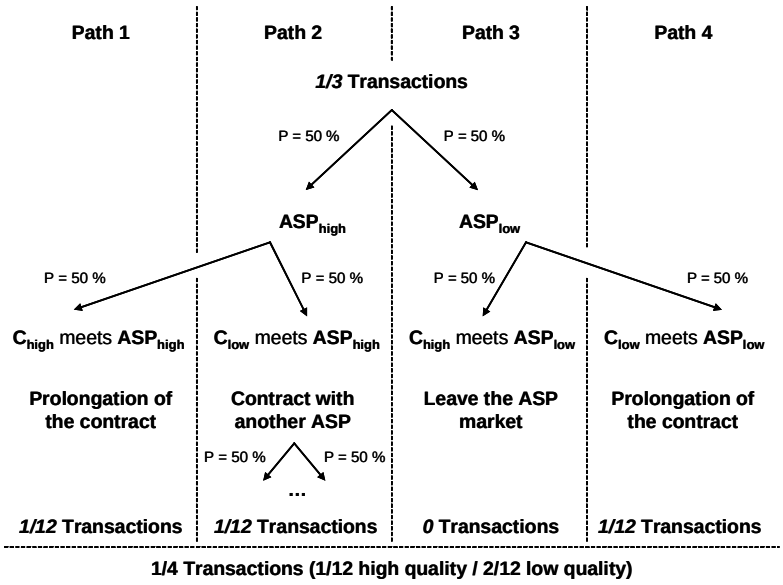

Fig. 5. Scenario for the development of the ASP market

In the following the four pathes are described. The description is based on four assumptions: (1) customers are risk neutral, (2) customers do not exchange quality information, (3) lock-in effects[4] are not considered, and (4) ASPs do not offer different service levels.

[4] Lock-in leads the value of the outsourcing relationship to exceed the value of the trading partners' outside cooperation alternatives creating what Klein et al. (1978) called quasi-rents.

Path 1: C_{high} meets ASP_{high}

After the end of the first contract period it might be expected that the contract will be prolonged at a price of € 200 to € 240.

Path 2: C_{low} meets ASP_{high}

After the end of the first contract period it might be expected that the customer will keep renewing contracts until he meets an ASP_{low}. This contract will be placed at a price of € 100 to € 120.

Path 3: C_{high} meets ASP_{low}

After the end of the first contract period it might be expected that the customer leaves the ASP market due to his negative experiences with the ASP model.

Path 4: C_{low} meets ASP_{low}

After the end of the first contract period it might be expected that the contract will be prolonged at a price of € 100 to € 120.

In the long run there will be 2/12 of the 100 transactions (~17 transactions) in the low quality market segment which represent the sum of path 2 and 4, and 1/12 of the 100 transactions (~8 transactions) in the high quality market segment (path 1).From the described model we draw the conclusion that the existence of quality uncertainty with an unknown quality ratio leads to a considerable reduction of the possible market transactions – in our examples at the extent of ⅔ (figure 4) to ¾ (figure 5).

3 Empirical Findings

3.1 Data collection

According to IFES (2003) the Austrian ASP market is still in a nascent stage. Such a market is an interesting object for analysis since quality uncertainty is of particular importance during take-off and early development of a market. By means of an online questionnaire data was collected in April and May 2003. The questionnaire was reviewed by practitioners to assure understandable content. Data collection took place with the support of the Austrian Chamber of Commerce, which put a link to the questionnaire on their highly frequented website (http://portal.wko.at/). A total of 104 questionnaires were returned. The responding firms (all potential ASP customers) came from several industrial sectors. The questionnaires were answered by the top management (Chief Executive or Chief Information Officers).

3.2 Measurement model

In order to measure service quality, several methods can be considered. According to Stauss & Hentschel (1992) we can distinguish conceptually between attribute-based and incident-based approaches. Attribute-based approaches share the common notion that customers evaluate a variety of service attributes. This process results in a global and subjective judgement of the perceived service quality. By means of a questionnaire customers are either asked directly about their satisfaction with a service offering or service quality is measured indirectly by calculating the satisfaction score from the difference of expected and perceived performance. The most discussed approach within the attribute-based measurement approaches is SERVQUAL[5] which was developed by Parasuraman et al. (1986).

The dominant method within the incident-based approach is the Critical Incident Technique (CIT) which is a method of collecting and classifying stories or 'critical incidents' by employing content analysis. Critical incidents are specific interactions between customers and service employees that are especially satisfying or especially dissatisfying. By interviewing the customers and by an analysis of their 'stories' a deep insight into service quality can be gained.

[5] Jiang et al. (2002) report on the debate over the use of SERVQUAL to measure IS service quality.

Services are basically intangible. Hence, the transformation of concrete incident-based experiences into abstract attribute-based evaluations is more difficult than for goods. Even so, we used the attribute-based approach to gain information about quality uncertainty on the Austrian ASP since it was not feasible to collect a high amount of quantitative data – which would have been necessary in our study to gain insights into quality uncertainty – by interviews. Furthermore, the use of an attribute-based approach is substantiated by several papers applying ASP choice criteria; e.g. Jayatilaka et al. (2003).

Our attribute-based measurement model follows the function:

$$P_{ij} = f(E_{ij1}, E_{ij2}, \ldots, E_{ijn}) \qquad \textbf{(1)}$$

P_{ij}: perceived quality of service j by customer i, and

E_{ijk}: quality perceptions of several characteristics k of service j by customer i (k = 1, …, n).

EN ISO 8402 (1995) defines quality as the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs[6]. In our study quality for each characteristic was captured by a gap score (E_{ijk}), where E_{ijk} is the difference between perceived performance (P) and importance (I) of the service for each characteristic:

$$E_{ijk} = P - I \qquad \textbf{(2)}$$

For measurement the following ordinal scales were used:

perceived performance	*importance*
1 = very poor	1 = unimportant
2 = poor	2 = less important
3 = good	3 = important
4 = very good	4 = very important

[6] This definition is based on established quality-definitions by Crosby (1979) and Parasuraman et al. (1985).

As indicated in table 1 the examined quality characteristics can be classified in three domains: application, security and services. The identification of the characteristics results from the review of ASP literature and exploratory research. The objective of the exploratory research was to ensure that all relevant quality characteristics had been identified during the literature review. Thus, the data of the exploratory research were used to confirm the characteristics found in the literature and also to identify new characteristics.

Table 1. ASP domains and quality characteristics

Application	**Security**	**Services**
CU / Customizing	AV / Availability	CP / Contact Person
FU / Functionality	CO / Confidentiality	IM / Implementation
MM / Multi-user and Multi-client ability	DL / Data Loss	MO / Monitoring
SC / Scalability	IN / Integrity	PM / Problem Management
SI / System Integration	ND / Non-Deniability	PR / Project Management
UF / User Friendliness	OA / Output Availability	RE / Reporting
WC / Web Centering		UT / User Training

3.3 Results

To ascertain the predominating quality uncertainty on the Austrian ASP market we used four different methods, two of them are based on the measurement model explained above. Before we describe the methods and the empirical results it should be mentioned that the existence of quality uncertainty assumes that potential ASP customers consider 'quality' as a relevant criterion when choosing an ASP from a multitude of providers. For this reason the questionnaire contained one question about the importance of 'high quality' versus 'low price': 83 % of the respondents stated that 'high quality' is the dominant factor while only 17 % preferred 'low price'.

Method (1)

This method is the simplest way to ascertain quality uncertainty. Akerlof (1970: 496) writes: "There is considerable evidence that quality variation is greater in underdeveloped than in developed areas." Although Akerlof (1970) may not have thought of developing business models (such as ASP in the late 1990s), in our opinion this quotation does apply to emerging business models rather well. Hence, we asked the 104 potential customers directly about the perceived differences between the ASPs service qualities.

Thesis 1: The higher the perceived differences between the ASPs service qualities, the higher the degree of quality uncertainty.

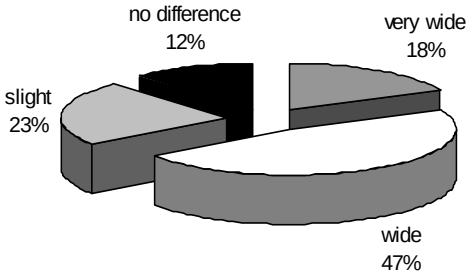

Fig. 6. Perceived service quality differences between Austrian ASPs

As visualized in figure 6 only 12 % of the respondents see no differences in the service quality offered by Austrian ASPs, furthermore two-thirds perceive wide or very wide differences. This result does not contradict thesis 1.

Method (2)

For a broad range of products known as search goods, the lack of quality information may be countered by simple measures like visual inspection. In comparison, many digital products are experience goods[7], whose quality becomes known only after consumption. ASP customers will only be able after 'consumption' to evaluate the performance of the majority of the quality characteristics listed in table 1. Hence, an ASP service is a typical example for an experience good.

Thesis 2: The higher the inability of potential customers to evaluate the ASPs performance, the higher will be the degree of quality uncertainty.

Sixty percent of the respondents were unable to evaluate the performance of the Austrian ASPs. This in itself is an indicator of the lack of information on the part of possible demanders of ASP services. This result does not contradict thesis 2.

Method (3)

As indicated in formula (2), the quality of each characteristic is measured by $E_{ijk} = P - I$. To draft a referring thesis and for illustration purposes we developed a so-called Importance-Perceived-Performance-Portfolio (IPPP). On the horizontal axis we measure the importance of the characteristics, on the vertical axis the perceived performance. In the IPPP (figure 7)

[7] The term was introduced by Nelson (1970).

the means of the twenty characteristics (both importance and perceived performance) are shown. Due to the fact that ASP quality is determined by all 20 characteristics listed in table 1, the distribution of the characteristics in the IPPP sheds light on the degree of quality uncertainty.

Thesis 3: If higher importance of a quality characteristic is associated with a larger negative difference between perceived performance and importance (= quality deficit), a high degree of quality uncertainty exists.

The correlation between the importance and the quality deficit can be calculated with Spearman's rank correlation coefficient (r_s)[8]; Spearman's r_s amounts to 0.75. This result does not contradict thesis 3.

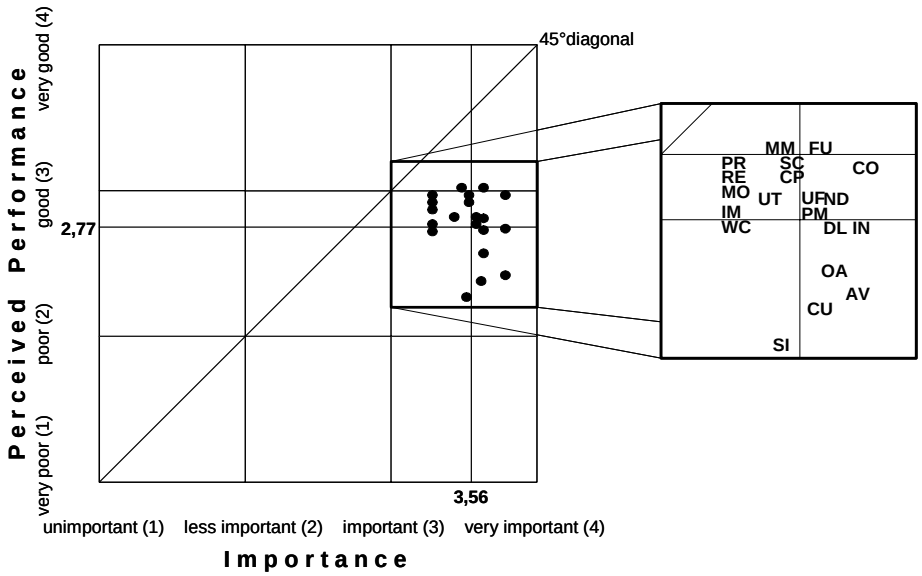

Fig. 7. Importance-Perceived-Performance-Portfolio (IPPP)

Figure 7 shows that the perceived performance was, in general, lower than the importance attributed to the different quality characteristics. Hence, all quality characteristics are positioned below the 45°diagonal. The importance averages 3.56, and the perceived performance has an average of 2.77. Aside from an 'inflation of aspirations' (see footnote 9) this could mean that in the eyes of potential customers high quality ASPs are not (not yet? no longer?)

[8] For details see e.g. Sixtl (1996).

present on the market. Hence, adverse selection is likely to be happening on the Austrian ASP market.

Furthermore, as indicated in figure 7, the quality deficits range from 0.44 (MM and PR) to 1.25 (AV). The quality deficit is ascertained by the vertical distance of each characteristic from the 45°diagonal – the larger the vertical distance, the larger is the quality deficit. All twenty characteristics are positioned in a 'deficit corridor' of 0.81 (= 1.25 – 0.44) which is 0.27 % of the scale maximum.

Method (4)

Another method to ascertain quality uncertainty is based on the idea to measure the standard deviation of the quality (or quality deficit) of each characteristic. The standard deviation reflects the quality perception of the customers regarding each characteristic, which is itself an indicator for the degree of quality uncertainty.

Thesis 4: The higher the standard deviations of the quality characteristics, the higher the degree of quality uncertainty.

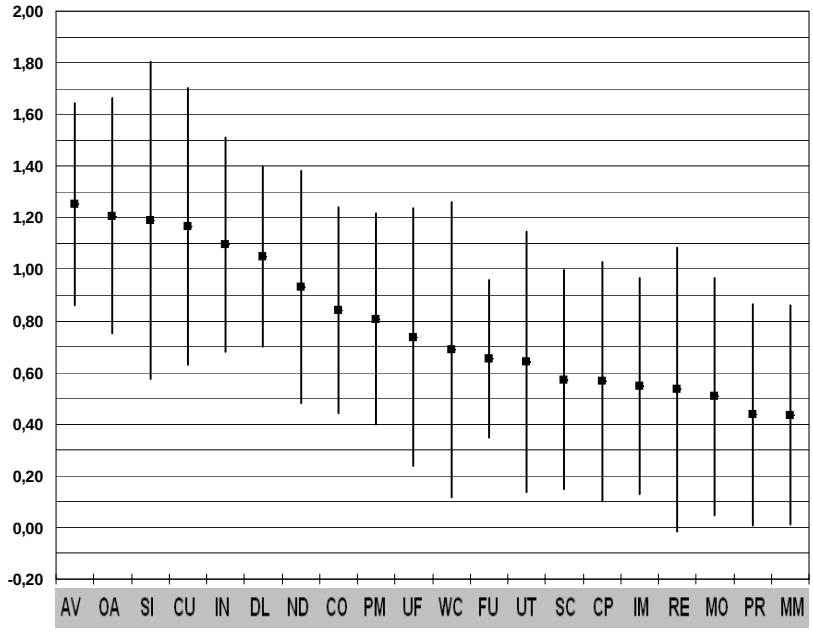

Fig. 8. Quality deficits and standard deviations

Figure 8 shows, on the one hand, the quality deficits of the quality characteristics in descending order (black squares), and on the other hand, the relevant standard deviations. The standard deviations range from 0.61 (FU) to 1.23 (SI). This result does not contradict thesis 4.

4 Conclusions

This paper has considered quality uncertainty in the context of the ASP market. It argues that quality uncertainty (asymmetric information) is a potential hindrance for the flourishing development of the ASP branch. Firstly, the negative development of the ASP market is shown. Secondly, a theoretical framework – with three different market situations – is presented to demonstrate the negative effects of asymmetric information, adverse selection and 'imperfect adverse selection'. Thirdly, empirical findings are shown for the Austrian ASP market which is an interesting object for analysis since asymmetric information is of particular importance during take-off and early development of a market.

To ascertain the predominating quality uncertainty we used four different methods, two of them are based on attribute-based service quality measurement. The results show that quality uncertainty is an inherent element of the Austrian ASP market and therefore an obstacle for the successful development of the ASP model.

Attribute-based service quality measurement models are discussed controversial in the literature. Some authors argue that these models cannot measure service quality as reliable as incident-based measurement models. They argue that respondents – when asked to evaluate single quality characteristics – start recounting their attribute-specific experiences and imageries. If they discover nothing extraordinary they will be inclined to rate the characteristic as good or very good (Stauss & Hentschel 1992). Some authors argue that the measurement of the importance of quality characteristics on ordinal scales does not lead to reliable results. The reason is called 'inflation of aspirations'[9] which means that measurement of importance of quality characteristics on ordinal scales tends to lead to high scores.

Future research can analyze measures to mitigate quality uncertainty and therefore contribute to the successful development of the ASP branch. Measures like signalling, screening, self

[9] The phenomenon of 'inflation of aspirations' was firstly described by Dichtl & Müller (1986). They report the empirical finding that the measuring of the importance of quality charateristics on ordinal scales tends to lead to high scores.

selection, contingency pricing, and internet-based market places (e.g. www.asperado.com) are discussed in the literature[10]. Further efforts can be focused on the development of third party certification programs to close the service quality information gap on the customers' side.

[10] See e.g. Riedl (2005), Bhargava & Sundaresan (2002), and Tamm (2003).

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