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MASTER DEGREE PROJECT

**The Consumption Function of
Luxury Goods**

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Qiongyan Zhang

Supervisor: Michael Olsson
Examiner: Max Zamanian

Abstract

In economics, luxury goods are goods for which demand increases relatively more than income increases. Luxury goods therefore have high income elasticity of demand. Also advertising is regarded as the foremost expenditure to influence the sales of luxury goods. Previous studies also proved that the consumption of luxury goods is influenced by stock premium and long term interest rates.

The goal of this thesis will be to formulate an economic model that exposes the relationship between consumption of luxury goods and selected factors which includes advertising, disposable income, interest rate, price index and stock premium.

By building the Multiple Linear Regressions model to formulate the consumption function and using the Ordinary Least Squares (OLS) as the method, it becomes apparent that advertising, disposable income and the previous quarter´s disposable income are the major parameters to affect luxury good consumption, of all the factors. Furthermore, the previous quarter´s disposable income has a slightly higher effect than the current one on luxury consumption. Similar studies, which focus on luxury items, have proposed models that test a single or a few variables at a time, and others that concentrate on durable goods have a wide range of variables to examine. I attempt to combine both in my model to test luxury consumption with a wide range of parameters.

Key words: consumption function, luxury goods, advertising, disposable income

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1. Introduction

It seems likely that the luxury industry will face a downturn in the coming years because of the financial crisis. The rich and ultra-rich still spend a large part of their income on leisure investments; art, cars, yachts, wine, travel and general well-being. Aït-Sahalia Y., Parker J. A. & Yogo M. (2003) described that consistent with the empirical evidence on the fast incensement of income and top wealth relative to the rest population, the growth rate of the luxury goods market has far exceeded that of aggregate consumption over the past decade, at the same time, poor people still do not have money to buy luxury goods whatever the state of the economy.

Luxury was regarded as possessions exclusively for the rich and upper-class, but due to the past few decades' changes in social wealth and demographics, luxury goods have already moved down the social ladder to include a larger customer base. But the result of down-marketing by luxury firms was a mass class of upscale consumption. The rise in upscale consumption by a larger class is clearly beneficial to luxury retailers.

The intent of the thesis is to find out how the luxury consumption expenditure react to advertising, disposable income, interest rate, price index and stock premium by building a Multiple Linear Regression model. It is apparent that luxury consumption is influenced by psychological factors, such as the Veblen effect and social effects, but those non-quantitative factors will not be my research area.

I hypothesize that the luxury consumption data from the Bvlgari Group, which is the third biggest luxury retailer in the world, can adequately represent the luxury consumption as a whole. This is because luxury goods and the luxury market per se lack an official definition and acquiring the relevant data is near impossible, it limits the validity of the conclusion. Other data will be fetched from Japan, which is the second biggest luxury market in the world. My estimate is that advertising and disposable income are the main factors to affect the luxury consumption, and that interest rate, and price index has a slight effect on increase and decrease of the luxury goods.

In this paper, I will detail the general characteristics of luxury market and look into related studies on the consumption topics in the introductory part. I will proceed with a primary review of consumption theory and luxury goods expenditure in the second part. The third part will explain the formulation of the original model and the derived data-tested model, and the forth part will explain the source of the data and analyze all the used data. Conclusion will be made out in the fifth part to explain how the luxury consumption reflects to the change of advertising, disposable income, and other factors. In the last part, abbreviated conclusion of the study result and propose of further study on this specific research area.

2. Theory of Consumption

Darby M. (2003) developed a model in his published journal which showed that consumer expenditure is primarily determined by permanent income, transitory income, the real money stock, long-term interest rate, relative price of durables and the stock of consumers' durable goods. He discovered that private-sector income is significantly better than disposable personal income for explaining consumer expenditure. He also found that the coefficient of the private-sector income is over twice of the coefficient of personal income. The abnormal return on the stock market significantly affects the consumer expenditure which is proved by its large coefficient. The coefficient of nominal interest rate is slightly positive which indicates the weaker effect on expenditure.

Lettau M. & Sydney C. L. (2003) reevaluated the wealth effect on consumption when they found out that the movements in asset values often does not seem relevant to important movements in consumer spending. They find a small fraction of the variation in household net worth is related to variation in aggregate consumer spending and conclude that conventional estimates of the wealth effect greatly overstate the response of consumption to a change in wealth. They discern that the permanent changes in wealth do affect the consumer spending, while most transitory changes in wealth are uncorrelated with consumption.

Shinsuke I. (2006) focused on the bilateral relationship between luxury goods consumption and wealth accumulation in her work Luxury and Wealth. Due to a lower time preference for luxury and a higher intertemporal elasticity of substitution, she finds current wealthy households are more likely to postpone luxury goods spending prior to necessity consumption when they feel short of future capital. Because people need to accumulate money to be able to afford luxury goods, a preference for luxuries leads to a higher steady-state value of wealth or capital.

Advertising is a means of identifying to the public the quality and value of luxury brands. Milgrom P.R. & Roberts J. (1986), in their working paper Price and Advertising

Signals of Product Quality, they attempt to explain why advertising might affect customer's choices and therefore why firms might choose to advertise. They based their research on the idea that the mere fact that a particular brand was advertised could be a signal to customers that the brand was of high quality. The important result is that if high quality brands advertise more and if advertising expenditures are observable then rational informed consumers will respond positively.

Hall R. E. (1985) investigated how consumption changes relatively to expected changes of real interest rates. He defines the expected real interest rate as the market nominal rate for an instrument of suitable term, adjusted for taxes, less the expected rate of change of the price level. Actual movements of consumption differ from planned movements and if expectations of real interest rates shift, then there should be a corresponding shift in the rate of change in consumption. Actual movements of consumption differ from planned movements and if expectations of real interest rates shift, then there should be a corresponding shift in the rate of change in consumption. He attempts to measure the intertemporal elasticity of substitution by making a regression of the rate of change of consumption on expected real interest rates. He concludes that the intertemporal elasticity of substitution is unlikely to be much above 0.1, and may very well be zero.

Aït-Sahalia Y., Parker J. A. & Yogo M. (2003) tested whether the covariance of return and marginal utility measured by luxury consumption is sufficient to justify the equity premium, and the conclusion is that the intertemporal elasticity of consumption is larger for luxury goods than aggregate consumption. This tells us that using luxury goods sales data instead of per capita consumption results in the fit and plausibility of the expected return-beta relationship relative to models that employ per capita consumption data leads a better result. Their estimates of risk aversion imply that the risk faced by wealthy households is adequate to justify the typical Return on Equity (ROE). Finally, they found that high wealth households maintain relatively stable basic consumption and choose to have luxury consumption react to market returns.

Campbell S. D. & Li C. l. (2003) explored differences in excess returns on the stock market between Democratic and Republican presidential administrations. They noticed that luxury consumption growth is considerably more sensitive to the business cycle as it more than doubled over Democratic presidencies, while both per capita consumption and luxury good consumption rise and fall with the business cycle. They concluded that large and unexpected differences in fundamentals over the presidential cycle are an important source of the large and observed differences in excess returns.

3. Method

The model represented in this thesis is based on the consumer expenditure function from Darby M. (2003), it will check if and how luxury goods, as one of the special non durable goods, are affected by advertising, disposable income, interest rate and stock premium. The model is intended to offer a broader analysis of the factors, and will examine which factors have a relatively small or no effect and which ones have strong effects.

OLS (Ordinary Least Squares) is the method used in my model. Least squares can be interpreted as a method of fitting data. The best fit in the least-squares sense is that instance of the model for which the sum of squared residuals has its least value, a residual being the difference between an observed value and the value given by the model. Least squares correspond to the maximum likelihood criterion if the experimental errors have a normal distribution and can also be derived as a method of moment's estimator.

Using the OLS method, the model is estimated by running a regression between luxury good consumption which is approximated by retailer´s luxury revenue and those parameters such as advertising, disposable income, interest rate and stock premium. The ideal model would be set like this:

$$\text{Y}_t = \beta_0 + \beta_1 X_a + \beta_2 X_d + \beta_3 X_i + \beta_4 X_p + \beta_5 X_s + \text{Rec}_t \qquad (1)$$

Y_t is the luxury sales, I use the data of the Bvlgari group.

X_a is the advertising expenditure.

X_d is disposable income of household.

X_p is the price index of nondurable goods.

X_i is the long term government bond rate.

X_s is the stock return, here I use the Nikkei Commodity Price Index data.

Rec_t is a dummy variable taking the value of one whenever there is a recession.

Before testing the model by entering all the data, one thing becomes obvious: parameters which are auto correlated should be avoided. If the data suffers this problem, the model cannot be built successfully. Therefore, the correlogram will be tested before I start building the model (see table 3).

Autoregressive distributed lag should also be considered since lag factors would probably have a significant effect on the current consumption.

By checking the single linear regression (see table 2) and it was found that advertisement has a direct influence on the model. First order lag of advertising, which is $X_a(-1)$, is not significant. Disposable income has both direct and hysteresis effect on the spending of luxury goods, so here we add $X_d(-1)$, which is first order lag of disposable income, in the model.

Similarly, by testing the data of interest rate and stock price, the P-value is quite high, which means the T-statistics is not significant. So X_i, X_p and X_s is deleted and instead of that, $X_i(-2)$, $X_p(-2)$ and $X_s(-2)$ are added into the model. When $Y_t(-2)$ is added to the model, all the statistical values, such as the F-value, the Durbin–Watson value, and the adjusted R^2 become better and more precise.

After the testing enough lag factors, the model is shown below:

$$Y_t = \beta_1 Y_t(-2) + \beta_2 X_a + \beta_3 X_d + \beta_4 X_d(-1) + \beta_5 X_i(-2) + \beta_6 X_p(-2) + \beta_7 X_s(-2) + \text{Rec}_t$$
$$(2)$$

In the new model, the constant, X_i, X_p and X_s are deleted, This is because the parameters are not significant, which has already been explained above.
And $Y_t(-1)$, $X_i(-1)$, $X_s(-1)$ are not added ,which is because all of them are not significant as well.

By testing the data in the model, some statistic values are achieved. Adjusted R^2 is 0.940379, which indicates that approximately 94.04% percent of the variation in the response variable, which is Y_t , can be explained by the explanatory variables.

The Durbin–Watson statistic is used to detect the autocorrelation in the residuals from the regression analysis, and the ideal value should be near 2 which indicate no autocorrelation. And in the presented model here, the D–W value is 1.621210, which is acceptable.

4. Data

Luxury Good Consumption

The quarterly revenue of luxury goods in Japan is from Bvlgari´s annual and quarterly reports. The quarterly extracted data encompasses 2001 to 2008. The reason I chose Japan as the research country is that Japan is the second biggest luxury good market, the market of the Japan is relatively mature, unexpected factors will be ruled out and this will make the research more reliable. And considering the Bvlgari group is the third biggest luxury retailer in the world it can adequately represent part of the luxury good sales, over a long period of the time. Because of this, it will reduce the impact of individual elements such as company management and advertisement. The data from the OLS model will correct or induce the influence from this aspect.

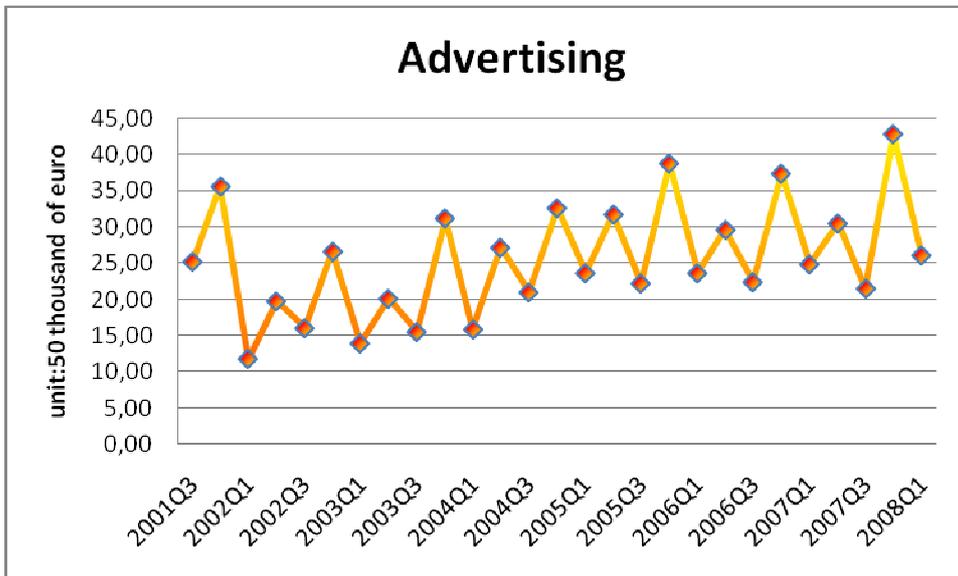**Figure 1: The Quarterly Luxury Consumption Expenditure (2001-2008)**
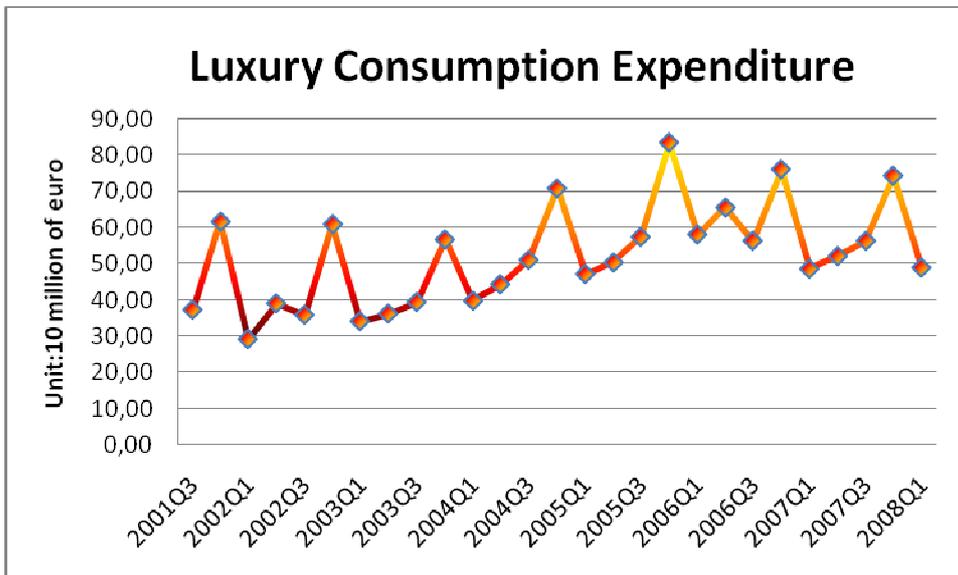
Source:Bvlgari official website http://www.bulgari.com/splash.php

Advertising

As one of the most important factors to influence the luxury expenditures, the data of advertising is vital, however the advertisement data of Japan is not represented in the annual report of the Bvlgari group, but considering the parallel properties of the whole sales and advertisement expenditure, the data can be calculated by the whole advertisement expenditure times the ratio.

**Figure 2: The Quarterly Advertising Expenditure (2001-2008)**

Disposable Income

The data of disposable income is from the Statistics Bureau of Japan, as well as the Cabinet Office which is the financial department of the Government of Japan. This will be used to devise a time series, in order to accurately construct an overview of Japanese luxury consumption. Using this, it will be possible to discern whether or not disposable income will influence luxury expense. The unit is billion of yen and the exchange rate from euro to yen is around 134.66 as of writing.

Figure 3: The Quarterly Disposable Income of Japan (2001-2008)
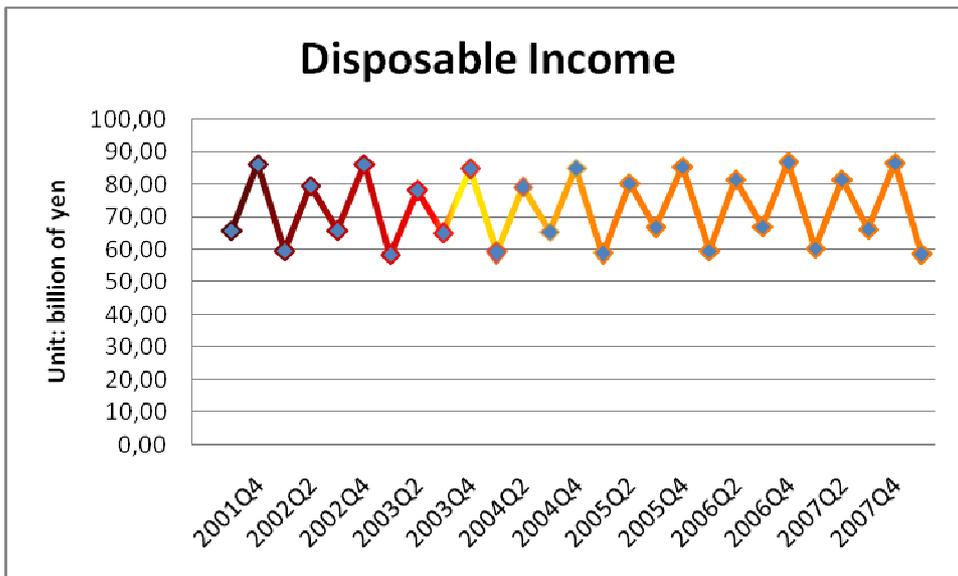
Interest Rate

From Government Bond Listed Yield on Tokyo Stock Exchange the data of long-term interest rates were gathered. The data describes a time period of ten years, and was acquired from the bank of Japan. It is necessary to take this data into consideration if one is to describe the current value of the currency, and therefore the value of actual wealth.

Figure 4: The Quarterly Interest Rate of Japan (2001-2008)
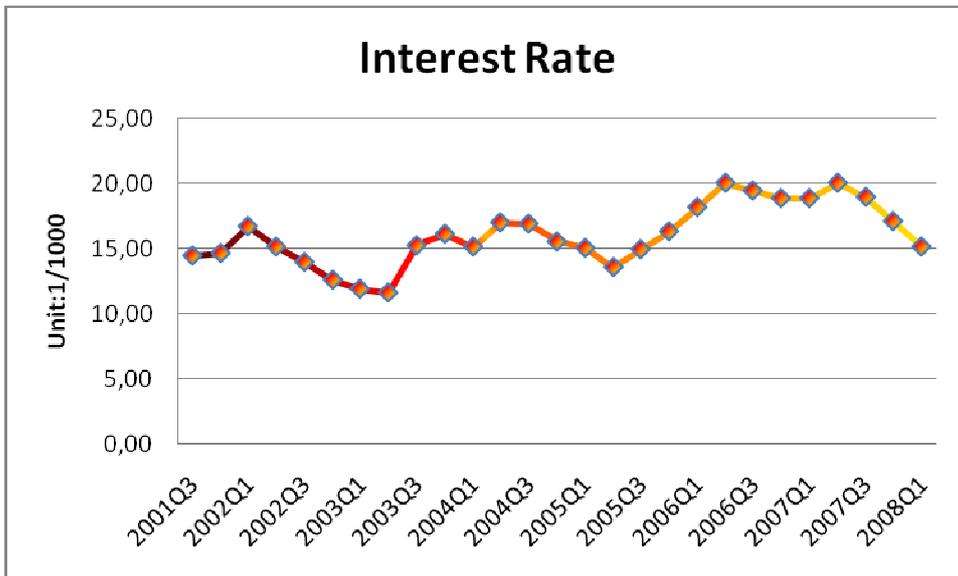
Source: From Government Bond Listed Yield from Bank of Japan http://www.boj.or.jp/en/

Price Index

The Statistic bureau of Japan provides the value for personal nondurable goods expenditure dating back to 2001, a time series will be constructed using the quarterly price value of expenditures on nondurable goods. This will account for changes in prices for nondurable goods relative to the prices of all goods.

Figure 5: The Quarterly Price Index of Japan (2001-2008)
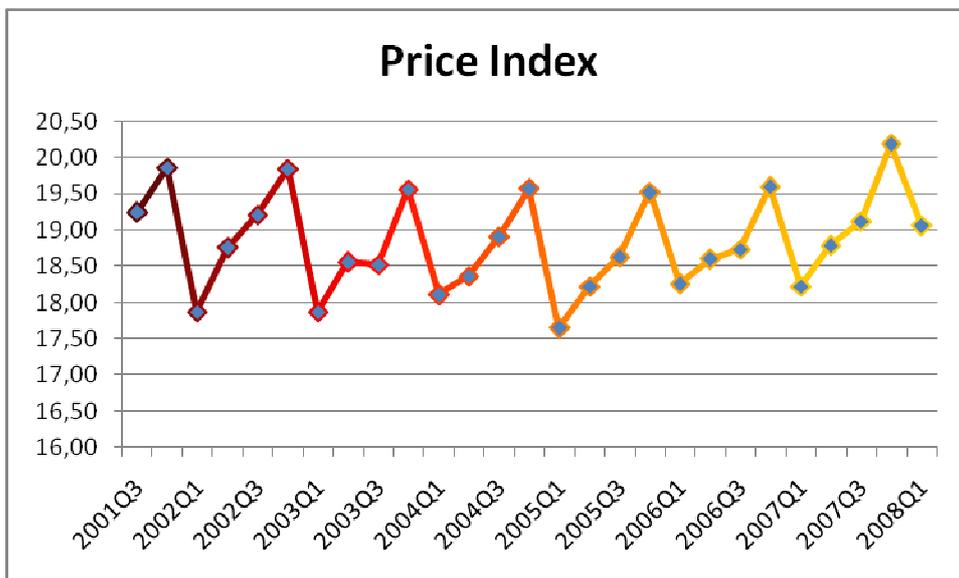
Source: price index of nondurable goods from The Statistics Bureau of Japan http://www.stat.go.jp/english/index.htm

Stock Return

Here the Nikkei-TOCOM (Tokyo Commodity Exchange) Commodity Index data is used to represent the data of excess return on the stock market, which can be accessed at the Tokyo Commodity Exchange. The Nikkei-TOCOM Commodity Index is based on the price of all the listed commodities at TOCOM for each market division, such as precious metals, aluminum, oil and rubber, and therefore gives an overall indication of the price levels on the Japanese stock market as a whole.

Figure 6: The Quarterly Excess Return on stock Market of Japan (2001-2008)
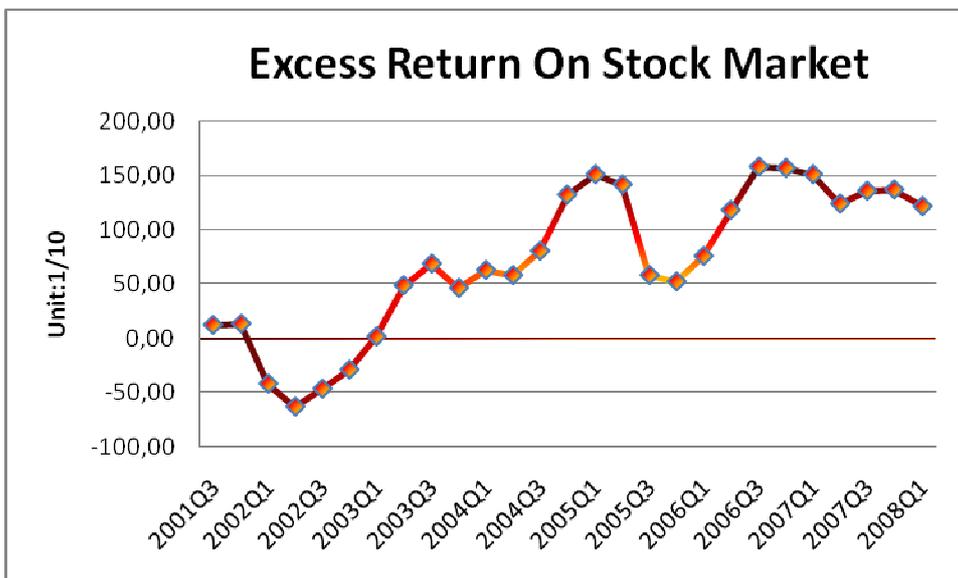
Source: Nikkei-TOCOM Commodity Index (Change From Previous Year) data from Tokyo Commodity Exchange http://www.tocom.or.jp/index.html.

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5. Results

According to the new formula, the result is as given the by the table below.

Table 1: Linear Regression Result of Luxury Consumption Function

	Coefficient	Std. Error	t-Statistic	Prob.
Yt(-2)	0.580224	0.104444	5.555348	0.0000
Xa	118.2425	21.55435	5.485786	0.0000
Xd	114.8894	17.84734	6.437339	0.0000
Xd(-1)	125.5353	14.09282	8.907743	0.0000
Xi(-2)	-82.75174	40.07749	-2.064793	0.0537
Xp(-2)	-882.0683	111.7557	-7.892823	0.0000
Xs(-2)	-4.045980	1.794652	-2.254465	0.0369

Luxury Good Consumption (Y_t)

Obviously, the consumption of luxury goods is slightly influenced by its own second-order lag factor $Y_t(-2)$. The reason might be the inertia of the consumption trend, and consumer groups´ psychological effect on themselves. Therefore this result proves that the higher previous half annual sales would translate into a higher expense of luxury goods.

Advertising (X_a)

The coefficient of advertising is 118.2425, which shows a strong impact on luxury expenditure. Unlike disposable income; this factor has no lag, which means that the current expenditure on advertising has a direct influence on sales of luxury goods. And by checking the first-order lag of advertisement, the parameter has no significant influence on luxury consumption. We can reach the apparent conclusion, which is that advertising has a direct and strong effect on the luxury goods consumption in the same period.

Disposable Income (X_d)

Not only will the current disposable income affect the consumption of luxury goods, but also the previous quarter´s disposable income. The coefficients are respectively 114.8894 and 125.5353. It is notable to see that the previous quarter´s disposable income has a higher influence on the current expenditure. And compared to all the other factors, disposable income has the highest influence on luxury consumption, which indicates that the consumption of luxury goods primarily depends on people´s wealth.

Interest Rate (X_i)

The interest rate coefficient is not significant and therefore is removed from the model, the second-order lag factor of Interest Rate, which is $X_i(-2)$ is added into the model, and the p-value is 0.0537, which means we cannot make the conclusion that there is a relation between interest rate and luxury consumption. This can be explained by the land where the data covers. During those researched years, Japan had a very low interest rate. People cannot benefit or profit from a low interest rate policy. Due to this, the interest rate has no influence on luxury consumption in the presented model.

Price Index (X_p)

The Second-order lag factor of price index, instead of current price index, has a significantly negative effect on luxury consumption. Although the relationship between price index and luxury consumption makes sense according to the time series model, the relative effect is over-estimated. The price index of nondurable goods includes many non-luxury items; and this affects the index of luxury consumption, thus is less than ideal.

Stock Return (X_s)

According to the result, the coefficient of second-order lag parameter of the stock return is -4.045980, which suggests that the previous half annual excess return on the stock market has a slightly negative impact on the current consumption of luxury goods. In other words, for wealthy households, the consumption of luxury goods responds to wealth stock due partially to stock return, and this confirms that a decrease in income on the stock market would translate into a lower consumption of luxury goods.

6. Conclusion and Further Study

The purpose of this study is to investigate how luxury consumption react to advertising, disposable income, interest rate, price index, and stock return. The consumption function is therefore built by using the Multiple Linear Regression model and the OLS method.

The conclusion is obvious: (1) among all those factors, advertising and disposable income are the major influencing parameters of luxury consumption. (2) The previous quarter´s disposable income has a slightly higher effect than the current one on luxury consumption.

Similar studies, which focus on luxury items, have proposed models that test a single or a few variables at a time, or some studies that concentrate on durable goods have a wide range of variables to examine. I attempt to combine both in my model to test luxury consumption with a wide range of parameters.

Considering the data from the Bvlgari group is used as a representative for the entire luxury markets it is less than ideal. In theory, over a long period it will be possible to discern how the market is reacting judging from a single company´s result. The equation of linear regression adequately expresses the relation between luxury consumption and other factors, such as advertising and disposable income. However if one were to use more data, such as data spanning longer periods of time, the model would have higher accuracy.

The trends in luxury good consumption are worth exploring as they may have several outcomes on the economy and implications for the future. There are some interesting topics for future studies; such as how the luxury consumption reacts to interest rate is controversial, since there have been different studies with varied results. To compare luxury expenditure between the developed and developing countries by historical data is worth researching.

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Bvlgari Group

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Appendices

Appendix 1

Table 2 Linear Regression

	Coefficient	Std. Error	t-Statistic	Prob.	Adjusted R^2	D-W stat
Xa	2.010021	0.061129	32.88151	0.0000	0.634309	2.159478

Dependent Variable: Luxury Good Sales

Single variable: Advertising

	Coefficient	Std. Error	t-Statistic	Prob.	Adjusted R^2	D-W stat
Xd	0.723618	0.028674	25.23583	0.0000	0.389164	0.389164

Dependent Variable: Luxury Good Sales

Single variable: Disposable Income

	Coefficient	Std. Error	t-Statistic	Prob.	Adjusted R^2	D-W stat
Xi	3.234440	0.152914	21.15200	0.0000	0.144730	2.131417

Dependent Variable: Luxury Good Sales

Single variable: Interest rate

	Coefficient	Std. Error	t-Statistic	Prob.	Adjusted R^2	D-W stat
Xp	278.8361	13.11286	21.26432	0.0000	0.153252	1.447323

Dependent Variable: Luxury Good Sales

Single variable: Price Index

	Coefficient	Std. Error	t-Statistic	Prob.	Adjusted R^2	D-W stat
Xs	0.436083	0.066346	6.572903	0.0000	-4.850763	0.422511

Dependent Variable: Luxury Good Sales

Single variable: Stock return

Appendix 2

Table 3 Correlogram of All the Parameters

	AC	PAC	AC	PAC	Q-Stat	Prob
			0,147	0,147	0,6503	0,42
			0,285	0,269	3,1944	0,202
			0,098	0,031	3,5101	0,319
			0,703	0,676	20,313	0
			0,003	-0,303	20,313	0,001
Yt			0,084	-0,276	20,578	0,002
			-0,037	-0,029	20,631	0,004
			0,389	-0,071	26,862	0,001
			-0,208	-0,201	28,744	0,001
			-0,191	-0,247	30,418	0,001
			-0,255	-0,182	33,604	0
			0,141	0,069	34,645	0,001
			AC	**PAC**	**Q-Stat**	**Prob**
			-0,214	-0,214	1,3796	0,24
			0,508	0,484	9,4582	0,009
			-0,229	-0,095	11,176	0,011
			0,66	0,532	26,025	0
			-0,257	-0,1	28,367	0
Xa			0,328	-0,202	32,381	0
			-0,366	-0,25	37,625	0
			0,45	0,083	45,988	0
			-0,339	-0,03	51	0
			0,17	-0,145	52,335	0
			-0,367	0,049	58,94	0
			0,223	-0,142	61,544	0

Xd	AC	PAC	Q-Stat	Prob
	-0,869	-0,869	22,747	0
	0,739	-0,065	39,873	0
	-0,783	-0,636	59,866	0
	0,844	0,123	84,12	0
	-0,74	0,35	103,63	0
	0,615	-0,063	117,75	0
	-0,65	-0,208	134,26	0
	0,695	-0,127	154,17	0
	-0,61	-0,002	170,34	0
	0,499	-0,053	181,8	0
	-0,522	-0,07	195,11	0
	0,558	-0,101	211,35	0

Xi	AC	PAC	Q-Stat	Prob
	0,802	0,802	19,389	0
	0,534	-0,309	28,316	0
	0,333	0,063	31,937	0
	0,171	-0,111	32,931	0
	0,081	0,089	33,165	0
	0,042	-0,019	33,231	0
	0,007	-0,039	33,233	0
	0,011	0,087	33,238	0
	0,059	0,082	33,391	0
	0,063	-0,116	33,575	0
	-0,023	-0,202	33,602	0
	-0,158	-0,147	34,91	0

Xs	AC	PAC	Q-Stat	Prob
	0,875	0,875	23,053	0
	0,674	-0,391	37,276	0
	0,472	-0,03	44,553	0
	0,347	0,213	48,645	0
	0,293	0,061	51,707	0
	0,243	-0,198	53,917	0
	0,159	-0,134	54,906	0
	0,034	-0,089	54,953	0
	-0,055	0,183	55,083	0
	-0,109	-0,121	55,628	0
	-0,117	-0,019	56,3	0
	-0,13	-0,105	57,186	0