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Government Deficits and Corporate Liquidity

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Abstract

This study examines the relationship between government deficit and corporate liquidity (cash holdings). Using data of nonfinancial firms in Taiwan from 1981 to 2009, this study finds that corporate liquidity is lower when government deficit is higher. In addition, corporate liquidity is related with other macroeconomic conditions, such as inflation, short-term interest rate, and economic growth. More precisely, results indicate that inflation and interest rates have a negative impact on corporate liquidity that is aggravated when government deficit is higher. Economic growth has a positive impact on corporate liquidity, and such positive impact is weakened when government deficit is higher.

Keywords: Government deficit, Corporate liquidity, Cash Holdings

JEL codes: G30, H60, E0

Introduction

Reeling from the effects of the recent global financial crisis, national governments around the world have been increasing government spending and running increasingly higher budget deficits to boost their respective economies. At the same time, many firms have been building up cash reserves in the belief that having sufficient internal funds can help them take advantage of investment opportunities and handle the crisis better (Duchin et al. 2010). Despite warnings that excess corporate saving can slow down economic recovery, such trend may not subside in the short run because the economy in the future is filled with uncertainty; thus, the precautionary motive for holding cash can remain strong under such circumstances (The Economist 2010). Therefore, relevant questions arise: Is government deficit a missing variable in explaining rising corporate liquidity? How should firms manage their liquidity in the presence of high government deficits?

Cash pileup of firms has been widely observed since the 1990s. Existing studies examine from different perspectives the factors that contribute to cash hoarding (Opler et al. 1999, Dittmar et al. 2003). These earlier studies focus on firm-specific determinants of corporate liquidity. More recent liquidity studies examine how corporate liquidity is determined by country-specific factors, including institutional variables, legal systems and macroeconomic conditions, such as access to capital market (Faulkender & Wang 2006); interest rates and GDP growth (García Teruel & Martínez Solano 2008, Chen and Mahajan 2010); financial development (Khurana, Martin, & Pereira 2006); future economic conditions (Kim, Mauer, & Sherman 1998); and macroeconomic uncertainty (Baum et al. 2006, 2008). However, macroeconomic conditions are relatively less explored than other country-specific factors. In addition, they only mainly serve as control variables in existing liquidity studies.

Baum et al. (2006, 2008) examine how corporate liquidity is related to macroeconomic uncertainty, but their work does not address the

impact of government deficit. Chen and Mahajan (2010) examine the impact of macroeconomic conditions on corporate liquidity in an international setting. However, their study simply provides a general survey of how macroeconomic conditions impact corporate liquidity, instead of focusing on the relationship between government deficit and corporate liquidity. In addition, their study examines the direct impact of government deficit on corporate liquidity without considering how the former can affect the latter indirectly through other macroeconomic channels, such as inflation, interest rate, and economic growth. Furthermore, they used a multi-country sample (Taiwan excluded), which complicates the analysis because it introduces cross-country differences inherent in multi-country setting.

Government spending is like a double-edged sword. On one hand, increasing government spending and running government deficit likely promote economic growth in the short run. Recently, the global economy has shown signs of recovery after huge amounts of government spending. If government spending can successfully boost the economy in the short run, firms should be inclined to hold more cash in anticipation of greater investment opportunities in the future. On the other hand, an increase in government spending may prove futile or detrimental to the economy in the long run because government deficits will have to be paid off eventually by money creation, increase in taxes, or more government borrowing. These measures can slow down future economic growth that may force firms to reduce cash holdings because there are likely less investment opportunities under such circumstances (Kim et al. 1998). In fact, before reaching the goal of stimulating the economy, the recent surge in government spending has caused severe problems in countries where governments were highly indebted before the crisis. For example, the debt crises in Greece and Ireland in 2010 raised an alert for other European countries and the rest of the world with similar situations. Hence, from the perspective of future economy and investment opportunities, the impact of government deficits on corporate liquidity depends on the relative strength of the short-run (positive) and long-run (negative) effects of government deficits. Therefore, firms should increase cash holdings if the short-run effect is more overwhelming than the long-run effect, and vice versa.

However, from the perspective of economic uncertainty, firms are likely to increase cash holdings as a precautionary measure when government deficit is higher and the future economy is filled with uncertainty. There are also other potential channels through which government deficits affect corporate liquidity, and these deserve to be carefully examined. In the presence of high government deficits, optimal liquidity management is an open question, which calls for thoughtful analysis on how government deficits signal other macroeconomic conditions in the future to balance things out.

In all, larger economic concepts should have an overriding impact on the financial decisions of firms than firm-level characteristics; hence, macroeconomic conditions should have a bearing on corporate liquidity and deserve the attention of firms. In particular, increasing government deficit should be formally considered in liquidity management. This is because government deficit actually involves uncertainty despite its intended goal of stabilizing the economy and promoting economic growth. However, minimal research currently provides theoretical foundation to explore the relationship between macroeconomic conditions and corporate liquidity. This issue should not be ignored because national governments have been running budget deficits to ride out the recent global crisis and boost their respective economies. Corporate liquidity, one of the major financial decisions of firms, should be adjusted optimally to better cope with the potential impact of government deficits for sustainability.

This study aims to fill this gap using data from Taiwan to analyze the macroeconomic perspective on corporate liquidity, with emphasis on its relationship with government deficit. Single-country data are used because they provide a cleaner comparison and interpretation of results than multi-country data, which introduce cross-country differences that

are difficult to control for and likely to complicate the analysis. In addition, Taiwan is a developing country where the documented relationships between government deficits and other macroeconomic conditions are more certain compared with other developed countries (Saleh and Harvie 2005). Furthermore, the Taiwan government has been experiencing a constantly increasing government deficit since a decade ago, especially after the 2008 global crisis. Given that government deficit signals future economic uncertainty and causes a major concern for Taiwan's people, conducting an examination of how government deficit is historically linked to corporate liquidity is worthwhile. This is because liquidity is an important corporate decision, and useful implications regarding how to maintain liquidity optimally can be provided for firms operating in today's environment characterised by high government deficit.

Two sets of hypotheses are tested in the study. First, government deficit generally causes inflation and interest rates to rise. As such, corporate cash holdings should be reduced because of the accompanying reduction in the real purchasing power of cash and increase in opportunity cost of holding cash. In addition, government deficit tends to reduce economic growth in the future (Saleh and Harvie 2005). Therefore, cash holdings should be decreased because investment opportunities are expected to be fewer and the inclination to hold cash for investment opportunities is weakened under such circumstances (Kim et al., 1998). Firms can hoard cash due to the lack of investment opportunities, more costly external financing, and higher economic uncertainty that could come with higher government deficit. However, if these effects are relatively weaker, the present study hypothesises that corporate liquidity should be lower when government deficit is higher.

Second, this study examines further the indirect impact of government deficit on corporate liquidity. It also investigates the potential interactions between government deficit and other macroeconomic variables (i.e., inflation, interest rate, and economic growth) in determining corporate liquidity to infer the potential signal effects of government deficits. This study hypothesises that if government deficit signals an increase in inflation and interest rates, any negative impact of inflation and interest rates on corporate liquidity should be reinforced. On the other hand, if government deficit signals economic slowdown, any positive impact of economic growth on corporate liquidity should be weakened.

Using single-country data from Taiwan from the period 1981 to 2009, the study indicates that government deficit, indeed, plays a role in determining corporate liquidity. Specifically, corporate liquidity is lower when government deficit is higher, supporting the major hypothesis proposed in this study. In addition, inflation and interest rates have a negative impact on corporate liquidity; such negative impact is reinforced when government deficit is higher, suggesting that government deficit signals an increase in inflation and interest rates. Economic growth has a positive impact on corporate liquidity, and such positive impact is weakened when government deficit is higher, suggesting that government deficit signals a decrease in economic growth.

Literature review

Firms hold cash for three major motives, namely, transaction cost motive, precautionary motive, and agency cost motive. More precisely, they hold more cash when transaction costs are higher. They also keep cash reserves to take advantage of investment opportunities because external financing is more costly. Furthermore, cash is free cash flow; thus, management tends to hoard cash under their discretion.

Previous studies explain liquidity using tradeoff theory, financing hierarchy theory, and agency theory. However, results do not favor any particular theory (Almeida, Campello, & Weisbach 2004; Bates, Kahle, & Stulz 2009; Opler et al. 1999). However, empirical evidence supports the presence of optimal cash holdings resulting from balancing marginal cost and marginal benefit of corporate liquidity, concurring with the prediction of tradeoff theory (Keynes 1936). The presence of optimal corporate liquidity is also implicitly supported by agency theory, because hoarding cash to gain discretionary power entails agency cost of cash

(Jensen, 1986). In contrast, financing hierarchy theory states that cash is preferred to debt, followed by equity in financing. Hence, there is no optimal corporate liquidity because variation in internal funds dictates the respective cash holdings of different firms (Myers & Majluf 1984; Shyam-Sunder & Myers 1999).

Recent liquidity studies attempt to explain corporate liquidity from new perspectives. For example, diversification has been found to play a role in determining the value of cash holdings. This is because agency problems are more severe in diversified firms such that cash is less valuable under such circumstance (Tong 2011). Another kind of liquidity research looks into the relationship between country-specific variables and corporate liquidity. For instance, country-specific proxies for investor protection as constructed by La Porta et al. (1998) and other governance ratings have been widely used in multi-country liquidity studies (Doidge et al. 2007). The predominance of these country-specific governance-related variables over firm-specific counterparts in explaining corporate liquidity has been well documented (Dittmar et al., 2003; Kalcheva & Lins 2007). This is expected because firms operate in a larger environment characterised by country-specific factors; thus, the financial decisions of firms should be affected by these larger concepts.

Corporate liquidity is related to macroeconomic conditions. For example, in anticipation of better future economic conditions, a firm's managers are inclined to hold more cash to take advantage of greater investment opportunities when such time arrives (Kim et al. 1998). In addition, when economic uncertainty is higher, firms are inclined to hold more cash as a precaution. Such cash hoarding is likely to prevail among firms because they generally fail to predict accurately their financial conditions; hence, they choose to build up cash reserves unanimously under such circumstances (Baum et al 2006, 2008). Furthermore, interest and inflation rates play a role in determining corporate liquidity, although the results are weak (García Teruel and Martínez Solano 2008; Natke 2001). Chen and Mahajan (2010) further find that other country-specific/macroeconomic variables, such as government deficit, inflation, credit spread and private credit, also play a role in explaining corporate liquidity. Finally, it has been documented that when inflation is lower and more stabilised, firms can make investments more effectively and reap higher returns because of higher price transparency (Beaudry et al. 2001). This implies that management can consider keeping less cash to make more investments in a low and stabilised inflation regime. In sum, macroeconomic conditions should play a role in determining corporate liquidity because firms are unlikely to isolate themselves from the impact of larger settings.

Hypotheses Development

Despite the good intention of national governments to increase government spending to boost the economy, an increase in government spending and indebtedness creates uncertainty for the economy (Hassan and Strazicich 2000). The purported positive effect of running government deficits on economic growth is likely to be minimal and temporary. In a sense, running government deficits means that governments are borrowing funds from the future for the present use. Eventually, government debt will have to be paid off or reduced through some measures sometime in the future. For example, if government deficit is to be monetised, inflation is expected to increase, and this will erode real purchasing power. Consequently, firms should reduce cash holdings because the real value of cash decreases under such circumstances.

In addition, an increase in government deficit also signals or results in changes in other macroeconomic conditions (Saleh and Harvie 2005). For example, increased government deficits are likely to raise interest rates because governments borrow to finance more expenditure by issuing debt at an attractive lower price (Premchand 1984). An increase in interest rates means higher opportunity cost of holding cash, which should result in a decrease in corporate money demand or cash holdings (Keynes 1936). Private investments are likely to be crowded out because of rising interest rates and reduced resources resulting from higher government spending and/or investment; therefore, economic growth is likely to slow

down. Accordingly, firms should reduce cash holdings because the need for holding cash to anticipate and take advantage of greater investment opportunities decreases (Kim et al., 1998).

Given that changes in government deficits can signal changes in inflation, economic growth, and interest rates, it is important to analyze first how inflation, economic growth, and interest rate affect corporate liquidity before examining the net impact of government deficit on corporate liquidity.

Inflation

When inflation is higher, firms should reduce non-interest-bearing cash holdings because the real purchasing power of cash decreases, and cash is less valuable under such circumstances (Natke 2001). At the same time, firms can increase interest-bearing short-term investments or marketable securities, which are components of corporate liquidity in existing liquidity literature. Hence, the impact of inflation on corporate liquidity is ambiguous, depending on the relative magnitude of these two opposing effects. However, if interest-bearing short-term investments can be excluded (which is the case in this study), the positive impact of inflation on corporate liquidity should be minimal or none, such that corporate liquidity should be negatively related to inflation. The hypothesis is formulated below.

Hypothesis 1: Inflation should have a negative impact on corporate liquidity.

Interest rate

Based on the prediction of money demand theory, when interest rates increase, firms should reduce non-interest-bearing cash holdings and increase investments in assets with higher real returns because the opportunity cost of holding cash becomes higher. As mentioned above, such negative effect is guaranteed because the cash variable in this study excludes short-term investments. However, another effect is also at play; that is, external financing is likely to become more costly when interest rates increase. It follows that firms should be inclined to hold more cash because internal financing is relatively cheaper under such circumstances. Hence, the net impact of interest rate on corporate liquidity is ambiguous, depending on the relative magnitude of these two opposing effects. However, if the positive effect of interest rates through external financing is overwhelmed by the negative effect of interest rate through the opportunity cost of holding cash, then a negative relationship between interest rates and corporate liquidity is expected. The above reasoning leads to the following hypothesis:

Hypothesis 2: Interest rate should have a negative impact on corporate liquidity.

Economic growth

Two opposing forces are at play with regard to the impact of economic growth on corporate liquidity. On one hand, a positive impact of economic growth on corporate liquidity is expected if firms hold more cash in anticipation of higher economic growth to take advantage of greater investment opportunities (Kim et al. 1998). On the other hand, higher economic growth implies higher opportunity cost of cash holdings because firms can invest idle cash in assets that yield higher real returns in anticipation of an economic boom. Hence, economic growth is expected to have a negative impact on corporate liquidity.

However, if the benefit of holding cash outweighs its cost when the economy is booming (i.e., the positive impact of economic growth on corporate liquidity is more overwhelming than its negative impact), corporate liquidity should have a positive relationship with economic growth. The hypothesis is as follows:

Hypothesis 3: Economic growth should have a positive impact on corporate liquidity.

The impact of government deficit (focus of this study) on corporate liquidity is not as clear as the other macroeconomic conditions because government deficit signals changes in future macroeconomic conditions. Analysis of the signal effects of government deficits is helpful so that the net impact of government deficit on corporate liquidity can be better inferred. This study focuses on how government deficit affects corporate liquidity through inflation, interest rates, and economic growth. These

variables are selected because they are more closely related to corporate liquidity (García Teruel and Martínez Solano 2008; Kim et al. 2008). In addition, previous research has provided sufficient evidence on how government deficit is linked to these three macroeconomic variables (Saleh and Harvie 2005).

Government deficits and inflation

Empirical evidence on the relationship between government deficit and inflation is mixed, depending on a variety of factors, such as country of study, degree of development, and methodologies used in the analysis. However, existing literature tends to support a positive relationship between government deficit and inflation (Choi and Devereux 2006; Fischer et al. 2002; Kia 2006; Sill 2005). For example, a cross-country study by Fischer et al. (2002) reveals a positive relationship between government deficit and inflation. This positive relationship is more pronounced in countries with hyperinflation and high inflation where government deficit is more likely to be financed by money creation (monetisation), which worsens government deficit further; that is, government deficit and inflation feed on each other in such countries.

Such a positive relationship is also observed by Sill (2005). Developing countries are shown to generally see a strong and positive relationship between government deficit and inflation as opposed to developed countries. This is because developing countries usually finance government deficit via debt monetisation. Overall, existing empirical evidence indicates that government deficit is positively related to inflation in high-inflation countries or developing countries.

Government deficits and interest rates

Government deficit/spending can be positively or negatively related to interest rates, depending on the level of real interest rates (Choi and Devereux 2006). However, existing literature provides sufficient evidence supporting the positive relationship between government deficits and interest rates, concurring with the prediction of the Keynesian model (Cebula and Cuellar 2010; Correia-Nunes and Stemitsiotis 1995; Georgiou 2009a; Georgiou 2009b; Hartman 2007; Quayes and Jamal 2007). Governments are likely to lower the bond prices to induce investors to invest in government-issued bonds to finance government spending, but this increases interest rates (Saleh and Harvie 2005).

Government deficits and economic growth

Existing literature does not show a clear relationship between government deficit/spending and economic growth due to various factors. For example, previous studies have found that an increase in government spending can promote economic growth in less developed countries, whereas more developed countries are likely to experience a negative impact of increased government spending (Guseh 1997; Hassan and Strazicich 2000; Lin 1994). In addition, expansionary government spending is more likely to promote short-term rather than long-term economic growth (Choi and Devereux 2006). Furthermore, the impact of government deficit/spending on economic growth also depends on the types of government spending.

Existing studies show that government deficits induced by increased public investment can cause the marginal product of capital to rise; therefore, private investment is crowded in and economic growth should be promoted. In contrast, an increase in government deficit due to public consumption spending tends to crowd out private investment, and thus have a negative impact on economic growth (Saleh and Harvie 2005).

Regardless of the mixed results and ambiguous relationship between government deficit and economic growth, financing government spending usually results in an increase in interest rates, which results further in an increase in cost of capital and a decrease in investments and bank lending to consumers such that economic growth is hampered (Georgiou 2009a; Georgiou 2009b). In addition, the negative relationship between government deficit and economic growth should be expected because the productivity of government sector is lower than that of the private sector (Cebula 1995). Furthermore, to the extent that government deficits have an inflationary effect especially when debts are

monetised, inflation is expected to be higher, such that expected real purchasing power decreases, so does future economic growth.

Lastly, empirical evidence strongly supports the conventional (Keynesian) view that government deficits lead to an increase in current account deficit. This is the so-called "twin deficits hypothesis," that is, a strong and positive relationship exists between current account balance and government budget balance (Normandin 1999). Accordingly, GDP growth should be affected negatively because of the worsening current account deficit induced by government deficit. Hence, government deficits are more likely to have a negative impact on economic growth.

Despite mixed results on the relationship between government deficit/spending and other macroeconomic variables (i.e., inflation, interest rate, and economic growth), empirical evidence tends to support the hypothesis that government deficits signal an increase in inflation particularly in developing countries, which should reduce corporate demand for cash because real purchasing power becomes lower. In addition, empirical studies support the positive relationship between government deficit and interest rates. Hence, firms should hold less cash when government deficit is higher because the opportunity cost of holding cash becomes higher under such circumstances.

Furthermore, despite mixed results on how government deficits affect economic growth, existing literature tends to favor a negative effect of government deficit on economic growth. Market participants generally perceive government deficit to be bad for the future economy, implying a negative effect of government deficit on economic growth (Hartman 2007). Reduction in real purchasing power due to government deficit-induced inflation results in reduced demand for domestic production, such that economic growth is negatively affected. Hence, the inclination of firms to hold cash should weaken when government deficit is higher as future economic growth and investment opportunities are perceived to be lower. Government deficits create economic uncertainty; thus, corporations are likely to hold more cash as a precaution. However, if the positive impact of government deficit on corporate cash holdings is overwhelmed by the negative impact of government deficit, cash holdings should decrease when government deficits are higher. The above reasoning is summarised below.

Hypothesis 4: Government deficit should have a negative impact on corporate liquidity.

As mentioned above, government deficits can signal changes in inflation, interest rates, and economic growth in the future. Hence, government deficits should exert an indirect impact on corporate liquidity. Specifically, when government deficits are higher, any negative impact of inflation and interest rates on corporate liquidity should be reinforced if higher government deficit signals an increase in inflation and interest rates, both of which should reduce corporate cash holdings.

In addition, any positive effect of GDP growth on corporate liquidity should be weakened by an increase in government deficits if government deficits signal an economic slowdown in the future, which should result in a decrease in corporate liquidity due to fewer investment opportunities. The following hypotheses are formulated:

Hypothesis 5: The negative impact of inflation on corporate liquidity should be reinforced when government deficits are higher.

Hypothesis 6: The negative impact of interest rate on corporate liquidity should be reinforced when government deficits are higher.

Hypothesis 7: The positive impact of economic growth on corporate liquidity should be weakened when government deficits are higher.

Data and Methodology

The sample consists of 1,841 nonfinancial firms from Taiwan. Following the majority of liquidity studies, the study excludes financial firms because they have different objectives. Nonfinancial firms that are government-related are also excluded because their liquidity management is likely to be affected by government regulations (Dittmar et al., 2003;

Opler et al., 1999). Firm-specific quarterly financial data are gathered from the Taiwan Economic Journal (TEJ) database for the period 1981Q1-2009Q3 (115 quarters total). Macroeconomic data are gathered from AREMOS (Advanced Retrieval Econometric Modeling System) Economic Statistical Databanks. The raw data gathered are further manipulated to derive variables used in this study.

Table 1 gives the descriptive statistics of corporate liquidity and other control variables, including firm-specific and macroeconomic variables. Descriptive statistics are reported for the observations used in regression analysis. The sample comprises 55,702 firm-year observations. The mean and median values for corporate liquidity are 0.103 and 0.047, respectively, which are below those reported in other studies (Dittmar et al. 2003); unlike other liquidity studies, marketable securities are excluded from cash holdings in this study.

Corporate liquidity (cash holdings) is proxied by the cash ratio, which is defined as cash plus its equivalents (CH) divided by total assets (TA) net of cash and its equivalents, or net assets (NA). NA rather than TA is used to derive the cash ratio because it should be "assets in place" that are related to firms' future profitability (Dittmar et al. 2003; Kalcheva & Lins 2007; Opler et al. 1999). The mean and median values of corporate liquidity for the entire sample are .103 and .047, respectively. Prior to estimation, given that firms with plenty of cash relative to total assets are likely to have higher cash ratios, the natural log of the cash ratio is computed for regression analysis to alleviate the concern about outliers (Foley et al. 2007).

Firm-specific variables

The choice of the firm-specific determinants of cash holdings follows previous liquidity studies. The market-to-book ratio (MTB), a proxy for investment opportunities or information asymmetry, is defined as the book value of total assets less the book value of equity, plus the market value of equity, divided by book value of total assets. Firm's profitability is proxied by the ratio of cash flow (CF) to NA, where CF is defined as earnings before interest and taxes, depreciation and amortisation, less interest, taxes, and common dividends. The additional liquidity asset of firms is proxied by the ratio of net working capital (NWC) to NA, where NWC is defined as total current assets less cash, less total current liabilities. NWC/NA is included because it has been found to be a substitute for cash holdings in previous studies. Leverage (LEV) is defined as total debt as a fraction of total assets. LEV is included because debt can reduce the agency problem within the firm. In addition, based on financing hierarchy theory, more cash means less need for debt financing (Opler et al. 1999). Dividend (DIV) is a dummy variable that takes on a value of one if a firm pays dividends, and zero otherwise. DIV is included because it can serve as a proxy for agency costs or financial constraints (Dittmar et al. 2003; Jensen 1986). Firm size (Size) is proxied by the book value of total assets in Taiwan dollar. Growth or potential investment opportunities are proxied by the ratio of capital expenditure (CAPX) to NA, where CAPX is defined as additions to fixed assets (Kacheva & Lins, 2007).[1] The reasons for including these firm-specific variables are well discussed in extant literature and are beyond the scope of this study.

Macroeconomic variables

Government deficit (GD) is defined as government expenditure minus government revenue, divided by nominal GDP. Inflation (I) is measured as percentage change in consumer price index with 2006 as the base year. Real GDP growth (RGDP), a proxy for economic growth, is measured as percentage change in RGDP with 2006 as the base year. Nominal short-term interest rate (IR), a proxy for opportunity cost of holding cash and external financing cost, is measured as the discount rate. The discount rate is used to proxy IR because it is what banks are to pay for to borrow funds from the Central Bank. Virtually all short-term interest rates change in response to changes in discount rate.

In addition, this study also considers two additional macroeconomic variables (i.e., credit spread and private credit) that might affect

[1] Following prior liquidity studies, the observations are further winsorised at 1% and 99% levels to remove outliers from the sample.

corporate liquidity. Credit spread (CS), a proxy for transaction cost and credit risk, is measured as the basic lending rate of the bank minus the discount rate, where the basic lending rate of the bank is measured based on the basic lending rates of the five largest banks in Taiwan. Based on the tradeoff theory, a positive relationship between credit spread and corporate liquidity is expected because firms should hold more cash when transaction cost is higher. Alternatively, when credit risk is higher and investors are less willing to lend to firms, firms should hold more cash because internal financing should be valued more (Almeida and Philippon 2007).

Private credit (PC), measured as the ratio of claims on the private sector by commercial banks and other financial institutions to nominal GDP, is a proxy for the depth of a country's debt market (Dittmar et al. 2003; Kalcheva & Lins 2007). A positive relationship is expected because when borrowing from banks or other financial institutions is higher, private firms face higher risk of financial distress and thus they should hold more cash to prevent it from happening (Dittmar et al. 2003).

Table 2 presents the correlation matrix of variables and the variance inflation factors (VIF) for the independent variables included in econometric models in Tables 3 and 4. Corporate liquidity correlates with its benchmark determinants and macroeconomic variables, justifying the suitability of including them in econometric models. All values for VIF are less than two, so the concern about multicollinearity can be alleviated.

Given the data are cross-sectional and time-series in nature, a panel data model is more appropriate. The Hausman specification test is conducted, and the results favor the fixed-effects (FE) over random-effects panel models; thus, the FE panel model is used as the econometric model. In addition, cluster-robust standard errors are estimated to obtain *t*-test statistics and *p*-values due to the intra-industry correlations embedded in the data structure. Year dummies are created to capture year-specific effects or business cycle effects.

Empirical Results

Government deficits and corporate liquidity

Table 3 shows the relationship of corporate cash holdings to government deficits and other macroeconomic variables. Column 1 presents the results of the benchmark model. Columns 2 to 7 include government deficit variable and other macroeconomic variables to examine how these additional macroeconomic variables influence corporate liquidity.

Results on how corporate liquidity is affected by the benchmark determinants are generally consistent with those from previous studies (Dittmar et al. 2003; Opler et al. 1999). For example, MTB shows a positive effect, indicating that management holds more cash in response to greater investment opportunities. CF has a positive effect on cash, indicating that firms, as a precaution, hold more cash when they are more profitable (Dittmar et al. 2003). Net working capital has a negative effect, confirming the notion that it is substitutable for cash. The coefficient of leverage is negative, suggesting that debt and cash are substitutes in terms of financing, concurring with the prediction of agency theory. Payment of dividends by firms and firm size do not show a significant impact on corporate liquidity. CAPX, a proxy for growth opportunities, has a positive effect, indicating that management holds more cash when growth opportunities are greater. Detailed discussion of the results on the impact of firm-specific variables on corporate liquidity is beyond the scope of the study.

As for macroeconomic variables, government deficit has a significant negative coefficient in Column 2 ($p < .01$), a robust result to different estimations where additional macroeconomic variables are included in Columns 3 to 7.[2] This negative relationship supports hypothesis 4 that corporate liquidity should be lower when government deficits are higher. Hence, the government deficit-signaled negative effect of inflation and short-term interest rate appears to dominate the positive effect of economic growth and economic uncertainty, such that the net effect of government deficit on corporate

[2] Not all macroeconomic variables are included simultaneously because of the multicollinearity concern. Since government deficit is the focus of the study, it is included in all estimations.

liquidity is negative.

Inflation has a negative effect ($p < .01$ in Columns 3 to 7), indicating that corporate liquidity is lower when inflation is higher; that is, firms tend to transform non-interest bearing cash into interest-bearing marketable securities and short-term investments with higher real returns under such circumstances. This confirms the notion that demand for cash reduces when real purchasing power is weaker under such circumstances. Results support hypothesis 1.

RGDP has a significantly positive coefficient ($p < .05$ in Columns 4 and 5; $p < .01$ in Columns 6 and 7). Hence, with stronger economic growth, the propensity of firms to hold more cash to take advantage of greater investment opportunities outweighs the propensity to hold less cash due to the higher opportunity cost of holding cash; the net effect of economic growth on corporate liquidity is positive. Results support hypothesis 3.

In column 5, short-term interest rate has a significant negative coefficient ($p < .01$), supporting hypothesis 2 that cash holdings should be lower when the opportunity cost of holding cash becomes higher; that is, the positive impact of interest rate on corporate liquidity through the external financing channel is overwhelmed by the negative impact of interest rates on corporate liquidity through the opportunity cost channel; the net impact of interest rate on corporate liquidity is negative.

CS is positively related to corporate liquidity ($p < .01$ in column 6). This indicates that firms hold more cash when transaction costs or credit risks are higher, concurring with the prediction of tradeoff theory and financing hierarchy theory.

PC, a proxy for the depth of the debt market, has a positive effect, indicating that firms hold more cash to prevent financial distress when the capital market is more developed and so they can borrow more from the market.

Government deficits and corporate liquidity: Interactions

Table 4 presents the results of additional tests on the relationship between government deficits and corporate liquidity. The government deficit variable is interacted with other macroeconomic variables, such as inflation, RGDP growth rate, and interest rate.

The results on the relationship between cash and its benchmark firm-specific determinants correspond with those in Table 3 and previous studies. In addition, the results above are robust to various model specifications in Columns 1 to 6 where different combinations of macro variables are included. The coefficients on the government deficit and inflation variables are significantly negative ($p < .01$) in Column 1, similar with the results in Table 3. In addition, the corresponding interaction variable GD×I is negatively related to corporate liquidity ($p < .05$). This indicates that the negative relationship between corporate liquidity and inflation is reinforced when government deficits are higher. This further suggests that an increase in government deficits signals an increase in future inflation; real purchasing power of cash is reduced, and thus cash holdings are lowered.

Column 2 examines the interaction between GD and (RGDP). The coefficient on GD is significantly negative ($p < .05$), whereas RGDP is significantly positive ($p < .01$), similar with the results in Table 3. The coefficient on GD×RGDP is significantly negative ($p < .01$), indicating that the positive effect of RGDP growth on corporate liquidity is weakened, or even reversed, when government deficits are higher. This also suggests that an increase in government deficits signals economic slowdown in the future; firms reduce cash holdings because investment opportunities decrease under such circumstances.

Column 3 examines the interaction between GD and IR. The coefficient on GD is insignificant, whereas IR is significantly negative ($p < .01$), consistent with the results in Table 3. The coefficient on GD×IR is significantly negative ($p < .1$), indicating that the negative relationship between interest rate and corporate liquidity is reinforced when government deficits are higher. This suggests that an increase in government deficits signals an increase in interest rate; cash holdings decrease further in response to higher opportunity costs of holding cash. The result

also implies that the government deficit-induced positive effect of interest rate on the cost of external financing is overwhelmed by the opportunity cost of holding cash; the net indirect impact of government deficit on corporate liquidity through the interest rate channel is negative. The results above are robust to different model specifications where CS and PC are added in Columns 4 to 6.

Conclusion

The study examines the determination of corporate liquidity by focusing on how corporate liquidity is related to government deficits and other macroeconomic conditions. Results on firm-specific determinants of cash holdings generally concur with those of previous research. In addition, results on macroeconomic conditions indicate that corporate liquidity is negatively related to government deficit, inflation, and short-term interest rate. On the other hand, corporate liquidity is positively related to economic growth, credit spread, and private credit. Furthermore, this study also explores the interplay between government deficit and other macroeconomic conditions in corporate liquidity determination. The negative relationship between corporate liquidity and inflation and short-term interest rate is reinforced when government deficit is higher. On the other hand, the positive relationship between corporate liquidity and economic growth is weakened when government deficit is higher. This supports the hypothesis that changes in government deficits signal changes in future economic conditions. More specifically, government deficit signals an increase in inflation and interest rate but a decrease in economic growth in the future.

This study recognises limitations and suggests directions for future research. First, the study examines the contemporaneous impact of government deficits and other macroeconomic conditions on corporate liquidity. The primary objective is to infer the long-term relationship of corporate liquidity to government deficit as well as other macroeconomic conditions based on the 29-year sample. Future research can consider the lead-lag effect to provide a better insight into how today's government deficits and other macroeconomic conditions affect future corporate liquidity in the future. Second, the signal effects of government deficits on other macroeconomic conditions are examined using a simple approach that considers interactions between government deficits and other macroeconomic conditions. Even though the results are intuitive and strongly validate the hypotheses proposed in this study, a more advanced methodology can be used to provide better insight into this research question. Third, the study results are obtained and interpreted based on the single-country sample. Future research can consider other countries for comparison to shed more light on the issue of how corporate liquidity is related to government deficit and other macroeconomic variables.

This study provides policy implications for Taiwan or other countries with similar level of economic development. First, macroeconomic conditions should be considered in future liquidity studies because country-level variables should have an overriding impact on firm-specific variables. Second, management of firms should consider the potential impact of government deficit and other macroeconomic conditions when maintaining optimal corporate liquidity. Firms, especially those that have been accumulating cash after the crisis, should reduce cash holdings when government deficits have been increasingly on the rise; an increase in government deficit signals an increase in inflation and interest rate, and a decrease in economic growth in the future. Accordingly, despite higher propensity to hoard cash due to economic uncertainty that comes with increasingly higher government deficits, firms are better off holding less cash so that they will be able to suffer less from reduced real purchasing power of cash, increased opportunity cost of cash, and reduced investment opportunities that accompany slower economic growth. Third, government authorities should also pay attention to the impact of running high budget deficits on firms. The prevailing corporate saving glut after the crisis reflects firms' overall perception of higher economic uncertainty. Based on available literature, while increasing government spending can help recover the economy, the accompanying corporate cash hoarding may hamper economic growth. Hence,

governments should try to spend less to ensure that economic recovery can be achieved, instead of causing firms to save more and invest less such that economic growth slows down, creating a vicious cycle.

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Table 1 Descriptive statistics for variables used in the study

Variable	Mean	Median	*sd*	*N*
CH/NA	0.103	0.047	0.159	55702
MTB	1.516	1.237	0.904	55702
CF/NA	0.035	0.030	0.073	55702
NWC/NA	0.103	0.098	0.193	55702
LEV	0.414	0.404	0.185	55702
DIV	0.252	0.000	0.434	55702
Size	9.18E+06	3.36E+06	1.79E+07	55702
CAPX/NA	0.028	0.010	0.049	55702
GD	0.025	0.038	0.051	55702
I	0.003	0.002	0.008	55702
RGDP	0.010	0.011	0.020	55702
IR	0.032	0.028	0.016	55702
CS	0.023	0.021	0.012	55702
PC	5.059	5.142	0.486	55702

Notes: This table presents mean, median, and standard deviation (*sd*) values of cash holding and other control variables used in the study. Cash holding (CH/NA) is the ratio of cash plus its equivalents (cash) to net assets. Net assets (NA) are total assets net of cash. Market-to-book ratio (MTB) is defined as the book value of total assets less the book value of equity plus the market value of equity divided by total assets. CF/NA is the ratio of cash flow to net assets, where cash flow is earnings before interest and taxes, depreciation and amortisation, less interest, taxes, and common dividends. NWC/NA is the ratio of net working capital (NWC) to net assets, where NWC is total current assets less cash less total current liabilities. Leverage (LEV) is the ratio of total debt to total assets. Dividend (DIV) is the dummy variable that returns a value of one if a firm pays dividends and zero otherwise. Firm size (Size) is total assets in billions of Taiwan dollar. CAPX/NA is the ratio of capital expenditure (CAPX) to net assets, where CAPX is additions to fixed assets. All financial ratios are winsorised at the 1% and 99% level. Government deficit (GD) is government deficit/surplus as percentage of GDP. Inflation (I) is annual percentage change in consumer price index. Real GDP growth rate (RGDP) is the annual percentage change in RGDP. Short-term interest rate (IR) is the discount rate. Credit spread (CS) is the basic lending rate of the bank minus the discount rate. Private credit (PC) is the ratio of claims on the private sector by commercial banks and other financial institutions to nominal GDP. *N* represents the number of firm-year observations.

Table 2 Correlation Matrix and Variance Inflation Factors

	CH/NA	MTB	CF/NA	NWC/NA	LEV	DIV	Size	CAPX/NA	GD	I	RGDP	IR	CS	PC	VIF
CH/NA	1.000														
MTB	0.268	1.000													1.33
CF/NA	0.247	0.369	1.000												1.39
NWC/NA	0.113	0.093	0.179	1.000											1.35
LEV	-0.305	-0.179	-0.309	-0.463	1.000										1.41
DIV	0.041	0.023	0.158	0.110	-0.137	1.000									1.10
Size	-0.141	-0.049	0.104	-0.178	0.120	0.104	1.000								1.11
CAPX/NA	0.052	0.169	0.267	-0.103	-0.052	0.111	0.046	1.000							1.17
GD	-0.054	0.038	0.010	0.001	-0.019	0.107	0.058	0.109	1.000						1.29
I	-0.003	0.124	0.014	0.006	-0.005	-0.106	0.009	-0.042	-0.204	1.000					1.20
RGDP	-0.026	0.146	0.062	-0.008	0.028	0.001	0.000	0.026	-0.036	0.115	1.000				1.09
IR	-0.061	0.314	0.077	-0.074	0.008	-0.027	0.103	0.197	0.159	0.222	0.057	1.000			1.32
CS	-0.135	-0.004	-0.003	-0.033	0.059	-0.035	0.061	0.044	0.399	-0.228	0.034	0.035	1.000		1.41
PC	0.110	-0.128	-0.077	0.060	-0.106	-0.027	0.005	-0.105	-0.087	-0.106	-0.239	-0.252	-0.312	1.000	1.31

Notes: This table presents the correlation matrix of variables used in the study and variance inflation factors (VIF). Cash holding (CH/NA) is the ratio of cash plus its equivalents (cash) to net assets. Net assets (NA) are total assets net of cash. Market-to-book ratio (MTB) is defined as the book value of total assets less the book value of equity plus the market value of equity divided by total assets. CF/NA is the ratio of cash flow to net assets, where cash flow is earnings before interest and taxes, depreciation and amortisation, less interest, taxes, and common dividends. NWC/NA is the ratio of net working capital (NWC) to net assets, where NWC is total current assets less cash less total current liabilities. Leverage (LEV) is the ratio of total debt to total assets. Dividend (DIV) is the dummy variable that returns a value of one if a firm pays dividends and zero otherwise. Firm size (Size) is total assets in billions of Taiwan dollar. CAPX/NA is the ratio of capital expenditure (CAPX) to net assets, where CAPX is additions to fixed assets. All financial ratios are winsorised at the 1% and 99% level. Government deficit (GD) is government deficit/surplus as percentage of GDP. Inflation (I) is annual percentage change in consumer price index. Real GDP growth rate (RGDP) is the annual percentage change in RGDP. Short-term interest rate (IR) is the discount rate. Credit spread (CS) is the basic lending rate of the bank minus the discount rate. Private credit (PC) is the ratio of claims on the private sector by commercial banks and other financial institutions to nominal GDP. VIF indicates the values of variance inflation factors for independent variables used in econometric models in Tables 3 and 4.

Table 3 Relation between government deficit and corporate liquidity

Dependent variable: ln(CH/NA)							
Independent variables	1	2	3	4	5	6	7
MTB	0.051*** [a]	0.050***	0.052***	0.050***	0.052***	0.052***	0.052***
	(7.83)[b]	(7.63)	(7.96)	(7.67)	(7.92)	(7.88)	(7.84)
CF/NA	1.596***	1.592***	1.585***	1.582***	1.584***	1.589***	1.572***
	(23.04)	(22.99)	(22.89)	(22.84)	(22.88)	(22.94)	(22.69)
NWC/NA	-0.676***	-0.674***	-0.667***	-0.667***	-0.665***	-0.665***	-0.664***
	(-18.93)	(-18.85)	(-18.67)	(-18.67)	(-18.62)	(-18.61)	(-18.58)
LEV	-2.441***	-2.446***	-2.445***	-2.447***	-2.447***	-2.446***	-2.449***
	(-61.14)	(-61.23)	(-61.23)	(-61.26)	(-61.28)	(-61.25)	(-61.31)
DIV	0.002	0.010	0.003	0.002	0.001	-0.000	-0.007
	(0.24)	(0.95)	(0.33)	(0.21)	(0.10)	(-0.02)	(-0.63)
ln(Size)	0.011	0.010	0.012	0.012	0.013	0.013	0.012
	(1.16)	(1.14)	(1.26)	(1.27)	(1.39)	(1.38)	(1.35)
CAPX/NA	0.700***	0.723***	0.682***	0.681***	0.669***	0.679***	0.655***
	(7.13)	(7.35)	(6.92)	(6.90)	(6.78)	(6.89)	(6.62)
GD		-0.316***	-0.417***	-0.398***	-0.453***	-0.494***	-0.345***
		(-3.61)	(-4.68)	(-4.45)	(-5.00)	(-5.33)	(-3.80)
I			-2.960***	-3.027***	-2.623***	-2.687***	-2.157***
			(-5.79)	(-5.91)	(-5.01)	(-5.17)	(-3.77)
RGDP				0.544**	0.548**	0.704***	0.881***
				(2.50)	(2.52)	(3.18)	(3.69)
IR					-4.458***		
					(-3.72)		
CS						5.744***	
						(3.88)	
PC							0.153***
							(3.43)
Constant	-1.346***	-1.340***	-1.334***	-1.339***	-0.831***	-1.455***	-1.644***
	(-6.77)	(-6.74)	(-6.71)	(-6.74)	(-3.44)	(-7.24)	(-7.55)
N	55,702	55,702	55,702	55,702	55,702	55,702	55,702
n	1,841	1,841	1,841	1,841	1,841	1,841	1,841
R^2	0.166	0.166	0.167	0.167	0.167	0.167	0.167

Notes: Cash holding (CH/NA) is the ratio of cash plus its equivalents (cash) to net assets. Net assets (NA) are total assets net of cash. Market-to-book ratio (MTB) is defined as the book value of total assets less the book value of equity plus the market value of equity divided by total assets. CF/NA is the ratio of cash flow to net assets, where cash flow is earnings before interest and taxes, depreciation and amortisation (EBITDA), less interest, taxes, and common dividends. NWC/NA is the ratio of net working capital (NWC) to net assets, where NWC is total current assets less cash less total current liabilities. Leverage (LEV) is the ratio of total debt to total assets. Dividend (DIV) is the dummy variable that returns a value of one if a firm pays dividends and zero otherwise. Firm size (Size) is total assets in billions of Taiwan dollar. CAPX/NA is the ratio of capital expenditure (CAPX) to net assets, where CAPX is additions to fixed assets. All financial ratios are winsorised at the 1% and 99% level. Government deficit (GD) is government deficit/surplus as percentage of GDP. Inflation (I) is annual percentage change in consumer price index. Real GDP growth rate (RGDP) is the annual percentage change in RGDP. Short-term interest rate (IR) is the interest rate with short term to maturity adjusted for inflation. Credit spread (CS) is the basic lending rate of the bank minus the discount rate. Private credit (PC) is the ratio of claims on the private sector by commercial banks and other financial institutions to nominal GDP. In all columns, year dummies are included to capture year-specific effects though not reported. *N* represents the number of firm-year observations; *n* stands for the number of firms. The numbers in the parentheses are cluster-robust t-statistics. ***, ** and * indicate coefficient is significant at the 1%, 5% and 10% level, respectively.

Table 4 Relation between government deficit and corporate liquidity: Interactions

Dependent variable: ln(CH/NA)						
Independent variables	1	2	3	4	5	6
MTB	0.052***	0.049***	0.052***	0.055***	0.053***	0.054***
	(7.97)	(7.41)	(7.96)	(8.34)	(8.01)	(8.27)
CF/NA	1.578***	1.595***	1.600***	1.580***	1.583***	1.587***
	(22.78)	(23.02)	(23.08)	(22.78)	(22.84)	(22.87)
NWC/NA	-0.665***	-0.672***	-0.670***	-0.662***	-0.663***	-0.666***
	(-18.61)	(-18.81)	(-18.76)	(-18.51)	(-18.54)	(-18.64)
LEV	-2.446***	-2.446***	-2.445***	-2.446***	-2.448***	-2.447***
	(-61.26)	(-61.22)	(-61.21)	(-61.25)	(-61.30)	(-61.25)
DIV	0.002	0.008	0.006	-0.004	-0.010	-0.003
	(0.18)	(0.78)	(0.58)	(-0.41)	(-0.97)	(-0.26)
ln(Size)	0.012	0.011	0.012	0.013	0.013	0.013
	(1.27)	(1.17)	(1.30)	(1.39)	(1.46)	(1.40)
CAPX/NA	0.670***	0.724***	0.710***	0.655***	0.662***	0.672***
	(6.79)	(7.36)	(7.20)	(6.62)	(6.70)	(6.78)
GD	-0.308***	-0.197**	-0.079	-0.361***	-0.304***	0.014
	(-3.08)	(-2.05)	(-0.37)	(-3.41)	(-2.96)	(0.06)
I	-2.250***			-1.438**		
	(-3.81)			(-2.20)		
RGDP		0.970***			1.507***	
		(3.34)			(4.93)	
IR			-5.517***			-7.748***
			(-4.69)			(-2.70)
GD × I	-24.681**			-24.928**		
	(-2.41)			(-2.41)		
GD × RGDP		-14.087***			-9.910*	
		(-2.57)			(-1.77)	
GD × IR			-11.206*			-12.759*
			(-1.69)			(-1.79)
CS				4.399***	5.987***	-3.716
				(3.01)	(4.01)	(-1.03)
PC				0.089**	0.218***	0.143***
				(2.16)	(5.45)	(3.86)
Constant	-1.334***	-1.353***	-0.683***	-1.597***	-1.904***	-0.631
	(-6.72)	(-6.81)	(-2.85)	(-7.41)	(-8.85)	(-1.40)
N	55,702	55,702	55,702	55,702	55,702	55,702
n	1,841	1,841	1,841	1,841	1,841	1,841
R^2	0.167	0.167	0.167	0.167	0.167	0.167

Notes: Cash holding (CH/NA) is the ratio of cash plus its equivalents (cash) to net assets. Net assets (NA) are total assets net of cash. Market-to-book ratio (MTB) is defined as the book value of total assets less the book value of equity plus the market value of equity divided by total assets. CF/NA is the ratio of cash flow to net assets, where cash flow is earnings before interest and taxes, depreciation and amortisation (EBITDA), less interest, taxes, and common dividends. NWC/NA is the ratio of net working capital (NWC) to net assets, where NWC is total current assets less cash less total current liabilities. Leverage (LEV) is the ratio of total debt to total assets. Dividend (DIV) is the dummy variable that returns a value of one if a firm pays dividends and zero otherwise. Firm size (Size) is total assets in billions of Taiwan dollar. CAPX/NA is the ratio of capital expenditure (CAPX) to net assets, where CAPX is additions to fixed assets. All financial ratios are winsorised at the 1% and 99% level. Government deficit (GD) is government deficit/surplus as percentage of GDP. Inflation (I) is annual percentage change in consumer price index. Real GDP growth rate (RGDP) is the annual percentage change in RGDP. Short-term interest rate (IR) is the interest rate with short term to maturity adjusted for inflation. Credit spread (CS) is the basic lending rate of the bank minus the discount rate. Private credit (PC) is the ratio of claims on the private sector by commercial banks and other financial institutions to nominal GDP. In all columns, year dummies are included to capture year-specific effects though not reported. *N* represents the number of firm-year observations; *n* stands for the number of firms. The numbers in the parentheses are cluster-robust t-statistics. ***, ** and * indicate coefficient is significant at the 1%, 5% and 10% level, respectively.

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