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Makiko Omura, Yuka Sakurai and Kensuke Ebihara

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An Analysis of Wine Consumption Trends and Food-Related Expenditures in Japan

Makiko Omura[1], Yuka Sakurai,[2] Kensuke Ebihara[3]

Abstract

This paper attempts to understand the mechanism of an upward trend in wine consumption in Japan by analysing its trend and possible correlations with food-related consumptions. Through the panel and time-series analyses of wine consumption and food-item expenditures, and of wine consumption and food-service industry sales, we investigate whether wine consumption is correlated with food westernisation in Japan and whether wine is gaining its steady place in daily life of Japanese. Although not robust, we find supportive evidences for both, particularly for the second one. While on-premise consumption, in particular at reasonably priced diners, is estimated to be an important factor for growing wine consumption in Japan, there are possible evidences that home consumption of wine is increasing. It is also suggested that reasonably price wine, especially that of imported wine, are likely to be the key for future wine consumption in Japan.

***Key Words:* wine, food expenditure, westernisation, food service industry, time-series/ panel analysis, Japan**

***JEL Classification:* L89, Q11,**

Introduction

Kōshu was registered as the first Japanese variety by the International Organisation of Vine and Wine (OIV) in 2010. The second variety Muscat Bailey A was then registered in 2013. The growth and maturing of Japanese wine production is not unrelated to the growth of wine consumption, which has seen a steady growth for several decades. Although wine consumption per capita still remains much lower in Japan compared to that of western counterparts, Japan is considered as a strategically important market for wine producers and

[1] Associate Professor, Faculty of Economics, Meiji Gakuin University, e-mail: makiko@eco.meijigakuin.ac.jp

[2] Affiliated Lecturer, Faculty of Economics, Meiji Gakuin University, e-mail: ysakurai@eco.meijigakuin.ac.jp

[3] Professor, Faculty of Law, Meiji Gakuin University, e-mail: ebi@law.meijigakuin.ac.jp

exporters, as it has demonstrated a steady growth in wine consumption in both total volume and value terms in recent decades. Statistics from the OIV indicate that Japan was the 15th world largest wine consumer in terms of volume in 2012, with 28% volume increase between 2000 and 2012 (OIV, 2013). According to the Deutsche Industrie und Handelskammer in Japan (German Chamber of Commerce and Industry in Japan (GCCIJ), 2011), the Japanese market size for wine accounted for JP¥171.1 billion (approximately Eur€1.31 billion). They state that the Japanese market is still regarded to be one of the most important and profitable import wine markets in the world.[4] Also, according to the United States Department of Agriculture (USDA) Foreign Agricultural Service Report in 2012, total imports of 2L or less bottled wine in 2012 increased by 25.5% to 1.81 million hectolitres (HL) compared to 2011, and its corresponding total value increased by 18.3% to US$1,037.5 million.[5]

Understanding the mechanism of this upward trend in wine consumption is considered crucial for predicting future market trends in Japan. Since wine is generally taken with food, it seems to be a reasonable starting point to analyse the wine trend and its correlations with food-related consumptions. Japan has a rich food culture and has evolved its cuisine in many directions – Japan is known to be one of the most gastronomic countries, Tokyo being the gourmet capital of the world, being awarded the largest total number of stars by the well-known Michelin Guide (Reynolds, 2007). We must note that, despite a generally accepted notion that wine is usually taken with food, there does not seem to be a study directly looking into the relationship between wine consumption and food consumption.[6] Thus, this paper explores whether the expansion of wine market is related to the evolution of food culture in Japan, in an attempted to derive a hypothesis concerning their linkages.

In terms of the paper structure, we first briefly review the background for wine consumption in Japan, in particular consumption trends for domestic, imported and total wine from 1970 to 2009. In this section, the evolution of food characterised by

[4] A report presented in the corresponding website (accessed 5 October 2013): http://www.japan.ahk.de/en/publications/surveys-of-the-gccij/the-japanese-market-for-wine/

[5] The report applies an exchange rate of JP¥79/US$1.00 throughout.

[6] There are of course numerous studies that ‘mention’ the linkages. For instance, Ritchie (2008), in her analysis of wine purchasing culture in the UK based on a consumer focus group interview (n=49), note that there is a general agreement amongst the consumers regarding a synergy between food and wine

diversification and westernisation is also examined. Then in order to analyse the linkages between wine and food consumption, we review the household food-related expenditure patterns since 1970, and consider stationarity of the data. We then analyse possible correlations and impacts of food-related expenditures on wine consumption applying several panel and time-series estimation models. In doing so, we carefully examine the data characteristics, notably of stationarity, autocorrelation, and heteroskedasticity. In addition to household food expenditures, we utilise data on food service industry (FSI) sales to explore the inter-linkages between growth of wine consumption and that of different food service sectors. A concluding remark is given at the end, also commenting on the induced hypotheses regarding wine and food consumptions, and their credibility based on the estimated results.

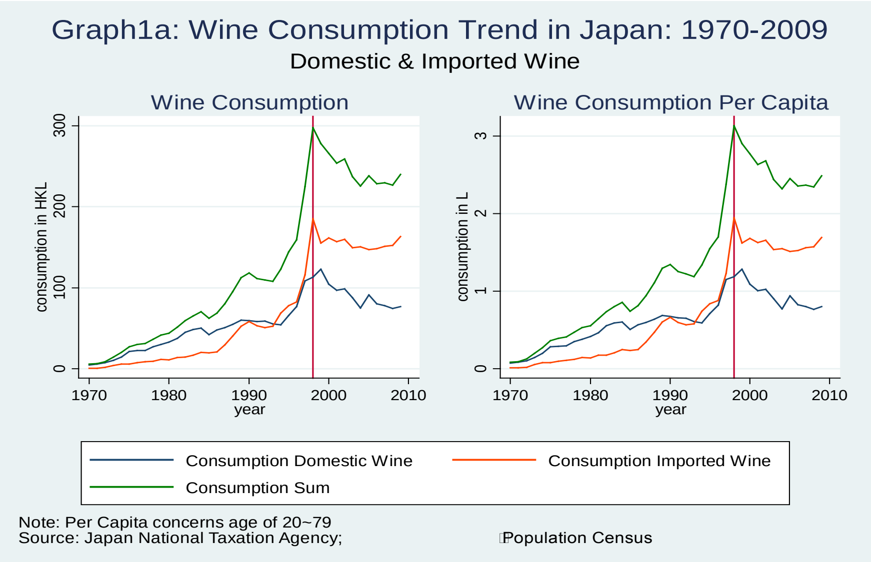
Wine Consumption and Food Westernisation in Japan

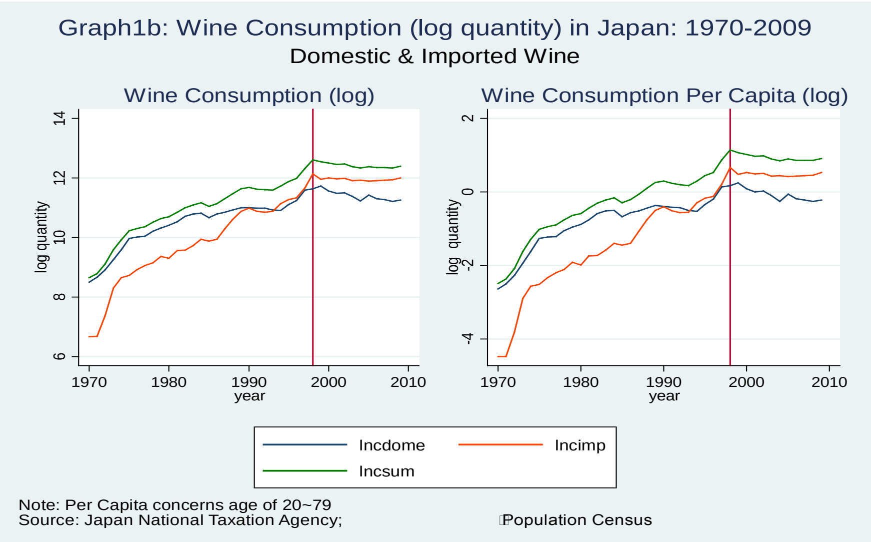
Wine Consumption Trends

Wine consumption in Japan has a general upward trend for the period between 1970 and 2010, although trend differences are seen between domestic and imported wine. Note that ‘domestic’ wine in Japan does not necessarily mean that wine is made from domestically produced grapes. According to the estimates from Suntory, one of the largest alcoholic beverage companies in Japan, the production of ‘true’ domestic wine or so called Japanese/Nippon wine accounted for only 8,460 kilolitre (KL) in 2012 (Sekiguchi, 2013).[7] The trends of total wine consumption and wine consumption per capita, for those of drinking age of 20 years and up, are very similar. While domestic wine consumption shows more steady increase, imported wine consumption exhibits a sharper increase, with a peak point in 1998, caused by the red wine polyphenol boom in Japan. During this period, a large quantity of wine was imported to Japan. Domestic wine has its peak in 1997, preceding that of imported one. Looking at Graph1a, we can see a rough trend in wine consumption exhibiting an exponential or increasing quadratic trend where its first and second

[7] This means that 91% of domestic wine is produced from imported grapes, and normally by mixing imported grape juice concentrate with water, often adding sugar to it for fermentation. “Wine” made as such is not necessarily recognised as “wine” in Europe, however, it is treated as wine in this paper as it is produced and consumed as wine in Japan.

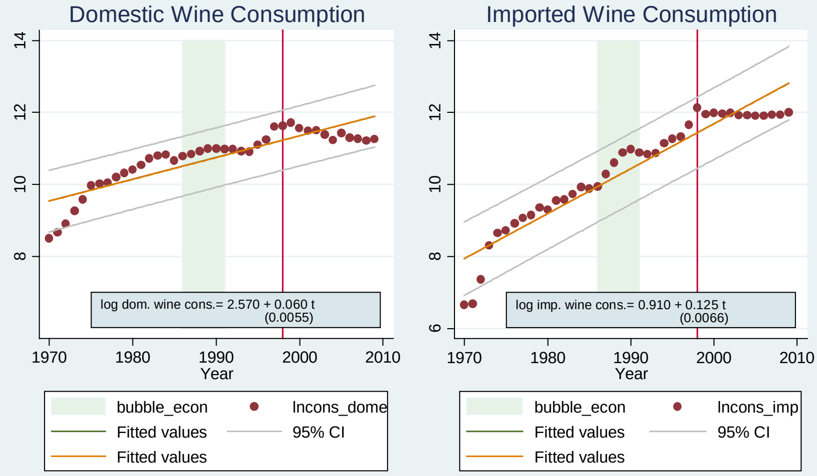
derivatives are increasing in time, while that of after 1998 the trend is reversed with both derivatives decreasing. Plotting natural logarithm of these wine consumption trends in and Graph1b, we still see increasing trends, although the peaks are more or less smoothed out. [Graph1a & Graph1b]





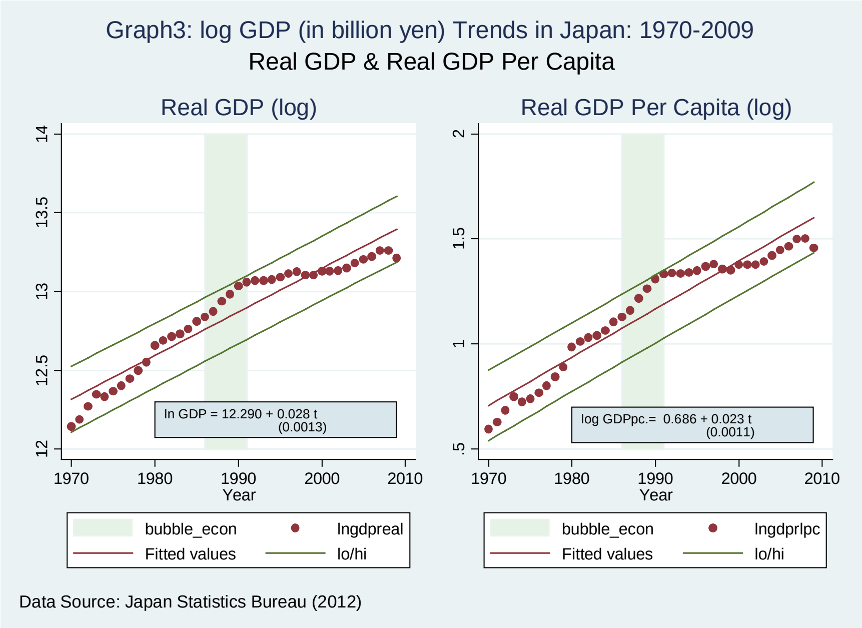
Plotting a regression coefficient of wine consumption on year, the growth trends of wine consumption are different for domestic and imported wine (Graph2). Both have high and increasing growth rates especially over the 1970s, with their growth rates becoming fairly stable with some bumps, especially for domestic wine. After 1988, the consumption growth of domestic wine has decreased, while that of imported wine remained stable. The regression coefficient of *year*, which is significant at the 1% level for both cases, is the estimated annual percentage growth rate of wine consumption, which is 6% and 12.5% for domestic and imported wine, respectively (Graph2 box).[8] The growth rates of country's real GDP and real GDP per capita during the same period are 2.8% and 2.3%, respectively (Graph3 box). The bumps in the late 1980s to early 1990s coincide with the period of Bubble Economy, highlighted in blue shade in Graph2 and Graph3 (highlights are for 1986-1991). These observations suggest that wine consumption is likely to have been accelerated by the economic growth. Nonetheless, it is probable that other factors were also inducing higher growth rate of wine consumption. Although the economic growth has been stagnant after the Bubble's burst around 1993, wine consumption growth does not seem to be much affected, at least in terms of quantity. The continuation of growth may be helped by the polyphenol boom around the mid- to late-1990s, as cited above, where red wine was widely publicised to promote health (Mercian, 2011). The evolution/diversification of food culture is also suspected as a factor encouraging such trend.

Graph2: Log Wine Consumption (in KL) Trends in Japan: 1970-2009
Domestic & Imported Wine



Data Source: Mercian Corp (2011), with original data form the Japan National Tax Agency

8 It should be noted that wine consumption data is only available in terms of quantity but not in values.



Evolution of Food

During the period of rapid economic growth especially for the period of 1954-1973 and the following decades, Japanese food culture has been on its continuous diversification path, leaning towards western food. A typical phenomenon is launching of the first McDonald branch in Ginza, Tokyo in 1971, but probably a more important fact is the adoption of bread as the main staple food for school meals in Japan in the early 1950s. Wheat was imported from the United States, where they had it for surplus, and was provided for school meals at a heavily subsidised price (Ichimi-Abumiya, unspecified year; Noguchi, 2000). At the same time, milk was also adopted for schools meals, a drink that was considered to be crucial for improving the nutritional status of Japanese children but not to go well with rice.[9] Children's food habit in turn influenced meals provided at home, and mothers were watching cooking programmes and participating in cooking classes mainly catering western food. According to Noguchi (2000), school meal policy is thus considered to be one of the largest factors of food westernisation in Japan.

Harada (2010: 234-241) offers another account on food evolution for these periods. He states that the rapid economic growth of the 1960s and 1970s fundamentally changed the

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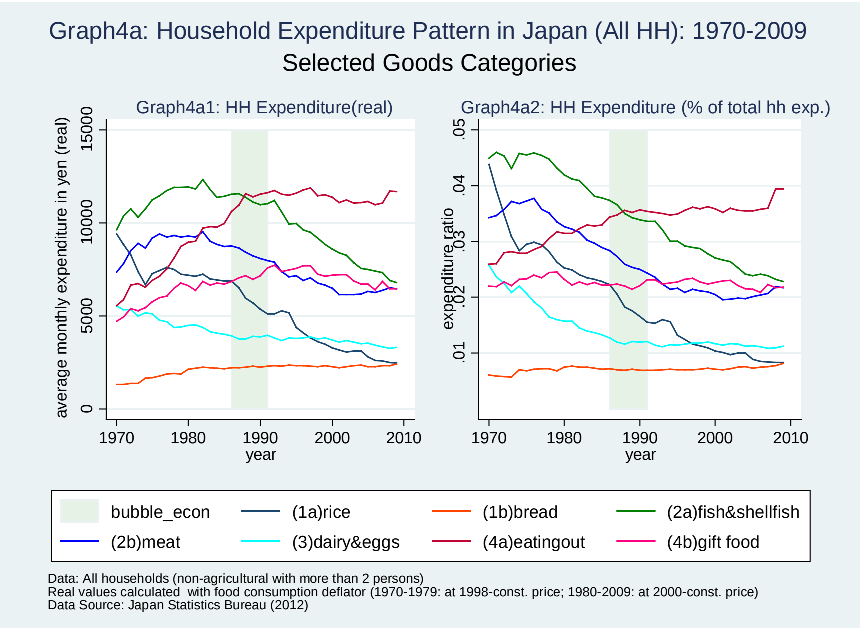
[9] These provisions originated from the UNICEF's donations of powdered milk during 1949–1950 and the US's donations of wheat flour during 1950–1951 (National Institute for Educational Policy Research, NIER).

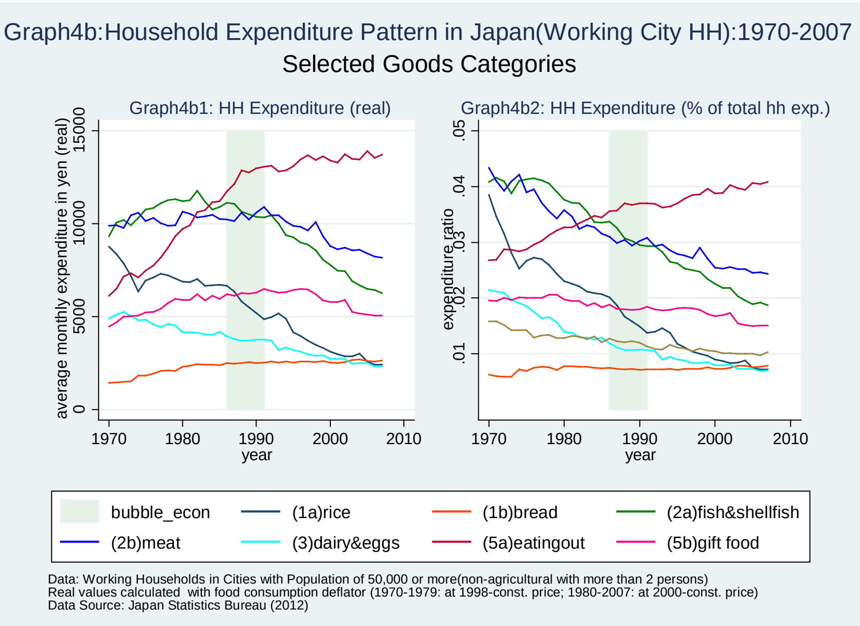
cooking facilities in households, which allowed fried and deep-fried items to be easily cooked. This in turn reduced the weight of traditional Japanese meals and increased that of western style and Chinese style meals taken at households, and shifted a typical diet consisting of rice, seafood and vegetable to that of meat, dairy and eggs. Other notable evolutions were the introductions of instant-food in the late 1950s, of fast-food and diner-chains in the 1970s, and of takeout-food in the 1980s, which were all rapidly incorporated into the daily life of Japanese consumers. The spread of takeout-food was closely linked to the diffusion of microwave and increasing women's participation in the workforce.

Whatever the drivers of food westernisation and diversification in Japan, the household expenditure data on basic food items since 1970 seem to support these evolutionary accounts. We have seven items, rice, bread, meat, fish & shellfish (*fish*), dairy & eggs (*dairy*), eating-out, and food-related gifts (*gift-food*) for two types of data, one for all households of at least two persons in Japan (hh^{all}) during 1970-2009, and the other for working households of at least two persons, living in cities of population of at least 50,000 (hh^{wc}) during 1970-2007. Graph4a with hh^{all} and Graph4b with hh^{wc} each exhibits two panels: the left one is average monthly expenditure at current value and the right one is the ratio of average monthly food expenditure to the total household expenditures. We see that *rice* consumption is decreasing largely throughout the period, both in real and in ratio terms. *Fish* is also on its decreasing trend for two decades, and for more than three decades in terms of ratio. *Meat* consumption level is constantly lower than that of *fish* for hh^{all} in Graph4a, yet it is not the case for hh^{wc} in Grah4b. Indeed, *meat* consumption is significantly higher for working households in cities with an average monthly expenditure of JP¥ 9,845 compared to that of JP¥7,883 for all households. Nonetheless, the general trends for *meat* are more or less similar to those of *fish*, and are decreasing especially after 1980/1990. Perhaps this can be explained by the increasing expenditure on *eating-out*, or perhaps people are spending more on readymade/take-out food. We see a notable trend of increasing *eating-out*, with an average annual growth of 3.7%. Whilst food-related gift (*gift-food*) shows a decreasing trend after the Bubble, household *eating-out* trend remains stable.[10]

[10] Unlike western countries, it is less common to host a dinner inviting guests at home in Japan, due to

Although not so obvious from the graphs, *bread* consumption is increasing at an annual growth rate of 3.2% and 3.4% on average during this period for hh^{all} and hh^{wc}, respectively. Together with the decreasing trend of *rice*, this may suggest increasing westernisation of food at the household level, which we shall consider more in detail in the later section.





generally limited sizes of houses. Instead, people have a habit of sending seasonal gifts of mostly around JP¥3,000~10,000 to business and social relations twice a year. These gifts are often food-related luxurious gifts, for which wine can be a good candidate. According to a survey research by a survey firm Oricon (2010) on seasonal gifts, with 1400 male/female samples, the average expenditure per gift was ¥4,947 and the average gift number was 3.5.

Linkages between Wine Consumption and Household Food Expenditure

As we have seen in the previous section, the evolution of food in Japan has taken a path toward diversification and westernisation. In present Japan, we can find varieties of cuisines, including adapted or Japanised variations of foreign cuisines, not only in cities but also in rural areas, and even in school meals. We thus investigate whether the changing diet has had any impact on wine consumption in Japan, and the magnitude of impacts of the polyphenol boom which seems to be significant. As we do not have an economic theory to deal with our research questions, we take an inductive approach and explore the possible linkages between wine and food consumption in Japan by analysing the data. Firstly we look at the data characteristics, in particular, the issue of stationarity which need to be considered for the time-series econometric analysis. Then we present estimation models and estimation results.

Stationarity Issues

Like many time series analysis, we attempt to examine the questions by inquiring what the data can tell us. From technical stand point dealing with time series, we need to consider the issue of stationarity and to apply relevant techniques accordingly, in order to avoid the problem of spurious correlations.[11] Graph5 shows consumption of wine and food items, one in real term and one in logarithm. Especially in real term, we see a sharp peak of wine consumption in 1998.[12] Consumptions patterns exhibit certain time trends, suggesting non-stationarity. We have to see whether they are trend stationary process or a unit root process. Graphical examinations and formal statistical tests, the augmented Dickey-Fuller test (ADF) (1979) and Phillips-Perron test (PP) (1988) with different specifications, suggest

[11] As we are using annual data, seasonality is not an issue, however trends seem non-stationary as shown in Graph5. As a rough guideline, the estimated autocorrelation factors are: ρ_{wine} = 0.935~0.988, for *wine*, ρ_{food} = 0.853~1.044 for food items, where the case for ρ_{food}.> 1 is confined to *fish*. According to Wooldridge (2013:385) most economics consider differencing warranted if sample correlation coefficient $|\rho|>0.9$, and some when $|\rho|>0.8$.

[12] Note that a sharp peak in wine consumption, shown in quantity data which is the only available form, is likely be slightly mitigated if it is put in a value term as in other food items, because average purchased price for wine is decreasing trend especially since 1993, corresponding to the burst of the *Bubble Economy*. The consumer price index (CPI) for wine, which is available only since 1980 for domestic wine and 1990 for imported win, has an average negative growth rate of *-0.0083* and *-0.0065* for domestic and imported wine, respectively. On the other hand, CPI for food in general has a positive growth rate of *0.0215*.

a possible presence of unit root for domestic, imported, and total wine consumption, although they turn stationary after first-differencing or taking a logarithm. Also, if we divide it in two periods before and after the polyphenol boom, no unit root is suggested after the boom.

For food items, we have incoherent or mixed results examined through ADF and PP tests with different specifications, with/without drift/trend, allowing for different number of lags, etc.[13] A presence of unit root is suggested for *rice*, *meat*, *fish*, *dairy* in both hh^{all} and hh^{wc} data sets, and *gift-food* in the latter when no trend is assumed.[14] On the other hand, unit root (without trend) is rejected at the 5% significance level for *bread*, *eating-out* in both data sets, and *gift-food* in hh^{all}. Also, unit root with trend is rejected at the 1% significance level for *meat* and *dairy* in both data sets, suggesting a trend stationary process. For differenced data, all reject unit root at the 1% significance level. Taking logarithms of variables, *wine*, *bread*, *eating*-out in both hh^{all} and hh^{wc} and *gift-food* in hh^{all} reject unit root at the 5% significance level in the ADF test without trend.

For detrended data, *rice*, *bread*, *meat*, *fish*, *dairy*, *total* and *imported wine* reject unit root at the level or either 1% or 5%, while *domestic wine*, *eating-out*, *gift-food* is rejected at the 10% level. Assuming no drift, unit root is rejected for *rice* in both data sets and *dairy* in hh^{all}. Looking at Graph5, it seems difficult to find cointegrated relationships between wine and food-related items, and indeed no cointegration is suggested between wine consumption and food item consumption, examined by the augmented Engle-Granger test (1987) for cointegration.

With all the examinations, we may say that *wine* consumptions in real terms are likely to have unit root processes, yet it is rather indecisive for the food items. Unfortunately, we cannot be definite whether any of the process is unit root or trend stationary, nor can we distinguish a unit root from a root that is very close to a unit with finite samples (Davidson

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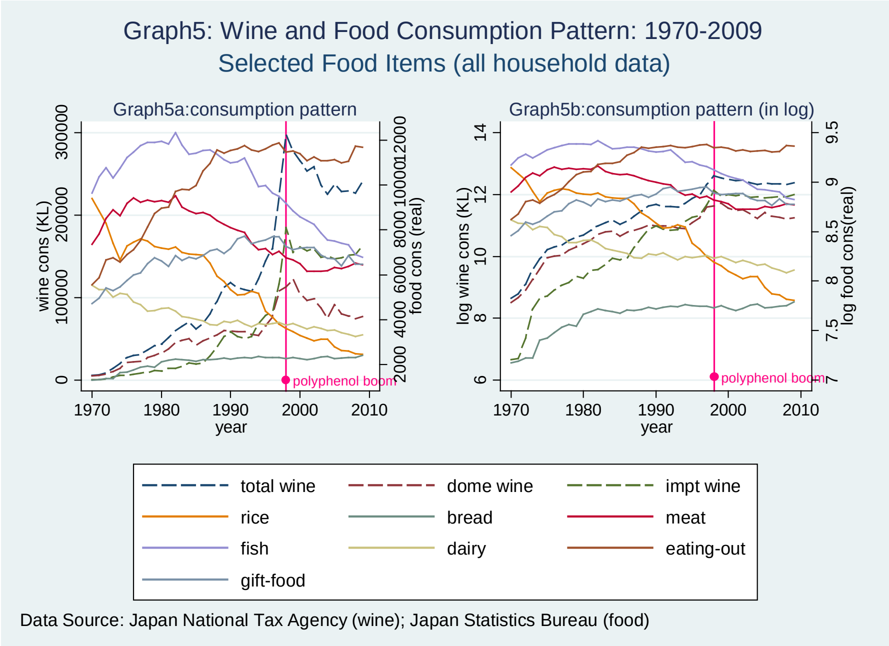
[13] The ADF test is modified to allow for serial correlation, while PP test use heteroskedasticity autoregressive conditional (HAC) estimator. We also applied modified augmented Dickey-Fuller test (ADFGLS) proposed by Elliott, Rothenberg and Stock (1996), applying a generalised least squares (GLS) transformation prior to the Dickey-Fuller regression. While the results of ADF and PP are quite similar, with DFGLS, none of the variables could reject the null hypothesis of unit root with one-lag specification, while rejecting at some higher lags. We shall rely mostly on ADF test results which perform better in finite samples than PP test (Davidson and Mackinon, 2009: 623).

[14] They are estimated with/without serially correlated error term, a drift/trend term.

and Mackinon, 1993: 705-715). We thus explore several different dynamic models, taking possible unit roots into account.



Estimation Models

Since wine is often taken with food, we may expect to see impacts of different types of food on wine consumption.[15] As discussed in the section on food evolution, we use the basic food items. Obviously, we cannot determine whether westernisation of food leads to increasing wine consumption, as wine can also be drunken with non-western food. Such tendency seems to be increasingly so, that nowadays, even *sushi* restaurants generally carry wine. Also, same food items can be used in various cuisines, so we cannot conclude westernisation of food itself just from our data. Nonetheless, it would be worthwhile to examine possible correlations between wine consumption and general food consumption trends for four decades. Additionally, we conduct estimations dividing the period into two, before/after the Bubble's burst in 1993, in order to investigate whether the Japanese consumers have become increasingly accustomed to wine consumption during the period of growing economy which particularly saw the diversification of food culture.

There are some additional considerations. For instance, food-related expenditure may be

[15] More precisely, it is the correlation between certain kinds of food consumption trends and that of wine which we estimate, since causality is not really possible to examine.

regarded as endogenous to wine consumption. Yet with current level of annual consumption of about 2L per capita, it would be unlikely to see any significant impact of wine on regular expenditures on certain food items. Food items are thus treated as exogenous to wine consumption. As we may expect food-westernisation to have preceded that of wine consumption, the presence of Granger causality from certain food items to wine would warrant investigation. However, our exploration on this approach produced only highly inconclusive results, so we shall not discuss this issue here.

We conduct estimation based on (1) panel of domestic and imported wine and (2) time-series for each of total, domestic and imported wine. Available data on wine consumption and household expenditures are all in aggregate forms. All estimation models apply a dummy variable for the red wine polyphenol boom, which is year 1997 and 1998 for panel, and for time-series, year 1998 for total and imported wine, and year 1997 for domestic wine. Note that wine consumption data is available only in terms of quantity in KL for the whole country, and not available in values. In order to get a sense of wine consumption trends in Japan, we estimate possible impact of average monthly household food-expenditure per capita on the annual wine consumption per capita in mililitre (ML). Each estimation model considered below is written in time-series specification, without *i* subscript for panel specification. Note that we do not have a vector of food expenditures or their ratios as a regressor due to high multicollinearity.

Given that all variables seem to achieve stationarity after first-differencing, we fist explore a first differenced (FD) estimation - regressing the FD wine consumption on the FD food-related expenditures. A dummy *y1997/1998* to capture the polyphenol boom is included since we see its pronounced impact even for FD-*wine*. Thus,

$$\Delta wine_{(t)} = \beta \Delta food_{(t)} + y1997/98 + u_{(t)}, \quad u_{(t)} \sim \mathrm{IID}(0,\sigma^2) \qquad \text{(FD model) (1)}$$

where $\Delta wine_{(t)} = wine_{(t)} - wine_{(t-1)}$ and $food_{(t)} = food_t - food_{(t-1)}$, and

$$wine_{(t)} = \rho wine_{(t-1)} + \epsilon_{(t)}, \quad food_{(t)} = \rho food_{(t-1)} + \epsilon_{(t)} \quad \epsilon_{(t)} \sim \mathrm{IID}(0,\sigma^2), \quad \rho=1 \text{ is assumed.}$$

Note that a FD estimation has a risk of misspecification, in particular for those food items that are not suggested as having unit root or a process integrated of order one, I(1). If a series is trend stationary rather than unit root, then FD will create a serially correlated trend in terms of moving average MA(1) process in the error term, in which case the estimated results with ordinary least squares (OLS) will be inefficient and the test results will be invalid (Greene 2012: 986). In addition, our FD model exhibits a difference-stationary process for *domestic* and *imported* wine consumption, while it still exhibits serial correlation in errors for the *total* (*domestic* + *imported*) wine consumption.[16] To counter these possible problems, we propose different estimation methods for differenced data.

Firstly, we apply the usual OLS for *domestic* and *imported* wine and the Newey-West heteroskedasticity and autocorrelation consistent (HAC) estimator developed by Newey and West (1987) for *total* estimations.[17] For panel data, we apply feasible generalised least squares (FGLS) allowing for heteroskedasticity across panels and panel specific autocorrelations for all the estimation models discussed in this section, given the evidence of both presence. Secondly, we apply a model that takes into account serial correlation in the error term, namely the integrated autoregressive moving-average model (ARIMA) estimation, differencing the assumed non-stationary processes and taking into account possible AR and MA processes.[18] The ARIMA (*p,d,q*) model is a flexible model which allows for *p*-autocorrelaed dependent variable (the AR component) as well as for *q*-autocorrelated random disturbances (the MA component), and *d* denotes the order of differencing to achieve stationarity. The general description of the model is:

$$\Delta^d wine_{(t)} = \alpha + \gamma_1 \Delta^d wine_{(t-1)} + \cdots + \gamma_p \Delta^d wine_{(t-p)} + \beta \Delta^d food_{(t)} + \Delta^d y1997/98_{(t)} + \epsilon_{(t)} + \theta_1 \epsilon_{(t-1)} + \cdots + \theta_q \epsilon_{(t-q)} , \qquad (2)$$

With our annual data, first differencing with a lag of 0 or 1for the AR/MA component seems to suffice.[19] In our case, the estimated equation is simply,

16 Adding a lagged dependent/independent variable does not solve the serial correlation problem. Besides, if lagged independent variable is included in the RHS, the OLS results will be biased and inconsistent.

17 For the HAC, there is little theoretical guidance as to the number of truncation parameters (*l*) to be included. Newey and West (1987) recommend *l* being the integer part of 4(*n*/100)2/9, which is 3. Given also the general guidance of *l* being 1 or 2 for annual data, or $l \approx t^{1/4}$ or $0.75t^{1/3}$, which is 2.1~2.5, we estimated the model with *l*=1, 2, 3. The estimated standard errors of these three options were all similar and did not change the significance level of any coefficient. The results with the least serial correlations are presented in the table.

18 Because we have an exogenous independent variable, this is sometimes called as ARIMAX model.

19 For model description, see Davidson and Mackinnon (2009). Since we do not have much theoretical suggestion in determining the appropriate number of lags for wine consumption, we made use of the correlogram, also run model with higher lags and checked for their significance, and used the following information criteria; the Schwarz's Bayesian information criterion (SBIC), the Akaike's information criterion (AIC) and the Hannan and Quinn information criterion (HQIC), suggested in Ivanov and Kilian, (2001). Becketti (2013) provides useful methods based on Box-Jenkins (1976, 2008) approach to check for suitable (*p, q*). Note that we may only apply ARMA model without differencing, if we assume series

$$\Delta wine_{(t)} = \alpha + \beta \Delta food_{(t)} + \Delta y1997/98_{(t)} + u_{(t)}, \quad \text{(ARIMA Model) (2')}$$

where $u_{(t)} \sim ARMA(p,q)$, or $u_{(t)} = \rho u_{(t-1)} + \theta\epsilon_{(t-1)} + \epsilon_{(t)}$, $E(u_t)=0$ and $\epsilon_{(t)} \sim$ IID$(0,\sigma^2)$.

In addition to the FD data, we also estimate the relationships with detrended (*dt*) data, since detrending seems to turn most data stationary.[20] With OLS estimation, we have significant serial correlation problem in the error term, although this problem is solved if we include a lagged dependent variable. We thus estimate the detrended series using AR(1) estimator and OLS with lagged-*wine*:

$$dt\_wine_{(t)} = \alpha + \beta dt\_food_{(t-p)} + y1997/98 + u_{(t)}, \quad \text{(DT model) (3)}$$

where $u_{(t)} = \rho u_{(t-1)} + \epsilon_{(t)}$, $\epsilon_{(t)} \sim$ IID$(0,\sigma^2)$, $\rho<1$,

$$dt\_wine_{(t)} = \alpha + L.\ dt\_wine_{(t)} + \beta dt\_food_{(t-p)} + y1997/98 + u_{(t)}, \quad \text{(DT model with Lag.wine) (3')}$$

where $u_{(t)} \sim$ IID$(0,\sigma^2)$.

Finally, we conduct the log-log estimation, for *wine* on *bread*, *eating-out* or *gift-food* without *t*, and on *meat* or *dairy* with *t*, since these trends become stationary when taking a logarithm.[21] Given significant serial correlations in all estimations, we estimate it with ARMA or AR disturbances. The estimation model is:

$$lnwine_{(t)} = \alpha + \beta lnfood_{(t)}\ (+\ t) + y1997/98 + u_{(t)}, \quad \text{(log-log model) (4)}$$

where $u_{(t)} = \rho u_{(t-1)} + \theta\epsilon_{(t-1)} + \epsilon_{(t)}$, $\epsilon_{(t)} \sim$ IID$(0,\sigma^2)$, $\rho<1$.

The estimated β in the log-log model gives the elasticity of wine consumption for each food-related item.

Estimation Results

Table1 shows results of FD estimations examining correlations between wine consumption and household expenditures on selected food-items, with hh^{all} data in the first panel and with hh^{wc} data in the second panel. For HAC estimation, we present results for estimation without lagged dependent variable since it is found insignificant and the results

to be stationary.

[20] Note however, unlike other detrended variables that rejected unit root (with/without drift, without trend) at the 1% or 5% significance level, detrended *domestic wine*, *eating-out* and *gift-food* could do so only at the 10% significance level for ADF test with a drift and no trend.

[21] A presence of unit root could not be rejected for *rice* and *fish* in hh^{all} and hh^{wc} data.

are similar with or without it. Only selected food items are shown due to limited space.[22] In terms of food expenditures, *eating-out* is found to be positively correlated with wine in panel estimation and with total wine at the 1% significance level for both hh^{all} and hh^{wc}, and with domestic wine consumption at the 5% and 1% significance level for hh^{all} and hh^{wc}, respectively, with lager coefficients for the latter. *Gift-food* is also found to be positive and significant for panel estimation and total wine at the 5% and 1% level in hh^{all} and hh^{wc}, respectively. It is also found to be significant for hh^{wc} domestic and imported wine. The other item of any significance at least at the 5% level is *meat* in hh^{wc}, *fish* in hh^{all} and hh^{wc}, and *dairy* in hh^{all}, all with positive coefficients in panel estimations. Although results are not shown, dividing the period into (1) 1970-1993 and (2) 1994-2009, we have significant positive coefficients for *meat* in period (1) in panel, and for *dairy* in period (2) in panel estimation, total and domestic wine time-series estimations for hh^{all}. *Eating-out* coefficient is found significant and positive in panel, total, domestic and imported wine estimations, yet only for period (1) in hh^{all} while for both periods in hh^{wc}. *Gift-food* is also found to have significant positive coefficients for both periods in panel and all time-series estimations, yet only in hh^{wc}. For both hh^{all} and hh^{wc}data, we found significant negative coefficients for *rice* in period (2) in total wine, and positive coefficients for *bread* in period (1) in total and domestic wine time-series estimations.

These results of suggest, for instance from panel estimations, that JP¥1,000 increase in *eating-out* will increase annual wine consumption per capita in hh^{wc} by 197ml, or that an increase of about JP¥2,000 in *gift-food* spending will increase wine purchase by one bottle (750ml) in hh^{wc}. Increasing wine consumption being affected by *eating-out*, and at a greater magnitude in city working-households seems reasonable. The estimated positive impact of *gift-food*, again with higher magnitude for hh^{wc} seems also understandable, since the social custom of sending seasonal gifts is pronounced amongst the business partners. Throughout the estimations, we see strong and highly significant impact of *y1997/98* dummy that captures the polyphenol boom, which seems to contribute to a fair part of the model fit that are not particularly high for this model.

[**Table1]**

[22] Other items, such as dairy, fish were not found significant.

The ARIMA model time-series estimation in Table2 provides results for I(1) and AR(1) estimation with Maximum Likelihood estimator. Results that are fairly similar to those of the FD time-series estimation in Table1 are *eating-out* on domestic wine in hh^{wc}, shown in the second panel. The significant positive impact of *y1997/98* dummy is pronounced and robust, capturing its large impact on wine consumption. Although not presented here, *eating-out*, *gift-food*, *meat* and *fish* have significant positive coefficient in IMA(1) estimation for total wine, though not robust. For period-wise estimations, there are robust evidences of *rice* coefficients being significant and negative for both periods in total and domestic wine estimations in hh^{all}, and of *eating-out* and *gift-food* for period (1) in total and domestic wine estimations in hh^{wc}

[Table2]

Turning to Table3 for detrended model estimation, *eating-out* is found to have positive impacts on domestic wine consumption in one of hh^{all} and both of hh^{wc} estimations at the significance level of 1~5%. For *gift-food*, it is found positive and significant only in one of the domestic wine estimations for both data sets. The magnitudes of impact generally seem to be affected by the presence of lagged dependent variable, which are found to be positive and highly significant in most cases. A large impact of polyphenol boom of *y1997/1998* is robustly found like in previous estimates. Although not presented here, we have significant negative coefficients for *rice* in panel and imported wine time-series estimations. Other food items which are found to be significant are *meat* on domestic wine (hh^{wc}) and *dairy* on domestic wine (hh^{all}), although these findings are not robust. For period-wise estimations, the only food item which is found to be robustly significant is *meat* on domestic wine in hh^{all} with positive impacts in period (1).

[Table3]

Table4 shows the results of log-log estimation with ARMA specification for *bread*, *meat*, *eating-out* and *gift-food*. *Meat*, like *dairy*, are found stationary with inclusion of trend, so we estimate it with *t* variable.[23] For *bread*, *meat*, *eating-out* and *gift-food*, all items are

[23] The results for *dairy* are excluded since none is found significant. We have also conducted estimation for all other food expenditures where robust significance is found for *rice* with negative coefficient on all wine types, and *fish* with positive coefficients on domestic wine. Nonetheless, these findings can be

found to be positive and significant in hh^{all}, apart from *meat* and *gift-food* in imported wine (both significant only at the 10% level). For hh^{wc}, results are similar, but some items are found to be not as significant as in hh^{all}, apart from *meat* on imported wine which is now found to be significant at the 5% level. All items presented in the table are found to be highly elastic, and particularly so for *eating-out*, whose elasticity of wine consumption is suggested to be 0.99 for panel, and 2.2~4.6 for time-series, depending on the wine type. The magnitudes of coefficients for *eating-out* and *gift-food* are higher for imported wine than domestic wine, and higher for hh^{wc} than hh^{all}. The magnitudes are reduced with the inclusion of *t* variable (results not shown). The robustness of polyphenol boom dummy is somewhat reduced in this log-log model. In general, the BIC and AIC statistics indicate that the estimation model is not particularly good fit for imported wine compared to domestic or total wine models. Reporting only the robust results for period-wise estimations, we find significant negative coefficients for *rice* on imported wine for both hh^{all} and hh^{wc} in both periods, and significant positive coefficients for *bread*, *eating-out* and *gift-food* on all type of wine for both hh^{all} and hh^{wc}, yet during the first period only. The polyphenol boom dummy is found to have significant positive impacts in the second period.

[Table4]

Overall, the estimated results confirm the high impact of the 1997/98 polyphenol boom on wine consumption, and autoregressive nature of wine consumption. There are robust evidences of significant positive impacts of food item consumption outside household, represented by *eating-out* and *gift-food*, especially that of *eating-out* on in working households in cities. The findings match the general observation made by Amine and Lacoeuilhe (2007) for France that wine is being drunken at socialising occasions, which mostly take place outside home in Japan. Comparing the periods before and after the Bubble Economy's burst, the significant positive impacts of *eating-out* and *gift-food* on wine consumption are robustly found particularly for the first period, when the Japanese economy was on its continuous growth path. As in the case of U.K. studied by Ritchie (2008), business related meals during this period may have been particularly important to diffuse the wine drinking culture. The results suggest that Japanese consumers had increasing wine-drinking occasions in socialising scenes particularly during the period of growing economy.

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spurious given that these variables may have a unit root in log form.

There are fair evidences that *meat*, some evidences that *bread*, and limited evidences that *fish* and *dairy* consumed in households are positively correlated with wine consumption, particularly in the first period, while *rice* is found to have negative correlations. These findings seem to give support for the linkages between wine consumption and food westernisation. Judging by the information criteria, the log-log model seems to offer the best fit, while others are more or less similar, in the order of FD model, ARIMA model, and detrended model.

Wine Consumption and Food Service Industry (FSI) Performances

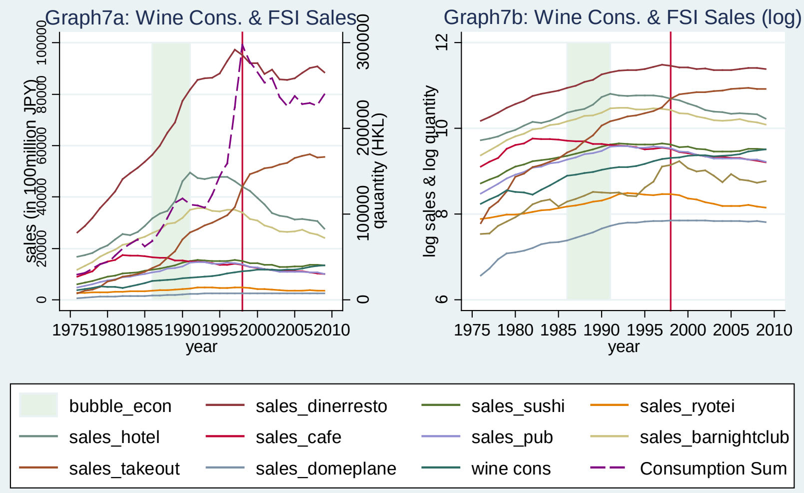
General Trends for Wine Consumption and FSI

Given the estimated significance of *eating-out* for wine consumption, we now examine the linkages between wine consumption and performances of different food-service industry (FSI) sectors. For food industry, we utilise two types of data: (1) data from the Foodservice Industry Research Institute (fsi_1); (2) data from the Japan Food Service Association (fis_2). The former provides data for the period of 1975-2010 on actual sales (in current JP¥) for various categories of FSI. We conduct analyses on selected service categories that might have either positive or negative correlations with wine consumption, namely: *diner & restaurant*, *sushi*, *ryotei* (traditional exclusive Japanese-style restaurant), *hotel*, *café*, *pub*, *bar & nightclub*, *domestic airplane* and *takeout*. The second data set provides data since 1994 in the form of growth rate or percentage-change from the previous year (Δ%) for sales, number of customers, number of premises and average spending per customer, for *fast-food*, *diner* (usually called *family restaurant* in Japan), *pub*, *restaurant* and *café*. We concentrate on the sales growth rate.

Graph6 provides two Graphs on FSI sales in current price and log-price, with an added line for the total wine consumption in quantity due to the unavailability of sales data. We see a fairly steady increase of *diner&restaurant* sales up until 1997 followed by its decrease and stagnation. This seems to coincide with the trend of wine consumption. On the other hand, we see a pronounced decrease in sales trend for *hotel* and *nightclub* after the burst of Bubble Economy, suggesting that these types of spending became increasingly unaffordable. Another notable trend is a steady increase of *takeout* sales, probably reflecting an increasing number of working women, also after their marriage, and increasing number of singles.[24] Graph7 shows the yearly trends of Δ% in fsi_2, with or without Δ% in wine consumption in each panel. The left panel, Graph7a shows particularly high peaks for 1997 and 1998's Δ% wine consumption. Excluding wine consumption in the right panel, we see more clearly the trends in FSI-sales. Generally speaking Δ% from previous year seems to fluctuate in the range of (-8%, +13%). A relatively sharp consecutive decrease in 2008 and 2009 for all FSI categories perhaps reflects the Lehman Shock which was triggered by the company's collapse in September 2008.

Graph6: Wine Consumption and Food-Service Industry Sales: 1975-2009

Selected Food-Service Categories

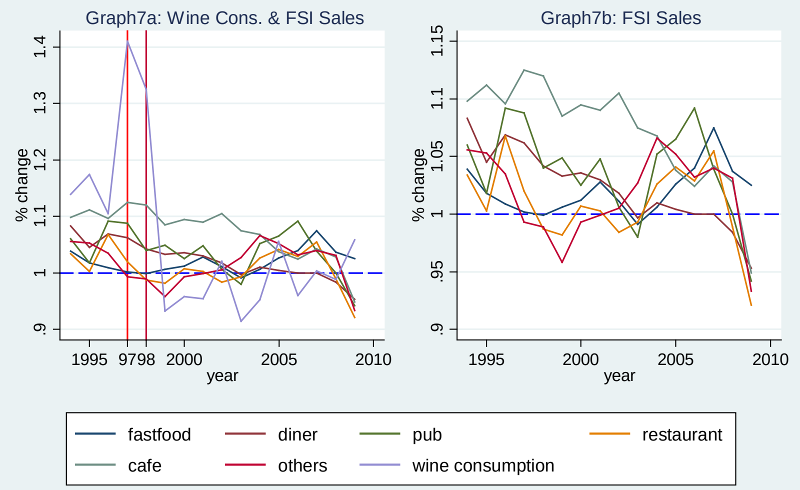


Note: Household Expenditure Data; Food-Service Industry Market Size Trend
Data Source: Japan Statistics Bureau; Foodservice Industry Research Institute

[24] The number of female labour force which was 34.1million in 1960 became 57.1million in 2010. The number of single male and female was 12.5million and 10.2million in 1970, and 16.6million and 13.1million in 2010, respectively (Statistics Bureau, 2013).

Graph7: Wine Consumption and Food-Service Industry Sales: 1994-2009

Percentage Chagnge from Previous Year



Note: Food-Service Industry Market Trend Survey
Data Source: Japan Food-Service Association

Correlations between Wine Consumption and FSI

Examining the stationarity of FSI variables, most FSI and all log-FSI are found to be stationary in fsi_1, although all FSI variables failed to reject the unit root test in fsi_2, which is already in terms of growth rate.[25] As before, wine consumption is stationary in FD or logarithmic form. No cointegration is suggested between wine consumption and FSI variables. We analyse the correlations between them with different estimation equations, using a vector of FSI-sales covariates or a single FSI-sales covariate for both fsi_1 and fsi_2. We estimate equation with/without the polyphenol dummy, as its impact may be internalised in the FSI-sales, particularly for the FSI vector. For fsi_1, we apply the following models, where $lnFSI_1$ is logarithmic FSI_1-sales, either in vector or in single form:

$$lnWine_{(t)} = \alpha + lnWine_{(t-1)} + \gamma lnFSI_{1\ (t)}\ (+\ y1997/98) + u_t, \qquad \text{(log-log/AR Model) (5)}$$

Due to the presence of serial correlation in the error term, we estimated model (5) either with OLS with lagged dependent variable which resolves serial correlation or with ARMA specification. The estimated coefficients γ indicate the elasticity of wine consumption

[25] Although first-differencing turns fis_2 variables stationary, such form of variable may not have substantive meaning to be analysed for correlations. We thus use the data in the current growth rate form based on the uncertainty of unit root test results, noted in the section above. We should nonetheless bear in mind possible spurious correlations.

vis-à-vis FSI-sales.

For fsi_2, which is in growth rate terms, we apply model (6), either with a vector of Δ%FSI or with single FSI_{2i}, where η indicates the impact of change in growth rate of FSI on the change in growth rate of wine consumption.

$$\Delta\%\ Wine_{(t)} = \alpha + \eta FSI_{2\ (t)}\ (+\ y1997/98) + \epsilon \quad (\Delta\%\ \text{Model}) \qquad (6)$$

It is not so obvious whether η will have substantive interpretable meaning. However, given that fsi_2 have more detailed categories for *diner&restaurant* in fsi_1, namely *fast-food*, *diner*, and *dinner restaurant*, and that wine consumption and *eating-out* are found to be strongly correlated, it can be informative to see if there is any correlation in terms of growth rate trends. No serial correlation is detected in the disturbances.

FSI Estimation Results

Table5 shows the results of multivariate estimations of different types of wine on various FSI-sales for panel and time-series OLS with lagged-wine and AR estimations. We find significant positive coefficients for *diner&restaurant* for all of total and domestic wine estimations. *Diner&restaurant* is also found positive and significant in one of imported wine estimations, at the 5% significance level, and two of them at the 10% significance level. The findings are robust with regards to the inclusion/exclusion of the polyphenol dummy. Nonetheless, we find strong evidence of multicollinearity amongst FSI variables which may turn the estimate inefficient. Thus turning to single FSI estimations, we find robust evidence of positive significant coefficients for *diner&restaurant* and *takeout* for all wine types (only results for these two items are presented). No significant effect is found for *ryotei*, *hotel* and *café*, while for the others, *sushi*, *pub*, *bar & night club*, *domestic airplane* and *others*, some evidence of significant positive correlation, particularly with domestic wine, is suggested.

While the finding of *diner&restaurant* is not surprising, *takeout* does not seem to be so obvious, although a closer look at Graph6 suggests similar trends for wine consumption and *takeout* sales. The estimated significant correlation between wine and *takeout* may be an indication of a recent trend of “in-house-drinking” in Japan, as suggested in WANDS (2012), that is said to be due to the stagnant general economic performance. While insignificance of *café* is understandable, that of *ryotei* and *hotel*, where wine is expected to be consumed, especially for the latter, may result from the fact that wine is in quantity data. Should wine data be in sales value, the results may have been different as both venues are expected to offer expensive wine. Also, there seems to be an influence of general economic performance. Both *ryotei* and *hotel* are found to have significant positive coefficients along with *diner&resutaurant*, *pub*, *bar*, *take-out* and *others* on all wine types, if we limit the period to 1975-1993, while only *diner&resutaurant* and *take-out* are found to have significant positive coefficients on total and 'imported' wine for the period after 1993. *Sushi* and *domestic airplane* are found to have significant positive coefficients for total and 'domestic' wine for 1975-1993, while only *domestic airplane* is found to have significant impact after 1993. Thus we can see the differences in FSI impacts between the period of economic growth and of economic stagnation. Whilst *y1997/98* dummy is found significant and positive for total and imported wine, it is not found so in domestic wine.

[Table5]

The panel and OLS estimated results of fsi_2 using model (6) are provided in Table6. Looking at the FIS_2 Δ% model estimation results on the left part, estimated coefficients that come up with significance of at least 5% level are *diner* in panel, total and imported wine with positive coefficients, *café* in panel and imported wine with negative coefficients and *others* in panel and imported wine with positive coefficients. These results seem to be sensitive to the inclusion of *y199798* dummy. Multicollinearity is very high with or without the *y199798* dummy, and the estimated results may indeed be affected. Shifting to the right part of Table6 which gives panel estimation results for each category, we see *diner* having positive and significant coefficients at the 1% level, regardless of the polyphenol dummy presence. This is unexpected at first glance that we did not find significant coefficient for *diner* and not for *restaurants*, since *diner*, which is called as "*famiresu*" as a shorter name for family restaurant in Japan, is regarded more as a place to eat with family without much image of alcohol drinking. Because the data is only in Δ% form, this may be a simple coincidence. Nonetheless, it is also true that diners increasingly carry wine on their menus, and it seems to have become the standard nowadays. Indeed, an expansion of wine market and increased availability of cheap domestic wine as well as inexpensive ranges of imported wine are considered to have caused a sort of price-slashing for wine in Japan, which used to be a luxurious commodity (Ebihara and Omura, 2010). One of the Italian diner chain that is known to provide a variety of wine, called *Saizeria* for instance, offers ranges of Italian wine selected and imported with sufficient care, and yet the price starts from as low as JP¥100 a glass.[26] They also claim that they are the largest Italian wine importer amongst the Italian food restaurants. Given the fact that this diner chain offers reasonably-priced menus and the main users are younger and middle-age generations, it can be inferred that these generations and casual eating-out occasions are important for current and future wine consumption in Japan.[27]

Indeed a study cited by WANDS (2012) finds that low price-range bottles (JP¥500~JP¥1,000) are on its rapid increase, now extending to 49% share of all imported wines in Japan. The fact that coefficients are fond to be significant in imported but not in domestic wine estimations may suggest a growth of imported wine in FSI sectors and that inexpensive imported wine may be taking over inexpensive domestic wine. Indeed we have seen in the previous section that the consumption growth rate of domestic wine has decreased, while that of imported wine remained stable after 1988. The figures from the Japan Annual Wine Report 2012 by the USDA, also states that increase in the import of inexpensive bulk wine in Japan from countries such as the US, Spain, Chile and France made low priced wine easily accessible to the Japanese consumers. The average prices per L for bulk wine were ranging from US$0.91 (Spanish) to US$2.06 (French), and the quantity of imported bulk increased by 10.6% in 2012. The imported wine figures from the report indeed suggest a decrease in average price of imported wine, given that 2012's volume

[26] See http://www.saizeriya.co.jp/corporate/effort/taste/ for their efforts and care on their offered wine, and see http://www.saizeriya.co.jp/menu/wine.html for their wine internet shopping (last accessed on5 October 2013, all web sites are in Japanese). *Saizeria* is reported to be the most popular restaurants by two of the internet-based consumer surveys conducted by market research companies called *Marsh* (2012, n=280) and *Do house* (Saito, 2010, n=1,200), and the second popular by series of reports by *MyVoice* (2011, n=11,885; 2010, n=11,867; 2009, n=13,888; 2008, n=15,326). In these surveys the main reason for going to casual restaurants are their reasonable price setting. *Marsh* (2012) report that an average price spent at a casual restaurant is JP¥2,368.

[27] According to a report by Nomura Research Institute (Ikeno, 2010, n=10,000), the proportion of individuals who use diner at least once a year, according to their age category is 58.7% (10s), 51.6% (20s), 44% (30s), 34.8% (40s), 26.1% (50s), and 21.8% (60s), and there is a clear declining trend for the use of diner according to age. There previous reports conducted in 2006, 2003 and 2000 show the same trend, apart from a change in the position of the teens that used to have lower proportion than those of the 20s in 2000.

increase (25.5%) was higher than the value increase (18.3%) by 7.2%.[28] This is contrary to the trends in France where younger generations are increasingly less likely to drink wine, and where wine is becoming more a drink of the wealthier class, with quality wine taken in fewer occasions (Amine and Lacoeuilhe, 2007; Aurier, 2007; Ebihara and Omura, 2009).

[Table6]

Conclusion

Although Japanese consumers do not drink as much wine as their Westerns counterparts, we see a sustained growing trend in wine consumption even during the period of economic stagnation. As this may suggest a possibility of wine steadily gaining its place in Japanese life, which has become increasingly westernised also in terms of diet, we have analysed possible inter-linkages between wine consumption and food-related expenditures. Without relevant established theories, we took an inductive approach to explore what the data tell us. We have utilised panel and time-series data on wine consumption, household expenditure patterns for 1970-2009, and two data sets on food service industry (FSI) sales for 1975-2009/1994-2009. Several estimation models and methods are applied given the data characteristics, notably non-stationarity, serial correlations and heteroskedasticity.

Whilst there are some differences in estimation results between the models, there are robust evidences of the significant impact of the polyphenol boom, as well as fair evidences of *meat*, and limited but some evidences of *fish*, *bread*, and *dairy* consumed in households being positively correlated with wine consumption, while *rice* is found to have negative correlations. Although the evidences are not strong enough to establish a general hypothesis linking food westernisation and wine consumption at the level of households, these are supporting evidences. The long-term trend analyses suggest that wine consumption is positively correlated with expenditures on *eating-out* and *gift-food*, suggesting that wine has been consumed mostly outside home, and particularly amongst those working household living in cities. Nonetheless, this trend may be shifting — we see that eating-out increased especially between 1970 and 1990, and has been remaining relatively stable thereafter. As

[28] They also summarise that market share of bottles priced JP¥500 ($6.33) or under and JP¥1000 ~1500 (US$12.66 ~ 18.99) continued to increase, while the mid-range category of JP ¥1,500 ~ 3,000 (US$18.99 ~ 37.97) continued to be smooth.

suggested by the period-wise results separating before and after the Bubble Economy's burst, it is likely that wine was mainly consumed outside home in restaurants in earlier days, then it has gradually started to be consumed at home, as Japanese consumers have increasingly acquired tastes for wine. Recent studies investigating wine sales by different types of shops suggest that wine consumption at home is on increase since the Lehman Shock in late 2008, and that this trend is strengthened by the North-Eastern Japan Earthquake in March 2011 (WANDS, 2012). In Japan, unlike other countries, socialising occasions mostly take place outside residence, given its limited space to host such occasions. Thus, this may suggest wine gaining a place in everyday life of Japanese, besides socialising occasions. The significant positive correlations of wine and *takeout* sales which has been on its increasing trend, also give support to this view.

It is also estimated that amongst various food-service industry sectors, diner and restaurant are the most important sectors correlated with wine consumption, rather than pub or other types of food-service industry. Looking closely at diner and restaurant category, diner is found to be significantly correlated with wine consumption, although this could be analysed only in terms of growth rate. Such findings suggest younger and middle-age generations are the main wine drinkers, at least in terms of quantity, and that reasonably-priced wines and casual eating-out occasions, in addition to home consumption, can be the key to the future wine consumption in Japan, contrary to the trends recently seen in France. Since we have not really distinguished different types of wine, in terms of its type, origin and price range, these factors remain to be investigated in future research. Nonetheless, it seems possible that Japanese consumers have become increasingly accustomed to wine consumption during the period of growing economy, followed by a large push by the polyphenol boom, thereby forming a habit of wine consumption which is not easily reversible.

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_______. 2013. *Population Census, 1920-2010*.

_______. 2012. *Labour Force Survey, 1950-2010*.

APPENDIX I: Basic Statistics Table

	Obsv.	Mean	Std. Dev.	Min	Max
Annual Data					
total wine consumption(a)	40	125.3	93.4	5.717	297.883
domestic wine consumption	40	56.9	31.6	4.934	122.798
imported wine consumption	40	68.4	63.9	0.783	184.985
GDP expenditure(b)	40	363408.6	154082	73345	523198
GDP per capita(c)	40	2.940891	1.153575	0.707144	4.146902
Monthly Household Expenditure (d)					
income	40	436166.3	146360.2	112,949	595,214
consumption	40	277387.3	82947.0	82,582	357,636
rice	40	4234.1	1287.1	2,243	6,107
bread	40	1991.8	648.9	488	2,583
fish	40	7985.1	1962.4	3,386	10,533
meat	40	6699.0	1371.6	2,658	8,082
dairy & egg	40	3520.3	509.7	2,090	4,083
eating out	40	9731.7	3596.7	2,112	13,192
gift-food	40	5051.4	1371.2	1,610	6,745
Food Service Industry Annual Sales Data(e)					
diner & restaurant sales	35	69886.6	23871.5	21,838	97,332
sushi sales	35	12276.4	2914.5	5,074	15,485
hotel sales	35	33433.3	10350.9	15,174	49,546
pub sales	35	10786.8	2943.9	4,035	14,629
bar & night club sales	35	26362.9	7175.6	10,267	35,752
café sales	35	13379.4	2626.6	7,375	17,396
domestic airplane sales	35	1989.1	640.7	646	2,581
takeout sales	35	28544.9	19823.2	2,016	56,581
other sales	35	8643.3	3076.0	3,266	13,447

(a) Units in 1,000KL; source Mercian (2011), based on National Tax Agency reports.
(b) Current GDP in billion Japanese Yen. Data for 1970-1979, 1980-1994, 1995-2009, taken from 2000, 2009 and 2010 statistics respectively.
(c) GDP per capita in million Japanese Yen.
(d) Annual Average of Monthly Receipts and Disbursements in JPY per Household (All Households and Working Households of 2 or more members) in All Japan and Cities with Population of 50,000 or more (1963-2010); source for (b) & (c): Ministry of Internal Affairs and Communications.
(e) Annual sales in JP¥ 100million; source: Foodservice Industry Research Institute (2012).

Table 1 First-Difference Estimation of Food Expenditure Per Capita on Wine Consumption Per Capita (Total, Domestic and Imported) for All Household and Working Household in Cities (Selected Food Items): 1970-2009

	Estimation Results: Wine Consumption Per Capita (All Households)															
	x: rice				x: meat				x: eating-out				x: gift-food			
	panel	total	domestic	imported	panel	total	domestic	imported	panel	total	domestic	imported	panel	total	domestic	imported
	FGLS	HAC	OLS	OLS	FGLS	HAC	OLS	OLS	FGLS	HAC	OLS	OLS	FGLS	HAC	OLS	OLS
FD.x	-0.033	-0.055*	-0.019	-0.028*	0.164*	0.037*	0.024	0.005	0.158***	0.046***	0.023**	0.02	0.225**	0.050**	0.024*	0.023
	[0.76]	[0.06]	[0.12]	[0.07]	[0.06]	[0.08]	[0.11]	[0.81]	[0.01]	[0.00]	[0.02]	[0.15]	[0.01]	[0.01]	[0.07]	[0.22]
y1997/98	354.607***	59.978***	25.923***	58.144***	338.719***	65.022***	26.681***	59.838***	340.832***	67.101***	26.835***	61.410***	345.686***	68.344***	27.547***	62.081***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
N	78	39	39	39	78	39	39	39	78	39	39	39	78	39	39	39
R-sq	.		0.39	0.62			0.39	0.58			0.44	0.61			0.4	0.6
Adj-R-sq	.		0.36	0.6			0.36	0.56			0.41	0.59			0.37	0.58
BIC		.	255.8	277.04			255.67	280.52		.	252.77	278.31		.	254.93	278.95
AIC		.	252.47	273.71			252.34	277.19		.	249.45	274.99		.	251.61	275.63
	Estimation Results: (Wine Consumption (Working Households in Cities)															
	x: rice				x: meat				x: eating-out				x: gift-food			
FD.x	-0.036	-0.053*	-0.021*	-0.027	0.140**	0.020	0.004	0.022	0.197***	0.063***	0.034***	0.023*	0.359***	0.105***	0.039**	0.061**
	[0.75]	[0.06]	[0.10]	[0.10]	[0.03]	[0.34]	[0.75]	[0.19]	[0.00]	[0.00]	[0.00]	[0.09]	[0.00]	[0.00]	[0.04]	[0.01]
y1997/98	358.068***	59.048***	26.257***	57.722***	338.624***	60.062***	27.771***	56.701***	325.132***	67.470***	24.725***	61.253***	342.367***	70.262***	27.373***	63.912***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
N	74	37	37	37	74	37	37	37	74	37	37	37	74	37	37	37
R-sq			0.4	0.62			0.35	0.61			0.55	0.63			0.43	0.66
Adj-R-sq			0.37	0.6			0.32	0.59			0.52	0.61			0.4	0.64
BIC		.	244.01	264.14	.		246.88	265.21		.	233.49	263.89		.	242.23	260.39
AIC		.	240.79	260.91	.		243.66	261.99		.	230.27	260.66		.	239.01	

Note: p-value in brackets (* p<0.05, ** p<0.01, *** p<0.001). Panel estimation for domestic and imported wine.

Data: Wine consumption data from Mercian (2011); Annual Average of Monthly Consumption Expenditures per Household (All Households with two or more household members in Japan) (1970~2007: Non-agricultural, forestry and fisheries households; 2008~2009: include agricultural, forestry and fisheries households); Working household in cities data available for 1970-2007.

Data source: National Tax Agency (for wine consumption data); Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications (expenditure, population, deflator data).

Table 2 ARIMA Estimation of Food Expenditure Per Capita on Wine Consumption Per Capita (Total, Domestic and Imported) for All Household and Working Household in Cities (Selected Food Items): 1970-2009

Estimation Results: Wine Consumption Per Capita (All Households)												
	x: eating-out						x: gift-food					
	Total		domestic		Imported		total		domestic		imported	
a)	I(1)	ARI(1)	I(1)	ARI(1)	I(1)	ARI (1)	I(1)	ARI (1)	I(1)	ARI (1)	I(1)	ARI (1)
FD.x	0.0173	0.0143	0.0187	0.0178	-0.0071	-0.0042	0.0091	0.018	0.0128	0.0149	-0.0098	-0.0007
	[0.67]	[0.67]	[0.32]	[0.39]	[0.71]	[0.82]	[0.80]	[0.57]	[0.48]	[0.40]	[0.60]	[0.96]
FD.	41.8748***	32.5113**	11.0195***	11.1622***	42.8154***	39.6827***	41.1665***	32.0345**	11.4939***	11.4702***	42.8606***	39.9251***
y1997/98	[0.00]	[0.02]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
constant	4.0876	4.3328	0.4169	0.482	4.0171***	3.888	4.9298*	4.7739	1.2608	1.2125	3.8100***	3.6526
	[0.10]	[0.33]	[0.71]	[0.75]	[0.00]	[0.12]	[0.05]	[0.30]	[0.25]	[0.41]	[0.01]	[0.11]
ARMA												
L.AR		0.4483		0.2317		0.4684		0.4641		0.2541*		0.4692
		[0.13]		[0.13]		[0.14]		[0.10]		[0.08]		[0.13]
Sigma	12.3127***	11.1102***	6.6397***	6.4505***	6.8091***	6.0336***	12.3656***	11.0722***	6.7302***	6.4997***	6.7955***	6.0425***
constant	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
N	39	39	39	39	39	39	39	39	39	39	39	39
Bic	321.16	317.03	272.99	274.46	274.96	269.44	321.49	316.78	274.05	275.06	274.8	269.55
Aic	314.51	308.72	266.34	266.14	268.3	261.12	314.84	308.47	267.39	266.74	268.15	261.23

Estimation Results: Wine Consumption (Working Households in Cities)												
	x: eating-out						x: gift-food					
	Total		Domestic		Imported		total		domestic		imported	
a)	I(1)	ARI(1)	I(1)	ARI(1)	I(1)	ARI (1)	I(1)	ARI (1)	I(1)	ARI (1)	I(1)	ARI (1)
FD.x	0.0564	0.0548	0.0436***	0.0450***	0.006	0.0061	0.037	0.049	0.0284	0.0264	0.0001	0.0146
	[0.21]	[0.11]	[0.01]	[0.00]	[0.76]	[0.71]	[0.35]	[0.17]	[0.29]	[0.31]	[1.00]	[0.40]
FD.	44.5535***	35.3502***	8.7038***	8.8465***	43.6547***	40.3805***	40.3530***	30.5678**	11.1231***	11.3992***	43.2570***	39.6580***
y1997/98	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.02]	[0.00]	[0.00]	[0.00]	[0.00]
constant	1.3605	1.2346	-1.2698	-1.4269	3.0908*	2.9813	4.7918	4.4042	1.3835	1.3574	3.4888**	3.2291
	[0.65]	[0.83]	[0.27]	[0.43]	[0.05]	[0.22]	[0.11]	[0.40]	[0.25]	[0.37]	[0.05]	[0.24]
ARMA												
L.AR		0.4991		0.3259*		0.481		0.4947*		0.2274		0.5047*
		[0.16]		[0.07]		[0.11]		[0.07]		[0.11]		[0.10]

Sigma	11.8568***	10.3605***	6.1009***	5.7541***	6.9165***	6.0590***	12.4461***	10.9306***	6.7568***	6.5724***	6.9313***	6.0172***
constant	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
N	37	37	37	37	37	37	37	37	37	37	37	37
BIC	302.44	296.36	253.27	252.66	262.55	256.63	306.03	300.31	260.83	262.45	262.71	256.15
AIC	296	288.3	246.83	244.61	256.11	248.58	299.59	292.26	254.38	254.4	256.27	248.1

Note: p-value in brackets (* p<0.05, ** p<0.01, *** p<0.001); a): I(1), AR(1) are all estimated with ARIMA specification with I(1), with/without AR(1). MA(1) estimation produce similar results to AR(1)

Data: Wine consumption data from Mercian (2011); Annual Average of Monthly Consumption Expenditures per Household (All Households with two or more household members in Japan) (1970~2007: Non-agricultural, forestry and fisheries households; 2008~2009: include agricultural, forestry and fisheries households); Working household in cities data available for 1970-2007.

Data source: National Tax Agency; Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications.

Table3 Detrended Estimation of Food Expenditure Per Capita on Wine Consumption Per Capita (Total, Domestic and Imported) for All Household and Working Household in Cities (Selected Food Items): 1970-2009

Estimation Results: Wine Consumption (All Households)

	x: eating-out							x: gift-food						
	panel	total		domestic		imported		panel	total		domestic		imported	
	FGLS	AR(1)	OLS	AR(1)	OLS	AR(1)	OLS	FGLS	AR(1)	OLS	AR(1)	OLS	AR(1)	OLS
DTR.x	0.00	0.013	0.011	0.023	0.009**	-0.011	-0.003	-0.037	0.011	0.022*	0.023	0.017**	-0.012	-0.001
	[1.00]	[0.81]	[0.19]	[0.23]	[0.05]	[0.65]	[0.56]	[0.78]	[0.77]	[0.08]	[0.21]	[0.04]	[0.54]	[0.87]
y1997/98	191.297***	42.094***	66.635***	11.054***	25.133***	42.653***	60.130***	196.107***	41.818***	66.374***	11.264***	23.750***	42.874***	59.811***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
L.DTR.wine			0.779***		0.798***		0.737***			0.764***		0.773***		0.754***
			[0.00]		[0.00]		[0.00]			[0.00]		[0.00]		[0.00]
Cons	-137.9	-1.343	-2.76	-1.895	-0.966	1.454	-2.235**	-140.221	-1.497	-2.796	-1.9	-0.948	1.679	-2.247**
	[0.12]	[0.95]	[0.12]	[0.79]	[0.30]	[0.91]	[0.04]	[0.12]	[0.93]	[0.11]	[0.79]	[0.31]	[0.88]	[0.04]
ARMA														
L.AR		0.870***		0.813***		0.904***			0.863***		0.804***		0.913***	
		[0.00]		[0.00]		[0.00]			[0.00]		[0.00]		[0.00]	
Sigma		11.948***		6.340***		6.688***			11.970***		6.431***		6.685***	
constant		[0.00]		[0.00]		[0.00]			[0.00]		[0.00]		[0.00]	
N	80	40	39	40	39	40	39	80	40	39	40	39	40	39
R-sq			0.86		0.82		0.9			0.86		0.83		0.9
Adj-R-sq			0.85		0.81		0.89			0.85		0.81		0.89
BIC		331.82	306.81	280.79	256.75	285.69	266.61			305.39		256.17		266.96
AIC		323.37	300.15	272.35	250.1	277.25	259.95			298.73		249.52		260.31

Estimation Results: Wine Consumption (Working Households in Cities)

	x: eating-out							x: gift-food						
	panel	total		domestic		imported		panel	total		domestic		imported	
	FGLS	AR(1)	OLS	AR(1)	OLS	AR(1)	OLS	FGLS	AR(1)	OLS	AR(1)	OLS	AR(1)	OLS
DTR.x	0.141	0.05	0.013	0.040***	0.011**	0.003	-0.003	0.007	0.03	0.025*	0.036	0.018**	-0.005	0
	[0.16]	[0.32]	[0.20]	[0.01]	[0.03]	[0.88]	[0.64]	[0.96]	[0.56]	[0.07]	[0.14]	[0.02]	[0.82]	[0.97]
y1997/98	166.141***	44.386***	66.872***	9.187***	24.929***	43.533***	60.015***	189.350***	40.968***	64.514***	11.252***	23.665***	43.391***	59.677***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]

L.DTR.			0.775***		0.763***		0.742***			0.784***		0.754***		0.761***
wine			[0.00]		[0.00]		[0.00]			[0.00]		[0.00]		[0.00]
cons	-125.934	3.704	-2.483	0.56	-0.598	3.442	-2.302**	-138.043	1.129	-2.53	0.155	-0.599	2.362	-2.327**
	[0.17]	[0.89]	[0.18]	[0.94]	[0.53]	[0.79]	[0.04]	[0.12]	[0.96]	[0.17]	[0.98]	[0.53]	[0.85]	[0.04]
ARMA														
L.AR		0.896***		0.821***		0.923***			0.865***		0.759***		0.915***	
		[0.00]		[0.00]		[0.00]			[0.00]		[0.00]		[0.00]	
sigma		11.554***		5.789***		6.829***			12.050***		6.328***		6.836***	
constant		[0.00]		[0.00]		[0.00]			[0.00]		[0.00]		[0.00]	
N	76	38	37	38	37	38	37	76	38	37	38	37	38	37
R-sq			0.85		0.8		0.9			0.86		0.81		0.9
Adj-R-sq			0.84		0.78		0.89			0.85		0.79		0.89
BIC		313.63	292.29	260.61	243.09	273.94	254.71			290.55		241.78		254.96
AIC		305.44	285.84	252.42	236.65	265.75	248.26			284.1		235.33		248.51

Note: (1) AR(1), (2) AR(1) with lag-wine, (3) OLS. p-value in brackets (* $p<0.05$, ** $p<0.01$, *** $p<0.001$).

Data: Wine consumption data from Mercian (2011); Annual Average of Monthly Consumption Expenditures per Household (All Households with two or more household members in Japan) (1970~2007: Non-agricultural, forestry and fisheries households; 2008~2009: include agricultural, forestry and fisheries households); Working household in cities data available for 1970-2007.

Data source: National Tax Agency; Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications.

Table 4. Log-Log Estimation of Food Expenditure Per Capita on Wine Consumption Per Capita (Panel, Total, Domestic and Imported) for All Household and Working Household in Cities (Selected Food Items): 1970-2009

	x: bread				x: meat				x: eating-out				x: gift-food			
	panel FGLS	total AR(1)	domestic AR(1)	imported AR(1)	panel FGLS	total AR(1)	domestic AR(1)	imported AR(1)	panel FGLS	total AR(1)	domestic AR(1)	imported AR(1)	panel FGLS	total AR(1)	domestic AR(1)	imported AR(1)
ln.x	1.036***	1.795***	1.777**	2.128**	0.834***	1.833**	2.183***	2.154*	0.998***	2.769***	2.193***	4.340***	1.121***	1.564**	1.668***	1.764*
	[0.00]	[0.01]	[0.02]	[0.03]	[0.00]	[0.01]	[0.00]	[0.07]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.03]	[0.01]	[0.08]
t					0.372*	0.082***	0.056***	0.123***								
					[0.07]	[0.00]	[0.00]	[0.00]								
y1997/98	0.370*	0.204	0.148**	0.354	0.043***	0.193*	0.101*	0.343	0.319	0.227***	0.116**	0.403***	0.294	0.203**	0.111**	0.352**
	[0.06]	[0.12]	[0.01]	[0.16]	[0.00]	[0.05]	[0.08]	[0.12]	[0.11]	[0.00]	[0.04]	[0.01]	[0.14]	[0.02]	[0.04]	[0.05]
constant	0.096	-7.446*	-7.822*	-10.670*	-0.647	-11.671**	-14.425**	-15.907*	-1.217***	-17.638***	-13.701***	-31.001***	-1.713***	-7.82	-9.142*	-10.448
	[0.78]	[0.07]	[0.09]	[0.07]	[0.39]	[0.03]	[0.01]	[0.08]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.14]	[0.05]	[0.13]
ARMA																
L.AR		0.988***	0.956***	0.988***		0.950***	0.949***	0.915***		0.899***	0.876***	0.830***		0.993***	0.980***	0.993***
		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]
Sigma		0.134***	0.131***	0.220***		0.111***	0.114***	0.185***		0.130***	0.125***	0.208***		0.140***	0.132***	0.226***
constant		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]
N	120	40	40	40	120	40	40	40	120	40	40	40	120	40	40	40
BIC		-25.14	-28.47	14.74		-38	-36.02	2.58		-29.53	-33.19	7.4		-21.2	-26.84	17.19
AIC		-33.59	-36.91	6.29		-48.13	-46.15	-7.56		-37.98	-41.63	-1.05		-29.64	-35.28	8.75

	x: bread				x: meat				x: eating-out				x: gift-food			
	panel FGLS	total AR(1)	domestic AR(1)	imported AR(1)	panel FGLS	total AR(1)	domestic AR(1)	imported AR(1)	panel FGLS	total AR(1)	domestic AR(1)	imported AR(1)	panel FGLS	total AR(1)	domestic AR(1)	imported AR(1)
ln.x	1.039***	1.751**	3.068***	2.156*	0.840***	1.180*	0.973	2.726**	0.990***	3.176***	2.468***	4.628***	1.175***	1.886**	1.961**	2.081
	[0.00]	[0.03]	[0.00]	[0.06]	[0.00]	[0.06]	[0.22]	[0.02]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.04]	[0.02]	[0.18]
t					0.265	0.091***	0.066***	0.133***								
					[0.20]	[0.00]	[0.00]	[0.00]								
y1997/98	0.376*	0.213*	0.133	0.367	0.042***	0.102	0.183*	0.153	0.318	0.233***	0.104*	0.405**	0.30	0.160**	0.112*	0.304**
	[0.06]	[0.09]	[0.11]	[0.12]	[0.00]	[0.62]	[0.08]	[0.63]	[0.10]	[0.00]	[0.06]	[0.02]	[0.14]	[0.03]	[0.05]	[0.05]
constant	-0.013	-7.318	-16.038***	-11.036	-0.826	-7.089	-5.575	-21.015**	-1.263***	-21.157***	-16.114***	-33.751***	-1.915***	-9.895	-11.015*	-12.476
	[0.97]	[0.14]	[0.00]	[0.12]	[0.31]	[0.16]	[0.38]	[0.02]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.11]	[0.05]	[0.23]
ARMA																
L.AR		0.989***	0.602***	0.989***		0.952***	0.955***	0.901***		0.850***	0.882***	0.798***		0.994***	0.988***	0.994***
		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]
Sigma		0.138***	0.139***	0.226***		0.122***	0.129***	0.188***		0.120***	0.116***	0.201***		0.141***	0.133***	0.231***
constant		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]
N	114	38	38	38	114	38	38	38	114	38	38	38	114	38	38	38

BIC	-20.52	-23.22	16.63	-28	-23.34	4.26	-33.81	-36.4	4.96	-18.08	-23.4	18.93
AIC	-28.71	-31.41	8.45	-37.83	-33.17	-5.57	-42	-44.59	-3.22	-26.27	-31.59	10.74

Note: (1) AR(1), (2) AR(1) with lag-wine, (3) OLS. p-value in brackets (* p<0.05, ** p<0.01, *** p<0.001).

Data: Wine consumption data from Mercian (2011); Annual Average of Monthly Consumption Expenditures per Household (All Households with two or more household members in Japan) (1970~2007: Non-agricultural, forestry and fisheries households; 2008~2009: include agricultural, forestry and fisheries households); Working household in cities data available for 1970-2007.

Data source: National Tax Agency; Statistical Survey Department, Statistics Bureau, Ministry of Internal Affairs and Communications.

Table 5. Log-Log Estimation of Multiple FSI Sales on Wine Consumption: 1975-2009

	Panel		Total		domestic		imported		panel		total		domestic		imported	
	FGLS	FGLS	OLS	AR(1)	OLS	AR(1)	OLS	AR(1)	FGLS	FGLS	AR(1)	AR(1)	AR(1)	AR(1)	AR(1)	AR(1)
L.lnwine	0.976***		0.583**		0.348		0.375*									
	[0.00]		[0.01]		[0.11]		[0.08]									
lndiner & restaurant	1.713***	2.547***	2.405**	2.714**	2.909**	2.998**	2.899**	2.958**	1.116***		0.949***		1.098***		0.427***	
	[0.00]	[0.00]	[0.03]	[0.03]	[0.01]	[0.03]	[0.01]	[0.03]	[0.00]		[0.00]		[0.00]		[0.00]	
lnshushi	-0.205	-1.806**	-1.576	-2.421	-2.985*	-3.296*	-2.922*	-3.243*								
	[0.77]	[0.03]	[0.27]	[0.15]	[0.06]	[0.07]	[0.06]	[0.08]								
lnryotei	0.228	0.507	0.623	0.701	0.609	0.884	0.733	0.89								
	[0.48]	[0.19]	[0.28]	[0.26]	[0.37]	[0.29]	[0.26]	[0.29]								
lnhotel	-0.411	-0.442	-0.019	-0.259	0.26	-0.292	0.205	-0.313								
	[0.21]	[0.11]	[0.97]	[0.70]	[0.67]	[0.61]	[0.73]	[0.57]								
lncafe	0.06	0.127	0.632	0.445	1.160*	0.928	1.165*	0.902								
	[0.81]	[0.68]	[0.21]	[0.47]	[0.06]	[0.19]	[0.06]	[0.21]								
lnpub	-3.273	-0.651	-2.688	-0.953	-1.231	-0.254	-1.413	-0.249								
	[0.13]	[0.72]	[0.47]	[0.80]	[0.76]	[0.94]	[0.72]	[0.94]								
lnbar& nightclub	2.957	0.34	1.792	0.56	0.465	0.274	0.629	0.295								
	[0.10]	[0.83]	[0.57]	[0.87]	[0.89]	[0.91]	[0.85]	[0.90]								
lntakeout	-0.531***	0.297*	-0.076	0.395	0.057	0.246	0.056	0.249		1.098***		1.505**		0.649***		0.954***
	[0.00]	[0.06]	[0.83]	[0.24]	[0.87]	[0.54]	[0.87]	[0.54]		[0.00]		[0.03]		[0.00]		[0.00]
lndomestic airplane	-0.023	-0.159	-0.486	-0.457	-0.595	-0.556	-0.662	-0.55								
	[0.95]	[0.69]	[0.48]	[0.65]	[0.45]	[0.57]	[0.39]	[0.56]								
lnother	0.053	0.078	0.272	0.173	0.136	-0.114	0.149	-0.123								
	[0.81]	[0.77]	[0.47]	[0.79]	[0.74]	[0.90]	[0.72]	[0.89]								
y1998					0.096	0.014			0.157***	0.164***	0.105**	0.199	0.160***	0.218***	0.161***	0.271
					[0.44]	[0.86]			[0.00]	[0.00]	[0.01]	[0.26]	[0.00]	[0.00]	[0.00]	[0.46]
constant	-9.680**	-0.941	-9.257	-1.913	-6.396	-2.034	-7.238	-1.911	-1.312	-0.488	0.445	-5.791		5.210***	6.720***	1.372
	[0.02]	[0.81]	[0.20]	[0.78]	[0.41]	[0.77]	[0.34]	[0.78]	[0.41]	[0.89]	[0.90]	[0.42]		[0.00]	[0.00]	[0.48]
ARMA																
L.AR				0.620***		0.555***		0.568***		0.960***	0.783***	0.970***	0.697	0.822***	0.702***	0.830***
				[0.01]		[0.00]		[0.00]		[0.00]	[0.00]	[0.00]	[0.67]	[0.00]	[0.00]	[0.00]
sigma				0.082***		0.086***		0.086***		0.092***	0.097***	0.139***		0.084***	0.096***	0.129***
constant				[0.00]		[0.00]		[0.00]		[0.00]	[0.00]	[0.00]		[0.00]	[0.00]	[0.00]
N	105	105	35	35	35	35	35	35	105	35	35	35	105	35	35	35
R-sq			0.99		0.97		0.97									
Adj-R-sq			0.98		0.95		0.95			-47.12	-45.32	-18.38		-55.35	-46.46	-25

BIC	-33.86	-28.89	-26.27	-22.3	-28.87	-25.82	-54.89	-53.09	-26.16	-63.13	-54.24	-32.78
AIC	-52.53	-49.11	-46.49	-44.07	-47.54	-46.04						

Note: p-value in brackets (* p<0.05, ** p<0.01, *** p<0.001).
Data source: National Tax Agency (for wine consumption); Foodservice Industry Research Institute (for FSI)

Table 6. Multivariate Estimation of Δ%FSI Sales on Δ%Wine Consumption (OLS): 1993-2009

	panel		total		domestic		imported		panel									
	FGLS	FGLS	OLS	OLS	OLS	OLS	OLS	OLS	FGLS	FGLS	FGLS	FGLS	FGLS	FGLS	FGLS	FGLS	FGLS	FGLS
fast-food	0.636	0.061	0.462	0.204	-0.974	-1.108	1.632	1.268	0.819	-1.514								
	[0.33]	[0.96]	[0.69]	[0.94]	[0.75]	[0.72]	[0.18]	[0.72]	[0.27]	[0.17]								
diner	3.904***	2.574*	3.665**	2.537	2.563	1.978	4.998***	3.406			1.108***	2.145***						
	[0.00]	[0.06]	[0.01]	[0.36]	[0.43]	[0.54]	[0.00]	[0.37]			[0.01]	[0.00]						
restaurant	-0.665	-1.743	-0.485	-1.892	0.651	-0.078	-1.584	-3.569					0.458	0.301				
	[0.40]	[0.26]	[0.73]	[0.55]	[0.86]	[0.98]	[0.26]	[0.41]					[0.26]	[0.65]				
pub	-1.069**	0.926	-0.983	0.917	-0.169	0.816	-1.595	1.084							0.227	1.004*		
	[0.04]	[0.35]	[0.31]	[0.65]	[0.94]	[0.73]	[0.11]	[0.69]							[0.53]	[0.06]		
café	-1.897***	-0.195	-1.827*	-0.101	-1.573	-0.678	-2.196**	0.237									0.255	1.305***
	[0.00]	[0.84]	[0.07]	[0.96]	[0.51]	[0.77]	[0.03]	[0.93]									[0.47]	[0.01]
other	1.247***	-0.008	1.076	0.081	-0.267	-0.782	2.207**	0.804										
	[0.01]	[0.99]	[0.21]	[0.96]	[0.90]	[0.72]	[0.02]	[0.75]										
y199798	0.430***		0.405***		0.21		0.570***		0.382***		0.326***		0.364***		0.354***		0.347***	
	[0.00]		[0.00]		[0.25]		[0.00]		[0.00]		[0.00]		[0.00]		[0.00]		[0.00]	
constant	-1.088	-0.623	-0.839	-0.76	0.853	0.894	-2.398*	-2.286	0.179	2.601**	-0.112	-1.137*	0.554	0.752	0.782**	0.014	0.745**	-0.342
	[0.14]	[0.68]	[0.53]	[0.80]	[0.81]	[0.80]	[0.09]	[0.58]	[0.81]	[0.02]	[0.79]	[0.07]	[0.18]	[0.26]	[0.04]	[0.98]	[0.05]	[0.50]
N	48	48	16	16	16	16	16	16	48	48	48	48	48	48	48	48	48	48
r2			0.89	0.33	0.34	0.22	0.94	0.32										
r2_a			0.79	-0.12	-0.23	-0.3	0.88	-0.14										
BIC			-30.71	-4.91	0.31	0.35	-31.1	4.66										
AIC			-36.89	-10.32	-5.87	-5.06	-37.28	-0.75										

Note: p-value in brackets (* p<0.05, ** p<0.01, *** p<0.001).
Data source: National Tax Agency (for wine consumption); Japan Food Service Association (for FSI)