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CREDIT RATING CALIBRATION

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Abstract

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In this paper we deal with determination of chosen characteristics of vending business in the Czech Republic. Vending seems to be dynamically developing sector of economics. A strong competition is present in this market. This can be a reason that new ideas of improvement appear continuously. Primary data are used to characterize vending business from the perspective of consumer as well as vending operator. The data are used as input to statistical tests; results are summarized and presented in economic terms. At first, survey (about 600 respondents) is analyzed in empirical way. It is informative in such sense, that vending machines are used by majority of users, more often in school or workplace. The main reasons of using vending machines are speed of shopping and no other shopping possibility. Further part is devoted to comparison of prices under different situations. For example, there are differences among various vending machine locations. Vending machine prices are not necessarily higher than prices in shops or cafeterias. Finally, operator profitability is explored based on company internal data. Among others, hot drinks vending machines are more profitable than vending machines selling bottled beverages of packaged food in general.

analysis of consumers, market research, primary data, vending business

With the continuous development of technology, people getting rid of the works, which held machines for them. This advancing automation brings positive aspects. Because the machine, unlike a man, is not subject to fatigue but works reliably and accurately, it helps to increase labor productivity. In today's hectic modern times, this leads to continuous growth and greater efficiency which saves already precious time.

One area of automation is also engaged in this work. We introduce certain characteristics of vending machines. We try to analyze behavior of both, consumers and operators. Currently, vending machines are still popular. Their number is increasing as well as range of products sold. They are not only a means of fast food in public places, but they are also responsible for giving drinks and meals in companies and enterprises.

A significant amount of consumer goods, as impulsively purchased goods such as drinks, sweets, newspapers, etc., is today sold by vending machines in economically developed countries. Their advantage is the continuous operating time. Therefore, it is a universal and mass equipment to simply get drinks and other goods directly to consumers, every day for 24 hours. Their other advantage is the ability to supply the simple range of goods immediately, which is also the most important role of vending machines at the present time. See, for example, Srpová (2010).

In addition, the machine also saves costs primarily associated with expensive labor powers and an extensive sales network. The commercial importance of vending machines is mainly in the extension of shopping options in terms of the time when the vending machines as a sales device enables fast continuous acquisition for 24 hours, even when other stores are closed. Vending machines often become organic part of the retail network, with the maximum approximation to the point of consumer demand.

The basic disadvantage of sales in vending machines can be considered its technical complexity and low economic performance. Customers must also count with the eventual problems with

machines and with the fact that already purchased goods cannot be returned. Another disadvantage can be a higher price of the goods. The limiting factor of the vending is also certain impersonality and complicated feedback from the customer. The problem with communication can be solved by emerging methods of cashless payment and records, what increase convenience of sales and simplify access for customers.

Vending also has special demands on the product mix. It focuses on everyday goods with a simple shape and small dimensions, such as hot and cold drinks, cigarettes, sweets, baguettes, etc. Vending machines are suitable for frequently required goods in places with a large catchment area and seasonality. Most machines are found in busy places such as recreational areas, railway stations, in large companies, schools, offices and cultural facilities. Vending machines complement a network of kiosks, stalls and small shops. Their deployment is based on the principle of expediency, they are placed either individually or in the case of busy place they concentrate several together. Therefore, vending machine producers have high demands on reliability and design that aims to attract, but not too distract in office spaces. Current manufacturers compete in innovations and in systems for improving the services. This provides, for example, the machines with highly hygienic design etc.

Vending industry has been less exposed to the recession than some other industries. The impact of the recession was minimized primarily by variety of products that are sold through vending machines. In addition, the strike of the recession was partially eliminated by encouraging growth in emerging Asian markets. It is interesting that recession in some aspects improved position of vending industry. For example, savings of consumers support the use of vending machines for coffee, because consumers save for waiter service. While the mixture of all these factors helped to mitigate the downturn in the industry, several other factors contributed to worsening of the situation.

Revenues from products sold through vending machines in 2008 and 2009 were moderate, because the demand in key sectors such as manufacturing, financial institutions and banks has been negatively affected by failures of companies and reducing the workforce. Revenues of customers were limited, as well as income of the main industry pillar, selling cold drinks. Vending machines are running mostly in the workplace, thus the increasing of the unemployment rate worsened overall impact and decreased frequency and amount of purchased goods. Legislative changes also increased the pressure on some types of products sold by vending machines, such as cigarettes, alcoholic drinks and confectionery. The sale of cigarettes was negatively affected by these changes due the ban on smoking in public places in most countries, see Companiesandmarkets.com.

The expansion of vending machines began thanks to several large multinational vending companies in the Czech Republic immediately after the revolution in 1989. They are followed with a great distance by smaller national operators and small entrepreneurs. The companies with the largest market share, regardless of the order, are: Equipment Service Ltd. Selecta, Alois Dallmayr Automaten-Service Ltd., Delikomat Ltd., AG Foods Group Inc. These companies also usually come with the proper know-how. News concern the technical solution of the machine, or proper assortment of beverages, such as bean coffee machines with ground or unground coffee, instant coffee – all in the required combinations, see Vending-europe.eu.

In 2002 there was based the Czech Vending Association (CVA) aimed at protecting vending industry in the country. According to the CVA, the vending sector covers operators and manufacturers of vending machines as well as suppliers of content, cups, accessories and spare parts for vending machines. The main activities of the Association are promoting the interests and needs of the vending sector as a whole, the development of technical, sanitary and other standards; regular gathering, organizing lectures, discussions, seminars and publishing newsletters for members of the association. CVA bodies are the General Meeting, Board, President and two Vice-Presidents and the financial controller. Members of the association shall comply with the Code of Ethics. Members are companies such as Selecta Ltd., Delikomat Ltd., Petrov Group Ltd., etc.

MATERIAL AND METHODS

Data related to the vending business were obtained by the survey, from internal sources of the vending company and by direct observations in shops etc. The questionnaire was completely anonymous; it could be answered electronically or in the printed form. The questionnaire has two slightly modified forms. For our purposes, particular questions of these two forms were merged (answers were reformulated where necessary). Totally, 619 filled questionnaires were collected. The data collection took place in the first quarter of 2011. During the data collection, there was an attempt to get respondents of all ages, educations and other categories. Data about product prices were collected mainly in Brno, partially in "Zlinsky" region. For particular analyses, data come from one destination only. Internal data are related to "Zlinsky" region. In all cases, at least 10 observations are taken (usually much more).

In this paper we use common statistical methods. The homogeneity test is used when exploring equality of factor level probabilities for the analysis of contingency tables coming from survey. The appropriate version of the t-test (chosen according to the test of variance equality or dependency of the samples) is used for comparison of mean values

in the case of two samples. One-way ANOVA is used for more than two samples, pairwise tests of simple contrasts are realized as Tukey or Scheffe tests (depending on equality of level counts). Detailed description of used methods is given in Anděl (2005). All tests are carried out on the level of significance 5%.

RESULTS AND DISCUSSION

Firstly we present results coming from the survey. The vast majority of respondents (98%) used vending machine at least once. Circa 67% of them use vending machine for hot drinks most often. A relatively large percentage (21%) purchased packaged beverage. Majority of respondents use vending machine at school or workplace. About 70% of respondents have vending machine there. As a reason for using vending machine 50% of respondents answered that it is fast, 35% respond that there is no other possibility to buy.

According to 55% of respondents, the biggest asset of vending machines is that they operate 24 hours a day. Another 26% of respondents said that it is speed of service and 12% availability. Most respondents said that the biggest weakness or negative of vending is loss of the complaint (64 %). Furthermore, only 17% of respondents reported distrust of machines.

The largest percentage of respondents (43%) purchased at vending machines exceptionally. Further 38% used the machines to purchase several times a month, 17% several times a week and 2% of respondents purchased at vending machines every day. As many as 87% of respondents did not plan purchases at vending machines, they buy instinctively, without prior rational balance.

Totally 78% of respondents completely agree and 18% of respondents tend to agree with the statement that it is simple to operate a machine for them. For another question, if respondents ever had a problem to control a machine, only 26% of respondents have experience with the fact that they sometimes did not know how the machine control.

Now we present some results of tested hypotheses (on the level of significance 5%) based on questionnaire data. Such hypotheses can be important for customer targeting. At first we tested if shopping at vending machines is distributed in both sexes equally. We cannot reject hypothesis of homogeneity that among respondents who buy in vending machines is the same proportion of men and women ($\chi^2 = 0.114 < 3.84 = \chi^2_{0.95}(1)$). For further hypothesis it is necessary to divide respondents into two groups: students and others. The group "others" include employees, self-employed, pensioners and beneficiaries of other benefits. The hypothesis is as follows: The proportion of people who buy in vending machines is the same for both students and the other respondents. We rejected the hypothesis of homogeneity ($\chi^2 = 42.066 > 3.84 = \chi^2_{0.95}(1)$); the percentage of shopper students is higher than for other respondents.

Further we discuss results related to testing equality of means for prices. The first question was about price level in vending machines related to other buying possibilities. We chose drink "kofola" as a typical product. We compared vending machine prices to cafeteria (from different locations), small shop and medium quality restaurant. Using ANOVA, the hypothesis about the same mean values (prices in our case) is rejected ($p < 0.001$). Pairwise analysis (Tukey test) showed that vending machine prices of kofola is significantly greater than in small shop, significantly lower than in medium quality restaurant and equal to cafeteria prices.

Now we look at this question from different side. We focus on hypothesis whether the prices of selected products from vending machines are higher than the prices of identical products in stores. We tested prices of selected bottled drinks and products of spiral slots (12 products totally). The results of two mean values equality tests point out that only three products are cheaper in vending

I: *Results of variances equality tests and one-sided tests of mean values equality for particular goods*

Goods	Test of variances equality		Test of mean values equality		
	F	H_0	T	$t_{0,95}(n_1 + n_2 - 2)$	H_0
Miňonky	3.8	not rejected	6.9	1.771	rejected
Horalky	1.0	not rejected	8.1	1.782	rejected
Bebe	9.4	rejected	3.1	1.796	rejected
M&M's	7.2	rejected	2.7	2.353	rejected
Twix	2.2	not rejected	3.1	1.782	rejected
3 Bit	5.5	not rejected	6.4	1.796	rejected
Mattoni	1.3	not rejected	9.6	1.796	rejected
Kofola	1.7	not rejected	2.3	1.771	rejected
Ice T	2.0	not rejected	–1.8	1.796	not rejected
Coca-cola	2.2	not rejected	–1.6	1.725	not rejected
Cappy	2.5	not rejected	–3.0	1.717	not rejected
Bonaqua	3.1	not rejected	2.1	1.717	rejected

machines than in stores. It is a drink Ice T, Coca-Cola and Cappy. Other products are sold at lower prices in shops than machines. Detailed results are presented in Tab. I.

We explored question if the common medium quality restaurants offer a smaller number of the coffee types than vending machines in empirical way only. There were in average 8 types of cafe in 20 restaurants. Nevertheless, vending machines usually offer 12 types of cafe. So they offer more types of cafe (at least according to labels, differences in taste can be questionable).

Now we investigate the hypothesis if the price of vending machines from different locations is the same or not. We split vending machines into three groups depending on the location. The first group consists of vending machines located in schools, the second group is located in shops and other buildings, and the last third group consists of vending machines located on other public areas. The null hypothesis of mean values conformity was rejected for all seven tested products (coffee, chocolate, tea, …). As an example, we present results for black coffee: for the general hypothesis we obtain and the post-hoc testing is stated in Tab. II.

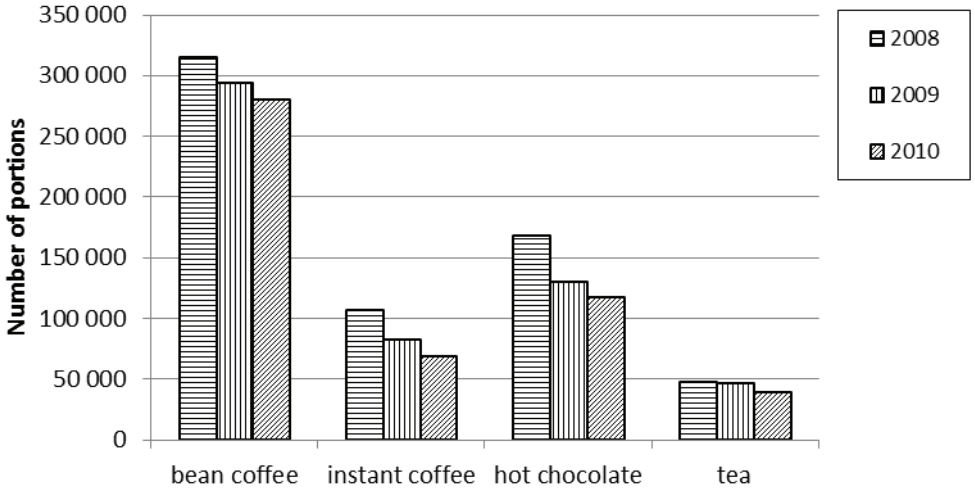
So we can conclude that the placement of vending machine is a factor that affects the price of offered goods. Further testing (using post-hoc Scheffe method) shows, that except the white chocolate, the mean price of vending machines products is always significantly lower in schools than at other locations.

Finally, we can illustrate results coming from vending company data. Empirical data shows, that the best-selling product in beverage machines is coffee and other coffee drinks such as coffee with milk, cappuccino and mocaccino (bean coffee 55%, instant coffee 14 %). The second best-selling drink (23%) is hot chocolate (milk chocolate, extra chocolate). An indispensable product in vending machines is soluble tea sold in about 8%. Other products such as soups and instant cold drinks are sold at volume less than 1%. The progress over time shows that in the years 2008–2010, the coffee is still the best-selling product in vending machines. We can also say that the number of servings decreases per year, which may be due to the evolving economic situation on the Czech market, see Fig. 1.

Now we focus on hypothesis that for operator is the hot drink vending machine more profitable than the vending machine for packaged foods and bottled cold drinks. Profitability of hot drink vending machines and vending machines for packaged foods and bottled cold drinks is defined as an amount or percentage that the company receives after deducting the cost of raw materials and machine operation. For a company, the operating profit from the drink machine is about 76% and the second kind of machine profit is about 23%. For both types, the employee must serve a machine (complete or clean). Drink machine is more difficult to maintain, but even though the gain in sales from the drink machine is about three times larger than from the machine on packaged foods and bottled cold drinks.

II: *Results of post-hoc Scheffe tests for black coffee*

Position 1	Position 2	Scheffe inequality		H_0
		Left side	Right side	
School	Shops	2.02	1.49	rejected
School	Other public areas	3.97	1.99	rejected
Shops	Other public areas	1.95	1.97	not rejected



1: *The best-selling products with progress over time (particular company data)*

The hot drink vending machine must be regarded as equipment for manufacturing and sales. This machine produces the final product to customer and then sells it to him, while the machine for packaged food and bottled cold drinks only sells ready-made products. For this reason, we encounter a different margin and other costs for these types of machines. To compare these two types of machines based on real data, we chose common locations, where both vending machine types are located at the same time. Selected locations are in hospitals, primary schools, hotels and high schools. Verification of the hypothesis that the profit is from both types of machines the same requires the usage of the paired t-test for mean values equality in this case. The null hypothesis was rejected ($p < 0.001$) and we can conclude that the hot drinks machine is thus more profitable than the vending machine for packaged cold drinks and packaged foods.

The last question is if positions in public spaces are more profitable than positions in closed places. Public space is a place where can enter an unlimited amount of people. Specifically, in this group are machines located in hospitals, schools, hotels or at the stadiums. Closed place is characterized by a limited number of persons. Such positions are located in factories, warehouses and offices. The main clients are employees of the company in those cases. Consequently, it is not possible to reject the null hypothesis that the profit of the machine located in a public space is the same as of the machine located in a closed place ($p = 0.294$). We cannot exactly specify which location is more convenient in general. It is entirely an individual matter and it is necessary to test each space by installing vending machines for a trial period.

We think that such research makes sense for newly entering companies because vending is still a growing industry with a high degree of competition. Although it may not be evident at first sight, new perspectives still open for vending machines. Currently it is primarily the application of machines in manufacturing plants and administrative centers. In manufacturing companies they can operate as cafeterias or they can issue work and personal protective equipment to employees. Regarding the administrative centers, one can through vending machines, specifically cafe automated service, achieve significant savings. If the company employs 100 employees and if each individual spend with preparing coffee 10 minutes daily, monthly it will make 20 working days, which is the salary of one worker. Annual company savings are about CZK 300 000 (see Beneš, 2008).

There are just a few trends of vending machines development. One of them is related to the development of telemetry. In this case the vending machine includes the telemetry equipment. This is a way of communication, which allows the operator to transfer information from a vending machine by mobile networks. Thanks to the telemetry device, in the case of failure, the vending machine immediately informs the operator to remedy this situation. This system also allows the authority to control the opening and management of machines and can send information on the audit of individual machines, either periodically or on demand via SMS. With telemetry we can manage data remotely, better monitor and supply products. Vending telemetry module also allows a detailed record of used machines, finances due to the cost center and also a very important statistic of sales and turnover in respect of vending machines and service periods (see Vending-europe.eu).

The design of new vending machines attempts to open the machine as much as possible to the customer. This leads to designing of machines with a glass front panel, through which the customer can view the products sold. As a sales promotion, a small LCD can be placed in the front panel. This LCD can run advertising for other products of the company. With the development of technology, LCD may not be used only for screen advertising. Currently, in the USA there are tested machines that will operate more like a modern touchscreen mobile phones. The vending machine will have on the front side 46-inch LCD touch panel that will show the products that the customer can buy. Consumer can see a product from all angles on this screen, which allows him also to read information such as product composition, nutritional value or shelf life.

In Japan, there are vending machines for cigarettes, which can recognize the buyer's age by analysis of his face. The machine takes the photograph, which is then evaluated. The analysis focuses mainly on his wrinkles and further signs of aging. Based on this analysis, client's legal age is then estimated with 90% success rate.

As a final remark we can state, that although vending develops rapidly, there is very little information in a serious literature, and perhaps there is room for further research.

SUMMARY

In this paper we deal with determination of chosen characteristics of vending business in the Czech Republic. Vending seems to be dynamically developing sector of economics. In this market, a strong competition is present, what can be a reason that new ideas of improvement appear continuously. There is sold a significant amount of consumer goods, the impulsively purchased goods such as drinks, sweets, newspapers, etc. by the vending machines in economically developed countries today. Their advantage is the continuous operating time. Therefore, it is a universal and mass equipment to simply get drinks and other goods directly to consumers, every day for 24 hours. Their other advantage

is the ability to readily supply the simple range, which is also the most important way of the vending machines at the present time. Vending industry has been less exposed to the recession than some other industries. The impact of the recession was minimized primarily by variety of products that are sold through vending machines.

Primary data are used to characterize vending position from the perspective of consumer as well as vending operator. The data are used as input to statistical tests; results are summarized and presented in economic terms. At first, survey (about 600 respondents) is analyzed mostly in empirical way. It is informative in such sense, that vending machines are used by majority of users, more often in school or workplace. The main reasons of using vending machines are speed of shopping and no other shopping possibility. Further part is devoted to comparison of prices under different situations. For example, there are differences among various vending machine locations. Vending machine prices are not necessarily higher than prices in shops or cafeterias. Finally, operator profitability is explored based on internal company data. Among others, hot drinks vending machines are more profitable than vending machines selling bottled beverages of packaged food in general. We think that such research makes sense for newly entering companies, because vending is still a growing industry in the Czech Republic. Although it may not be evident at first sight, new perspectives still open for vending machines.

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