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Export Volatility and Corporate Financing Decisions in Australia: A Dynamic Panel Data Approach

Chow Yee Peng[a*], Junaina Muhammad[b], Bany Ariffin Amin Noordin[b], Cheng Fan Fah[b]

[a]*Putra Business School, Universiti Putra Malaysia, Malaysia*
[b]*Faculty of Economics and Management, Universiti Putra Malaysia, Malaysia*

Abstract

This paper investigates the influence of export volatility on corporate financing decisions of a sample of non-financial firms listed on the Australian Securities Exchange over the period 2004-2014. The GARCH model is employed to model export volatility. Using a dynamic panel data method, namely the robust two-step system GMM estimation procedure, the results show that export volatility has a significant negative effect on the financing decisions of Australian firms. The results also reveal that while long-term debt is affected by export volatility, similar observation does not hold for short-term debt. This indicates that Australian firms are chiefly concerned about the adverse effect of export volatility in the long-run. The results also provide evidence of the importance of accounting for the effects of the Global Financial Crisis. Policy implications are derived from the findings.

Keywords: Corporate financing decisions, Capital structure, Leverage, Export volatility, System GMM, GARCH

1. INTRODUCTION

Research on corporate capital structure has evolved over time since the introduction of the irrelevance theorem by Modigliani and Miller (1958). Initially, these studies are primarily focused on identifying firm-specific factors such as tangibility, firm size, growth opportunities, profitability and non-debt tax shields as determinants of corporate capital structure (Vo, 2017; Huang and Wang, 2015; Antonczyk and Salzmann, 2014; Dang, Kim and Shin, 2014; Ebrahim, Girma, Shah and Williams, 2014). More recently, some studies have also considered the influence of macroeconomic variables such as exchange rate, inflation rate, Gross Domestic Product (GDP), interest rate and fiscal policy as capital structure determinants (Zeitun, Temimi and Mimouni, 2017; Memon, Md Rus and Ghazali, 2015; Mokhova and Zinecker, 2014; Muthama, Mbaluka and Kalunda, 2013).

Nevertheless, only a handful of research has examined the influence of macroeconomic volatility on firms' capital structure (Caglayan and Rashid, 2014; Rashid, 2013; Baum, Stephan and Talavera, 2009; Hatzinikolaou, Katsimbris and Noulas, 2002). Moreover, past research on the association between macroeconomic volatility and capital structure has only considered certain sources of macroeconomic volatility such as volatility of inflation rate (Hatzinikolaou et al., 2002), volatility of real GDP (Caglayan and Rashid, 2014; Rashid, 2013) and volatility of interest rates (Caglayan and Rashid, 2014). However, to date, no research has been conducted on the influence of volatility of exports on firms' capital structure choices.

*Corresponding author.
E-mail: chowyeepeng@gmail.com

Drawing on the case of Australia, one of the major sources of macroeconomic volatility faced by the Australian economy stems from the volatility of its exports. This is chiefly attributed to the significance of exports in the composition of the Australian endowment bundle (Valadkhani, Layton and Karunaratne, 2005). Being an open economy, exports contribute significantly to Australia's GDP. For instance, exports constitute almost 20% of the country's GDP in 2015 (Australian Trade and Investment Commission, 2015). Since a substantial proportion of the country's resources are channelled to export production, any volatility or uncertainty faced in the country's exports will affect its aggregate income, business operations and social welfare.

This paper, thus, investigates the influence of export volatility on the firms' capital structure choices in a developed country, namely Australia. Precisely, this study is based on an annual panel dataset for a sample of 221 non-financial Australian firms over the period 2004-2014. The Australian economy encountered significant volatility during this period of analysis, which had either directly affected its export sector or indirectly affected its exports through the effect on Australia's major trading partners' economies. This volatility was attributed to various internal and external factors including the Severe Acute Respiratory Syndrome (SARS) outbreak, volatile commodity prices, natural disasters and anomalous weather conditions (such as severe drought, floods and cyclone), capacity constraints in several industries, shortage of labor, the Global Financial Crisis, sovereign debt problems in Europe, global economic slowdown and the Australian dollar's volatile movements.

To achieve this objective, we adopt the generalized autoregressive conditional heteroscedasticity (GARCH) model to model export volatility. Furthermore, we employ a dynamic panel data method, namely the robust two-step system generalized method of moments (system GMM) estimation procedure to estimate the influence of export volatility on the firms' capital structure decisions. The results reveal that export volatility has a significant negative influence on the leverage of Australian firms. The results also show that while long-term debt is affected by export volatility, similar observation does not hold for short-term debt. This indicates that Australian firms are chiefly concerned about the adverse effect of export volatility in the long-run.

This paper makes important contributions to the capital structure literature. Although research has been conducted to examine the effect of macroeconomic volatility on firms' capital structure, so far none of these studies have investigated the influence of volatility of exports on capital structure decisions. Moreover, the existing literature has mainly documented evidence on the influence of macroeconomic volatility on capital structure in the U.S. (Baum et al., 2009; Hatzinikolaou et al., 2002) and the U.K. (Caglayan and Rashid, 2014; Rashid, 2013). Adding to the body of literature, this paper investigates how export volatility affects the financing decisions of firms in Australia. It is important for Australian firms to consider the influence of export volatility on their financing policy since a substantial proportion of the country's resources are channelled to export production. Hence, any volatility or uncertainty faced in the country's exports will affect the business operations and financing decisions of Australian firms. The results of this study may be of interest to the policy makers as well to assist them to formulate appropriate measures to mitigate the unfavorable effects arising from volatility in the country's exports.

The remainder of this paper is structured as follows. The next section discusses the literature and the hypotheses. The third section describes the data and methodology, while the fourth section discusses the empirical results. The last section concludes this paper.

2. LITERATURE REVIEW AND HYPOTHESES

Past research has attempted to investigate the association between macroeconomic volatility and firms' capital structure decisions. For instance, some theoretical papers have examined the firm leverage's response to unpredictable changes in macroeconomic conditions. Bhamra, Kuehn and Strebulaev (2010) develop a structural-equilibrium framework to demonstrate how time-varying macroeconomic conditions influence capital structure. The authors find that when firms encounter high macroeconomic volatility, they tend to select optimally lower debt to enhance their financial flexibility. As a result, firms are more conservative in using leverage during bad times. Chen (2010) adopts a dynamic capital structure model incorporating macroeconomic conditions to show the lower consumption of debts among firms during periods of heightened macroeconomic volatility. The author predicts higher risk premia and lower expected growth rates of cash flows during such times, which subsequently reduce the discounted value of expected tax benefits of debts and make leverage unattractive to the firms.

Empirical studies on the association between macroeconomic volatility and firms' capital structure choices also report similar results. For instance, Baum et al. (2009) examine the association between macroeconomic and firm-specific sources of volatility and the optimal leverage level of U.S. non-financial firms. The authors find that when either forms of volatility increases, firm leverage will decline due to expectations of lower revenues and declining cash flows. Meanwhile, Caglayan and Rashid (2014) empirically study the effects of macroeconomic and firm-

specific volatility on the U.K. manufacturing firms' leverage. They find that during periods of high volatility, less short-term debt is used. The authors suggest that during such times, firms are conscious about the financial distress risk and thus, carry less debt.

However, these studies have only considered certain sources of macroeconomic volatility such as volatility of inflation rate (Hatzinikolaou et al., 2002), volatility of real GDP (Caglayan and Rashid, 2014; Rashid, 2013) and volatility of interest rates (Caglayan and Rashid, 2014). According to Huizinga (1993), before assessing the impact of volatility, the source of volatility must be identified beforehand. Besides that, Helliar, Lonie, Power and Sinclair (2002) report that managers often see risk or volatility as multidimensional and adopt an assortment of risk measurements. Consistent with this argument, Olaberria and Rigolini (2009) state that the identification of the sources of macroeconomic volatility is also important from the policy makers' viewpoint. For instance, if firms are found to be vulnerable to external sources of volatility such as terms of trade shocks, policy makers should formulate measures to improve domestic factors which are under domestic control as a way to counterbalance the external upward pressure on volatility. However, to date, no study has sought to empirically examine other sources of macroeconomic volatility, in particular, the volatility of exports on capital structure decisions. This paper argues that in the case of Australian firms, export volatility could be an important source of macroeconomic volatility since exports contribute significantly to the country's GDP.

On a broader note, the literature has reported about the influence of volatility of exports on related areas such as investment and economic growth. For instance, Dawe (1996) examines the effect of export volatility on investment and growth of a large number of countries from around the world, and the results reveal that export volatility is positively associated with investment but negatively associated with growth. Likewise, Lensink, Bo and Sterken (1999) also study the influence of export volatility on the economic growth of a large number of countries, and find a significant negative relationship between both variables. Furthermore, Arza (2013) investigates the relationship between export volatility and the investment behavior of firms in Argentina, and finds a positive association between the two variables.

At the same time, some studies report a relationship between investment and financing decisions. For instance, Hennessy and Whited (2005) adopt a dynamic trade-off model to demonstrate that firms decide on both leverage and investment matters jointly, and this joint decision depends heavily on expected and present financing margins. Similarly, Bhagwat and DeBruine (2009) investigate a sample of shipping firms, and find a positive association between investment and financing decisions. Meanwhile, there are also studies that report a relationship between economic growth and financing decisions. For example, Bokpin (2009) analyzes the relationship between GDP per capita and firms' capital structure decisions for 34 emerging market economies, and the results reveal that a negative association exists between both variables. Similarly, Muthama et al. (2013) investigate the influence of GDP growth rate on the capital structure choices of listed firms in Kenya, and find that GDP growth rate is positively related to long-term debt ratio but is negatively related to both short-term and total debt ratios.

Hence, this paper expects that export volatility should affect firms' financing decisions as well. However, there is still no clear direction on the relationship between export volatility and firms' capital structure, suggesting that more research needs to be conducted in order to add clarity to this issue. Based on this discussion, we hypothesize that there is a significant negative association between export volatility and firm leverage in Australia.

3. DATA AND METHODOLOGY

3.1 Data Description and Variables

This study is conducted on 221 firms listed on the Australian Securities Exchange over the period 2004-2014. These firms are randomly chosen from all major sectors, except for the financial sector due to the significant disparities observed between the capital structures of financial versus non-financial firms. We exclude firms with less than five years of consecutive data. Firm-specific data are obtained from Datastream, while macroeconomic data are collected from the International Financial Statistics by the International Monetary Fund. All data associated with the firm-specific and macroeconomic variables are winsorized at the upper and lower 1% to alleviate concerns for outliers. The final sample is made up of an unbalanced panel of 2,350 firm-year observations.

Table 1. GARCH (1,1) model of export volatility

Panel A: GARCH (1,1) estimates	
AR(1)	-0.059 (0.10)
AR(2)	-0.602*** (0.10)
AR(3)	-0.263*** (0.09)
AR(4)	0.611*** (0.09)
AR(5)	-0.240** (0.11)
AR(6)	0.214** (0.11)
MA(1)	-0.003 (0.05)
MA(2)	0.999*** (0.02)
ARCH(1)	0.375* (0.22)
GARCH(1)	0.606 *** (0.19)
Constant	0.015** (0.01)
Panel B: Diagnostic tests for remaining GARCH effects	
Log-likelihood	152.159
Observations	98
LM-test(6)	1.189
p-value	0.238
Q(11)	5.461
p-value	0.141

Notes: Standard errors are given in parentheses. ***, ** and * indicate statistical significance at the level of 1, 5 and 10%, respectively.

3.2 Measures of Leverage

This paper adopts three different book leverage ratios as dependent variables, namely the book value of total debt ratio (measured as the book value of total debt over book value of total assets), book value of short-term debt ratio (book value of short-term debt over book value of total assets) and book value of long-term debt ratio (book value of long-term debt over book value of total assets). These measures of leverage are also adopted in previous research such as Nadarajah, Ali, Liu and Haung (2016), Zhang, Han, Pan and Huang (2015) and Huang and Wang (2015).

3.3 Export Volatility

The independent variable of interest is export volatility. We employ the GARCH model introduced by Bollerslev (1986) to model export volatility. To be specific, allowing for ARMA errors in the mean equation, the GARCH (1,1) model is estimated for the growth rate of exports over the period 1990Q1-2014Q4. Following Caglayan and Rashid (2014), Rashid (2013) and Baum et al. (2009), the GARCH model is estimated over a longer period rather than for the study period of 2004-2014 to improve the performance of the model. The arithmetic average of the relevant four-quarter series of conditional variance is computed to obtain the annual measure of export volatility. Table 1 summarizes the details of the model.

3.4 Control Variables

We have also included three firm-specific control variables and a crisis dummy into the analyses. The choice of control variables is determined based on past empirical literature on capital structure. The firm-specific control variables are sales (measured as sales over total assets), firm size (natural logarithm of total assets) and liquidity (current assets over current liabilities). A crisis dummy is also incorporated to account for the Global Financial Crisis, where the crisis dummy equals one if the year is between 2008 and 2009, and otherwise zero.

3.5 Methodology

The capital structure regression model can be written as follows:

$$LEV_{it} = \beta_0 + \beta_1 LEV_{it-1} + \beta_2 EX\_VOL_t + \beta_3 SALES_{it} + \beta_4 FIRM\_SIZE_{it} + \beta_5 LIQUIDITY_{it} + \beta_6 CRISISDUM_t + \varepsilon_{it}$$

where subscript i denotes the firm and t denotes the year. LEV is the leverage ratio, EX_VOL denotes export volatility, SALES represents sales of the firm, FIRM_SIZE denotes firm size, LIQUIDITY is liquidity of the firm, CRISISDUM represents crisis dummy to account for the Global Financial Crisis and ε is the error term.

We adopt a dynamic panel data method, namely the two-step system GMM estimator propounded by Blundell and Bond (1998) to estimate the regression model. The system GMM estimator has the ability to deal with estimation problems commonly faced by panel data such as the non-exogenous nature of the firm-specific variables. For instance, in the context of this study, when the firm leverage is subject to export volatility, it is also likely for this volatility to have an impact on other regressors such as sales and firm size. In addition, leverage is likely to exhibit persistence effects, where it is likely for firms having high leverage ratio to use more leverage in the subsequent period (Caglayan and Rashid, 2014; Rashid, 2013). This results in problems of endogeneity and serial correlation. Such problems are taken into account by the system GMM estimator and as a result, the parameter estimates are consistent. Besides that, the system GMM estimator also enables the adoption of different instruments with different lag structure for both level and first-differenced equations, removes unobserved firm-specific fixed effects and controls for heterogeneity across individual firms (Bond, 2002; Blundell and Bond, 1998, 2000).

Two specification tests are applied to check the efficiency of the system GMM estimators. The first is the Hansen (1982) *J*-statistic, a test of overidentifying restrictions of the null hypothesis that the instruments are valid. Failure to reject the null hypothesis indicates that the instruments are valid and the model is correctly specified. The second is Arellano and Bond (1991) autocorrelation test of the null hypotheses of no second-order serial correlation in the residuals of the model, where the residuals should not exhibit second-order serial correlation, AR(2), if the instruments are valid. Moreover, we adopt the two-step estimator since it is more efficient than the one-step estimator.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

A summary of descriptive statistics is provided in Table 2. The Australian firms have, on average, a book value of total debt ratio of 21.1%, with a standard deviation of 33.0%. Meanwhile, the firms have, on average, a book value of short-term debt ratio of 5.5% (with a standard deviation of 12.3%) and a book value of long-term debt ratio of 15.5% (with a standard deviation of 27.9%). This indicates that the firms depend more on long-term debts than short-term debts. Meanwhile, Table 3 presents the correlation analysis between the explanatory variables. Since the correlation coefficients between these variables are generally low, multicollinearity is not a major concern in this study.

Table 2. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
TD	2,350	0.211	0.330	0.000	6.260
STD	2,350	0.055	0.123	0.000	2.514
LTD	2,350	0.155	0.279	0.000	5.698
EX_VOL	2,350	0.006	0.006	0.001	0.019
SALES	2,350	0.902	0.828	0.000	5.171
FIRM_SIZE	2,350	19.010	2.615	10.617	25.758
LIQUIDITY	2,350	3.096	6.269	0.018	105.447
CRISISDUM	2,350	0.188	0.391	0.000	1.000

Notes: TD = Book value of total debt ratio; STD = Book value of short-term debt ratio; LTD = Book value of long-term debt ratio; EX_VOL = Export volatility; SALES = Sales; FIRM_SIZE = Firm size; LIQUIDITY = Liquidity; CRISISDUM = Crisis dummy.

Table 3. Correlation matrix between explanatory variables

	EX_VOL	SALES	FIRM_SIZE	LIQUIDITY	CRISISDUM
EX_VOL	1.000				
SALES	-0.012	1.000			
FIRM_SIZE	0.025	0.072*	1.000		
LIQUIDITY	-0.013	-0.228*	-0.202*	1.000	
CRISISDUM	0.514*	-0.007	0.004	0.004	1.000

Notes: EX_VOL = Export volatility; SALES = Sales; FIRM_SIZE = Firm size; LIQUIDITY = Liquidity; CRISISDUM = Crisis dummy. An * indicates statistical significance at the level of 5% or less.

Table 4. Two-step system GMM estimation of leverage models

	Model 1 TD	Model 2 STD	Model 3 LTD
Lagged dependent variable	0.622*** (0.06)	0.560*** (0.11)	0.569*** (0.02)
EX_VOL	-1.537*** (0.40)	0.194 (0.40)	-1.351*** (0.44)
SALES	-0.016*** (0.01)	-0.006** (0.00)	-0.009** (0.00)
FIRM_SIZE	0.007*** (0.00)	-0.001 (0.00)	0.009*** (0.00)
LIQUIDITY	-0.002** (0.00)	-0.002** (0.00)	-0.001* (0.00)
CRISISDUM	0.021*** (0.01)	0.003 (0.01)	0.014** (0.01)
Constant	-0.034 (0.04)	0.052*** (0.02)	-0.097*** (0.04)
Observations	2,129	2,129	2,129
AR(2): *p*-value	0.699	0.539	0.654
J-statistic: *p*-value	0.267	0.527	0.178

Notes: TD = Book value of total debt ratio; STD = Book value of short-term debt ratio; LTD = Book value of long-term debt ratio; EX_VOL = Export volatility; SALES = Sales; FIRM_SIZE = Firm size; LIQUIDITY = Liquidity; CRISISDUM = Crisis dummy. Asymptotic standard errors (in parentheses) are heteroscedasticity robust. ***, ** and * indicate statistical significance at the level of 1, 5 and 10%, respectively.

4.2 Regression Results

Table 4 presents the estimates for the two-step system GMM estimation on the book value of total debt ratio (Model 1), book value of short-term debt ratio (Model 2) and book value of long-term debt ratio (Model 3). Asymptotic standard errors are robust to heteroscedasticity. Two specification tests are applied to check the robustness of the instrumental variables used in the system GMM estimations. For all three models, the Hansen *J*-statistics confirm the validity of the instruments, and the estimated statistics for AR(2) test indicate that the residuals of the models are not subject to second-order correlations.

In Models 1 and 3, the coefficient for export volatility is negative and significant at the 1% level, which supports our hypothesis. The results indicate that export volatility has a significant negative effect on the financing decisions of Australian firms. This implies that when firms encounter increasing export volatility, they use less leverage in their capital structures. This is in accord with prior research by Caglayan and Rashid (2014) and Rashid (2013) who find that macroeconomic volatility negatively affects the leverage of firms in the U.K. Similar evidence is reported by Baum et al. (2009) who find a negative relation between macroeconomic volatility and leverage of U.S. firms. However, the coefficient for export volatility in Model 2 is positive but not significant. Hence, the results also suggest that while long-term debt is affected by export volatility, similar observation does not hold for short-term debt. Overall, this indicates that Australian firms are chiefly concerned about the adverse effect of export volatility in the long-run.

The coefficient for the lagged dependent variable is positive and significant at the 1% level in all regression models. This indicates the persistence effects of leverage, that is, it is likely for firms having high leverage ratio to use more leverage in the subsequent period. This is consistent with past findings by Caglayan and Rashid (2014), Rashid (2013) and Antoniou, Guney and Paudyal (2008).

The coefficient for sales is negative and significant in all regression models. This result is in agreement with the findings by Caglayan and Rashid (2014) and Baum et al. (2009), implying that less borrowing takes place among firms as sales improve.

The coefficient for firm size is positive and significant at the 1% level for both the book value of total debt and long-term debt ratios. This supports the trade-off theory which postulates that large firms have better diversification and lower chances of bankruptcy. Moreover, the good reputation earned by these firms in the debt markets enables them to have greater bargaining power to negotiate for more favorable borrowing rates. This is also consistent with prior studies by Vo (2017), Chakraborty (2013) and Rashid (2013). However, the coefficient for firm size for the book value of short-term debt ratio is negative but not significant.

The coefficient for liquidity is negative and significant in all regression models. This supports the pecking order theory which posits that firms with higher liquidity have less debt. This is also supported by previous research by Chong and Law (2013), Udomsirikul, Jumreornvong and Jiraporn (2011) and de Jong, Kabir and Nguyen (2008).

Lastly, the coefficient for the crisis dummy is positive and significant for the book value of total debt and long-term debt ratios. This agrees with prior research by Zeitun et al. (2017) which reveals that the Global Financial

Crisis had adverse effects on the leverage ratios of Gulf Cooperation Council firms due to a drop in the supply of debt by lenders. This is also in accord with Dang et al. (2014) who report about the credit supply shock generated by the Global Financial Crisis, which subsequently had affected the demand and supply of funds among firms. However, the coefficient for crisis dummy for the book value of short-term debt ratio is positive but not significant.

5. CONCLUSION

This paper investigates the influence of export volatility on corporate financing decisions based on an unbalanced panel of 221 listed non-financial Australian firms over the period 2004-2014. We employ the GARCH model to model export volatility, and the robust two-step system GMM estimation procedure to estimate the capital structure regression models. After controlling for a number of capital structure determinants, this study finds that export volatility has a significant negative effect on the financing decisions of Australian firms. The results also reveal that while long-term debt is affected by export volatility, similar observation does not hold for short-term debt. This indicates that the leverage of Australian firms is primarily affected by export volatility in the long-run. The results also provide evidence of the importance of accounting for the effects of the Global Financial Crisis.

In terms of policy implications, the findings of this study shed new light into the financing decisions of firms when encountering volatility in exports in the Australian context. This may be beneficial to the capital structure literature, policy makers, managers of firms and investors. The results contribute to the literature on how macroeconomic volatility influences the firms' capital structure decisions, which has to date, not explored the potential effects of export volatility and is primarily confined to firms in the U.S. and the U.K. These findings are also important to the policy makers to assist them to formulate appropriate measures to mitigate the unfavorable effects arising from the volatility of the country's exports. This is important to countries such as Australia since a substantial proportion of the country's resources are channelled to export production. Hence, any volatility or uncertainty faced in the country's exports will affect the business operations and financing decisions of the firms. These results may also provide useful information to guide managers of firms and investors to devise appropriate financing and investment strategies, respectively.

The findings of this study are subject to several limitations. Firstly, we have only considered the book leverage ratio as the dependent variable, which is derived from accounting-based historical values. Future research should also take into consideration the market leverage ratio as an alternative leverage measure. The market leverage ratio is determined based on expected future cash flows, and is more forward looking than the book leverage ratio. Secondly, we did not control for industry effects to account for the potential disparities in leverage ratios across various industries. Future research should, therefore, take this into consideration as well. As such, the findings of this study would benefit from further research that takes these limitations into account. Future research could endeavor to address these limitations, and further offer new evidence on the influence of export volatility on the financing decisions of firms.

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