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Improved Generalized Method of Moments (GMM_d), Liquidity Risk, and the Pástor-Stambaugh Extension of the Fama-French Model

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Abstract

This paper uses an instrumental variable technique to minimize the specification errors in the Pástor-Stambaugh (PS) extension of the Fama-French (FF) model. In particular, we use an improvement of Hansen's generalized method of moments that uses higher moments, which we call GMM_d. Results with this GMM_d estimator indicate that the liquidity measure used in the PS extension of the FF model is improperly measured and/or is ill-conceived.

Keywords: GMM_d; specification errors; robust instrumental variables; higher moments; Fama-French model; liquidity risk

I. Introduction

Since the seminal work of Frisch (1934), treatment of specification errors, particularly endogeneity, is regarded as a challenging problem in empirical economics. Endogeneity, measurement errors, or more broadly, specification errors may lead to an inconsistent ordinary least squares (OLS) estimator and yield unreliable results. In the econometric literature, specification errors generally lead to non-orthogonality between the regressors and the error term. Spencer and Berk (1981) conjecture that specification errors originate from many sources, such as omission of relevant regressors, errors in variables, inappropriate aggregation over time, simultaneity (endogeneity), and incorrect specification form. Traditionally, a Hausman (1978) test may be used to identify this problem. This paper proposes a modified Hausman test using robust instrumental variables. As is well known in the literature, the use of weak instrumental variables can actually worsen the problem. We use the approach proposed by Racicot (2013) and Racicot and Théoret (2014). This procedure generates robust instruments that are able to tackle the weak instrumental variables problem[1]

The Fama and French (1992, 1993) or FF model as well as the Pástor and Stambaugh (2003) or PS extension are expressed in terms of unobservable expectations of the explanatory and dependent variables. In fact, however, estimates of these models use *realized* values of the variables. In essence, these realizations are the expectations measured with error. So, *a priori*, using OLS to find the parameters of the FF or PS models would yield incorrect estimation. More precisely, when there are measurement errors[2], endogeneity, or more generally specification errors, the OLS estimator is inconsistent. Thus, a robust instrumental variables approach is strongly recommended when estimating financial models based on expected values.

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[1] Racicot and Théoret (2014) tested for the weak instrumental variable problem using a test analogous to the Stainger and Stock (1997) test and concluded that their instrumental variables were not weak.

[2] In his book *Irrational Exurberance*, Schiller (2005) states that speculative bubbles can incur when price increases spur investor enthusiasm. In other words, observed prices are not always equilibrium prices and hence observed prices may be viewed as equilibrium prices with measurement errors. See also Schiller (2014).

2. Applying GMM_d to the Pástor-Stambaugh Model

2.1 The Pástor and Stambaugh five-factor model

The cost of equity for firm *i*, $E(R_i)$, is given by Equation (1) and follows the well-known convention that now appears in many textbooks such as Copeland, Weston, and Shastri (2005),

$$E\left(R_i\right)-R_f=\sum_{k=1}^{n}E\left(\tilde{\delta}_k\right)\beta_{ik} \qquad (1)$$

where $E(.)$ is the expectation operator, $\tilde{\delta}_k$ is an unobservable variable, and β_{ik} is the sensitivity of stock *i* to the unobservable variable $\tilde{\delta}_k$ .For n = 1, we obtain the CAPM with $E(\tilde{\delta}_1)$ equal to the market risk premium (expected return on the market minus the risk free rate). Fama and French (1993) proposed a three-factor model that was then extended to a four-factor model by Carhart (1997). Subsequently, Pástor and Stambaugh (2003) further extended this model to include a fifth factor. The five factors are market risk premium, SMB (return on a portfolio of small cap stocks minus the return on a portfolio of large cap stocks), HML (return of a high book-to-market stock portfolio minus return of a low book-to-market stock portfolio), MOM (Carhart momentum factor), and LIQ (Pástor and Stambaugh measure of market liquidity).

The empirical version of the cost of equity for stock i may be written as

$$R_i-R_f=\alpha_i+\sum_{k=1}^{n}\delta_k\beta_{ik}+\varepsilon_i \qquad (2)$$

where n = 1 for CAPM and n = 5 for the Pástor and Stambaugh model. The parameter α_i is the abnormal return for stock *i* known as the Jensen (1968) performance measure, δ_k is a proxy for the unobservable variable $\tilde{\delta}_k$, and ε_i is the error term. The proxy variable δ_k is defined by matrix equation (3).

$$\delta=\tilde{\delta}+u \qquad (3)$$

δ is a matrix of dimension $T\times n$ of the n observable factors and $\tilde{\delta}$ is a matrix of dimension $T\times n$ of the factors measured with error. u is a matrix of measurement errors which we assume to be normally distributed. Substituting (3) into the matrix version of (2) yields (4).

$$R_i - R_f = \alpha_i i_T + \delta\beta_i + \varepsilon_i - u\beta_i = \alpha_i i_T + \delta\beta_i + e_i \tag{4}$$

where i_T is a identity vector of dimension $T \times 1$. Estimating (4) by OLS yields inconsistent estimators. This is the classical errors-in-variables problem (Fomby, *et al.,* 1984)[3].

2.2 Robust Instrumental Variables

Here we present an extension of the generalized method of moments (GMM) originally developed by Hansen (1982). This new approach we call GMM_d and is based on our robust instrumental variable that can be visualized as a distance estimator. In this paper we show how to incorporate this measure into the GMM framework[4].

The GMM_d formulation of our robust instrumental variable estimator is as follows:

$$\arg\min_{\hat{\beta}} \left\{ n^{-1}\left[d'\left(y - X\hat{\beta} \right) \right]' W n^{-1} \left[d'\left(y - X\hat{\beta} \right) \right] \right\} \tag{5}$$

where W is a weighting matrix that can be estimated using the HAC[5] estimator and y is defined as

$$y = X\beta + \varepsilon \tag{6}$$

and where $\hat{\beta}$ is defined as

$$\hat{\beta} = \hat{\beta}_{TSLS} = \left(X'P_z X \right)^{-1} X'P_z y \tag{7}$$

P_z is defined as the standard "predicted value maker" used to compute

$$P_z X = Z\left(Z'Z \right)^{-1} Z'X = Z\hat{\theta} = \hat{X} \tag{8}$$

where Z contains the Durbin and Pal instruments defined later in equation (13). More precisely, Z may be obtained by optimally combining the Durbin (1954) and Pal (1980) estimators using GLS. The result is based on the Bayesian approach of Theil and Goldberger (1961). This leads to estimators that are more asymptotically efficient or at least as asymptotically efficient as using either only the Durbin or Pal estimators.

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[3] Note that in the classical errors-in-variables problem the assumptions of normally distributed errors is not required but the OLS estimators remain inconsistent even with the normally distributed assumption.

[4] The GMM_d estimator first appeared in Racicot and Théoret (2014).

[5] HAC is the heteroscedasticity and autocorrelation consistent estimator. See Newey and West (1987).

From (8) we extract the matrix of residuals

$$d = X - \hat{X} = X - P_z X = \left(I - P_z\right) X \tag{9}$$

Alternatively, $\hat{\beta}$ in (5) above is obtained by estimating the following equation using OLS:

$$y = X\beta + \hat{\omega}\varphi + \varepsilon * \tag{10}$$

It is a two-stage least squares estimator because $\hat{\omega}$ is also obtained by OLS and (10) can be rewritten as

$$y = X\hat{\beta}_{TSLS} + \hat{\omega}\varphi + \varepsilon * \tag{11}$$

where $\varphi = \theta - \beta$ measures the under/over estimation of the OLS benchmark estimator. The resulting t statistics can be analyzed in the usual fashion. That is, if a significant t statistic is obtained, there are significant specification/measurement errors in the model. $\hat{\omega}$ is a vector of residuals of the regression of each explanatory variable on the instrument set. Equation (11) is a Hausman (1978) artificial regression that can also be obtained using TSLS with the same set of instruments (Spencer and Berk, 1981).

In (5) the vector d is a vector of instruments than can be defined individually as

$$d_{it} = x_{it} - \hat{x}_{it} \tag{12}$$

Intuitively, the variable d_{it} is a filtered version of the endogenous variables. It potentially removes non-linearities that might be hidden in x_{it}. The smoothed variable d_{it} can be seen as a proxy for the long-term expected value of x_{it}. The $\hat{x}_{it}$ in (12) are obtained applying OLS on using the z instruments.

$$\hat{x}_{it} = \hat{\gamma}_0 + z\hat{\phi} \tag{13}$$

The z instruments are defined as $z = \{z_0, z_1, z_2\}$ where $z_0 = i_T$, $z_1 = x \odot x$, $z_2 = x \odot x \odot x - 3x$ $[E(x'x/T) \odot I_n]$ where $\odot$ is the Hadamard product and I_n is a identity matrix of dimension n x n. z_1 contains the instruments used in the Durbin (1954) estimator, and z_2 contains the cumulant instruments used by Pal (1980).

3. Empirical Results

3.1 Data

Our sample is composed of monthly returns of 12 indices classified by FF industrial sectors. The observation periods are from August 1962 to December 2012 for a total 485 observations. The FF risk factors are drawn from French's website[6]. The PS liquidity factor is from Pástor's website[7].

3.2 Estimating the Fama-French and Pástor-Stambaugh Models with Specification Errors

Insert Table 1 here

Estimates of the parameters of all of the models appear in Table 1. Equation (14) is the empirical formulation of the Fama-French model as augmented by Carhart (1997) by the momentum factor.

$$R_{it} - R_{ft} = \alpha_i + \beta_{1i}\left[R_{Mt} - R_{ft}\right] + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}MOM_t + \varepsilon_{it} \tag{14}$$

Equation (15) is the GMM_d formulation of equation (14).

$$R_{it} - R_{ft} = \alpha_{GMM_d i} + \beta_{GMM_d 1i}\left[R_{Mt} - R_{ft}\right] + \beta_{GMM_d 2i}SMB_t + \beta_{GMM_d 3i}HML_t + \beta_{GMM_d 4i}MOM_t + \tilde{\varepsilon}_{it} \tag{15}$$

Equation (16) is the Pástor-Stambaugh (2003) empirical model.

$$R_{it} - R_{ft} = \alpha_i + \beta_{1i}\left[R_{Mt} - R_{ft}\right] + \beta_{2i}SMB_t + \beta_{3i}HML_t + \beta_{4i}MOM_t + \beta_{5i}LIQ_t + \varepsilon_{it} \tag{16}$$

Equation (17) is the GMM_d formulation of equation (16).

$$\begin{aligned} R_{it} - R_{ft} = {} & \alpha_{GMM_d i} + \beta_{GMM_d 1i}\left[R_{Mt} - R_{ft}\right] + \beta_{GMM_d 2i}SMB_t + \beta_{GMM_d 3i}HML_t \\ & + \beta_{GMM_d 4i}MOM_t + \beta_{GMM_d 5i}LIQ_t + \tilde{\varepsilon}_{it} \end{aligned} \tag{17}$$

Equation (18) is the $Haus_d$ formulation of equation (14).

$$\begin{aligned} R_{it} - R_{ft} = {} & \alpha_{Haus_d i} + \beta_{Haus_d 1i}\left[R_{Mt} - R_{ft}\right] + \beta_{Haus_d 2i}SMB_t + \beta_{Haus_d 3i}HML_t + \beta_{Haus_d 4i}MOM_t \\ & + \varphi_{Mi}\hat{\omega}_{Mi} + \varphi_{SMBi}\hat{\omega}_{SMBi} + \varphi_{HMLi}\hat{\omega}_{HMLi} + \varphi_{MOMi}\hat{\omega}_{MOMi} + \tilde{\varepsilon}_{it} \end{aligned} \tag{18}$$

[6] French's website is http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.
[7] Pástor's website is http://faculty.chicagobooth.edu/lubos.pastor/research/liq_data_1962_2012.txt

Equation (19) is the Haus_d formulation of equation (15).

$$\begin{aligned} R_{it} - R_{ft} = \alpha_{Haus_d i} + \beta_{Haus_d 1i}\left[R_{Mt} - R_{ft}\right] + \beta_{Haus_d 2i}SMB_t + \beta_{Haus_d 3i}HML_t + \beta_{Haus_d 4i}MOM_t \\ + \beta_{Haus_d 5i}LIQ_t + \varphi_{Mi}\hat{\omega}_{Mi} + \varphi_{SMBi}\hat{\omega}_{SMBi} + \varphi_{HMLi}\hat{\omega}_{HMLi} + \varphi_{MOMi}\hat{\omega}_{MOMi} + \varphi_{LIQi}\hat{\omega}_{LIQi} + \tilde{\varepsilon}_{it} \end{aligned} \tag{19}$$

Insert Table 2 here

For all estimation methods, the coefficient for the market factor is significant for all 12 FF sectors as shown in Tables 1 and 2. The coefficient for the SMB factor is significant for 9 of the 12 sectors using OLS. However, this coefficient is significant for only 3 sectors using GMM_d. This suggests that the SMB factor may contain measurement errors. The Haus_d artificial regression further suggests that there are errors, as there are 2 sectors for the estimated ω_{SMB} coefficient that have significant *t* values. The results for the HML factor are even more strongly suggestive of measurement errors. The coefficient for the HML factor is significant for 5 of the 12 sectors using OLS. This coefficient is **NOT** significant for any sector using GMM_d! The HML factor is regarded as a value return premium. That is, high book to market is indicative of value firms and low book to market is indicative of growth firms. The Haus_d method also suggests that there are errors in this variable, as there are 4 sectors for the estimated ω_{HML} coefficient that have significant *t* values.

The coefficient for Carhart's MOM factor is significant for 11 of the 12 sectors using OLS. However, this coefficient is **NOT** significant for any sector using GMM_d![8] Haus_d suggests that there are errors, as there are 2 sectors for the estimated ω_{MOM} coefficient that have significant *t* values. We note that the MOM variable is really a behavioral finance variable, not a risk factor. *So, the fact that the coefficient for the MOM variable for all 12 FF sectors is insignificant, is actually an argument for market efficiency.*

When dealing with the FF sectors, the sector volatility of returns can itself be volatile. Furthermore, the heating and cooling of these volatilities does not always happen simultaneously. Thus, the risk-return profile of the industrial sectors may differ substantially and be quite dynamic[9].

[8] This result is in line with Kothari, Shanken, and Sloan (1995).

[9] The authors would like to thank William Ferrell of Ferrell Capital Management for making this observation.

Pástor-Stambaugh included a liquidity variable as a risk measure. However, the Pástor-Stambaugh liquidity variable LIQ likely contains significant measurement errors. As evidence of this, the addition of the liquidity variable actually reduces the adjusted R squared from 0.69 to 0.67 in the GMM_d estimation in Table 1. Furthermore, the $Haus_d$ artificial regression coefficient for the ω_{LIQ} variable in Table 1 shows 4 sectors with significant measurement error. In Tables 1 and 2, the number of significant sectors for the LIQ factor is 3 for both OLS and GMM_d. However, only Sector 3 Manuf is in common between the two methods, with Sector 5 Chems and Sector 12 Other being significant for OLS and Sector 9 Shops and Sector 11 Money being significant for GMM_d. The adjusted R squared, ω_{LIQ} variable, and OLS versus GMM_d results suggest that the LIQ variable is improperly measured and/or is ill-conceived in its construction. The *t* tests for the coefficients of the PS empirical model should not be surprising. Pagan (1984, 1986) shows that constructed variables may increase the variance of the OLS estimator but the estimator remains unbiased. Further evidence of the unreliability of the constructed variables used by FF and PS is provided by Harvey, Liu, and Zhu (2013). They argue that unless a *t*-ratio for a factor is greater than 3, any claimed research finding for a factor is likely to be false and the result of data mining. Cochrane (2011) expresses doubts about the importance of the plethora of factors discovered recently as a “zoo of new factors”.

4. Conclusions

GMM_d provides insight into the Pástor-Stambaugh model. Our results show that there are significant measurements errors in several Fama-French sectors. We note a significant reduction in adjusted R-squared in the GMM_d approach compared to OLS in both the Fama-French and Pástor-Stambaugh models. The adjusted R-squared for the Pástor-Stambaugh model is lower than the value for Fama-French using GMM_d. This suggests measurement issues in the Pástor-Stambaugh liquidity variable. We also find issues with the HML and MOM variables. The coefficients are insignificant for all of the FF sectors when using GMM_d.

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Tables

Table 1

OLS versus GMM_d and $Haus_d$ estimation methods for Fama-French and Pástor-Stambaugh models

	c	R_n-R_f	*SMB*	*HML*	*MOM*	*LIQ*	$\hat{\omega}_{R_m-R_f}$	$\hat{\omega}_{SMB}$	$\hat{\omega}_{HML}$	$\hat{\omega}_{MOM}$	$\hat{\omega}_{LIQ}$	$\bar{R}^2$	*DW*
Fama-French													
OLS	0.0013	0.9679	0.1594	0.0722	0.0000							0.79	1.91
Abs *t*-mean	*2.92*	*46.96*	*6.39*	*5.57*	*2.24*								
GMM_d	-0.0007	0.9594	0.1375	0.2991	0.0013							0.69	1.82
$Haus_d$	0.0013	0.9594	0.1375	0.2991	0.0013		0.0098	0.0416	-0.2454	-0.0013		0.79	1.91
Abs *t*-mean	*2.84*	*11.47*	*1.53*	*1.81*	*1.52*		*1.49*	*1.08*	*1.57*	*1.31*			
Abs *t*-min	*0.28*	*6.17*	*0.48*	*0.33*	*0.45*		*0.30*	*0.16*	*0.08*	*0.07*			
Abs *t*-max	*6.30*	*19.74*	*3.79*	*4.73*	*4.22*		*3.26*	*2.18*	*4.59*	*4.05*			
# of signif. indices	7	12	4	4	4		4	2	4	2			
Pastor-Stambaugh													
OLS	0.0011	0.9648	0.1568	0.0718	0.0000	0.0110						0.79	1.90
Abs *t*-mean	*2.15*	*11.13*	*1.86*	*1.91*	*1.38*	*0.01*							
GMM_d	-0.0011	0.9475	0.1351	0.2860	0.0012	0.0150						0.67	1.84
$Haus_d$	0.0012	0.9475	0.1351	0.2860	0.0012	0.0150	0.0195	0.0421	-0.2333	-0.0011	-0.0059	0.79	1.90
Abs *t*-mean	*0.80*	*7.28*	*1.08*	*0.95*	*0.81*	*1.28*	*1.37*	*1.08*	*1.55*	*1.36*	*1.60*		
Abs *t*-min	*0.09*	*3.29*	*0.04*	*0.01*	*0.03*	*0.10*	*0.11*	*0.10*	*0.05*	*0.32*	*0.04*		
Abs *t*-max	*1.69*	*17.61*	*2.23*	*1.71*	*1.31*	*2.66*	*3.69*	*2.26*	*4.11*	*3.38*	*3.18*		
# of signif. indices	5	12	3	5	5	6	4	2	5	3	4		

Note: Results in this table are the averages of the 12 Fama-French sectors. The t-statistics are in italics. DW represents the Durbin-Watson statistics. $\bar{R}^2$ represents the adjusted R squared.

Table 2

OLS versus GMM_d estimation methods for Pástor-Stambaugh model by Fama-French sectors

		c	R_m-R_f	*SMB*	*HML*	*MOM*	*LIQ*	$\bar{R}^2$	*DW*
Sector	**Pastor-Stambaugh**								
1 NoDur	OLS	-0.0025	0.8626	0.0996	0.0767	0.0003	0.0278	0.80	1.75
	t-stat	*-1.90*	*44.49*	*2.97*	*2.17*	*1.30*	*1.57*		
	GMM_d	-0.0045	0.9071	0.1118	0.5644	0.0038	0.0213	0.72	1.68
	t-stat	*-0.50*	*6.15*	*0.42*	*1.31*	*1.21*	*0.32*		
2 Durbl	OLS	0.0053	1.1039	0.3777	0.4663	-0.0008	0.0387	0.81	1.97
	t-stat	*2.96*	*41.28*	*8.17*	*9.56*	*-2.25*	*1.58*		
	GMM_d	-0.0122	0.8310	0.9171	1.1571	0.0013	0.0938	0.65	1.95
	t-stat	*-0.95*	*3.77*	*2.23*	*1.71*	*0.27*	*1.04*		
3 Manuf	OLS	0.0054	1.0702	0.3174	0.1370	0.0002	0.0505	0.92	2.00
	t-stat	*5.48*	*72.66*	*12.47*	*5.10*	*1.16*	*3.74*		
	GMM_d	0.0060	1.0805	0.2177	0.2329	0.0000	0.1000	0.91	2.04
	t-stat	*1.32*	*17.61*	*1.75*	*0.96*	*-0.03*	*2.66*		
4 Enrgy	OLS	0.0000	0.9399	-0.0883	0.2520	0.0021	0.0418	0.62	1.87
	t-stat	*0.00*	*29.11*	*-1.58*	*4.28*	*4.65*	*1.41*		
	GMM_d	0.0224	1.4261	-0.4388	0.2256	0.0029	-0.1503	0.44	1.86
	t-stat	*1.69*	*7.42*	*-0.94*	*0.36*	*0.68*	*-1.63*		
5 Chems	OLS	0.0011	0.9613	-0.0054	0.0703	0.0002	0.0373	0.84	2.00
	t-stat	*0.86*	*50.37*	*-0.16*	*2.02*	*0.65*	*2.13*		
	GMM_d	-0.0105	0.8892	0.3167	1.0474	0.0062	0.0729	0.56	1.76
	t-stat	*-0.74*	*3.94*	*0.71*	*1.47*	*1.17*	*0.78*		
6 BusEq	OLS	0.0097	1.0921	0.4644	-0.5701	-0.0020	-0.0368	0.84	1.95
	t-stat	*5.97*	*44.84*	*11.03*	*-12.83*	*-5.86*	*-1.65*		
	GMM_d	-0.0024	0.7924	0.6595	-0.7455	-0.0040	-0.0087	0.79	1.88
	t-stat	*-0.25*	*4.93*	*2.15*	*-1.37*	*-1.03*	*-0.10*		
7 Telcm	OLS	-0.0038	0.8616	-0.0540	0.0910	-0.0005	-0.0433	0.69	1.95
	t-stat	*-2.27*	*34.02*	*-1.23*	*1.97*	*-1.39*	*-1.87*		
	GMM_d	-0.0099	0.5862	-0.2313	-0.5906	-0.0057	0.0805	0.50	1.83
	t-stat	*-0.97*	*3.29*	*-0.69*	*-1.01*	*-1.31*	*0.89*		
8 Utils	OLS	-0.0110	0.7529	-0.1083	0.3590	0.0014	-0.0207	0.60	1.87
	t-stat	*-6.26*	*28.62*	*-2.38*	*7.48*	*3.87*	*-0.86*		
	GMM_d	-0.0116	0.7717	-0.1767	0.4772	0.0031	-0.1176	0.56	1.86
	t-stat	*-1.14*	*5.45*	*-0.51*	*0.90*	*0.84*	*-1.73*		
9 Shops	OLS	0.0019	0.9510	0.3241	-0.0882	-0.0009	0.0121	0.82	1.87
	t-stat	*1.32*	*44.42*	*8.76*	*-2.26*	*-2.90*	*0.62*		
	GMM_d	0.0007	0.9365	0.1290	0.0883	-0.0002	0.1395	0.79	1.84
	t-stat	*0.09*	*8.12*	*0.44*	*0.25*	*-0.08*	*2.25*		
10 Hlth	OLS	0.0011	0.8947	-0.1081	-0.3381	-0.0002	-0.0420	0.74	1.95
	t-stat	*0.69*	*36.51*	*-2.55*	*-7.57*	*-0.66*	*-1.87*		
	GMM_d	-0.0032	0.9662	-0.0152	0.5575	0.0059	-0.1694	0.50	1.89
	t-stat	*-0.24*	*4.22*	*-0.04*	*0.73*	*1.05*	*-1.49*		
11 Money	OLS	0.0041	1.0494	0.1399	0.3265	-0.0001	0.0279	0.84	1.78
	t-stat	*2.97*	*50.68*	*3.91*	*8.65*	*-0.27*	*1.47*		
	GMM_d	0.0069	1.0363	-0.2465	-0.0038	-0.0020	0.1045	0.79	1.72
	t-stat	*0.96*	*8.75*	*-1.16*	*-0.01*	*-0.82*	*2.12*		
12 Other	OLS	0.0023	1.0382	0.5226	0.0794	0.0003	0.0389	0.92	1.89
	t-stat	*2.19*	*66.93*	*19.50*	*2.81*	*1.61*	*2.74*		
	GMM_d	0.0046	1.1466	0.3776	0.4217	0.0029	0.0138	0.87	1.80
	t-stat	*0.81*	*13.73*	*2.00*	*1.32*	*1.25*	*0.34*		

Note: Results in this table are each of the 12 Fama-French sectors. The t-statistics are in italics. DW represents the Durbin-Watson statistics. $\bar{R}^2$ represents the adjusted R squared.