Endogeneity bias in the OLS estimates of Basu's model

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Abstract: Basu (1997) is the main reference in the market-based accounting literature related to the measurement of conditional conservatism. However, the econometric specification of Basu's model involves an endogeneity problem due to simultaneity in the variables used in its empirical application: earnings and returns. In this paper we analyse the effect of endogeneity on the Basu's conditional conservatism measure by using two alternative estimation techniques: the usual Ordinary Least Squares, affected by endogeneity, and System Generalized Method of Moments, specially designed to deal with the endogeneity problem. We apply these estimation procedures to a comparative model of the conditional conservatism in order to analyse the effect of IFRS first adoption on conditional conservatism. Our results evidence that endogeneity problem exists, that it induces bias in the OLS estimations, and that biases can be large enough to modify empirical conclusions.

Key-Words: Conditional conservatism; earnings conservatism; IFRS first adoption; market-based accounting research; panel data; System Generalized Method of Moments.

1 Introduction

As Huijgen and Lubberink (2005) point out, the conservatism is an intrinsic characteristic of accounting. In this sense, Sterling (1967) claims that conservatism is "the most ancient and probably the most pervasive principle of accounting valuation". This accounting principle involves prudence when changes in assets and liabilities values and economic results are accounted. According to Beaver and Ryan (2005) and Basu (2005) among others, we can observe in the financial statements two kinds of accounting conservatism.

The first one is the named unconditional, balance sheet or *ex-ante* conservatism. Feltham and Olhson (1995) define it as the systematic, and news independent, persistence to undervalue the net assets of the company (equity) through policies and methods that are conservative. Christie (1990) and Fields, Lys and Vincent (2001) survey the empirical evidence regarding unconditional conservatism in the literature. Gray (1980, 1988) developed the seed of an international research line in this field. And more recently, Givoly and Hayn (2000) have analysed the time evolution of this kind of conservatism in US. Givoly and Hayn (2000) methodology is being widely used to test the effects of IFRS first adoption on unconditional conservatism in several countries, reviving a research stream waned by the early 1990s (García and Mora 2004; Ferreira, García and Gonçalves, 2007; Iñiguez, Poveda and Vázquez, 2013; Lai, Lu and Shan, 2013; Khalifa, Othman and Hussainey, 2016; and Fullana and Toscano, 2016).

The other kind of conservatism that we find in financial statements was defined by Basu (1997) as the accountant's practice of recognizing bad news more quickly than good news. It is named as conditional, earnings or *ex-post* conservatism. In his definition, Basu in a simple way translates into financial economics terminology the accounting principle of "anticipate all losses but anticipate no gains", already reflected in the Bliss (1924) book.

The Basu (1997) paper has had an important subsequent influence and, as Hsu, O'Halon and

Peasnell (2012) note, his model is commonly used to measure the conditional conservatism in the literature. Moreover, it has become one of the principal models of the financial accounting literature. A large number of papers, as Pope and Walker (1999), Ball, Kothari and Robin (2000), Ryan and Zarowin (2003), Sivakumar and Waymire (2003), and Beaver and Ryan (2005), among many others, analyse earnings conservatism using the Basu's asymmetric timeliness measure. Ball, Kothari and Nicolaev (2013) have documented that at July 2013, the Basu (1997) paper had 2116 citations in Google Scholar (as of May 2016 has 3455) and 355 citations in the Social Sciences Citation Index (as of May 2016 has 587), making it one of the most highly referenced papers in the modern accounting literature.

As Ball, Kothari and Nicolaev (2013) argue, the importance (quantitative and qualitative) of the applications of Basu's model bears out the researchers' confidence in the validity of their estimates of it. This confidence has been increased by the consistency of the evidence that these applications show. However, it is a blind confidence, based on researchers' intuitive appeal but not on a rigorous analysis. In fact, the model is not without controversy and some papers focus on the discussion around whether the Basu asymmetric timeliness coefficient is a valid measure of conservatism (Pae et al., 2005; Givoly et al., 2007; Roychowdhury and Watts, 2007; Dietrich et al., 2007; Patatoukas and Thomas, 2011, 1013 and 2015; Ball, Kothari and Nicolaev, 2012 and 2013; Collins, Hribar and Tian, 2014; Cano-Rodriguez and Nuñez-Nickel, 2015; and Banker, Basu, Byzalov and Chen, 2015).

In this context, this paper focuses on the effects of the endogeneity problem that the econometric specification of Basu's model involves due to simultaneity in the variables used in its empirical application. As it is well known, the endogeneity problem induces biases in the coefficients estimated by Ordinary Least Squares (OLS) and in their standard errors, since changes in the error term affect not only the dependent variable but also the independents (Dietrich et al., 2007; Wang et al., 2009; and Dechow et al., 2010). To measure the endogeneity effect on the Basu asymmetric timeliness coefficient we use two alternative techniques for estimate the Basu's model: OLS and System Generalized Method of Moments (GMM-sys), specially designed for panel data with endogeneity problems (Arellano and Bover, 1995; and Blundell and Bond, 1998).

We apply these two alternative estimation procedures to a comparative model of the conditional conservatism based on Basu's model and design *a la* Ball, Kothari and Robin (2000). With this methodology we analyse the effect of IFRS mandatory first adoption by listed firms on their conditional conservatism. We find that significant differences arise between results provided by the two alternative estimations techniques. These results confirm the presence of an endogeneity bias. Moreover, this bias is large enough to change the conclusions of our analysis.

The remainder of this paper is structured as follows. Section 2 shows the econometric models used to measure conditional conservatism. The sample and data are described in Section 3. In Section 4 the estimates results are showed and discussed. Finally, Section 5 concludes.

2. Market-based measurement of conditional conservatism

2.1. Basu's (1997) (econometric) model

In Basu (1997) the conditional conservatism is considered as a consequence of the tendency in the accounting practice of requiring a greater degree of verification to recognize in the financial statements the positive news than to recognize the negative news. Under this interpretation, the income statement reflects the bad news faster than good news, being conditioned to the relative importance of good and bad on the total news of the period to which they are referred to. Likewise, the slow incorporation of the good news to the results causes an increase in their time persistence.

The basic idea in Basu (1997), used by the author to formulate the econometric model developed to measure the degree of conditional conservatism, is the efficiency of capital markets. The market efficiency of the assets, at its strongest level, involve that both good and bad news, which could be accounted for, are included in the market price. Thus, the gap between the recognition of incomes and expenses, which bias the financial results, is not present in market returns, computed from the stock prices that collect symmetrically all the news related to the profit and loss account. From this perspective, it is expected that the correlation between market returns and firm earnings is higher when market returns are negative (bad news) that when those returns are positive (good news).

Basu captures this idea through modelling a linear relationship between firm earnings and market returns, allowing a different relationship when returns are positive than when returns are negative. The difference between these two linear relationships measures the conditional conservatism. The analytical expression of the proposed model by Basu is as follows:

$$\frac{EPS_{i,t}}{P_{i,t-1}} = \lambda_0 + \lambda_1 D_{i,t} + \lambda_2 R_{i,t} + \lambda_3 D_{i,t} R_{i,t} + \mu_{i,t} \qquad (1)$$

where:

$EPS_{i,t}$ is earnings per share of the *i*-firm for period *t*;
$P_{i,t-1}$ is the stock price market of the *i*-firm at beginning of the period *t*;
$D_{i,t}$ is a dichotomy variable equal to one if market return of the *i*-firm for period *t* is negative and zero otherwise; and
$R_{i,t}$ is the market return of the *i*-firm for period *t*.

The coefficient λ_3 in the equation (1) measures the average intensity of asymmetric relations between earnings and market returns of all companies considered, i.e. it measures the (equally-weighted) average of the conditional conservatism degree for the group of companies that comprise the sample used in the analysis. When conditional conservatism affects earnings, we expect that λ_3 is positive and significant.

In equation (1) returns are used as a proxy for news, i.e., in the unstated underlying economic model "news" is the independent variable. Then, the empirical model appears to reverse the traditional return-earnings model. Actually, in the footnote seven of Basu (1997) the author calls his model as "simple 'reverse' regression" and explicitly recognizes this fact. The use of returns as news proxy induces an endogeneity problem since earnings (the dependent variable in the model) cause returns and then a simultaneity problem arises.

Another econometric problem comes from the need to define the good and bad news from returns as Dietrich et al. (2007) highlight. The level of returns that partitions news into good and bad news is arbitrarily selected and obviously affect results. In this paper we do not address this issue, so we select as a cut-off level the most common in the literature: the zero return. Then we maintain this election along our analysis with the aim that this problem does not interfere in our conclusions.

2.2. Testing the variation in conditional conservatism

Ball et al. (2000) were pioneers in enlarging de Basu's model to perform comparative analyses. They used their model specification to introduce an international perspective in the analyses and test conditional conservatism differences among the seven countries analysed. Following them, several authors have analysed across different contexts variation in conditional conservatism. Their framework is useful to test the major explanations of accounting conservatism listed by Watts (2003): contractual relations, relations with shareholders, taxation and accounting regulations, and for search new interpretations for (and consequences of) conditional conservatism. Changes in accounting regulation, the last of the four circumstances list by Watts (2003) that induce accounting conservatism, justifies a body of empirical work dedicated to measuring the effects on conditional conservatism caused by the country adoption of IFRS from local GAAP.

In the presence of a pooled sample with *n* groups of firm-observations defined by a specific characteristic, e.g., that belong to different countries, Ball et al. (2000) adapt Basu´s model by adding *n-1* dummy variables that permit achieve *n* different coefficients of the Basu´s model avoiding multicollinearity. The coefficients of the group without a specific dummy variable are the base coefficients and the rest are incremental coefficients relative to the base ones. We use this framework to analyse the effect of the adoption of IFRS on conditional conservatism. The date of the first IFRS adoption divides the whole sample into two subsamples defined by two time periods: the local GAAP period previous to the date of the first IFRS adoption, and the IFRS period that starts at this date. To carry out this analysis, we adapt the Basu's model in (1) as follows:

$$\begin{aligned}\frac{EPS_{i,t}}{P_{i,t-1}} &= \alpha_0 + \alpha_1 IFRS_t + \alpha_2 D_{i,t} + \\ &+\alpha_3 IFRS_t D_{i,t} + \alpha_4 R_{i,t} + \alpha_5 IFRS_t R_{i,t} + \\ &+\alpha_6 D_{i,t} R_{i,t} + \alpha_7 IFRS_t D_{i,t} R_{i,t} + \varepsilon_{i,t}\end{aligned} \qquad (2)$$

where the dichotomy variable $IFRS_t$ is equal to one if t belongs to the IFRS period, and equal to zero if t belongs to the previous local GAAP period; and the other variables are defined as in (1).

In equation (2) the parameter that measure the difference between the conditional conservatism previous to the date of the first IFRS adoption and after that date, is α_7. The sign and significance of α_7 become an empirical question due to the different arguments, hypothesis and evidence about them found in the literature (Barth *et al*., 2008; García *et al*., 2008; Kabir *et al.*, 2010; Zhang, 2011; and Piot *et al*., 2011). On the other hand, parameter α_6 measures conditional conservatism in the local GAAP period, and then, (α_6 + α_7) measures conditional conservatism in the IFRS period. The contemporary response of earnings to good news (positive returns) is measure in equation (2) by α_4 for the local GAAP period and by (α_4 + α_5) for the IFRS period. In the same way, the contemporary response of earnings to bad news (negative returns) is measure by (α_4 + α_6) for the local GAAP period and by (α_4 + α_5 + α_6 + α_7) for the IFRS period.

3. Sample and data

With respect to the selection of the data sample to implement our analysis, it is crucial do not mix data of firms whose different environmental characteristics may suggest that the effect of changes in the accounting normative on their financial statements differs significantly among them. In this regard, Daske *et al.* (2008) alerts about mixing voluntary and mandatory adopters. Put together data of continental and Anglo-Saxon systems can be also problematic insomuch as in the continental systems accounting numbers had low volatility under the local GAAP (Ball et al., 2000) and it is expected to increase with IFRS adoption (Leuz *et al*., 2003; Rivard *et al*., 2003; Ball, 2004; and Graham *et al*. 2005). Finally, Soderstrom and Sun (2007) note that the political and legal system in which firms are located also affects to the financial statements quality. Following all these arguments and with the aim of not distort our results and/or hinder interpretation of them, we select a sample of firms that adopted IFRS by mandate and belong to a single country, and thus a single accounting-, political-, and legal-system. Concretely, we use data of the Spanish listed firms that in January 2005 by an UE mandate adopt IFRS for first time.

All sample data required for our analysis are obtained from the Compustat Global Vantage database. A total of 148 companies listed on the Spanish continuous market are included in the database. From these firms, 41 belong to the financial industry according to the sector classification of Madrid Stock Exchange. And only 103 of the remaining 107 have data available in our analysis period of 18 years, from 1995 to 2012. The number of firm-year observations for which we have all required data is 1,255. Then, we remove 293 firm-year observations with atypical values. Outliers are selected by the minimum covariance determinant method for multivariate outlier detection as performed by Verardi and Dehon (2010). From these firm-year observations, 449 (from 74 companies) belong to the local GAAP period (from 1995 to 2004) and 513 (from 103 companies) belong to the IFRS period (from 2005 to 2012).

The time period of the sample is not centred on the date of first application of IFRS by listed companies in the Spanish continuous market, thus the local GAAP period is longer. This fact reflects an attempt to balance the subsamples data as possible. Table 1 shows the variables used and their summary statistics, both for the whole sample in Panel A and for the two subsamples: the local GAAP period in Panel B, and the IFRS period in Panel C. We extract directly from the database the following variables: the December-end firm market capitalization from 1994 to 2011 (MKVAL); annual firm net income (NI) and annual firm minority interest (MII), that we sum to compute annual earnings before extraordinary items; and finally, monthly market returns including dividends (MKRTXM: by ex-date) that we compose to compute annual market returns. The dependent variable, annual earnings per share over the share price at beginning of the year, is computed as the annual earnings before extraordinary items over the December-end firm market capitalization of the previous year.

4. Results

Results of estimating three different specifications of the comparative model in equation (2) alternatively by OLS (with pooled data) and by GMM-sys (with panel data) are shown in Table 2 and Table 3, respectively. In the specification (i) that not accounts for the asymmetric timeless nor the normative change, we can observe through the parameter α_4 that market returns explain earnings at

1% of significance level. In the OLS estimation the R^2 of about 28% is higher than found in other papers due to the more rigorous outliers selection procedure used. The constants are also significant and thus the Wald test in both OLS and GMM-sys estimates are also significant at 1% level.

In the specification (ii) that takes into account the asymmetric timeless but not the normative change, i.e., the original Basu´s econometric model shown in equation (1), independently of the estimation technique used, the parameter α_6 that measure conditional conservatism is not significant. This result could be affected by the normative change through the adoption of IFRS. The value of R^2 (in the OLS estimation) and the Wald test significance remains in the levels observed in specification (i).

Specification (iii) in Table 2 and Table 3 show results for the full comparative model in equation (2), designed *a la* Ball, Kothari and Robin (2000). When it is estimated using the technique of OLS pooled regression, results in Table 2 show that the introduction of the normative change in the analysis has not affect conditional conservatism in the local GAAP period where it (measured by α_6) remains not significant. Moreover, the effect of the IFRS adoption (measured by α_7) does not affect it significantly thought the negative sign points more toward an average reduction than an average increment. This result is in line to previous evidence found by Andre and Filip (2012) in our context that, to the best of our knowledge, is unique in the literature. In a European analysis, Andre and Filip (2012) also use OLS pool-data estimations and show specific results for Spain with no significant values for conditional conservatism before IFRS adoption along with a no significant change of it (but positive in contrast to ours) due to the IFRS adoption.

The tests of significance of the meaningful sums of parameters described in Section 2.2 confirm that IFRS introduction did not change the fact that there was not accounting conservatism in the local GAAP period as (α_6 + α_7) is highly not significant. In the other three cases, these tests confirm that in the both periods analysed both kinds of news (positive and negative returns) explain earnings significantly.

Alternatively, results in Table 3 of estimating the full specification (iii) of the comparative model (2) by GMM-sys with panel data show that there was significant conditional conservatism in the local GAAP period at 1% level. These results also evidence that IFRS adoption implies a significant reduction at 1% level of conditional conservatism. However, the significance, also at 1% level, of (α_6 + α_7) shows that conditional conservatism is not removed completely in the IFRS period. Interestingly, these three results are contrary to those reported in Table 2 when the comparative model (2) is estimate by OLS with pooled data. The results of the other tests of significance of the meaningful sums of parameters in Table 3 show a reduction in the significance of both positive and negative news following IFRS adoption. Another outcome not captured by the OLS estimation.

5. Conclusions

Despite the great importance of Basu's (1997) paper in the measure of conditional conservatism that we have documented, the empirical model implemented in it has been questioned en la literature mainly in two ways: because it can induce a misspecification bias; and because it can introduce econometric estimation problems that also bias results. In this context, this paper focuses on the effects of the endogeneity problem that the econometric specification of Basu's model involves due to simultaneity in the two variables used in its empirical application.

To measure the endogeneity effect on the Basu's asymmetric timeliness coefficient we use two alternative techniques for estimate the Basu's model and then we compare their results. The first is the usual Ordinary Least Squares (OLS) approach whose estimations, as is well known, are biased in presence of endogeneity. The alternative estimation technique we use is System Generalized Method of Moments (GMM-sys) that, in contrast, is specially designed for panel data with endogeneity problems. Concretely, we apply these two alternative estimation procedures to a comparative model of the conditional conservatism based on Basu's model and design *a la* Ball, Kothari and Robin. With this methodology we analyse the effect of IFRS first adoption on conditional conservatism of firms of a single accounting-, political-, legal- system sample where only listed firms, and by mandate, adopted IFRS: the Spanish listed firms.

Our results show that when we use OLS with pooled data the effect of the IFRS adoption does not affect conditional conservatism significantly in line to previous evidence. Results also show that conditional conservatism is not significant nor before IFRS adoption neither after. Finally, results confirm that in the both periods analysed both kinds of news (positive and negative returns) explain earnings significantly. In contrast, results using GMM-sys with panel data show that there was significant conditional conservatism in the local GAAP period at 1% level; that IFRS adoption implies a significant reduction at 1% level of conditional conservatism; that conditional conservatism is not removed completely in the IFRS period; and that a reduction in the significance of both positive and negative news to explain earnings following IFRS adoption. These results show evidence that endogeneity problem exists, that it induces bias in the OLS estimations and that the bias can be large enough to modify empirical conclusions.

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Table 1. Sample data: summary statistics.

Panel A. Period: 1995 – 2012. # Firms: 98. # Observations: 962.

	mean	sd	min	Q1	median	Q3	max
Capitalization	3.8704	10.4245	0.0073	0.1467	0.5331	2.3119	104.634
Earnings	0.2898	0.8530	-0.0321	0.0080	0.0334	0.1440	10.0720
EPS_t/P_{t-1}	0.0681	0.0365	-0.0203	0.0432	0.0666	0.0928	0.1629
Return	0.0592	0.3134	-0.8287	-0.1288	0.0774	0.2799	0.9333

Panel B. Period: 1995 – 2004. # Firms: 72. # Observations: 449.

	mean	sd	min	Q1	median	Q3	max
Capitalization	8.7499	0.0076	0.1139	0.3602	1.5780	80.9180	8.7499
Earnings	0.4632	-0.0006	0.0078	0.0220	0.1046	3.2583	0.4632
EPS_t/P_{t-1}	0.0747	0.0357	-0.0123	0.0495	0.0722	0.0992	0.1629
Return	0.1007	0.2925	-0.7442	-0.0819	0.1278	0.2973	0.9057

Panel C. Period: 2005 – 2012. # Firms: 98. # Observations: 513.

	mean	sd	min	Q1	median	Q3	max
Capitalization	4.6299	11.6369	0.0073	0.2175	0.8259	2.9551	104.634
Earnings	0.3735	1.0719	-0.0321	0.0085	0.0502	0.1772	10.0720
EPS_t/P_{t-1}	0.0623	0.0361	-0.0203	0.0374	0.0612	0.0863	0.1628
Return	0.0230	0.3263	-0.8287	-0.1565	0.0370	0.2543	0.9333

Note: Market capitalization and earnings are in thousands of millions of euros. EPS_t/P_{t-1} and Return are annual simple rates.

Table 2. The comparative model estimated by OLS

	OLS – Pool data		
	(i)	(ii)	(iii)
α_0	0.0953	0.0972	0.1018
	[11.92]***	[12.10]***	[12.12]***
α_1			-0.0193
			[-2.41]**
α_2		-0.0063	-0.0113
		[-2.10]**	[-2.26]**
α_3			0.0089
			[1.28]
α_4	0.0616	0.0588	0.0429
	[8.80]***	[8.40]***	[3.90]***
α_5			0.0298
			[1.86]*
α_6		-0.0101	0.0062
		[-0.92]	[0.38]
α_7			-0.0299
			[-1.42]
R^2 adjusted	28.23%	28.40%	28.41%
Wald	190.9***	193.8***	213.1***
AR(2)	4.87***	4.83***	4.82***
Obs	962	962	962
H_0: $(\alpha_4 + \alpha_5)=0$			47.24 [0.000]***
H_0: $(\alpha_4 + \alpha_6)=0$		37.30 [0.000] ***	15.52 [0.000]***
H_0: $(\alpha_4 + \alpha_5 + \alpha_6 + \alpha_7)=0$			26.57 [0.000]***
H_0: $(\alpha_6 + \alpha_7)=0$			0.01 [0.992]

Note: This table shows the estimated constant and slope coefficients of model in equation (2) and, in brackets, the HAC t-statistic computed using Newey and West (1987). With the t-statistic, *** denotes significance at 1% level, ** denotes significance at 5% level, and * denotes significance at 10% level. The null of AR (2) is that residuals have autocorrelation of order 2. The Wald test is a test of joint significance of the parameters. Test of significance of slope coefficients sums are reported with their HAC p-values in brackets computed using Newey and West (1987): *** denotes p <1%, ** denotes p <5%, and * denotes p <10%.

Table 3. The comparative model estimated by GMM-sys

	GMM-SYS – Panel data		
	(i)	(ii)	(iii)
α_0	0.0928	0.0891	0.0349
	[8.21]***	[4.30]***	[1.75]*
α_1			0.0245
			[1.06]
α_2		0.0086	0.1961
		[0.36]	[3.50]***
α_3			-0.1617
			[-2.69]***
α_4	0.1728	0.1725	0.1266
	[8.07]***	[3.56]***	[1.94]**
α_5			-0.0803
			[-1.02]
α_6		0.0199	0.633
		[0.22]	[4.01]***
α_7			-0.5833
			[-3.52]***
Wald	65.15***	61.84***	33.68**
AR(2)	1.233**	1.014**	0.4636***
Sargan	33.69***	32.89***	13.03***
Obs	962	962	962
H_0: $(\alpha_4 + \alpha_5)=0$			1.12 [0.29]
H_0: $(\alpha_4 + \alpha_6)=0$		8.75 [0.003] ***	18.16 [0.000]***
H_0: $(\alpha_4 + \alpha_5 + \alpha_6 + \alpha_7)=0$			5.08 [0.024] **
H_0: $(\alpha_6 + \alpha_7)=0$			12.70 [0.000]***

Note: This table shows the estimated constant and slope coefficients of model in equation (2) and their HAC t-statistic in brackets computed using Windmeijer (2005). With the t-statistic, *** denotes significance at 1% level, ** denotes significance at 5% level, and * denotes significance at 10% level. The null of AR (2) is that residuals have autocorrelation of order 2. The null of Sargan test is that the instruments are not valid to correct the endogeneity. The Wald test is a test of joint significance of the parameters. Test of significance of slope coefficients sums are reported with their HAC p-values in brackets computed using Windmeijer (2005): *** denotes p <1%, ** denotes p <5%, and * denotes p <10%.