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The Impact of Aggregate and Disaggregate Consumption Shocks on the Equity Risk Premium in the United Kingdom

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We examine the impact of aggregate and disaggregate consumption shocks on the ex-post Equity Risk Premium (ERP) of FTSE indices and the 25 Fama-French portfolios. Findings suggest that aggregate consumption shocks seem to explain significant time variation in the ERP. At disaggregated level, the ERP increases when the actual consumption is less than expected. Finally, durable and semi-durable consumption shocks have a greater impact on the ERP than non-durable consumption shocks.

Key Words: Equity Risk Premium; Consumption Wealth Channel; Consumption Shocks; Structural Vector Autoregression; Asset Pricing.
JEL Classification Numbers: E0, E2, E6, G0.

1. INTRODUCTION

The classical Consumption Capital Asset Pricing Model (CCAPM), first proposed by Rubinstein (1976), Lucas (1978), and Breeden (1979) provided an alternative way for pricing assets. In this version of CCAPM, a representative agent seeks to maximise the time-additive discounted utility as a function of stochastic consumption. Furthermore, in CCAPM, a representative agent is assumed to smooth-out lifetime consumption by optimally allocating wealth between consumption and savings in different time periods. The classical form of CCAPM attempts to explain the Equity Risk Premium (ERP) by the risk associated with the inter-temporal marginal rate of substitution of consumption. However, Mehra and Prescott (1985) find that the classic from of CCAPM does not accurately match the model

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implied ERP with the observed ERP thus giving rise to the well-known 'ERP puzzle'.

Subsequently, many new consumption-based models have been proposed in which the canonical non-linear pricing factor has been replaced by approximate linear pricing factor which is a linear combination of consumption growth rate and some state variables [See for example, Lettau and Ludvigson (2001a), Lettau and Ludvigson (2001b), Jacobs and Wang (2004)]. Lettau and Ludvigson (2001b) show that agent's consumption (c), asset wealth (a) and income (y) are cointegrated and transitory deviations defined as 'cay' is able to predict excess returns. Jacobs and Wang (2004) show that when the stochastic discount factor is expressed as a linear function of the first two moments of consumption growth rate, then these factors help explain the variations in the cross-sectional stock returns. Della Corte, Sarno and Valente, (2010) provide mixed evidence of predictive ability of 'cay' over a period of one hundred years in four major economies. Sousa (2010) extends the work of Lettau and Ludvigson (2001b) and show that the transitory deviations in the long-run relationship between consumption, asset wealth, housing wealth and income ("cday" variable) is able to better predict US and UK quarterly excess stock returns. His result suggests that housing wealth has persistent impact on consumption than financial wealth and therefore the long-term risk in these variables help drive the excess stock returns.

Further, the Long-run Risk model of Bansal and Yaron, (2004) imply that if volatility shocks to consumption are persistent and are observable, then their impact should be reflected in the asset prices. Extending their Long-run Risk model, Bansal, Dittmar and Kiku, (2009) further show that incorporating the long-run relation between consumption and dividends can significantly explain the cross-sectional variance of asset risk premia at long-term investment horizons.

Despite extensive work on consumption-based asset pricing, the extant literature ignores the role of monetary policy, which has a significant impact on the investors' consumption choices. The classical consumption-wealth channel postulates that the current and future consumption levels are significantly influenced by the monetary policy through the stock market and/or housing wealth[1]. Further, the deviations in agent's consumption path can also be influenced by exogenous shocks in inflation. In this paper, we investigate the impact of consumption shocks arising from interest rate and inflation as well changes in the agent's wealth and income on the UK ERP.

Specifically, we examine the impact of private consumption shocks at the aggregate and dis-aggregate levels on the ERP of the FTSE 100, FTSE 250

[1]See Ando and Modigliani, (1963); Modigliani, (1963, 1971).

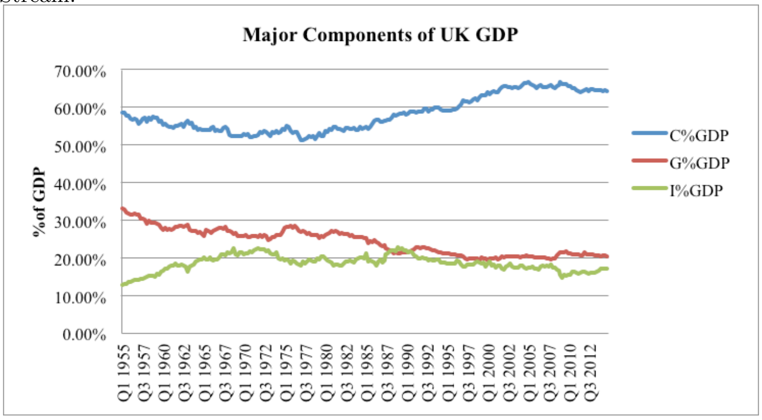
indices as well as the ten most widely followed sectors in the in the UK. We also examine the impact on ERPs of 25 Fama-French value-weighted portfolios based on size and book-to-market characteristics. We believe that findings of our research will be particularly useful since FTSE indices are widely used as benchmarks by both retail and institutional investors. Further, the consumption shocks extracted using the Structural Vector Autoregression (SVAR) model represent an unexpected rise or fall in aggregate personal consumption. These structural shocks proxy the deviations of the actual consumption from the expected consumption under the assumption that consumption-wealth channel of transmission of monetary policy exists. Therefore, a positive consumption shock would suggest higher than expected consumption and a negative consumption shock would indicate lower than expected consumption. We model these consumption shocks by considering the changes in interest and inflation rates which carry information about the evolution of the expected news regarding stochastic discount factor (Bansal et al. 2014).

Figure 1 provides anecdotal evidence, which further motivates us to investigate the impact of consumption on excess stock returns. The figure shows the three main components of Gross Domestic Product (GDP) as a percentage of GDP over the past 59 years in the UK; namely personal/private consumption (C), government consumption (G) and Gross Fixed Investment (I). It is quite evident that aggregate personal/private consumption is the major contributor to the GDP in the UK. The average quarterly share of personal consumption in the GDP for the period of 1955 to 2014 is 58.11%. The private consumption as a percentage of GDP has always been above 60% since the mid-1990s. Thus, personal/private sector consumption is the "engine of growth" in the UK and hence it is systemically important to understand the impact of consumption shocks on the ERP.

We also study the impact of disaggregated consumption shocks. That is, we investigate whether durable, semi-durable and non-durable consumption shocks are able to explain significant variations in the ERPs of the various FTSE indices, both at aggregate and industry level. There are far fewer studies which provide evidence at the disaggregate level. We make an important contribution to the extant literature by providing the evidence of the impact of consumption shocks on the ERP at both aggregate and disaggregate levels. Such evidence will provide useful insights about the impact of business cycle on the stock returns.

There are several reasons why we believe that dis-aggregated consumption shocks should have a significant impact on the ERP. First, the canonical CCAPM links consumption to asset returns using preferences which aggregates the optimising behaviour of the agents using aggregate consumption and ignore the services provided by the durable consumption.

FIG. 1. Components of GDP as a percentage of total GDP in the UK. Source: DataStream.



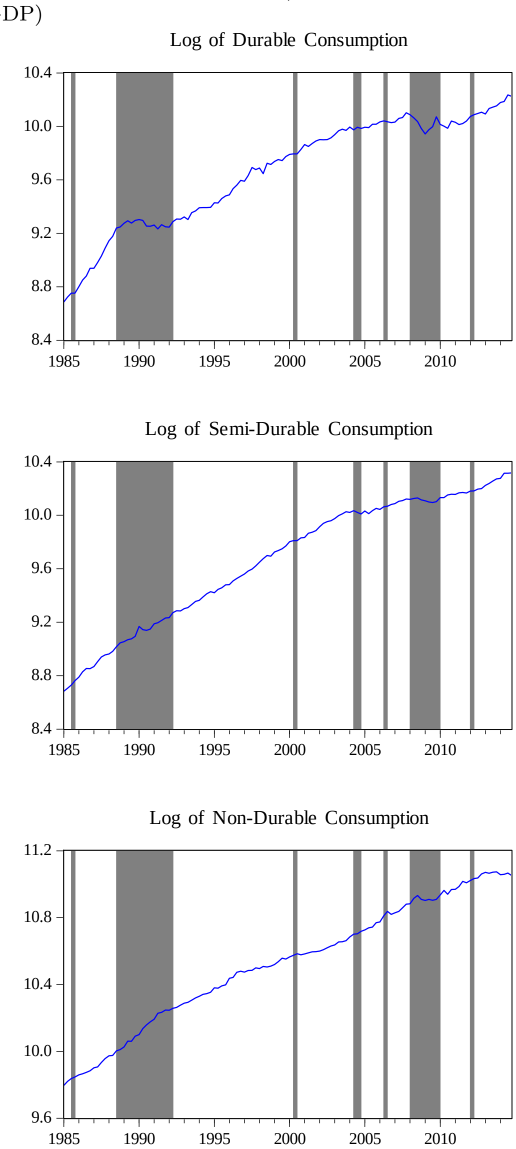
Piazzesi, Schneider and Tuzel, (2007) show that a Constant Elasticity of Substitution (CES) non-separable preference defined over both non-durable and housing services consumption (which can be interpreted as durable consumption) can help rationalise asset pricing models and also explain the behaviour of the ERP.

Second, as shown by Yogo (2006), the ERP is time-varying and countercyclical. The ERP rises when durable consumption falls relative to non-durable consumption. The expected returns on stocks are higher at business cycle troughs than at peaks. This may be partly because within the CCAPM framework, the marginal utility of consumption is a measure of risk aversion. Yogo, (2006) assumes the utility of durable and non-durable consumption as non-separable. When the elasticity of substitution between the durable and non-durable goods and service is more than the intertemporal marginal rate of substitution, then as durable consumption falls, the marginal utility of consumption rises. Thus, it is critical to examine separately the impact of durable and non-durable consumption shocks on the ERP.

Further, Power, (2004) argues that durable and semi-durable consumption in the UK are strongly pro-cyclical. Moreover, durable consumption is more volatile than non-durable consumption. This is partly because the services offered by durable and semi-durable goods are typically consumed over longer period of time than those offered by non-durable consumption goods and services and partly because expenditure on durable and semi-durable goods is discretionary and deferrable (Black and Cusbert 2010).

Figures 2 and 3 illustrate above argument and exemplify the cyclical properties of dis-aggregated consumption. Figure 2 shows the time series plots of log levels of durable, semi-durable and non-durable consumption in

FIG. 2. Time series plot of log levels of Durable Consumption, Semi-Durable Consumption and Non-Durable consumption in the UK. Sample period 1985Q1-2014Q4. Shaded areas are the recessions in the UK (measured as two consecutive quarters of decline in real GDP)



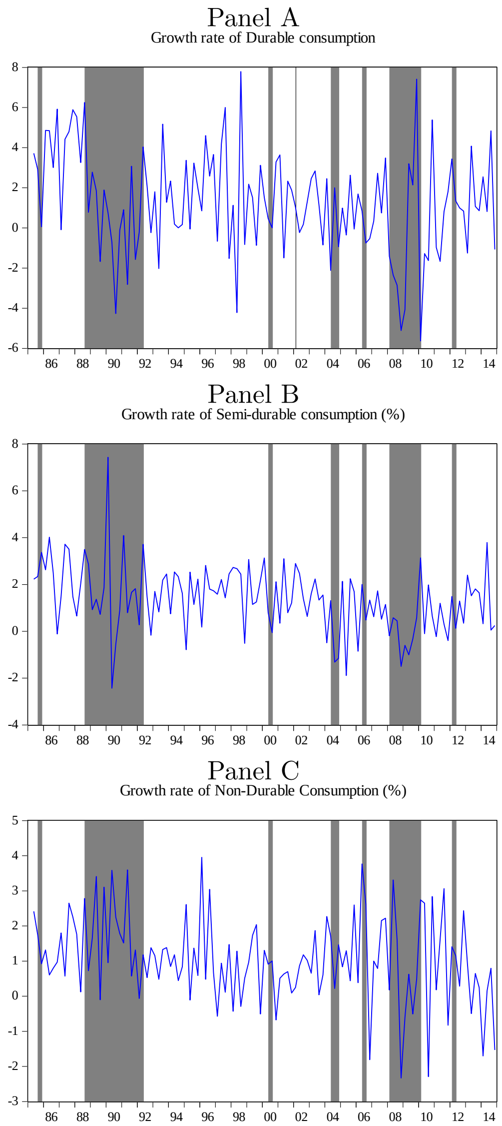
the UK while figure 3 shows the time-series plots of durable consumption growth rate (Panel A), semi-durable consumption growth rate (Panel B) and non-durable consumption growth rate (Panel C). The shaded regions in the plots represent periods of recession in the UK, which is measured, as period of decline in the real GDP in two consecutive quarters. It can be seen that the durable consumption growth is more volatile than semi-durable consumption growth, which in turn is more volatile than non-durable consumption growth. The annualised standard deviations of durable, semi-durable and non-durable consumption growth rates are 5.16%, 2.86% and 2.49% respectively, for the sample shown in figure 3 (1985Q1 — 2014Q4).

Detemple and Giannikos (1996) argue that durable consumption has two key attributes. First is known as the usage function, which represents services provided over longer period of time than non-durable goods. Durable goods not only provide utility in the current period, but they also provide gratification over future period of time. The second attribute is that durable goods provide immediate feeling of status, which provides symbolic value. They show that in presence of this multi-attribute durable good, equilibrium interest rates and asset risk premia are linked not only to marginal utilities of non-durable but also of status and services that are provided by durable goods.

Using the data from 1988Q1 to 2014Q4 for the UK, we examine the impact of durable, non-durable and semi-durable consumptions shocks on the UK ERP. Our main findings are as follows. First, we find that aggregate personal consumption shocks have a negative impact on the ERPs of the various FTSE indices both at aggregate and sectoral level. A fall in actual consumption relative to the expected consumption increases the ERP confirming countercyclical nature of stock returns. Aggregate consumption shocks seem to explain approximately 21.4% variations in the ERPs of FTSE 100 and FTSE 250 indices and about 14% variations in the ERPs of the ten sectoral indices. The ERPs of cyclical industries seems to be more sensitive to the aggregate consumption shocks. Furthermore, the traditional Fama and MacBeth, (1973) analysis shows that the exposure to aggregate consumption shocks can explain about 28% variation in the ERPs of the various FTSE indices and these excess returns seems to increase linearly with the increase in the exposure to aggregate consumption shocks.

Our results for the ERPs of 25 value-weighted Fama-French style portfolios are fairly similar. Aggregate personal consumption shocks have a negative impact on the ERPs of the 25 portfolios. On the basis of size characteristic, the ERPs of portfolios of small stocks are relatively more sensitive to aggregate consumption shocks than the ERPs of large stocks. The ERPs of portfolio of value stocks are more sensitive to the aggregate personal consumption shocks than the ERPs of portfolio of growth stocks. Aggregate personal consumption shocks can explain approximately 44% variation in the ERPs of the 25 Fama-French portfolios after controlling

FIG. 3. Time series plot of growth rates of Durable Consumption, Semi-Durable Consumption and Non-Durable consumption in the UK. Sample period 1985Q1-2014Q4. Shaded areas are the recessions in the UK (measured as two consecutive quarters of decline in real GDP)



for the size and value premiums of Fama and French (1992) and momentum premium of Carhart (1997).

Finally, shocks to the durable and the semi-durable consumption have a negative impact on the ERPs of the various FTSE indices as well as sectoral indices. On the contrary, the shocks to non-durable consumption exert a positive impact on the ERPs of FTSE indices. This implies that durable and semi-durable consumption exhibits more pro-cyclical properties than non-durable consumption. Furthermore, the cross-sectional regression results suggest that the ERP increases with the increase in the exposure to the shocks in durable and semi-durable consumption. On the contrary, the ERP decreases with the increase in exposure to non-durable consumption shocks. Our results are broadly similar for the 25 Fama-French portfolios.

The remainder of the paper is organised as follows; Section 2 explains the theoretical background and our empirical approach used in the study. Section 3 describes the data used. Section 4 discusses the empirical results and section 5 concludes.

2. THEORETICAL BACKGROUND AND EMPIRICAL FRAMEWORK

2.1. Theoretical Background

Under the canonical CCAPM, expected excess returns on risky assets are related to consumption risk. As discussed in the introduction, a representative agent prefers not to have choppy future consumption levels and maximise the expected future utility of consumption discounted by the agent's impatience. This is represented as;

$$U(C_t, C_{t+1}) = u(C_t) + \beta \cdot E_t[u(C_{t+1})] \tag{1}$$

where, the period utility function $u(\cdot)$ is concave and increases with the increase in the level of consumption. $0 < \beta < 1$ captures the agent's impatience. The utility function in (1) imply that agents strictly prefer increasing consumption ("greedy") however the marginal utility of consumption diminishes over time ($u'' < 0$). Under the assumption that the agent can freely trade assets to smooth the consumption, along with the objective of maximising the utility of consumption in presence of inter-temporal budget constraint, the agent's first order condition for an optimal consumption and portfolio choice is given by

$$P_t \cdot U'(C_t) = E[\beta \cdot U'(C_{t+1}) \cdot x_{t+1}] \tag{2}$$

where, x_{t+1} is the total payoff from the asset with price P_t and C_t is the consumption level at time t. Equation 2 implies that loss in utility by giving up the current consumption and using the proceeds to buy an asset at price P_t must be at the most equal to discounted future augmented utility. In other words, the marginal cost of losing the consumption must be equal to marginal gain in the utility of consumption due to the expected random payoff x_{t+1} from the purchased asset. This is the Euler equation, which can be written as;

$$1 = E_t(m_{t+1}R_{t+1}) \tag{3}$$

where R_{t+1} is the gross rate of return and $m_{t+1} = \beta \cdot \frac{u'(C_{t+1}}{u'(C_t)}$ is the stochastic discount factor which is equal to the intertemporal marginal rate of substitution. Since the marginal investment in the asset results in same level of increase in the expected future utility, and since the excess return on any risky asset (ERP) is the return on zero-cost portfolio, it can be written as

$$0 = E_t[u'(C_{t+1}) \cdot R^e_{t+1}] \tag{4}$$

where, R^e_{t+1} is the ERP of the risky asset. Equation (4) implies that excess returns on any risky asset are sensitive to their co-movement with consumption level of the agent. Therefore, a shock to consumption level that may arise due to a change in agent's income or wealth or due to some exogenous factors should be reflected in the ERP. It is worth pointing here that we have not made any assumption regarding the specific nature of functional form of the agent's preferences i.e. whether it is time separable or non-separable, except that it is concave and increasing. Next, we discuss the methodology.

2.2. Identification of Consumption Shocks

We use a two-step approach in our analysis. In the first step, we use the SVAR approach for extracting the consumption shocks. In the second step, we examine the implications of these shocks for the asset prices in the UK. For this purpose, we use the Fama and MacBeth (1973) regressions to estimate the factor risk premiums arising from exposure to these consumption shocks.

We begin by identifying the consumption shocks. For this we use the SVAR framework of Ludvigson et.al. (2002) who use it to examine the consumption-wealth channel of the transmission of monetary policy in the US. MacDonald, Mullineux and Sensarma (2011) also employ similar approach for examining the consumption-wealth channel in the UK. The theoretical underpinnings of this framework is deeply rooted in the Life-Cycle theory of consumption proposed by Modigliani, (1963) and Ando and Modigliani, (1963). The consumption-wealth channel describes the response of aggregate consumption to monetary policy changes via the changes in the aggregate wealth. For example, an accomodative monetary policy can boost the market value of both the financial and housing wealth which can be subsequently used to increase household consumption either by withdrawing the equity from the housing wealth or by liquidating the financial wealth[2].

We model the UK economy as;

$$AZ_t = A^*(L)Z_{t-1} + Bu_t \tag{5}$$

where, Z is n dimensional vector of macroeconomic variables, $A^*(L)$ is the p^{th} order polynomial matrix in the lag operator L, A is the $n \times n$ matrix of contemporaneous coefficients, B is a $n \times n$ matrix relating the structural innovations u_t to the reduced form innovations and $u_t \sim N(0, \Sigma)$ is a $n \times 1$ vector of structural shocks assumed to have ortho-normal co-variance matrix similar to an identity matrix i.e. $E[u, u'] = I$. In order to estimate (5) we first estimate the following reduced form VAR

$$Z_t = C(L)Y_{t-1} + \varepsilon_t \tag{6}$$

where ε_t is the reduced form residuals such that $\varepsilon_t^i \sim (0, \Omega)$ and $\Omega = E[\varepsilon, \varepsilon']$ is the residual covariance matrix and $C = A^{-1}A^*$. Following Amisano and Giannini, (1997) and Lutkepohl, (2005) we have,

$$A\varepsilon_t = Bu_t \tag{7}$$

The assumption of ortho-normal covariance matrix of the structural shocks leads to following condition

$$A\Omega A' = BB' \tag{8}$$

The short-run restrictions implied by (7) were also imposed by Gali, (1992) and Pagan, (1995) to study and test the traditional IS-LM model to the post-war US data.

Similar to Ludvigson et.al. (2002), we use five macroeconomic variables in (5) i.e., inflation, aggregate income, aggregate consumption, aggregate wealth and Bank of England's base rate. Thus, we have,

$$Z_t = [\pi_t, y_t, c_t, w_t, r_t]' \tag{9}$$

where, $\pi_t = \ln\left[\frac{P_t}{P_{t-1}}\right]$ is the inflation measured using log changes in Consumer Price Index, $y_t = \ln I_t$ is the log of aggregate income, $c_t = \ln C_t$ is the aggregate household consumption, $w_t = \ln W_t$ is the gross aggregate wealth, r_t is the Bank of England's base rate. In order to identify the A and the B matrices in (7), we need to impose restrictions on the elements

[2]The Bank of England has maintained its accommodative monetary policy stance by keeping the base rate at its historic low levels since March 2009.

that are theoretically motivated. We impose the short-run restirctions suggested by Ludvigson et.al. (2002). The restrictions on matrix A are driven by the following assumptions; (i) the base rate responds contemporaneously to consumption and income, (ii) wealth is not contemporaneously affected by consumption however, the opposite is true and finally (iii) the Bank of England is assumed not to react contemporaneously to changes in wealth, though simultaneous reaction between wealth and base rate is allowed. This final assumption implies that Bank of England does not target wealth directly. With these set of assumptions the matrix of contemporaneous coefficients A takes the form;

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & a_{34} & 0 \\ a_{41} & a_{42} & 0 & 1 & a_{45} \\ a_{51} & a_{52} & a_{53} & 0 & 1 \end{bmatrix} \tag{10}$$

While the matrix B is assumed to be an identity matrix. Thus (7) becomes;

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & a_{34} & 0 \\ a_{41} & a_{42} & 0 & 1 & a_{45} \\ a_{51} & a_{52} & a_{53} & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} \varepsilon_t^{\pi} \\ \varepsilon_t^{y} \\ \varepsilon_t^{c} \\ \varepsilon_t^{w} \\ \varepsilon_t^{r} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} u_t^{\pi} \\ u_t^{y} \\ u_t^{c} \\ u_t^{w} \\ u_t^{r} \end{bmatrix} \tag{11}$$

The structural consumption shocks u_t^c can be computed from (11) once the unknown parameters in A are estimated.

2.3. Asset Pricing Implication

In the previous section, we described the methodology to extract the structural consumption shocks. We now outline the procedure to investigate whether these consumption shocks are priced in aggregate and cross-sectional stock returns. For this, we estimate the factor loadings of our test portfolios on the consumption shocks by estimating the following quarterly time series regression model;

$$R_{t,i}^e = \alpha_i + \beta_c^i u_t^c + \varepsilon_t \tag{12}$$

where, $R_{t,i}^e$ is the Equity Risk Premium (ERP) of the i^{th} test portfolio measured using the total return on the portfolios over and above risk-free interest rate, α is the constant, β_c^i is the factor loading of the i^{th} portfolio on the consumption shocks u_t^c and ε is assumed to be a white-noise process. It is important to note that since u_t^c in equation (12) is not an excess return on freely traded portfolios, the sample mean of the factor does not correspond to its risk premia. Therefore, under such conditions, the estimated constant term (α_i) in equation (12) cannot be considered as pricing error in explaining the ERPs of a particular portfolio. As such the Gibbons, Ross and Shanken, (1989)'s approach for testing the null hypothesis that all the (α_i)s are jointly significantly different from zero is not strictly applicable here.

We investigate the factor loading for three types of portfolios. First is the total excess return on two popular and mostly tracked indices in the UK, the FTSE 100 index and the FTSE 250 index. These two indices serve as a benchmark for most UK fund managers. The second is the excess returns on ten most widely used sectoral indices in the UK. These indices are popular with the tracker Exchange Traded Funds (ETFs) which provide opportunities to the investors to get sectoral exposure. Third, we also investigate the factor loadings for the excess returns on value-weighted 25 Fama-French-style portfolios sorted on size and book-to-market. The goal here is to examine whether the impact of consumption shocks is consistent and significant within the cross-sectional variation in the excess returns. The Fama-French portfolios reflect two most important aspects of asset returns; the "size premium" and the "value premium".

In order to estimate the factor risk premium due to the exposure to the consumption shocks in (12), we employ two-step cross-sectional regression approaches of Fama and MacBeth, (1973). The first step is to estimate the time-series regression (12) and recover the factor loadings $\widehat{\beta_c}$. In the second step, we estimate the cross-sectional regression of ERP on these loadings $\widehat{\beta_c}$ obtained from the first step to examine the exposure of the excess returns to the factor loading over time. Thus, the second stage regression is;

$$R^e_{t,i} = \gamma_0 + \gamma_1 \widehat{\beta_c} + \varepsilon_1 \tag{13}$$

where, γs are the regression coefficients that are used for calculating the factor risk premium due to the exposure to the consumption shocks under the assumption that ε is white noise. The t-statistics associated with the factor risk premium is computed using Newey and West (1987) heteroskedasticity and autocorrelation corrected standard errors.

3. DATA

We use quarterly UK data from 1988Q1 to 2014Q4 taken from DataStream. To estimate the impact consumption shocks, we use personal durable, semi-durable and non-durable consumption, which is measured using seasonally adjusted UK household consumption and covers spending on goods and services except for: buying or extending a house, investment in valuables (paintings, antiques etc.) or purchasing second-hand goods. See

Appendix A for more details about the measurements and components of durable, semi-durable and non-durable consumption by the Office of National Statistics.

We use following variables in constructing SVAR. Total Gross Wealth, which is the total gross value of accumulated assets by households; the sum of four components: property wealth, physical wealth, financial wealth and private pension wealth. Aggregate personal income is measured using income approach of secondary distribution of income accounts and uses the disposable income of households and Non-Profit Institutions Serving Households (NPISH). Inflation is calculated using the log difference of the harmonised consumer price index. We use Bank of England's (BOE) base interest rate as a proxy of the UK's monetary policy.

The ERP of the FTSE indices is estimated using the difference between the returns on the total return indices, which includes dividends, and the 3-month UK treasury bills rate. The ERPs of the 25 value-weighted Fama-French style portfolios are calculated using the difference between the returns on these portfolios and the 3-month UK treasury bills rate.[3]

TABLE 1.

Descriptive Statistics of the annualised ERPs of FTSE indices and 25 value weighted Fama-French portfolios.

Panel A								
	Mean (%)	Median (%)	Std. Dev.(%)	Skewness	Kurtosis	Jarque-Bera	Probability	Count
FTSE 100	3.58	7.19	30.07	−0.61	3.60	8.26	0.02	108
FTSE 250	5.88	8.59	36.80	−0.70	4.02	13.66	0.00	108
Basic Materials	2.47	8.95	53.20	−1.45	6.46	91.75	0.00	108
Consumer Service	2.29	7.18	34.82	−0.75	3.93	14.03	0.00	108
Consumer Goods	4.54	8.81	41.14	−0.57	4.69	18.75	0.00	108
Financials	3.64	10.08	43.32	−0.76	4.40	19.15	0.00	108
Healthcare	5.43	9.27	27.88	−0.43	3.19	3.44	0.18	108
Industrials	3.43	8.75	43.41	−0.92	4.95	32.54	0.00	108
Oil and Gas	4.73	9.03	34.30	−0.78	4.34	18.95	0.00	108
Technology	1.53	6.89	73.87	−0.53	7.48	95.37	0.00	108
Telecommunications	4.07	5.13	41.73	−0.37	3.65	4.34	0.11	108
Utilities	8.90	10.40	28.47	−0.47	2.78	4.17	0.12	108

Table 1 provides the descriptive statistics. Panel A shows ERPSs of aggregate and disaggregated FTSE indices. The Utility sector offers highest average excess returns amongst all UK sectors and outperforms the aggregate FTSE 250 average returns. On the hand, the Technology sector

[3]Return data of the 25 Fama-French portfolios and pricing factors i.e., size premium (SMB), value premium (HML) and momentum premium (UMD) for the UK are taken from Gregory, Tharyan and Christidis, (2013).

provides the lowest excess returns and highest volatility. All excess returns are negatively skewed. The Jarque-Bera statistics are significant for all returns except for Healthcare, Telecommunication, and Utility sectors. Panel B presents descriptive statistics of 25 Fama-French portfolios excess returns. For the ease of reading, we maintain the same naming conventions as in Gregory, Tharyan and Christidis (2013). We find that the third middle portfolio (EM3H) offers the highest excess returns whilst the small and growth portfolio (ESL) shows the highest volatility. Overall, all returns are negatively skewed and show excess kurtosis except for EM3H portfolio.

TABLE 1—*Continued*

Panel B

	Mean (%)	Median (%)	Std. Dev.(%)	Skewness	Kurtosis	Jarque-Bera	Probability	No. of Quarters
ESL	1.68	9.40	54.50	−0.45	5.27	26.83	0.00	108
ES2	4.42	4.54	46.32	−0.19	4.04	5.51	0.06	108
ES3	4.92	5.46	42.11	−0.52	4.36	13.23	0.00	108
ES4	6.10	7.92	44.31	−0.49	4.82	19.23	0.00	108
ESH	6.65	5.34	42.57	−0.66	5.14	28.46	0.00	108
ES2L	0.12	3.83	55.85	−0.85	6.14	57.33	0.00	108
ES22	2.97	8.88	51.09	−0.84	4.56	23.71	0.00	108
ES23	4.41	8.69	40.36	−0.61	4.06	11.68	0.00	108
ES24	4.87	6.84	39.27	−0.46	3.82	6.87	0.03	108
ES2H	5.36	11.02	51.47	−0.61	6.31	55.88	0.00	108
EM3L	1.61	7.91	53.20	−1.42	7.74	137.46	0.00	108
EM32	1.34	6.69	43.75	−0.59	4.27	13.55	0.00	108
EM33	4.39	7.59	43.19	−1.07	5.59	50.75	0.00	108
EM34	3.36	9.90	44.95	−0.97	5.29	40.48	0.00	108
EM3H	7.39	10.07	46.39	−0.36	3.55	3.69	0.16	108
EB4L	6.03	13.08	44.68	−0.33	6.37	53.16	0.00	108
EB42	3.14	4.66	40.13	−0.76	4.20	16.73	0.00	108
EB43	7.06	10.64	39.48	−0.80	4.38	20.06	0.00	108
EB44	4.16	9.68	45.99	−0.67	3.80	11.00	0.00	108
EB4H	4.99	9.74	51.07	−0.60	4.32	14.31	0.00	108
EBL	3.42	9.18	31.64	−0.68	4.11	14.03	0.00	108
EB2	3.22	8.01	31.23	−0.59	3.20	6.39	0.04	108
EB3	3.90	8.08	36.98	−0.67	4.38	16.62	0.00	108
EB4	4.12	9.03	36.12	−1.32	7.17	109.69	0.00	108
EBH	3.62	7.59	36.76	−0.67	4.07	13.30	0.00	108

Notes: Panels A reports the descriptive of annualised ERPs (%) of the FTSE indices. Panel B reports the annualised ERPs (%) 25 value-weighted Fama-French Style Portfolios. The naming convention is same as in Gregory, Tharyan and Christidis, (2013). For example, "SH" denotes small cap-high book-to-market (BTM) "S4" denotes small and 4th lowest BTM, "B4" denotes big and 4th highest BTM "BH" denotes big size and highest BTM, "M3L" middle 3rd size and largest BTM and "M32" middle 3rd size and 2nd BTM. Sample: 1988Q1-2014Q4

4. RESULTS

4.1. The impact of aggregate consumption shocks on ERPs of different industries.

The results of time series regression specified in equation (12) are presented in table 2. The results show the factor loadings of consumption shocks on the ERPs of various FTSE indices (Column B of Table 2). The beta coefficients are significantly negative for the ERP of all the FTSE indices. Aggregate personal consumption shocks seem to have negative impact on the ERP of the aggregate FTSE indices (FTSE 100 and FTSE 250). The ERP of FTSE 250 index is more vulnerable to consumptions shocks than the ERP of FTSE 100 index ($|-5.40| > |-4.82|$). This is presumably because companies in the FTSE 250 index are more focused to the UK domestic economy than the companies in the FTSE 100 index. On the sectoral basis, the ERPs of cyclical industries such Financial firms seem to be most vulnerable to consumption shocks ($beta = -7.45$) than any other industry. This is, presumably, because consumption in the UK is largely financed by consumer credit. Similarly, other cyclical industries such as Technology, Industrials and Consumer Services seem to be more vulnerable to consumption shocks than the non-cyclical industries such as Utilities, Consumer Goods and Healthcare. On an average, consumption shocks can explain almost 14% variation in the ERPs of cyclical industries and 12.11% variation in the ERPs of non-cyclical industries. Overall, these results lend support to the hypothesis that ERPs of different industries react heterogeneously to consumption shocks.

We check the robustness of these results by investigating whether aggregate consumption shocks are significant in driving the ERP in presence of the size premium (SMB) and the value premium (HML) of Fama and French, (1992) and the momentum factor (UMD) of Carhart, (1997). For this we estimate the following regression model;

$$R^e_{t,i} = \alpha_i + \beta^i_c u^c_t + \beta^i_s \cdot SMB_t + \beta^i_v \cdot HML_t + \beta^i_m \cdot UMD_t + \varepsilon_t \qquad (14)$$

where; R^i_t is the ERP of i^{th} portfolio, u^c_t represents the consumption shocks derived from the SVAR model, SMB_t is the return on a portfolio which is long in small size stocks and short in big size stocks, HML_t is the return on portfolio which is long on high book-to-market ratio and short on low book-to-market ratio and finally UMD_t is the momentum factor which is derived from the difference in returns form "winners" and "losers" portfolio.

Table 3 shows the impact of aggregate consumption shocks on the ERP after controlling for the size, value and momentum premiums. Consistent with results reported in table 2, the aggregate personal consumption shocks exert a negative impact on the ERP. In cases of ERPs of FTSE 100 and Consumer goods, Utilities and Telecom sectors, aggregate personal con-

TABLE 2.

The impact of consumption shocks on the ERPs of FTSE indices.

Portfolios	α	β_c	F-Stat	DW-Stat	R^2
	(A)	(B)	(C)	(D)	(E)
FTSE 100	0.87	-4.82^{***}	28.67^{***}	1.99	23.24%
	(1.35)	(−5.15)			
FTSE 250	1.55^{*}	-5.40^{***}	23.83^{***}	1.78	19.69%
	(1.73)	(−4.14)			
Basic Materials	0.84	-3.76^{***}	4.38^{**}	1.87	4.43%
	(0.77)	(−2.73)			
Consumer Services	0.60	-5.22^{***}	24.32^{***}	1.89	20.22%
	(0.69)	(−4.03)			
Financials	0.86	-7.45^{***}	33.93^{***}	1.74	25.90%
	(0.81)	(−5.32)			
Consumer Goods	1.35	-4.98^{***}	14.91^{***}	1.99	13.74%
	(1.52)	(−3.32)			
Healthcare	1.30^{**}	-4.01^{***}	23.28^{***}	1.94	19.52%
	(2.04)	(−4.17)			
Industrials	0.79	-6.36^{***}	22.45^{***}	1.89	18.96%
	(075)	(−3.96)			
Oil and Gas	1.21^{*}	−1.20	1.07	2.43	1.14%
	(1.75)	(−1.23)			
Utilities	2.28^{***}	-3.07^{***}	11.65^{***}	2.07	10.79%
	(3.26)	(−4.22)			
Telecom	1.01	-5.11^{***}	14.54^{***}	1.81	13.10%
	(0.79)	(−4.61)			
Technology	0.53	-8.31^{*}	12.10^{***}	1.51	11.27%
	(0.17)	(−1.93)			

Notes: The dependent variable is ERPs of various FTSE indices (in percentage) calculated as the difference between total return and the 3 month Gilts rate. The independent variable is the consumption shocks. The model estimated is (12). The table reports quarterly estimates of the coefficients. Figures in the parentheses are t-statistics computed using Newey-West heteroskedastic-robust standard errors with 4 lags (initial pre-whitening using 2 lags). Adjusted sample period is 1990Q2 — 2014Q3

sumption shocks eclipses the size, value and the momentum premiums. In each of these cases the respective adjusted R-squares are high with statistically significant F-Statistics. Overall, consumptions shocks appear to have a significant impact on the ERPs with the sole exception of Oil and Gas industry.

To estimate the price of risk associated with the exposure to the risk of aggregate consumption shocks we employ the second-stage Fama and

TABLE 3.

The impact of consumption shocks on the ERPs of FTSE indices

FTSE Indices	α_i	β_c^i	β_s^i	β_v^i	β_m^i	R^2	F-stat
	(A)	(B)	(C)	(D)	(E)	(F)	(G)
FTSE 100	0.89	-4.73^{***}	0.36	-0.21	-0.03	21.17%	7.51^{***}
	(1.18)	(-5.07)	(1.03)	(-0.68)	(-0.10)		
FTSE 250	1.32	-4.78^{***}	2.25^{***}	0.05	-0.10	43.60%	19.75^{***}
	(1.67)	(-4.32)	(5.98)	(0.12)	(-0.26)		
Basic Materials	0.10	-3.32^{*}	2.07^{**}	1.46^{**}	0.20	15.88%	5.58^{***}
	(0.07)	(-1.84)	(2.70)	(1.98)	(0.27)		
Consumer Services	0.85	-4.67^{***}	1.26^{***}	-0.57	-0.34	30.96%	11.88^{***}
	(1.09)	(-4.12)	(3.41)	(-1.50)	(-0.85)		
Financials	0.62	-6.85^{***}	1.83^{***}	0.60	-0.11	37.95%	15.83^{***}
	(0.56)	(-5.44)	(2.55)	(1.06)	(-0.25)		
Consumer Goods	1.36^{**}	-4.47^{***}	1.11^{*}	0.36	-0.23	17.60%	6.18^{***}
	(2.06)	(-4.19)	(1.69)	(1.16)	(-0.84)		
Healthcare	1.81^{***}	-3.97^{***}	-0.75^{***}	-0.73^{***}	-0.29	25.26%	9.20^{***}
	(2.90)	(-4.42)	(-2.19)	(-2.44)	(-1.10)		
Industrials	0.80	-5.75^{***}	1.97^{***}	-0.43	-0.23	32.20%	12.52^{***}
	(0.89)	(-4.37)	(4.68)	(-0.83)	(-0.45)		
Oil and Gas	0.98	-1.44	-0.45	0.51	0.21	1.04%	1.26
	(1.17)	(-1.59)	(-1.02)	(0.96)	(0.46)		
Utilities	2.22^{***}	-3.07^{***}	-0.36	0.58	0.02	12.04%	4.32^{***}
	(3.28)	(-3.29)	(-0.92)	(1.44)	(0.06)		
Telecom	1.31	-5.17^{***}	-0.20	-0.98	-0.10	13.95%	4.93^{***}
	(1.30)	(-5.67)	(-0.39)	(-0.98)	(-0.14)		
Technology	1.74	-7.07^{***}	3.17^{***}	-3.85^{***}	-1.04	44.82%	20.70^{***}
	(1.32)	(-4.00)	(4.43)	(-3.04)	(-0.90)		

Notes: The dependent variable is ERPs of various FTSE indices (in percentage) calculated as the difference between total return and the 3 month Gilts rate. The independent variable is the consumption shocks, SMB, HML and UMD. The model estimated is (14). The table reports quarterly estimates of the coefficients. Figures in the parentheses are t-statistics computed using Newey-West heteroskedastic-robust standard errors with 4 lags (initial pre-whitening using 2 lags). Adjusted sample period is 1990Q2 — 2014Q3.

MacBeth, (1973) cross- sectional regressions approach. Since, the factor in equation (12) is not a return on a traded portfolio, we can rely on the two-stage approach developed by Fama and MacBeth, (1973). Table 4 reports the results of Fama-MacBeth two stage regressions. In column (1) we present the price of risk i.e. the factor risk premium of the arising due to exposure to the aggregate personal consumption shocks. In column (2) we assess the pricing ability of the aggregate consumption shocks in presence

TABLE 4.

Pricing of Consumption Shocks

	1	2
γ_0	1.77***	1.56***
	(4.33)	(3.96)
Aggregate Consumption shocks	0.14**	0.087
	(2.11)	(1.24)
SMB		−0.17
		(−1.33)
HML		0.29
		(1.58)
UMD		−1.10
		(−1.18)
R-squared	28.12%	6.00%
F-statistics	3.91*	1.17

Notes: The table reports the estimates of second-stage cross-sectional regressions of Fama and MacBeth (1973). The dependent variable is cross-sectional ERPs of the FTSE indices and the independent variables are the exposure to aggregate personal consumption shocks and other cross-sectional pricing factors obtained from the first-pass regression results in tables 2 and 3.

of size premium (SMB), value premium (HML) and the momentum premium (UMD). The t-statistics associated with the estimates are corrected for heteroscedasticity and autocorrelation (Newey and West, 1987). From column (1) we can see that exposure to the aggregate personal consumption is priced positively at 5% significance. A one-unit increase in the exposure to the aggregate personal consumption shocks leads to an increase in the ERP of the FTSE indices by 0.14%. The exposure to aggregate consumption shocks can explain 28.12% variation in the ERP of the FTSE indices. The F-statistics is significant at 10%. This suggests that ERP of the FTSE indices increases linearly as the exposure to the aggregate consumption shocks increases. However, from column (2) we can see that the pricing ability of aggregate consumption shocks decreases once we control for size, value and momentum premiums.

4.2. The impact of consumption shocks on ERPs of 25 Fama-French portfolios

This section investigates whether consumption shocks can explain significant variation in the ERPs of the 25 Fama-French style portfolios in the UK, sorted on the size and book-to-market characteristics. For this, we estimate the quarterly time series regression (12) with the ex-post ERPs of the 25 portfolios as dependent variables. The results of this time series regressions are reported in table 5. Panels (A) and (B) reports the intercept and slope coefficients in equation (12) along with their associated t-statistics which are computed using Newey-West heteroskedastic and autocorrelation corrected — robust standard errors. Panel C reports the adjusted R^2 of each time-series regression, which shows how much variation in the ERPs of the respective portfolios can be explained by consumption shocks. Panel C also reports the F-statistic of each individual regressions.

TABLE 5.

The impact of aggregate consumption shocks on the ERP of 25 Fama-French style portfolios sorted on size and book-to-market characteristics.

Panel A: Constant											
	Small	Size 2	Size 3	Size 4	Large	Average	T-statistics				
Growth	0.41	0.35	0.36	0.66	0.36	0.43	0.71	0.70	0.46	1.49	1.29
BM2	0.63	0.49	0.47	0.60	0.46**	0.53	1.56	1.08	1.33	1.65	2.06
BM3	0.66	0.57*	0.60*	0.80***	0.54***	0.63	1.68	1.69	1.85	2.64	2.56
BM4	0.75	0.68**	0.38	0.50	0.32	0.53	1.98	2.18	0.92	1.58	1.25
Value	0.77	0.64**	0.87**	0.66	0.47*	0.68	2.02	1.48	2.34	1.51	1.77
Average	0.64	0.54	0.53	0.64	0.43						
Panel B: Loadings on Consumption Shocks											
	Small	Size 2	Size 3	Size 4	Large	Average	T-statistics				
Growth	−1.87***	−1.73***	−1.72	−1.55	−1.66***	−1.71	−3.22	−2.89	−1.63	−2.91	−4.47
BM2	−1.37*	−1.76***	−1.90***	−2.18***	−1.22***	−1.68	−2.58	−2.90	−3.66	−4.00	−3.39
BM3	−1.61***	−1.44***	−1.52***	−1.32***	−1.48***	−1.47	−3.48	−3.11	−3.61	−2.62	−3.99
BM4	−1.45***	−1.74***	−1.72***	−1.88***	−1.38***	−1.64	−2.99	−3.98	−2.88	−3.89	−3.62
Value	−1.57***	−2.16***	−2.20***	−2.18***	−1.50***	−1.92	−3.71	−3.95	−4.39	−3.84	−5.31
Average	−1.57	−1.77	−1.81	−1.82	−1.45						
Panel C											
R-squared							F-statistics				
	Small	Size 2	Size 3	Size 4	Large	Average					
Growth	9.52%	7.90%	8.99%	9.70%	22.89%	11.80%	10.10	8.23	9.48	10.32	28.50
BM2	6.99%	9.77%	14.42%	18.22%	9.40%	11.76%	7.21	10.40	16.18	21.38	9.96
BM3	12.03%	10.50%	10.76%	9.31%	13.74%	11.27%	13.13	11.26	11.57	9.85	15.29
BM4	8.76%	16.24%	12.71%	18.32%	16.55%	14.52%	9.22	18.61	13.97	21.53	19.04
Value	11.05%	14.15%	17.81%	14.97%	13.66%	14.33%	11.93	15.82	20.80	16.90	15.19
Average	9.67%	11.71%	12.94%	14.10%	15.25%						

Notes: This table reports the impact of aggregate consumption shocks on the ERP of 25 portfolios, sorted on size and book-to-market characteristics. The independent variable is the shocks in the aggregate consumption shocks. The reported t-statistics are corrected for heteroscedasticity and autocorrelation. Panel C- reports the R-squared and F-statistics of individual regressions. Adjusted sample period is 1990Q2 — 2014Q3

On the basis of size dimension, we find that, on an average, consumption shocks are able to explain 9.67% variation in the ERPs of the small size portfolios and 15.25 % variation in the ERP of the big stocks. On the basis of value dimension, we find that consumption shocks are able to explain, on average, 11.80% and 14.33% variation in the ERP of the growth and value portfolios respectively. From panel B, we can observe that there is a fair degree of heterogeneity in the response of ERP of these portfolios to aggregate consumption shocks. Furthermore, we can also observe that the aggregate personal consumption shocks exert a negative impact on the ERP of these 25 portfolios. The ERPs of both small and large portfolios are highly statistically significant at 1% level.

Similar to small size stocks, we can see that most of the sensitivities of the ERPs of big size portfolios to consumption shocks are statistically significant irrespective of book-to-market ratios. The average sensitivity of the ERP of the big size portfolios is -1.45. Although the average variation in the sensitivities of the ERP of portfolios on the basis of size dimension is not large, yet we can see that the small firms are slightly more sensitive to consumption shocks than big firms. Consequently, when there is negative consumption shock i.e. when the actual consumption is well below the theoretical consumption implied by the SVAR model, small firm stocks seem to be most adversely affected.

On value dimension, the average absolute sensitivity of the ERP of the value stocks is 1.92 and for the growth stocks is 1.71. The ERPs of value stocks in both small size and big size category seems to be more sensitive to aggregate consumption shocks than their respective growth counterparts in the both the size categories. This is, presumably, because when there is negative consumption shock, the prices of value stocks fall much more than the growth stocks thereby raising their expected returns. As such, the ERPs of the value stocks are more sensitive to consumption shocks than the ERPs of growth stocks. Another plausible explanation for this phenomenon is that value stocks are more sensitive to ultimate consumption risk (long run consumption co-variance risk) proposed by Parker and Julliard, (2005). An analogues explanation for this phenomenon can be provided on the basis of the intuition of results by Hansen, Heaton and Li, (2008). They show that the cash flows from value stocks are relatively more vulnerable to long term macroeconomic risk arising from shocks to consumption growth rate. The cash flows from the value stocks seem to positively co-vary with consumption while cash flows from growth stocks seem to co-vary with consumption negligibly, in the long run. Therefore, it may not be unreasonable to deduce that ERP of value stocks are more sensitive to consumption shocks.

We then repeat the analysis to check the robustness of the underlying essence of the results in table 5. For this we examine whether the aggregate personal consumption shocks have a significant impact on the ERPs of the 25 Fama-French portfolios in presence of the size premium, value premium and momentum factor by estimating the following regression.

$$R^e_{t,i} = \alpha_i + \beta^i_c u^c_t + \beta^i_s \cdot SMB_t + \beta^i_v \cdot HML_t + \beta^i_m \cdot UMD_t + \varepsilon_t \qquad (15)$$

TABLE 6.

The impact of aggregate consumption shocks on the ERP of the 25 value-weighted Fama-French portfolios

Panel A: Loadings on Consumption Shocks											
	Small	Size 2	Size 3	Size 4	Large	Average	t-statistics				
Growth	-1.66^{***}	-1.54^{***}	-1.44^{***}	-1.45^{***}	-1.64^{***}	-1.55	-5.03	-4.79	-3.81	-3.11	-5.10
BM2	-1.05^{***}	-1.35^{***}	-1.58^{***}	-1.84^{***}	-1.19^{***}	-1.40	-2.87	-3.92	-3.34	-3.97	-3.12
BM3	-1.32^{***}	-1.26^{***}	-1.35^{***}	-1.14^{***}	-1.59^{***}	-1.33	-4.77	-3.04	-3.64	-2.65	-4.16
BM4	-1.13^{***}	-1.52^{***}	-1.41^{***}	-1.70^{***}	-1.35^{***}	-1.42	-4.03	-5.12	-4.69	-4.31	-4.00
Value	-1.22^{***}	-1.77^{***}	-1.91^{***}	-1.72^{***}	-1.29^{***}	-1.58	-3.69	-5.08	-4.22	-4.06	-7.10
Average	-1.28	-1.49	-1.54	-1.57	-1.41						
Panel B: Loadings on SMB											
	Small	Size 2	Size 3	Size 4	Large	Average	t-statistics				
Growth	1.31^{***}	1.12^{***}	0.93^{***}	0.62^{***}	-0.01	0.80	5.13	6.60	7.68	3.63	-0.05
BM2	1.28^{***}	1.30^{***}	1.02^{***}	0.76^{***}	0.04	0.88	9.41	8.71	6.20	4.81	0.25
BM3	1.14^{***}	0.94^{***}	0.98^{***}	0.73^{***}	0.17	0.79	9.61	6.56	5.91	5.03	1.54
BM4	1.22^{***}	0.97^{***}	0.98^{***}	0.66^{***}	0.07	0.78	10.69	10.00	6.94	3.21	0.50
Value	1.14^{***}	1.23^{***}	1.03^{***}	0.93^{***}	-0.28^{*}	0.81	8.40	8.55	8.40	5.34	-1.83
Average	1.22	1.11	0.99	0.74	-0.003						
Panel C: Loadings on HML											
	Small	Size 2	Size 3	Size 4	Large	Average	t-statistics				
Growth	-0.57^{**}	-1.02^{***}	-0.88^{**}	-0.65^{***}	-0.53^{***}	-0.73	-2.07	-2.64	-2.31	-2.63	-4.48
BM2	-0.29^{**}	-0.22	0.42^{***}	0.35^{**}	0.30^{*}	0.11	-2.00	-1.24	3.23	2.20	1.84
BM3	-0.02	0.19	0.27	0.21	0.04	0.14	-0.13	1.30	1.64	1.61	0.19
BM4	0.32^{***}	0.30^{***}	-0.44^{**}	-0.06	-0.25^{*}	-0.03	2.62	2.69	-2.01	-0.40	-1.78
Value	0.47^{***}	0.60^{***}	0.57^{***}	0.55^{***}	0.17	0.47	4.18	2.70	4.56	3.62	0.47
Average	-0.02	-0.03	-0.01	0.08	-0.05						

The results are reported in table 6. Panel A of Table 6 shows the impact of the aggregate consumption shocks on the ERP of these 25 portfolios (β^i_c). Panels B, C and D show the impact of size, value and the momentum factors respectively. It can be seen from Panel A that underlying essence of the results in table 5 is robust after controlling for the size, value, and momentum factors. Aggregate personal consumption shocks exerts negative impact on the ERPs of the 25 value weighted Fama-French style portfolios. In all the cases the momentum factor is not statistically significant and does

TABLE 6—*Continued*

Panel D: Loadings on UMD											
	Small	Size 2	Size 3	Size 4	Large	Average	t-statistics				
Growth	0.01	−0.08	−0.19	−0.05	−0.08	−0.08	0.03	−0.47	−0.64	−0.23	−0.81
BM2	−0.07	−0.15	−0.04	−0.12	0.02	−0.07	−0.45	−1.06	−0.39	−0.85	0.14
BM3	−0.04	0.05	0.08	0.00	0.15	0.05	−0.23	0.42	0.63	0.03	0.92
BM4	−0.02	0.03	−0.16	−0.05	−0.06	−0.05	−0.14	0.36	−0.98	−0.31	−0.43
Value	−0.03	−0.05	0.00	−0.19	−0.25	−0.10	−0.32	−0.50	0.01	−1.55	−0.99
Average	−0.03	−0.04	−0.06	−0.08	−0.04						
	Adjusted R-squared						F-statistics				
	Small	Size 2	Size 3	Size 4	Large	Average					
Growth	51.48%	57.10%	50.46%	35.22%	40.22%	46.90%	26.73	33.28	25.70	14.18	17.32
BM2	57.04%	54.20%	52.89%	42.09%	10.89%	43.42%	33.20	29.69	28.22	18.63	3.96
BM3	57.54%	41.67%	42.53%	29.83%	12.43%	36.80%	33.87	18.32	18.95	11.31	4.44
BM4	59.06%	56.23%	53.04%	33.89%	18.27%	44.10%	35.98	32.15	28.39	13.43	6.42
Value	65.45%	60.18%	56.87%	51.20%	21.05%	50.95%	46.93	37.65	32.98	26.44	7.46
Average	58.11%	53.88%	51.16%	38.45%	20.57%						

Notes: Note: The dependent variable is the ERP of the 25 Fama-French portfolios. The independent variables are consumption shocks, SMB, HML and UMD. The model estimated is (15). The table reports quarterly estimates of the coefficients. The t-statistics computed using Newey-West heteroskedastic-robust standard errors with 4 lags (initial pre-whitening using 2 lags). Adjusted sample period is 1990Q2 — 2014Q3

not have a significant impact on the ERPs of these portfolios. The average absolute loadings on consumption shocks are higher than the average loadings on size, value and momentum premiums. This suggests that, on average, ERP of these portfolios are more sensitive to consumption shocks than to size, value and momentum premiums. However, unlike the results in table 5, the ERPs of small stocks are not more sensitive to aggregate consumption shocks than the ERPs of large stocks after controlling for the size premium. The average absolute sensitivity of the ERP of small stocks is 1.28 while the average absolute sensitivity of the ERP of the large stocks is 1.41. Similarly, the difference in the sensitivity of the ERP of value and growth portfolios to consumption shocks has decreased after controlling for the value premium. From the panel of adjusted R-squared we find that, on average, the aggregate consumption shocks can explain 58.11% and 20.57% variation in the ERP of small stocks and large stocks respectively. On the basis of value, consumption shocks can explain, on average, 50.95% and 46.90% variation in the ERP of value and growth stocks.

Table 7 reports the pricing implications of the aggregate consumption shocks for the cross-section of the 25-Fama-French style portfolios using the traditional Fama-MacBeth two stage regressions. Column (1) presents the pricing of aggregate consumption without controlling for any of the

TABLE 7.

Pricing of Consumption Shocks

	1	2	3	4
γ_0	0.45**	0.48	0.60***	0.55***
t-statistics	(2.42)	(1.70)	(4.35)	(3.22)
Aggregate Consumption shocks	0.06	−0.07	0.08	0.09
t-statistics	(0.61)	(−0.61)	(0.90)	(0.90)
Market premium		0.07		−0.06
t-statistics		(0.29)		(−0.33)
Size premium			0.11***	0.11**
t-statistics			(2.77)	(2.37)
Value Premium			0.21***	0.21***
t-statistics			(4.69)	(5.49)
Momentum Premium			0.22***	0.27**
t-statistics			(2.90)	(2.49)
R-squared		−0.7%	48.92%	46.97%
F-statistics		0.18	6.75***	5.17***

Notes: The table reports the estimates of second-stage cross-sectional regressions of Fama and MacBeth (1973). The dependent variable is $R_{i,1} - R_{f,t}$, quarterly cross-sectional ERPs of the 25 Fama-French style portfolios. The independent variable is the factor loading from first-pass time-series regressions on respective factors.

cross-sectional asset pricing factors. The first stage factor loadings for this column are from table 5. Column (2) reports the pricing ability of the aggregate consumption shocks in presence of the exposure to the market risk premium. In column (3), we report the pricing of consumption shocks in presence of the size, value and momentum premiums. In column (4) we control for all the cross sectional asset pricing factors. The reported t-statistics are corrected for heteroscedasticity and auto-correlation. Although, we do not find evidence of significant pricing ability of aggregate consumption shocks in the cross-section of ERPs of the 25 portfolios, yet from column (4) we note that the ERPs of the 25 portfolios are positively related to the sensitivity of aggregate personal consumption shocks after controlling for the cross-sectional asset pricing factors.

4.3. The impact of disaggregated consumption shocks on the ERP of FTSE indices

In the previous sub-sections we examined the impact of structural shocks in aggregate consumption on the ERPs of various FTSE indices (at aggregate and industry level) and the ERPs of the 25- Fama-French style portfolios. The key element in our examination was the structural shocks to aggregate consumption. In this sub-section we now broaden the scope of our investigation and examine the impact of structural dis-aggregated consumption shocks i.e., durable, semi-durable and non-durable shocks on the ERPs of the aggregate and sectoral FTSE indices and the value-weighted 25 Fama-French style portfolios sorted on size and book-to-market characteristics. We follow the same two-step procedure as outlined in section 2.2. In the first step, we derive the durable, semi-durable and non-durable shocks separately. In the second step, we investigate their effect on the ERP.

To derive the structural shocks of durable, semi-durable and non-durable consumption, we replace the aggregate consumption in the vector of endogenous variables in (5) and estimate three separate SVARs corresponding to durable, semi-durable and Non-durable consumption. Thus, vector of variables in (5) are changed as follows;

$$Z_{1,t} = [\pi_t, y_t, dc_t, w_t, r_t]' \tag{16}$$
$$Z_{2,t} = [\pi_t, y_t, sdc_t, w_t, r_t]' \tag{17}$$
$$Z_{3,t} = [\pi_t, y_t, ndc_t, w_t, r_t]' \tag{18}$$

where dc_t, sdc_t, ndc_t are the logs of durable, semi-durable and non-durable consumption respectively. The estimated durable, semi-durable and non-durable structural consumption shocks are further used to examine their impact on the ERPs of the FTSE indices and the 25 Fam-French portfolios;

$$R^e_{t,i} = \alpha_{1,i} + \beta_{dc} u^{dc}_t + \varepsilon_{1,t} \tag{19}$$
$$R^e_{t,i} = \alpha_{2,i} + \beta_{sdc} u^{sdc}_t + \varepsilon_{2,t} \tag{20}$$
$$R^e_{t,i} = \alpha_{3,i} + \beta_{ndc} u^{ndc}_t + \varepsilon_{3,t} \tag{21}$$

where, $R^e_{t,i} = R_{i,t} - R_{f,t}$ is the ERP of the test portfolios, $\alpha_{n,i}$ $(n = 1, 2, 3)$ are the constants (intercepts), β_{dc}, β_{sdc} and β_{ndc} are factor loadings on the structural durable, semi-durable and non-durable consumption shocks (u^{dc}_t, u^{sdc}_t and u^{ndc}_t) and $\varepsilon_{n,t}$ $(n = 1, 2, 3)$ are assumed to follow a white noise process.

We then study the pricing implications of disaggregated consumption shocks separately using the second stage Fama and MacBeth, (1973) cross-sectional regressions.

$$R^e_{t,i} = \gamma^{dc}_0 + \gamma_{dc} \cdot \widehat{\beta_{dc}} + \mu_1 \tag{22}$$
$$R^e_{t,i} = \gamma^{sdc}_0 + \gamma_{sdc} \cdot \widehat{\beta_{sdc}} + \mu_2 \tag{23}$$
$$R^e_{t,i} = \gamma^{ndc}_0 + \gamma_{ndc} \cdot \widehat{\beta_{ndc}} + \mu_3 \tag{24}$$

where $R^e_{t,i}$ is ERPs of the test portfolios over the sample period and γ_{dc}, γ_{sdc} and γ_{ndc} are the prices of risks due to the exposure to the estimated factor loading $\widehat{\beta_{dc}}$, $\widehat{\beta_{sdc}}$ and $\widehat{\beta_{ndc}}$ on durable, semi-durable and non-durable consumption from (21), (22) and (23) respectively.

TABLE 8.
The impact of dis-aggregated consumption shocks on the ERP of FTSE sectoral indices.

	Durable Consumption Shocks			Semi-Durable Consumption Shocks			Non-Durable Consumption Shocks		
	Panel A			Panel B			Panel C		
	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)
Portfolios	$\alpha_{1,i}$	β_{dc}	R^2	$\alpha_{2,i}$	β_{sdc}	R^2	$\alpha_{3,i}$	β_{ndc}	R^2
FTSE 100	0.76	-5.02^{***}	28.42%	0.78	-4.86^{***}	28.40%	0.84	4.77^{***}	31.91%
	(1.17)	(−6.36)		(0.89)	(−6.86)		(1.40)	(6.56)	
FTSE 250	1.46^{*}	-5.55^{***}	22.89%	1.41	-5.25^{***}	21.93%	1.40^{*}	5.28^{***}	25.9%
	(1.69)	(−4.94)		(1.55)	(−5.23)		(1.73)	(5.55)	
Basic Materials	0.65	-5.14^{***}	9.34%	0.60	-4.79^{***}	8.69%	0.54	5.17^{***}	11.92%
	(0.63)	(−3.65)		(0.55)	(−4.08)		(0.48)	(4.27)	
Consumer Services	0.56	-5.53^{***}	25.51%	0.51	-5.53^{***}	27.53%	0.55	5.38^{***}	30.01%
	(0.66)	(−4.86)		(0.58)	(−5.60)		(0.68)	(5.62)	
Financials	0.77	-6.83^{***}	24.82%	0.82	-6.54^{***}	24.30%	0.85	6.07^{***}	24.44%
	(0.78)	(−6.81)		(0.78)	(−6.93)		(0.87)	(5.85)	
Consumer Goods	1.24	-5.81^{***}	20.62%	1.21	-5.65^{***}	20.79%	1.28	5.72^{***}	24.93%
	(1.52)	(−3.91)		(1.45)	(−4.26)		(1.59)	(5.46)	
Healthcare	1.16^{*}	-4.25^{***}	24.40%	1.18^{*}	-4.10^{***}	24.37%	1.28^{*}	3.85^{***}	24.68%
	(1.74)	(−5.28)		(1.71)	(−5.47)		(1.98)	(5.35)	
Industrials	0.70	-6.48^{***}	22.78%	0.65	-5.96^{***}	20.28%	0.65	6.12^{***}	25.07%
	(0.74)	(−4.32)		(0.61)	(−4.50)		(0.69)	(5.01)	
Oil and Gas	0.98	-2.45^{***}	5.16%	1.07	-1.95^{**}	3.50%	1.08	2.12^{**}	4.82%
	(1.47)	(−2.62)		(1.53)	(−2.48)		(1.61)	(2.46)	
Utilities	2.16^{***}	-2.95^{***}	11.32%	2.22^{***}	-2.49^{**}	8.50%	2.23^{***}	2.75^{***}	11.92%
	(3.23)	(−3.47)		(3.25)	(−2.41)		(3.60)	(3.29)	
Telecom	0.97	-5.23^{***}	15.65%	0.98	-5.42^{***}	17.77%	1.03	5.24^{***}	19.57%
	(0.77)	(−6.87)		(0.88)	(−5.91)		(0.98)	(4.86)	
Technology	0.66	-9.34^{***}	16.23%	0.37	-9.37^{**}	17.11%	0.24	9.27^{***}	19.51%
	(0.24)	(−3.08)		(0.13)	(−2.40)		(0.12)	(3.22)	

Notes: The dependent variable is ERPs of various FTSE indices (in percentage) calculated as the difference between total return and the 3 month Gilts rate. Models estimated are (19), (20) and (21) in Panels A, B and C respectively. The table reports quarterly estimates of the coefficients. Figures in the parentheses are t-statistics computed using Newey-West heteroskedastic-robust standard errors with initial pre-whitening using 2 lags. Adjusted sample period is 1989Q2 — 2014Q4.

The impact of disaggregated consumption shocks on the ERP of FTSE indices are presented in Table 8. Panels A, B and C report the results of quarterly regressions (19), (20) and (21) and the sensitivities of the ERPs to shocks in durable, semi-durable and non-durable consumption. On average, the shocks in durable, semi-durable and non-durable consumption are able to explain 25.65%, 25.17% and 28.91% time variation in the ERPs of the aggregate FTSE indices. On the other hand, the average time variation in the ERPs of ten FTSE industry portfolios explained by the durable, semi-durable and non-durable consumptions are 17.59%, 17.28% and 19.69% respectively. The shocks in durable, semi-durable and non-durable consumption can explain 17.31%, 16.90% and 19.30% time variation in the ERPs of cyclical industries as compared to 17.99%, 17.86 % and 20.28% variation in the ERPs of non-cyclical industries.

Similar to the findings reported earlier where we used the aggregate consumption shocks, we find that the impact of durable and semi-durable consumption shocks on the ERP of the FTSE indices is negative. This suggests that an unexpected fall in the durable and semi-durable consumption will increase the ERP. This is probably because the marginal utility of durable and semi-durable consumption rises more during a recession as opposed to the marginal utility derived from the non-durable consumption. This would imply that stocks must provide higher risk premium to compensate the investor for bearing additional risk of durable and semi-durable consumption shocks.

On the contrary, we find that the non-durable consumption shocks are positively related to the ERP, which suggests that an unexpected fall in non-durable consumption leads to fall in the ERP. This could be because non-durable consumption does not show strong pro-cyclical properties as compared to durable or semi-durable consumption. Therefore, an unexpected deviation of non-durable consumption from its theoretically expected path may not exert the similar impact compared to the one by the durable of semi-durable consumption shocks. This could also explain why the ERP measured using canonical C-CAPM is different from the actual ERP since empirical applications of C-CAPM mostly use non-durable consumption data. Another possible explanation for this asymmetric impact is that since durable and semi-durable consumption provide services and utility for longer periods of time, these can be postponed especially during recession and/or due to unexpected change in income. Hence, the consumption of durable and semi-durable goods are relatively discretionary than non-durable consumption. Therefore, the relationship of non-durable consumptions shocks with ERP is different than the relationship between durable and semi-durable consumption shocks with the ERP.

To check the robustness of these results we repeat our analysis by including control factors i.e., the size premium, value premium and the momentum factor. We estimate the following regressions:

$$R^e_{t,i} = \alpha_{1,i} + \beta^i_{dc} \cdot u^{dc}_t + \beta^i_s \cdot SMB_t + \beta^i_v \cdot HML_t + \beta^i_m \cdot UMD_t + \varepsilon^i_{1,t} \quad (25)$$
$$R^e_{t,i} = \alpha_{2,i} + \beta^i_{sdc} \cdot u^{sdc}_t + \beta^i_s \cdot SMB_t + \beta^i_v \cdot HML_t + \beta^i_m \cdot UMD_t + \varepsilon^i_{2,t} \quad (26)$$
$$R^e_{t,i} = \alpha_{3,i} + \beta^i_{ndc} \cdot u^{ndc}_t + \beta^i_s \cdot SMB_t + \beta^i_v \cdot HML_t + \beta^i_m \cdot UMD_t + \varepsilon^i_{3,t} \quad (27)$$

TABLE 9.

The impact of dis-aggregated consumption shocks on ERP of FTSE Indices.

Panel A							
Durable Consumption Shocks							
FTSE Indices	α_i	β^i_{dc}	β^i_s	β^i_v	β^i_m	R^2	F-stat
FTSE 100	0.84	-4.91^{***}	0.33	-0.08	-0.11	26.68	10.01^{***}
	(1.03)	(-7.11)	(0.96)	(-0.18)	(-0.26)		
FTSE 250	1.30^{*}	-5.12^{***}	2.23^{***}	0.19	-0.17	47.93	23.78^{***}
	(1.69)	(-6.24)	(7.16)	(0.40)	(-0.42)		
Basic Materials	-0.10	-5.17^{***}	2.05^{***}	1.64^{**}	0.22	22.28	8.10^{***}
	(-0.07)	(-4.11)	(2.82)	(2.29)	(0.29)		
Consumer Services	0.86	-5.06^{***}	1.25^{***}	-0.45	-0.40	36.05	14.95^{***}
	(1.09)	(-5.65)	(4.30)	(-1.15)	(-0.99)		
Financials	0.67	-6.52^{***}	1.80^{***}	0.76	-0.25	39.28	17.01^{***}
	(0.57)	(-7.00)	(2.91)	(1.43)	(-0.56)		
Consumer Goods	1.27^{*}	-5.58^{***}	1.09^{*}	0.53	-0.26	26.22	9.80^{***}
	(1.85)	(-5.30)	(1.93)	(1.69)	(-1.00)		
Healthcare	1.73^{***}	-4.09^{***}	-0.78^{***}	-0.61^{**}	-0.36	29.01	11.11^{***}
	(2.64)	(-5.39)	(-2.77)	(-2.12)	(-1.51)		
Industrials	0.81	-5.95^{***}	1.94^{***}	-0.28	-0.33	36.02	14.93^{***}
	(0.90)	(-5.48)	(5.52)	(-0.53)	(-0.64)		
Oil and Gas	0.73	-2.74^{***}	-0.47	0.63	0.22	5.71	2.50^{**}
	(1.10)	(-3.17)	(-1.17)	(1.25)	(0.53)		
Utilities	2.14^{***}	-3.11^{***}	-0.37	0.68	-0.04	14.11	5.07^{***}
	(3.20)	(-3.92)	(-0.99)	(1.69)	(-0.15)		
Telecom	1.34	-5.05^{***}	-0.22	-0.88	-0.20	15.43	5.52^{***}
	(1.01)	(-5.52)	(-0.39)	(-0.93)	(-0.20)		
Technology	1.94	-7.68^{***}	3.12^{***}	-3.69^{***}	-1.15	48.18	24.01^{***}
	(1.49)	(-4.95)	(5.03)	(-2.91)	(-0.94)		

Panels A, B and C of Table 9 respectively show the impact of durable, semi-durable and non-durable consumption shocks. Durable and semi-durable consumption shocks exerts a negative impact on the ERPs of the various FTSE indices, whereas non-durable consumption shocks have a positive impact, even after controlling for the size premium, value premium and the momentum factor. In all the cases, the momentum factor does not

TABLE 9—*Continued*

	Panel B						
	Semi-Durable Consumption Shocks						
FTSE Indices	α_i	β^i_{sdc}	β^i_s	β^i_v	β^i_m	R^2	F-stat
FTSE 100	0.88	-4.75^{***}	0.31	-0.07	-0.11	26.46	10.00^{***}
	(1.05)	(-7.92)	(0.96)	(-0.15)	(-0.25)		
FTSE 250	1.35^{*}	-4.88^{***}	2.20^{***}	0.19	-0.18	47.27	23.41^{***}
	(1.71)	(-6.95)	(7.36)	(0.41)	(-0.43)		
Basic Materials	-0.06	-4.88^{***}	2.03^{***}	1.65^{**}	0.21	21.89	8.01^{***}
	(-0.05)	(-4.23)	(3.02)	(2.21)	(0.29)		
Consumer Services	0.84	-5.08^{***}	1.26^{***}	-0.43	-0.38	37.83	16.21^{***}
	(1.05)	(-7.00)	(4.30)	(-1.14)	(-0.97)		
Financials	0.81	-6.29^{***}	1.71^{***}	0.76	-0.27	38.09	16.38^{***}
	(0.76)	(-7.28)	(2.68)	(1.34)	(-0.58)		
Consumer Goods	1.27^{*}	-5.45^{***}	1.10^{**}	0.54	-0.25	26.65	10.08^{***}
	(1.85)	(-4.63)	(2.15)	(1.67)	(-0.83)		
Healthcare	1.71^{***}	-3.94^{***}	-0.76^{***}	-0.60^{**}	-0.36	28.85	11.14^{***}
	(2.59)	(-5.57)	(-2.76)	(-1.96)	(-1.40)		
Industrials	0.85	-5.47^{***}	1.93^{***}	-0.28	-0.34	34.28	14.04^{***}
	(0.87)	(-6.52)	(5.97)	(-0.44)	(-0.54)		
Oil and Gas	0.83	-2.23^{***}	-0.53	0.61	0.19	4.17	2.09^{*}
	(1.03)	(-3.22)	(-1.26)	(1.11)	(0.41)		
Utilities	2.23^{***}	-2.63^{***}	-0.41	0.66	-0.06	11.39	4.21^{***}
	(3.16)	(-2.81)	(-1.21)	(1.61)	(-0.27)		
Telecom	1.31	-5.22^{***}	-0.20	-0.85	-0.18	17.47	6.29^{***}
	(1.02)	(-6.30)	(-0.35)	(-0.95)	(-0.18)		
Technology	1.70	-7.76^{***}	3.29^{***}	-3.64^{***}	-1.09	49.60	25.61^{***}
	(1.34)	(-5.13)	(5.47)	(-2.84)	(-0.85)		

have a significant impact on the ERPs of the FTSE indices. In some cases, such as the ERPs of the FTSE 100 index and the ERP of Oil and Gases and Telecoms, the durable, semi-durable and non- durable consumption shocks overshadows the size premium, value premium and the momentum factor. The ERP of FTSE 250 index is marginally more sensitive to durable, semi-durable and non-durable consumption shocks as the beta coefficients are higher than the ones for FTSE 100 index.

Next, we estimate the traditional Fama and MacBeth, (1973) model. Table 10 reports the estimations of second-stage cross-sectional regressions. Results show that ERPs of the various FTSE indices are positively related to the sensitivities (betas) of durable, semi-durable and non-durable consumption. The risk from the exposure to durable and semi-durable consumption shocks are positively priced suggesting that the ERPs of the var-

TABLE 9—*Continued*

	Panel C						
	Non-Durable Consumption Shocks						
FTSE Indices	α_i	β^i_{ndc}	β^i_s	β^i_v	β^i_m	R^2	F-stat
FTSE 100	0.80	4.76***	0.31	0.10	0.01	30.01	11.93***
	(1.40)	(7.84)	(1.31)	(0.19)	(0.01)		
FTSE 250	1.25*	5.03***	2.21***	0.38	−0.05	50.90	27.43***
	(1.73)	(7.66)	(7.44)	(0.85)	(−0.13)		
Basic Materials	−0.28	5.69***	2.06***	1.90***	0.40	26.84	10.35***
	(−0.22)	(5.78)	(3.18)	(2.74)	(0.56)		
Consumer Services	0.76	4.95***	1.26***	−0.25	−0.26	39.29	17.50***
	(0.99)	(6.68)	(4.32)	(−0.67)	(−0.68)		
Financials	0.74	6.02***	1.71***	0.96*	−0.14	38.58	17.02***
	(0.68)	(6.34)	(2.93)	(1.81)	(−0.34)		
Consumer Goods	1.20	5.73***	1.09**	0.76*	−0.10	31.19	12.56***
	(1.38)	(5.78)	(2.08)	(1.79)	(−0.36)		
Healthcare	1.71***	3.63***	−0.77***	−0.49	−0.29	28.22	11.03***
	(2.69)	(5.04)	(−2.68)	(−1.58)	(−1.21)		
Industrials	0.71	5.70***	1.94***	−0.05	−0.18	37.96	16.61***
	(0.89)	(7.35)	(5.67)	(−0.08)	(−0.28)		
Oil and Gas	0.74	2.59***	−0.52	0.73	0.28	6.69	2.83**
	(0.92)	(3.00)	(−1.28)	(1.41)	(0.63)		
Utilities	2.20***	3.06***	−0.42	0.78**	0.02	16.41	6.01***
	(3.64)	(4.02)	(−1.18)	(1.97)	(0.09)		
Telecom	1.21	5.02***	−0.19	−0.67	−0.06	18.37	6.74***
	(1.33)	(5.12)	(−0.42)	(−0.69)	(−0.10)		
Technology	1.40	7.15***	3.37***	−3.36***	−0.91	49.11	25.61***
	(1.14)	(4.26)	(5.73)	(−2.67)	(−0.73)		

Notes: The dependent variable is the ERPs of the FTSE indices (in percentages). The independent variable is durable, semi durable and non-durable consumption shocks in Panels A, B and C respectively controlling for size premium (SMB), value premium (HML) and momentum factor (UMD). Table reports the estimated parameters of model (25), (26) and (27). Figures in parentheses are t-statistics computed using Newey-West HAC standard errors with 4 lags (initial pre-whitening with 2 lags). Adjusted sample size, 1990Q1 — 2014Q4.

ious FTSE indices linearly increase with the exposure to shocks in durable and semi-durable. The risk from non-durable consumption shocks is negatively priced. This suggests that one unit increase in the exposure to non-durable consumption shocks leads to decrease ERP of the FTSE indices. The exposures to the durable, semi-durable and non-durable consumption shocks can explain 39.61%, 41.80% and 39.18% variation in the ERPs of the various FTSE indices respectively.

TABLE 10.

Pricing of dis-aggregated consumption shocks in the FTSE indices.

	1	2	3	4
γ_0	1.98^{***}	1.99^{***}	2.02^{***}	2.04
	(4.67)	(4.37)	(4.22)	(1.00)
Durable Consumption Shocks	0.16^{**}			0.28
	(2.41)			(0.44)
Semi-Durable Consumption Shocks		0.17^{**}		0.35
		(2.38)		(0.94)
Non-Durable Consumption Shocks			-0.17^{**}	−0.14
			(−2.32)	(−0.29)
Size Premium				−0.09
				(−0.27)
Value Premium				0.27
				(1.57)
Momentum Premium				−1.75
				(−1.22)
R-Squared	39.61%	41.80%	39.18%	13.35%
F-statistics	6.56^{**}	7.18^{**}	6.44^{**}	1.28

Notes: The table reports the estimates of second stage Fama and MacBeth (1973) cross-sectional regression The dependent variable ERPs of the FTSE indices. The independent variables are the time-series loadings on durable, semi-durable and non-durable consumption shocks and other factors. The reported t-statistics are corrected for heteroscedasticity and auto-correlation

4.4. The impact of disaggregated consumption shocks on the ERP of 25 size and value portfolios.

In this sub-section we examine the impact of dis-aggregated consumption shocks on ERP of 25 value-weighted Fama-French style portfolios. Subsequently, we investigate the cross-sectional pricing implications of these shocks in the cross-section of excess returns of these portfolios.

Panels A, B and C of Table 11 report the estimated impact of the shocks in the durable, semi-durable and non-Durable consumption on the ERPs of the 25 portfolios respectively. On average, the contemporaneous durable, semi-durable and non-durable consumption shocks are able to explain about 16.09%, 15.58% and 18.93% variation in the ERPs, respectively. As far as the exposure to durable and semi-durable consumption shocks is concerned, the ERPs of small size portfolios have higher absolute betas (−1.65 and −1.59), on average, than of big size portfolios (−1.57 and −1.54). This may be because the returns on small stocks are more procyclical. On the basis of value dimension, however, we find that on average, the ERP of value stocks seems to be less sensitive to the shocks in durable, semi-durable and non-durable consumption shocks than the ERP of growth

TABLE 11.
The Impact of dis-aggregate consumption shocks on the ERP of the 25 value-weighted Fama-French portfolios.

Panel A: Loadings on Durable Consumption Shocks											
	Small	Size 2	Size 3	Size 4	Large	Average	t-statistics				
Growth	-2.08^{***}	-2.07^{***}	-1.91^{***}	-2.00^{***}	-1.85^{***}	-1.98	-4.91	-3.66	-3.03	-4.38	-5.63
BM2	-1.43^{***}	-2.08^{***}	-1.95^{***}	-2.14^{***}	-1.42^{***}	-1.80	-3.09	-4.16	-4.30	-4.44	-4.35
BM3	-1.57^{***}	-1.51^{***}	-1.69^{***}	-1.58^{***}	-1.55^{***}	-1.58	-4.31	-3.72	-4.60	-3.49	-4.67
BM4	-1.59^{***}	-1.67^{***}	-1.95^{***}	-1.94^{***}	-1.59^{***}	-1.75	-3.90	-3.95	-4.30	-4.77	-5.26
Value	-1.58^{***}	-2.00^{***}	-1.85^{***}	-2.08^{***}	-1.43^{***}	-1.79	-4.74	-4.76	-3.77	-4.45	-7.78
Average	-1.65	-1.87	-1.87	-1.95	-1.57						
R-Squared							F-statistics				
Growth	13.34%	12.76%	12.58%	18.10%	32.18%	17.79%	14.77	14.05	13.82	21.22	45.56
BM2	8.65%	15.50%	18.30%	19.94%	14.55%	15.39%	9.09	17.61	21.50	23.92	16.34
BM3	13.03%	12.97%	15.22%	15.06%	17.04%	14.66%	14.38	14.31	17.23	17.02	19.71
BM4	11.89%	16.93%	17.36%	22.06%	24.74%	18.59%	12.95	19.57	20.16	27.18	31.55
Value	12.64%	13.75%	14.26%	15.41%	13.98%	14.01%	13.88	15.30	15.96	17.49	15.60
Average	11.91%	14.38%	15.54%	18.11%	20.50%						
Panel B: Loadings on Semi-Durable Consumption Shocks											
	Small	Size 2	Size 3	Size 4	Large	Average	t-statistics				
Growth	-2.13^{***}	-2.10^{***}	-1.81^{**}	-1.97^{***}	-1.84^{***}	-1.97	-4.75	-3.53	-2.23	-4.60	-5.50
BM2	-1.40^{***}	-1.85^{***}	-1.82^{***}	-1.96^{***}	-1.41^{***}	-1.69	-3.26	-3.86	-4.45	-3.91	-4.70
BM3	-1.43^{***}	-1.37^{***}	-1.62^{***}	-1.53^{***}	-1.45^{***}	-1.48	-4.32	-3.66	-4.63	-3.69	-4.80
BM4	-1.47^{***}	-1.55^{***}	-1.74^{***}	-1.89^{***}	-1.56^{***}	-1.64	-3.71	-3.66	-3.71	-5.17	-5.83
Value	-1.49^{***}	-1.90^{***}	-1.76^{***}	-1.93^{***}	-1.45^{***}	-1.71	-4.63	-4.92	-3.93	-4.31	-4.88
Average	-1.59	-1.76	-1.75	-1.86	-1.54						
R-Squared							F-statistics				
Growth	14.80%	14.00%	11.91%	18.76%	33.92%	18.68%	16.67	15.62	12.97	22.17	49.28
BM2	8.84%	13.01%	15.91%	17.64%	15.04%	14.09%	9.31	14.36	18.17	20.56	17.00
BM3	11.45%	11.40%	14.78%	14.86%	15.76%	13.65%	12.41	12.35	16.65	16.76	17.96
BM4	10.83%	15.51%	15.49%	22.29%	25.35%	17.89%	11.66	17.62	17.59	27.54	32.59
Value	11.99%	13.05%	13.57%	14.15%	15.29%	13.61%	13.08	14.40	15.07	15.82	17.33
Average	11.58%	13.39%	14.33%	17.54%	21.07%						

stocks. Moreover, the absolute sensitivity of the ERP of the value stocks to the shocks in durable and semi-durable consumption is more than the sensitivity to non-durable consumption shocks.

In Table 12, we examine whether the shocks in durable, semi-durable and non-durable consumption are priced in the cross-section of the 25 portfolios or not by estimating the second stage Fama and MacBeth (1973) cross-sectional regressions. Columns (1), (2) and (3) report the pricing ability of the risk exposure to durable, semi-durable and non-durable consumption

TABLE 11—*Continued*

Panel C: Loadings on Non-Durable Consumption Shocks

	Small	Size 2	Size 3	Size 4	Large	Average	t-statistics				
Growth	2.09^{***}	2.24^{***}	2.05^{**}	2.04^{***}	1.90^{***}	2.06	3.91	2.50	2.01	4.28	6.08
BM2	1.52^{***}	1.97^{***}	1.87^{***}	2.06^{***}	1.36^{***}	1.75	3.49	4.29	5.97	5.53	5.37
BM3	1.52^{***}	1.39^{***}	1.56^{***}	1.50^{***}	1.59^{***}	1.51	4.35	3.55	4.95	4.07	5.87
BM4	1.37^{***}	1.55^{***}	1.94^{***}	1.90^{***}	1.68^{***}	1.69	3.80	3.87	4.62	5.69	6.76
Value	1.40^{***}	1.73^{***}	1.75^{***}	1.91^{***}	1.56^{***}	1.67	4.67	4.98	4.22	4.78	6.01
Average	1.58	1.77	1.83	1.88	1.62						
	R-Squared						F-statistics				
Growth	16.47%	18.20%	17.66%	23.01%	41.75%	23.42%	18.93	21.36	20.59	28.69	68.82
BM2	11.92%	16.91%	19.31%	22.52%	16.16%	17.36%	12.99	19.53	22.97	27.90	18.51
BM3	14.92%	13.37%	15.79%	16.59%	21.77%	16.49%	16.84	14.81	18.00	19.10	26.71
BM4	10.78%	17.90%	22.32%	25.78%	33.60%	22.07%	11.59	20.93	27.59	33.34	48.58
Value	12.13%	12.53%	15.46%	15.99%	20.34%	15.29%	13.25	13.75	17.56	18.27	24.51
Average	13.24%	15.78%	18.11%	20.78%	26.72%						

Notes: The dependent variable is the ERP of the 25 value weighted Fama-French Portfolios. The independent variables in Panels A, B and C are the durable, semi-durable and Non- durable personal consumption shocks. The tables reports the estimated parameters of Models (19), (20) and (21). The t-statistics computed using Newey-West heteroskedastic-robust standard errors with 4 lags (initial pre-whitening using 2 lags).

shocks separately without controlling for the cross-sectional asset pricing factors. Column (4) reports the pricing of all three consumption shocks together, while columns (5), (6) and (7) reports the pricing ability of the dis-aggregated consumption shocks in presence of the cross-sectional asset pricing factors. It seems that only the risk exposure to non-durable consumption shocks are significantly priced in the cross-section of the ERPs of the 25 Fama-French portfolios.

5. CONCLUSIONS

The paper investigates the impact of aggregate and disaggregated personal consumption shocks on the ERP of various industry and 25 Fama-French value weighted portfolios in the UK. Using the idea of consumption-wealth channel of monetary policy, we derive aggregate and dis-aggregated consumption shocks. Assuming that consumers prefer smooth consumption path and maximise the expected discounted utility of future consumption we derive shocks as the deviation of actual consumption from a theoretically expected consumption. We then investigate the impact of contemporaneous aggregate consumption shocks and find that they exert statistically significant negative impact on the ERPs of various FTSE indices and the 25 Fama-French portfolios. The results are robust even after controlling

TABLE 12.

The pricing of dis-aggregated consumption shocks in the 25 Fama-French portfolios sorted on size and book-to-market characteristics

	1	2	3	4	5	6	7
Constant	0.80***	0.89***	1.05***	0.80***	0.68***	0.69***	0.60***
	(3.31)	(3.93)	(5.44)	(5.11)	(4.00)	(4.00)	(3.32)
Durable Consumption Shocks	0.14			−0.02	0.11	0.13	0.16
	(1.04)			(−0.25)	(1.39)	(1.11)	(1.57)
Semi-Durable Consumption shocks		0.19		−0.001	0.11	0.09	0.13
		(1.51)		(−0.05)	(1.42)	(0.73)	(1.14)
Non-Durable Consumption shocks			−0.28**	−0.18**	−0.29***	−0.14	−0.18*
			(−2.61)	(−2.17)	(−3.55)	(−1.43)	(−1.71)
Market Factor					−0.18		−0.11
					(−1.06)		(−0.55)
Size Premium						0.11**	0.10*
						(2.54)	(1.99)
Value Premium						0.22***	0.23***
						(4.49)	(4.44)
Momentum Premium						0.15	0.14
						(1.39)	(1.09)
Adjusted R^2	4.67%	8.84%	23.36%	44.85%	33.24%	45.75%	44.30%
F-Statistics	1.13	2.23	7.01**	5.88**		4.37***	3.73**

Notes: The table reports the estimates of second stage Fama and MacBeth (1973) cross-sectional regression The dependent variable ERPs of the FTSE indices. The independent variables for columns (1), (2), and (3) are exposures of durable, semi-durable and non-durable consumption shocks from table 11. Column (4) reports the pricing of all three consumption shocks together. In column (5), (6) and (7) we control for other cross-sectional asset pricing factors. The t-statistics are in reported in parentheses and are corrected for heteroscedasticity and auto-correlation

for the size premium, value premium and the momentum factors. The evidence is consistent with Parker, (2003) who also find that contemporaneous consumption risk was negatively related to the expected stock returns.

We further analyse the impact of the durable, semi-durable and the non-durable consumption shocks. We find that contemporaneous durable and semi-durable consumption shocks have a negative impact on the ERPs of the FTSE indices and the 25 Fama-French portfolios, which is consistent with our results when we use aggregate consumption shocks. On the contrary, the non-durable consumption shocks have a positive impact on the ERP. Further, the ERPs of small and value portfolios are more sensitive to durable and semi-durable consumption shocks than to non-durable consumption shocks, implying that size and growth portfolios may provide protection against the changes in durable and non-durable consumption.

Our results lend support to CCAPM, which suggests that asset prices are contemporaneously related to the consumption risk.

APPENDIX A

The Office of National Statistic (ONS) measures consumer spending by the final consumption expenditure of households and Non-Profit Institutions Serving Households (NPISH). The quarterly data is chained-weighted 2011 British Pound Sterling. Based on ONS definition Durable goods are consumer products that do not need to be purchased frequently because they are made to last for a long time (usually lasting for three years or more). Examples of such goods are washing machines, cars, fridges etc. There are approximately 22 components of durable goods in the ONS series of durable goods. Semi-durable goods are goods which are neither indestructible nor lasting but they can be used more than once before there is a need to replace them; they fall in-between Durable goods and Nondurable goods; examples include clothing and footwear or preserved foods. There are approximately 20 components of semi-durable goods in the ONS series. Nondurable goods are the opposite of durable goods. They are defined as goods that are immediately consumed in one use or ones that have a lifespan of less than 3 years. Examples include food, cleaning products, food, fuel, beer, cigarettes, medication, office supplies, packaging and containers, paper and paper products, personal products. There are approximately 20 components of non-durable goods and service in the ONS series.

The components of wealth are as follows; Physical Wealth is the total household physical wealth is calculated as the sum of the values recorded for each household for contents of the main residence, contents of other property, collectables and valuables, vehicles and personalised number plates. (Households may borrow money to buy things such as vehicles and contents. However, borrowing to finance such purchases will be covered when considering financial wealth. For these reasons, total physical wealth figures are only ever presented on a gross basis and do not consider liabilities).

Gross financial wealth is the sum of: formal financial assets (not including current accounts in overdraft), plus informal financial assets held by adults, plus financial assets held by children, plus endowments for the purpose of mortgage repayment (For the record, net financial wealth is the same minus financial liabilities which are the sum of arrears on consumer credit and household bills plus personal loans and other non-mortgage borrowing plus informal borrowing plus overdrafts on current accounts).

Private Pension Wealth is all pensions that are not provided by the state. They comprise occupational and personal pensions, and include pensions of public sector workers.

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