

# Is firm leverage policy a residual of the other financial policies?

Shengfeng Li

University of York

## Abstract

DeAngelo and Roll (2015) raise the concern that firm leverage ratio might be a residual, and of second-order importance. This is not consistent with traditional trade-off theory which suggests that firms are following an optimal leverage ratio, where firms could balance the benefit and cost of extra debt financing. Lambrecht and Myers (2012) also suggest that firm dividend policy, investment policy and leverage policy need to be modelled together. Therefore, this chapter empirically weights the residual theory, seeing to what extent firm leverage policy is determined by the other financial policies. Results show that firm capital structure is not of first-order importance and it is largely affected by the other financial policies. However, it seems firm leverage ratio is not a pure residual and it tends to revert to a target level at a moderate speed of adjustment.

Key words: capital structure, leverage policy, firm financial policies, residual, leverage target

JEL classification: G32, G35

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## 1. Introduction

DeAngelo and Roll (2015) raise the concern that firm leverage ratio might be a residual among firm financial policies, or of second-order importance. This is not consistent with traditional trade-off theory which suggests that firms are trying to balance the benefit and cost of extra debt financing, and to reach the optimal capital structure level where firm net profit could be maximized. Lambrecht and Myers (2012) also suggest that firm dividend policy, investment policy and leverage policy need to be modelled together. Therefore, it is very important to evaluate whether firm leverage policy is the first-order consideration, or whether it is a residual of the other financial policies.

Trade off theory, pecking order theory and market timing theory debate heavily on the motivation behind firm leverage decisions. Modern theoretical research on determinants of capital structure started from Modigliani and Miller (1963), who argue that firms should raise debt as much as they can to shield the tax levied on firm gross profit. However, Kraus and Litzenberg (1973) notice that issuing debt could bring extra cost at the same time. Hence, firm value would be maximized when the tax benefit is neutralized by the extra cost, and firms tend to move towards this optimal leverage ratio. Hovakimian et al. (2001) continue by suggesting that firms would follow a target leverage ratio, even though the target ratio often changes over time. Under trade off theory, equity issuance works as the method to rebalance leverage to target. One of the other important branches is based on pecking order theory. Myers and Majluf (1984) highlight the pecking order theory by suggesting firms raising capital firstly through retained earnings, secondly by issuing debt, and lastly by issuing equity. This indicates that firm leverage decisions are based on the demand for external financing, rather than leverage targeting, and equity

issuance works as the last resort after debt financing. Through recording equity issuing and repurchasing behaviours, Baker and Wurgler (2002) suggest that firm leverage ratio is an accumulated result of firm market timing behaviours, which also indicates that firms are not trying to balance the benefit and cost of extra debt financing. These are the main theories in capital structure studies, which have been discussed for more than a half century.

Empirical studies agree on the classification of firm leverage ratio variation, as cross-country variation (Fan et al., 2012; Hoque and Kashefi-Pour, 2016), cross-industry variation (Rajan and zingales, 1995), cross-firm variation (Graham and Leary, 2011) and within-firm variation (Titman and Wessels, 1988). However, Graham et al. (2014) notice that there is still variation that has not been explained by existing empirical models, especially in the within-firm variation. More specifically, most previous papers analysed firm-level variation based on firm-level characteristics, such as Return on Asset (ROA), total asset (TA), and Market to Book ratio (M/B). However, few of those papers notice that firm leverage policy might be affected by the other firm financial policies, such as dividend policy, investment policy, and equity issuance policy.

Recent empirical papers record a slow Speed of Adjustment (SOA) to the target leverage ratio, such as Kayhan and Titman (2007), and DeAngelo and Roll (2015). Kayhan and Titman (2007) explain that firms would move back to the target capital structure level at a slow speed, when the actual leverage ratio deviated due to financial deficit, capital raising requirement and stock price tendency. However, DeAngelo and Roll (2015) start to raise the concern that firms could not target leverage ratio and dividend payout ratio (Lintner, 1956) at the same time, while new investment also needs to be funded. Lambrecht and Myers (2012) also mention that firm dividend policy, investment policy

and leverage policy need to be modelled together. In summary, it is still unclear whether firm capital structure is the first-order consideration or not. If not, considering firms also need to accommodate the other financial policies, are leverage decisions affected by the other financial policies? Is firm capital structure a 'by-product' among the other financial policies, or even a residual? To our knowledge, these questions have not been addressed in the literature.

Therefore, this paper introduces the conflict among firm financial policies, and measure how firm leverage policy is influenced by the other financial policies, such as investment policy, dividend policy and equity policy. This paper aims to answer DeAngelo and Roll (2015)'s question on whether firm capital structure is a residual of the other financial policies. To answer this question, this paper firstly measures how firm leverage policy is affected by the other financial policies, and secondly checks whether firm leverage ratio tend to reverse to a target level.

This paper argues that firm capital structure is not a pure residual, even though firm leverage decisions are significantly affected by the other financial policies. More specifically, results suggest that firm capital structure is not the first-order consideration; and the reliance on debt financing is positively influenced by investment requirements and dividend payments, and negatively influenced by firm profitability and equity issuance. However, even though firm leverage decisions are affected by the other financial policies with higher priority, firm leverage ratio would revert to a target level in a longer period, at a slow adjustment speed. Additionally, this paper also notices that firm Cash holdings are more likely the residual among those financial policies, because there is no evidence that firm cash holdings are empirically moving back to a target level. Evidence also shows that firm leverage policy can be explained by trade off

theory, pecking order theory and market timing theory to some extent; but none of those theories could explain the whole leverage variation independently. These are supported by evidence based on annual report data of unregulated S&P 500 component firms, which are collected from Center for Research in Security Prices (CRSP) Compustat database.

The argument in this paper is different from traditional trade off theory by looking at the trade-off effects among firm financial policies. Traditional trade-off theory (Kraus and Litzenberg, 1973) suggests that firm leverage ratio would eventually reach a balance between tax benefit and cost of extra debt financing, whereas this paper is focusing on the trade-off effects among firm financial policies. The argument in this paper accepts the fact that firms are targeting capital structure ratio and dividend payout ratio at the same time, and firms would adjust quickly to the one with higher priority (dividend payout ratio) and move slowly to the one with lower priority (capital structure ratio). Additionally, firms are timing the market by issuing or repurchasing stocks, and new investment also need to be funded. As firm profitability, investment requirement, dividend payment, and equity issuance (repurchase) all influence the demand for extra capital, firm leverage decisions would absorb the trade-off effects among those financial policies, and the final result is revealed in the annual report.

This paper contributes to the existing literature in the following ways. Firstly, this paper shows that firm leverage policy is significantly affected by the other financial policies. Firms tend to accommodate financial policies with higher priority by sacrificing leverage policy, which answers Lambrecht and Myers (2012)'s question on how firms accommodate several financial policies at the same time, and how firm dividend target and leverage target could coexist.

Secondly, this paper suggests that firm capital structure is not a pure residual, even though firm leverage policy is significantly affected by the other financial policies. This paper records mean reversion and adjustment to target in firm leverage variation, which shows that firm leverage ratio would revert to the target level in a longer period. Additionally, result suggests that firm cash holdings are more likely the residual among financial policies than firm leverage policy. Thirdly, this paper contributes to studies on determinants of capital structure by using the other financial policies as explanatory variables. This finding particularly helps explaining annual leverage variation that can hardly be explained by country level variables in Graham et al. (2014). This paper opens the door for modelling leverage policy with the other financial policies for future research. Fourthly, figures and regression results show evidence supporting or not supporting trade-off theory, pecking order theory and market timing theory, which indicates that firm leverage policy can be explained by trade off theory, pecking order theory and market timing theory to some extent; but none of those theories can explain the whole leverage variation independently.

This paper is organized as follows. Section 2 firstly discusses firm leverage target and the reason for deviation, and secondly introduces what are the other financial policies, and how they would affect firm leverage decisions. Through discussing the conflicts among firm financial policies, we develop the general hypothesis. Section 3 shows the data, and discusses some figures on the moving trends of firm financial policies. Section 4 develops econometric models and shows the estimating methods. This paper firstly develops two Dynamic Panel Data models to estimate how firm leverage policy is affected by the other firm financial policies. Secondly, this paper uses mean reversion model to test leverage mean-reverting effects, and run partial adjustment

models to measure firm leverage targeting speed. Section 5 discusses the regression results and reflections on trade off theory, pecking order theory and market timing theory. Section 6 summarizes this paper and clarifies our contributions and limitations. Further directions are given in section 7.

## 2. Leverage target and conflicts among corporate financial policies

In this section, we firstly discuss firm leverage target and deviation in section 2.1. Secondly, we discuss the conflicts among those corporate financial policies in section 2.2. We summarize this section by developing the general hypothesis.

### 2.1 Leverage target and deviation

The theory of leverage target has been developed for many years, and recent empirical papers recorded a slow Speed of Adjustment (SOA) to the target leverage ratio. According to traditional trade off theory (Kraus and Litzenberg, 1973), firms are adjusting debt ratios towards a specific level, where extra tax benefit is neutralized by the cost of extra debt finance. Through running partial adjustment model, most up-to-date studies, such as Kayhan and Titman (2007), and DeAngelo and Roll (2015), agree that firms are moving back towards a target capital structure ratio, but at a very slow speed. Additionally, by simulating leverage variation, DeAngelo and Roll (2015) conclude that leverage target reversion is motivated, rather than a result driven by the other factors.

Shyam-Sunder and Myers (1999) announce that pecking order theory has a stronger explanatory power than trade off theory, which explains leverage deviation. According to Shyam-Sunder and Myers (1999), firm leverage variation are more driven by the financial deficit than the leverage target,



because the cost of adjustment to target often exceeds the cost of deviation or remaining off target. This explanation might indicate the fact that the optimal capital structure is of second-order importance. Additionally, Flannery and Rangan (2006) explain that adjustment cost is the reason for slow SOA. If there is no adjustment cost such as debt issuance cost, firms would immediately move back to the optimal leverage level. If the adjustment cost is high, firms would choose to remain deviated and move back to the optimal leverage ratio slowly.

Bradley et al. (1984) state that firms are generally moving towards an individual target leverage level, and firm level characteristics are taken as the first order determinants; however, Shyam-Sunder and Myers (1999), and Chang and Dasgupta (2009) notice that the motivation of external financing is the need for capital, rather than targeting a leverage ratio. Kayhan and Titman (2007) also suggest that firm cash flow, financial deficit and stock price changes would significantly affect financial decisions. Therefore, it is reasonable to propose that firms are targeting an optimal leverage ratio; however, actual leverage ratio is also affected by factors influencing financial deficits and capital demands. Firms tend to accommodate capital demands first, and give leverage targeting behaviour second-order priority.

## 2.2 Conflicts among corporate financial policies

Except for the fact that firms are following a target leverage ratio, Lambrecht and Myers (2012) show that firms are also following a target dividend payout ratio. Lambrecht and Myers (2012) add that those two target adjustment models cannot coexist. DeAngelo and Roll (2015) also suggest that firms cannot target liquidity ratio, dividend payout ratio and capital structure ratio, as well as satisfy investment requirement at the same time, due to limited

funds. These are the main conflicts among firm financial policies, and firm leverage policy is likely affected by the other financial policies due to their influence on financial deficits and requirements for debt capital.

### 2.2.1 Dividend policy

There is also solid evidence that firms are targeting a dividend payout ratio. Leary and Michaely (2011) and Lambrecht and Myers (2012) both confirm that firms are following a target dividend ratio, which is consistent with Lintner (1956)'s conclusion that firms tend to maintain a long run dividend payout ratio. Lintner (1956) notes that firm retained earnings and cash flow are likely the residuals after dividend-payout balancing. Fama and French (2002) also record that firm dividend policy is 'sticky', and it would not vary due to short-term investment variation.

Myers (1984) indicates that firms often raise debt to accommodate a sticky dividend payout ratio. Therefore, it is reasonable to propose that firm dividend policy would affect leverage policy. If we control all the other variables, firms with higher dividend payment would reserve less capital for operation activities. Hence, those firms are more likely to rely on external financing, especially debt financing. Additionally, firm dividend payout changes are also likely to influence leverage variation, because it would increase or reduce the demand for extra capital. Therefore, this paper takes firm dividend policy as one of the important factors affecting firm leverage decisions.

### 2.2.2 Equity policy

Literature suggests that equity financing is performed independently, rather than working as the last resort after debt financing. According to trade-off theory explained in Myers (1984), equity financing is taken as a tool to

rebalance debt ratios. When it comes to pecking order theory (Myers and Majluf, 1984), firm equity financing would be employed only if retained earnings and debt capital are not sufficient to meet capital demand. Both of those theories indicate that equity financing is only considered after debt financing. However, Fama and French (2005) conclude that firm equity financing is not the last selection among financing sources, with two strong pieces of evidence. First, the fact the net issuance of equity often succeeds the net issuance of debt violates trade off theory; and secondly, the evidence that equity repurchases also happen among those firms with huge capital demand violates pecking order theory. Moreover, according to market timing theory (Baker and Wurgler, 2002), firms' equity issuance and repurchase are highly based on stock price fluctuation; but not for the purpose of rebalancing leverage or maintaining debt capacity. Additionally, Fama and French (2005) notice that equity issuance and repurchase behaviours often happen in the same year. These facts all suggest that equity financing is not the last resort after debt financing.

Considering firm equity financing is not the last resort after debt financing, it is reasonable to propose that firm leverage decisions are influenced by equity decisions. According to market timing theory, firms tend to issue equity when stock price is over-valued and tend to repurchase equity when stock price is under-valued, which will lead to variation in capital supplement. As we have discussed in section 2.1, firms tend to issue debt due to the financial deficit and requirement for extra capital. Firms with higher net equity issuance tend to rely less on debt financing because they have lower demand for extra capital, and vice versa. Therefore, this paper takes firm equity policy as a factor affecting leverage policies.

### 2.2.3 Firm investment policy

As the main driving force for financing sources, firm investment would heavily influence financial decisions through influencing financial deficits and demands for extra capital. Firm investment, measured by long term asset plus inventory, stands for a large proportion in firm total assets. The increase in general investment level and annual investment increment need to be covered by capital funds. Once internally generated funds are not adequate for investment requirements, firms would turn to external financing, typically debt financing.

Therefore, it is reasonable to propose that firm investment policy would influence leverage policy, and firms with higher investment requirement would rely more on debt financing. This paper takes investment policy as one of those factors influencing firm leverage decisions.

### 2.2.4. Conflicts and accommodation

Lambrecht and Myers (2012) and DeAngelo and Roll (2015) suggest that firms are unable to fully accomplish leverage targeting, dividend targeting, equity marketing, and funding investment at the same time. Therefore, it is reasonable to state that firms would accommodate the one with highest priority, and finally reach a balance among those financial policies. In this situation, the financial policy with lowest priority would be heavily influenced by the other financial policies.

DeAngelo and Roll (2015) suggest that firm investment, dividend target and equity issuance (or repurchase) are more important than capital structure target. Considering firm investment is largely decided by market conditions and investment opportunities, and firm equity decisions are largely dependent

on market timing behaviours; it is reasonable to accept that firm investment and equity issuance are more important than leverage target, because firms are rational and tend to take advantage of market opportunities first. Fama and French (2002) record the fact that dividend-paying firms would give higher priority to dividend policy than capital structure policy. Hoque and Kashefi Pour (2016) also state that banks with more frequent dividend payout tend to employ more debt. Hence, it is likely that firms are giving higher priority to targeting dividend payout ratio than targeting capital structure ratio, because firms need to maintain a consistent and high dividend payment to attract potential equity buyers, and raise share price for the interest of existing shareholders. After synthesizing this evidence, it is reasonable to propose that firms are balancing those financial policies at the same time, and firm leverage policy would be affected by investment policy, dividend policy and equity policy.

Therefore, this paper draws the general hypothesis that firm leverage policy is not a residual of the other financial policies, even though it is affected by the other financial policies, due to their influence on financial deficit and demand for extra capital. More specifically, firms with more investment and dividend payment tend to raise more debt; and higher net equity issuance and profitability tend to reduce the reliance on debt financing. However, firms tend to adjust their leverage ratio back towards the optimal level in a longer period, and financial policy is not the pure residual of the other financial policies.

### 3. Data, descriptive statistics and moving trends of corporate financial policies

In this section, we firstly show how the data are collected and present descriptive statistics, and secondly discuss the moving trends of corporate financial policies.

### 3.1 Data and descriptive statistics

The data are collected from Centre for Research in Security Prices (CRSP) Compustat database, which includes firms from the United States or listed on United States stock market. This paper employs those unregulated firms from S&P 500 index components (updated on 12/10/2015), with financials, utilities, railroads and telecommunications excluded (following Graham et al., 2014, and DeAngelo and Roll, 2015). Graham et al. (2014) admit that those regulations are dynamic and heterogeneous, and use this classification as 'merely labels'. We exclude those regulated firms, firstly because those firms tend to maintain a high leverage level, and the leverage levels of those firms are constrained by financial regulations (Graham et al., 2014). Secondly, this paper uses data with similar characteristics in the literature, so that our results are comparable with previous papers. The time period available on CRSP Compustat is from 1950 to 2014. Once those financially regulated firms are separated, we have 13685 observations. The time period for stock market data is from 1998 to 2014, which leads to a smaller number of observations for market leverage ratio. All the variables employed in this paper are listed and explained in appendix 1.

We chose S&P 500 firms firstly because those are large firms heavily influencing the U.S. economy, and they are also the leading firms within individual industries. Secondly, Jensen (1986) suggests that the capital structure theory is not suitable for small firms which have high external financing cost. Conversely, large firms are facing lower debt-raising barriers

and are more likely to target an optimal leverage ratio. Leary and Roberts (2005) note that firms would adjust debt ratios on yearly basis; hence, this chapter mainly focuses on annual report data of unregulated firms during 1950 to 2014. Common equity data start from 1960, which are slightly shorter than the aggregate time period.

The variables calculated from collected data are described in Appendix 2 Table 1, and the definitions for variables are listed in Appendix 1. *Total leverage* ratio stands for the proportion (0.223 for mean) of total debt to book value of total asset. *Long term leverage* (0.183) and *short term leverage* (0.04) stands for the proportions of long term debt and current debt to the book value of total asset, respectively. Result shows that *long term leverage* stands for the major proportion of total leverage. Compared to *Total leverage*, *Market leverage* (0.183) uses the market value of equity rather than book value. *Leverage change* (0.044) measures annual changes in leverage ratio,  $Total\ leverage_t - Total\ leverage_{t-1}$ . *Debt issuance ratio* stands for the proportion of net debt issuance in year  $t$  to the book value of total asset in the year  $t-1$ , and a positive mean of 0.044 represents the net issuance speed. *Leverage change* and *debt issuance ratio* have similar distribution, due to the fact that the gap between  $total\ asset_t$  and  $total\ asset_{t-1}$  is small.

Return on Asset (*ROA*) is employed to measure firm profitability, and this paper uses *ROA* to show firm ability to generate financing sources internally. Following Graham et al. (2014), this paper measures firm investment by the sum of long term asset and inventory. We use *Investment to Asset* to represent firm total investment level, and *Investment change* ( $Investment\ to\ asset_t - investment\ to\ asset_{t-1}$ ) to represent new investment on annual basis. We use *Common Equity to Asset* (0.452) to represent the book value of common equity

to that of total asset, and *equity issuance ratio* to measure the proportion of net equity issuance in year  $t$  to the book value of total asset in year  $t-1$ . Results show that firms issue equity (0.12) faster than issuing debt (0.044), which is consistent with Fama and French (2005), and this indicates that the purpose of equity issuance is not to balance debt issuance. However, the higher standard deviation of *equity issuance* (0.923) than that of *debt issuance* (0.230) shows that debt financing is steadier than equity financing. This evidence is in favour of the market timing explanation, as firm equity issuance or repurchase is highly based on volatile stock prices.

### 3.2 Moving trends of corporate financial policies

In this section, we show the moving trends of those corporate financial policies based on the data collected in section 3.1. In those figures, the value of variables in each fiscal year is the average value among firms (mean). This section presents and discusses evidences recorded in those figures.

#### 3.2.1 Firm financing sources and changes in firm financing sources

Figure 1. Firm financing sources

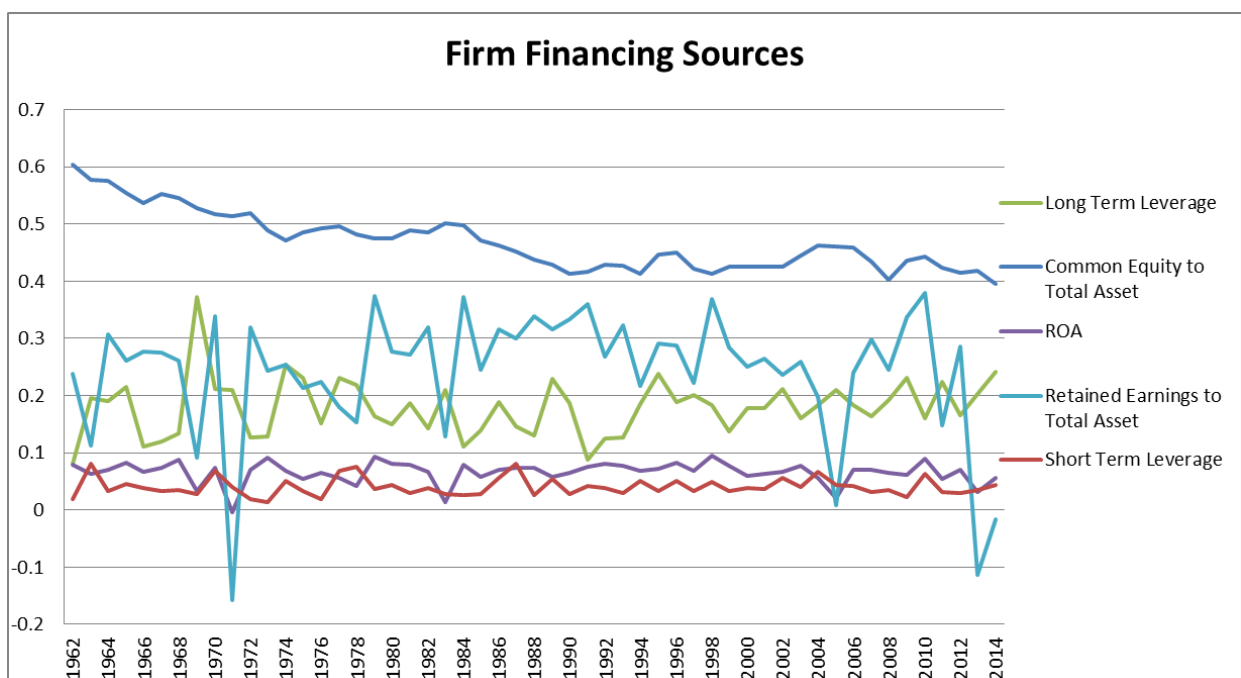




Figure 1. Firm financing sources. The data are collected from CRSP Compustat database. The sample includes unregulated S&P 500 component firms, with financials, utilities, railroads and telecommunications excluded; the time period is from 1962 to 2014, and the data are collected on annual basis. Figure 1 presents the moving trends for common equity to total asset, retained earnings to total asset, long term leverage, ROA and short term leverage from top to bottom. The definitions and explanations of variables are summarized in Appendix 1.

Figure 1 shows the moving trends of firm financing sources. As we can see, the amount of equity used by firms is decreasing, from 60% in 1962 to 40% in 2014; however, it is still the main financing source compared to others. Retained earnings have high volatility, but generally follow a slightly increasing trend. After 1970, the use of retained earnings exceeded long term leverage, and became the second important source for capital. Long term leverage is roughly stable over time, fluctuating around 20%. Reliance on ROA and short term leverage is fairly low, but the use of short term leverage is slightly increasing (also show in Figure 3 as the gap between total leverage and long term leverage). The long run trend is consistent with pecking order theory (Myers, 1984), which suggest firms relying firstly on retained earnings (generally increasing in Figure 1), secondly on debt financing (roughly stable) and lastly on equity financing (decreasing). There is evidence that firms tend to raise more debt when retained earnings levels decrease, such as in 1963, 1969, 1977, 1982, 2005 and 2013, which conforms to the pecking order theory explanation that firms would refer to debt capital if retained earnings are not sufficient to meet capital demand. Additionally, firms tend to raise more debt when profitability (measured by ROA) drops, such as in 1969, 1977, 1983, 2000, and 2005; and firms tend to issue less debt when profitability reaches a peak, such as in 1968, 1973, 1979, 1984, 1992, 1998 and 2010.

Figure 2. Changes in firm financing sources

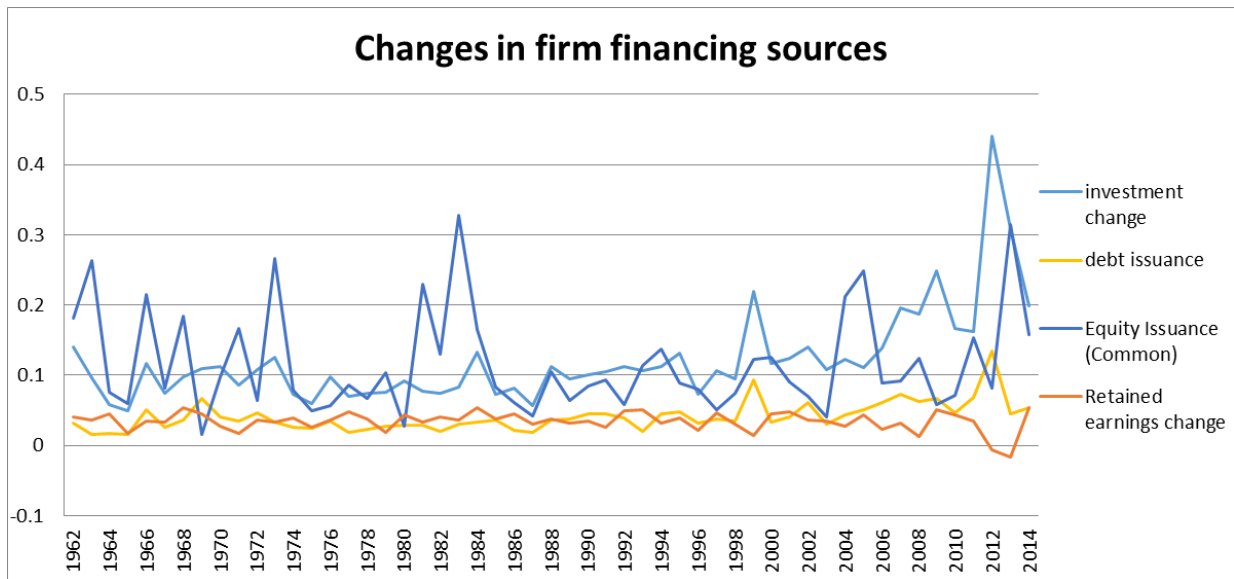


Figure 2. Changes in firm financing sources. The data are collected from CRSP Compustat database. The sample includes unregulated S&P 500 component firms, with financials, utilities, railroads and telecommunications excluded; the time period is from 1962 to 2014, and the data are collected on annual basis. Figure 2 presents the moving trends for annual changes in firm investment, total debt, common equity, and retained earnings from top to bottom, all of which are scaled by total asset. The definitions and explanations of variables are summarized in Appendix 1.

Figure 2 shows the moving trends for changes in firm financing sources. Firm investment increases heavily after 1990s, which shows a rapid extension. As we can see, equity issuance speed often exceeds investment requirements, which are the main driving source for capital, such as in 1960s, 1980s and 2005. This is consistent with the Fama and French (2002)'s contention that equity issuance does not follow pecking order theory and it is not the last resort after debt financing. This is also in favour of market timing theory, which suggests that firm equity issuance policy is highly based on market conditions rather than only based on capital requirement. We also notice that debt issuance follows the same pattern of investment change during the whole period, which indicates that a large amount of capital demand is absorbed by net debt issuance. This is consistent with the hypothesis that firm investment policy would influence leverage policy. Moreover, there is evidence that firms would go to debt financing once retained earnings are not sufficient for capital demands, and this is obviously clear in 1999, 2007 and 2012. Additionally,

Figure 2 records large equity issuance in 1966, 1970s, and 1980s; even though this caused dramatic decrease in long term leverage ratio in Figure 1, the leverage ratio quickly recovers and move back to the original level in later years. This is consistent with Hovakimian (2006) who concludes that equity market timing would affect leverage ratios in the short run but not in the long run. Last but not least, the trends for retained earnings and firm investment are not fully consistent, especially in 1970s, 1980s and after 2006. We also notice that firms issue a large amount of equity during those periods. This evidence violates pecking order theory, which suggests that retained earnings are not always the first-order financing source. This evidence is also consistent with Fama and French (2005) that firm equity issuance is not the last resort after debt financing, but should be considered at least independently. In summary, there is clear evidence that firm leverage policy is influenced by investment policy and equity policy in the short term, but firm leverage ratio tends to move back to a target level within a few years.

### 3.2.2 Total leverage and long term leverage

Figure 3. Total leverage and long term leverage

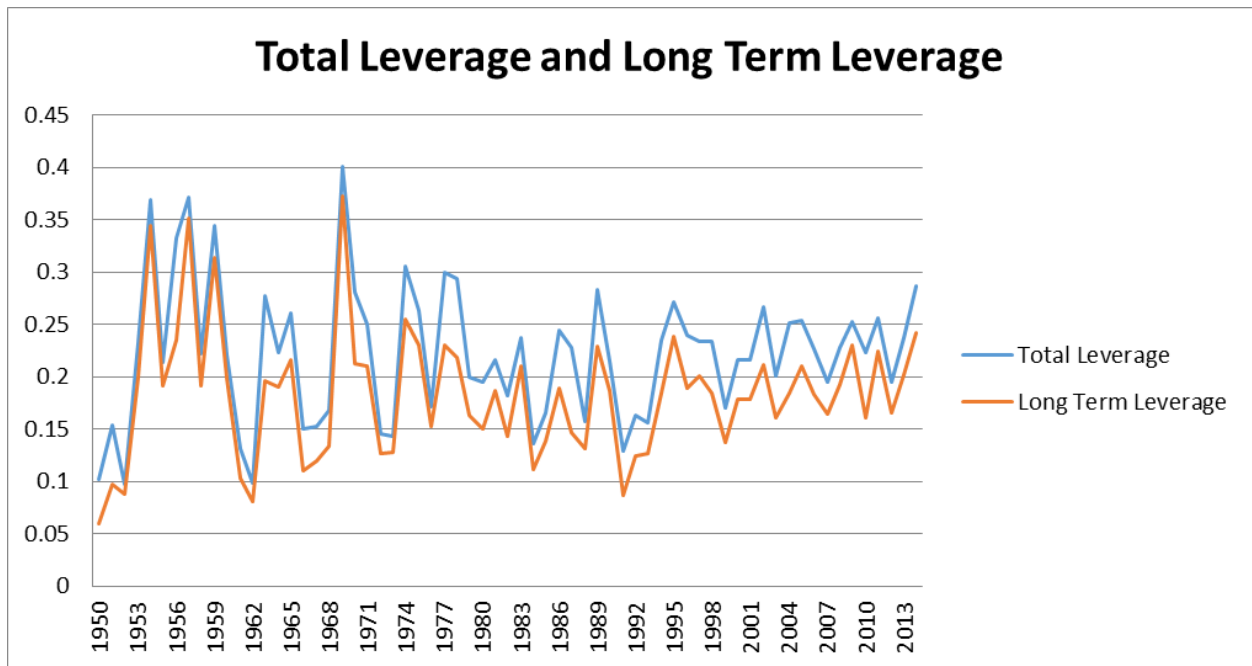


Figure 3. Total leverage and long term leverage. The data are collected from CRSP Compustat database. The sample includes unregulated S&P 500 component firms, with financials, utilities, railroads and telecommunications excluded; the time period is from 1950 to 2014, and the data are collected on annual basis. Figure 3 presents the moving trends for total leverage ratio and long term leverage ratio from top to bottom. The definitions and explanations of variables are summarized in Appendix 1.

As is revealed in Figure 3, the leverage ratio of unregulated S&P 500 firms is fairly stable, which is consistent with Jensen (1986) who states that larger firms tend to maintain a stable leverage ratio and are more likely to have a target. Similar with Graham et al. (2014), this paper also records dramatic increases in leverage ratios in early 1950s and 1960s; and the total leverage ratio reached 0.4 at around 1970. However, after 1970, those sample firms relied less on debt financing, and the total leverage ratio fell and started to fluctuate between 15% and 30%. The steady moving trends indicate that firms are likely adjusting towards a target leverage ratio in a fairly long time, which is consistent with trade off theory and leverage target theory. Additionally, evidence also supports Graham et al. (2014) who states that long term leverage variation accounts for the main variation of total leverage; and both the mean (0.04) and the standard deviation (0.063) of short term leverage are small, as is reported in Table 1.

### 3.2.3 Book leverage, market leverage and Equity Issuance

Figure 4. Total leverage (Book), Market Leverage and Equity issuance

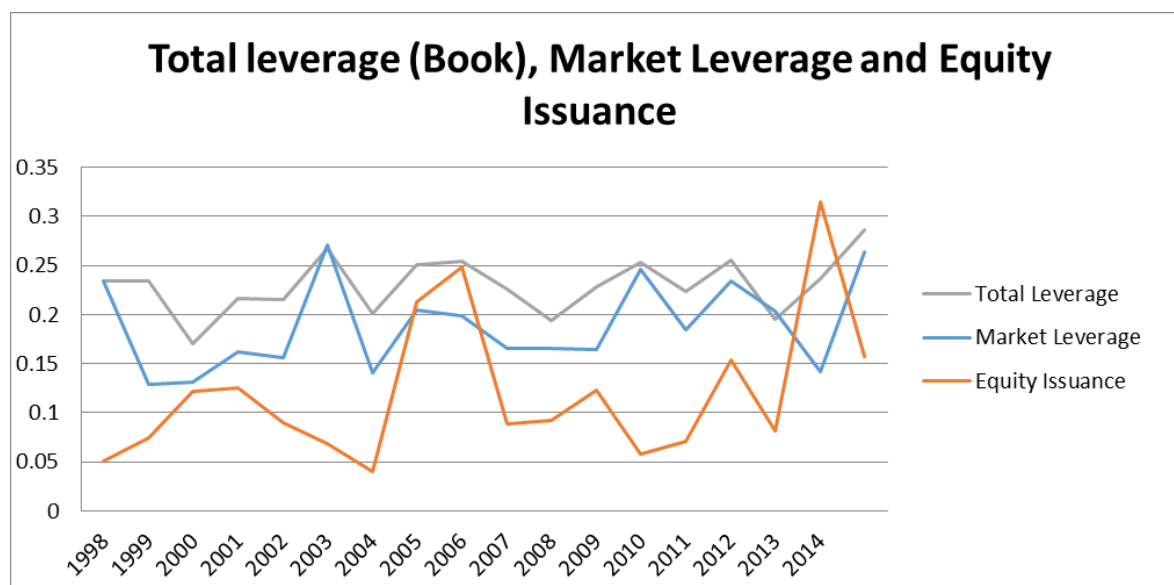


Figure 4. Total leverage (Book), Market leverage and Equity issuance. The data are collected from CRSP Compustat database. The sample includes unregulated S&P 500 component firms, with financials, utilities, railroads and telecommunications excluded; the time period is from 1998 to 2014, due to the constraint that stock price data are only available from 1998 to 2014. The data are collected on annual basis. Figure 4 presents the moving trends for total leverage ratio (Book leverage ratio), market leverage ratio, and equity issuance (common equity) speed from top to bottom. The definitions and explanations of variables are summarized in Appendix 1.

As is shown in Figure 4, firm total leverage ratio and market leverage ratio follow the same pattern, and market leverage ratio fluctuates more drastically, due to the influence of stock price fluctuations. In Figure 4, the total leverage ratio (book leverage ratio) is stable around 0.223 (the mean), whereas market leverage ratio varies heavily. For the market leverage ratio, the reversion to 0.183 is not obvious, and the deviation is more persistent, such as from 1999 to 2002, from 2007 to 2009, and from 2009 to 2013. It could hardly be noticed that firms are targeting a market leverage ratio as tight as targeting book leverage target. This is in line with Graham et al. (2014) who state that firms often make financial decisions based on the book value of assets. Figure 4 also records the fact that firms tend to issue equity once there is a large gap between market leverage ratio and book leverage ratio, due to a high stock

price. This is consistent with Baker and Wurgler (2002), who records firms' market timing behaviour. Additionally, this is inconsistent with trade off theory which takes equity issuance as a method to rebalance firm leverage ratio, because issuing equity when market leverage ratio is low would further reduce leverage ratio, rather than push it back to a higher level.

### 3.2.4 Long term leverage, short term leverage and dividend

Figure 5. Long term leverage, short term leverage and Dividend to asset

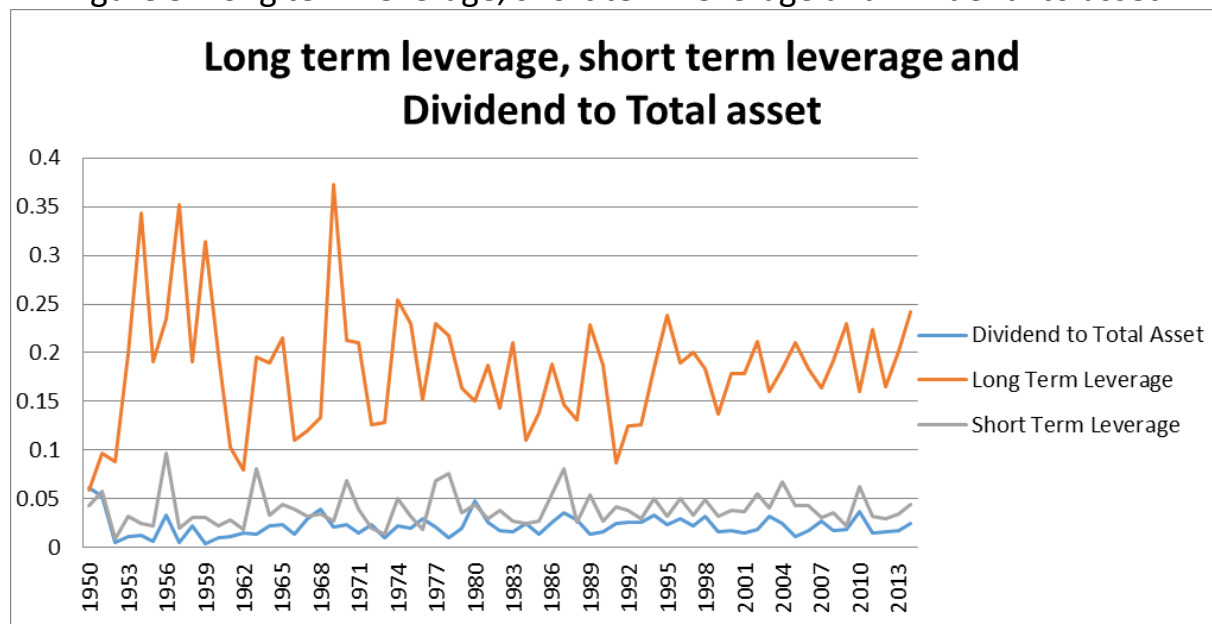


Figure 5. Long term leverage, short term leverage and dividend to asset. The data are collected from CRSP Compustat database. The sample includes unregulated S&P 500 component firms, with financials, utilities, railroads and telecommunications excluded; the time period is from 1950 to 2014, and the data are collected on annual basis. Figure 5 presents the moving trends for long term leverage, short term leverage and dividend to asset ratio from top to bottom. The definitions and explanations of variables are summarized in Appendix 1.

As is shown in Figure 5, firm dividend to asset ratio and short term leverage ratio fluctuate in the same pattern, especially clear before 1965 and after 1980s. Figure 5 also shows that firm dividend fluctuation is closer to short term leverage ratio than long term leverage ratio. These might indicate that firms tend to issue short term debt to accommodate dividend targeting. Therefore, it is likely that firm dividend policy would affect leverage decisions through affecting short term debt issuance. This is consistent with DeAngelo and Roll

(2015)'s prediction that firm dividend policy is more important than leverage policy.

In summary, these figures show evidence supporting the general hypothesis that firm leverage policy is not a residual, even though it is affected by firm profitability, investment policy, dividend policy, and equity issuance policy. Figures show that firms tend to raise debt capital to accommodate dividend payment and investment requirement, and relax debt when ROA is high. Moreover, equity financing is not the last resort after debt financing, as it is highly based on stock price volatility; and it is not a method to balance leverage ratio, because net equity issuance exceeds net debt issuance. Additionally, figure 1 and figure 2 also show evidence that equity issuance would affect the leverage ratio in the short run. During the whole period, firm total leverage ratio tends to fluctuate around the mean (0.223). This suggest that firms tend to reverse to the stable leverage level, after a deviation caused by the other financial policies.

Figures also show evidence supporting or not supporting trade off theory, pecking order theory and market timing theory. For trade off theory, figure shows that firms tend to reverse back to a stable debt level, whereas equity financing is not to rebalance the leverage ratio. For pecking order theory, we note that firms are relying more on retained earnings, less on equity financing, and maintain leverage on a stable level; and firms would turn to debt financing once retained earnings are not sufficient for capital requirement. However, equity financing relies more on the market condition and stock price volatility, rather than only working as the last resort after debt financing. Last but not least, the trends for retained earnings and firm investment are not fully consistent, which is not in line with pecking order theory that takes retained

earnings as the first-order financing source. For market timing theory, figures reveal that firms are timing the market, and equity policy would result in capital structure fluctuation. However, the firm leverage ratio tends to move back to the target level in a few years, and equity issuance or repurchase behaviours would not affect the leverage ratio in the long run. Therefore, it could be concluded that firm leverage policy follows trade off theory, pecking order theory and market timing to some extent, but none of those theories could explain firm leverage variations independently.

#### 4. Models and estimating methods

This section develops econometric models to test the general hypothesis. In order to answer the question on whether firm leverage policy is a residual of the other financial policies, this paper firstly measures how firm leverage policy is affected by the other financial policies, and secondly tests whether firm leverage ratio tend to revert to a target level.

##### 4.1 Dynamic panel data models

This section firstly develops two dynamic panel data (DPD) models to estimate how firm leverage policy is affected by the other financial policies. Secondly, section 4.1.2 discusses those variables selected or unselected in DPD models. Thirdly, section 4.1.3 discusses the endogeneity problem and how those two models control endogeneity with two-step system GMM estimation (Blundell and Bond, 1998).

##### 4.1.1 Models and hypotheses

We have two general hypotheses on how firm leverage policy is affected by the other financial policies. First, firm leverage level is influenced by the financial ratios of the other financial policies. This is consistent with most



previous papers, which model firm leverage as a function of the other firm level characteristics. Second, firm annual debt issuance is affected by changes in the other financial ratios. This paper develops DPD models (following Antoniou, et al., 2008, and Wintoki, et al., 2012) to estimate those two hypotheses. This paper aims to explain leverage policy on both leverage ratio level and annual debt issuance level, and it makes no sense to argue that either of those two models is superior to the other.

#### A. Dynamic Panel Data model one

$$\text{Total leverage}_{i,t} = \alpha_0 + \beta_0 * \text{Total leverage}_{i,t-1} + \beta_1 * \text{ROA}_{i,t} + \beta_2 * \text{Investment to asset}_{i,t} + \beta_3 * \text{Dividend to asset}_{i,t} + \beta_4 * \text{Equity issuance ratio}_{i,t} + u_i + \varepsilon_{i,t}, \quad (1)$$

The dependent variable is total leverage, measured by the proportion of total debt to the book value of total assets (following Graham et al., 2014). *Total leverage*<sub>*i,t*</sub> stands for the total leverage ratio for firm *i* in year *t*. The independent variables are *ROA*, *Investment to asset ratio*, *Dividend to asset ratio*, *Equity issuance ratio*, and one-year lagged *total leverage ratio*. We use *Equity issuance ratio* rather than the proportion of common equity to asset in order to control the endogeneity problem, because debt and equity are both proportions of total assets, and the increase of non-debt liabilities will definitely reduce the proportions of debt and equity. Following Antoniou et al. (2008) and Wintoki et al. (2013), this paper uses the one-year lagged dependent variable *Total leverage*<sub>*i,t-1*</sub> to represent the influence of dynamic effect, and we will check the autocorrelation for AR(1) and AR(2). We use *u<sub>i</sub>* to represent firm fixed effects. *ε<sub>i,t</sub>* is mean zero, but contains heteroscedasticity and possible autocorrelation. *α<sub>0</sub>* is a constant, and those coefficients are estimated with two-step system Generalized Method of Moments (Two-step GMM). The hypotheses are listed as follows:

The null hypothesis ( $H_N: \beta_0 = 0$ ) is that firm leverage ratio is not influenced by the other financial policies.

The alternative hypothesis for *Total leverage*  $_{i,t-1}$  ( $H_{A0}: \beta_0 > 0$ ) is that firms with higher leverage ratio in year  $t-1$  tend to rely more on debt financing in year  $t$ , because firms tend to maintain their value and financial strategy.

The alternative hypothesis for *ROA*  $_{i,t}$  ( $H_{A1}: \beta_1 < 0$ ) is that more profitable firms tend to rely less on debt financing, due to a lower demand for external capital.

The alternative hypothesis for *Investment to asset*  $_{i,t}$  ( $H_{A2}: \beta_2 > 0$ ) is that firms with higher investment level tend to rely more on debt financing, due to a higher demand for capital.

The alternative hypothesis for *Dividend to asset*  $_{i,t}$  ( $H_{A3}: \beta_3 > 0$ ) is that firms with higher dividend payment need more debt financing, due to a higher demand for external capital.

The alternative hypothesis for *Equity issuance ratio*  $_{i,t}$  ( $H_{A4}: \beta_4 < 0$ ) is that firms with higher equity issuance speed tend to rely less on debt financing, due to a lower demand for extra capital.

#### B. Dynamic Panel Data model two

$$\begin{aligned} \text{Debt issuance ratio }_{i,t} = & \alpha_0 + \beta_0 * \text{Debt issuance ratio}_{i,t-1} + \beta_1 * \Delta \text{ROA }_{i,t} + \beta_2 * \Delta \\ & \text{Investment to asset }_{i,t} + \beta_3 * \Delta \text{Dividend to asset }_{i,t} + \beta_4 * \text{equity issuance ratio }_{i,t} + \\ & u_i + \varepsilon_{i,t}, \end{aligned} \quad (2)$$

The dependent variable is *Debt issuance ratio*  $_{i,t}$ , measured by  $(\text{Total debt }_{i,t} - \text{Total Debt }_{i,t-1}) / \text{Total Asset }_{i,t-1}$  (following Graham et al., 2014). *Debt issuance ratio*  $_{i,t}$  stands for the proportion of net debt issuance  $_{i,t}$  to total asset  $_{i,t-1}$  for firm  $i$  in year  $t$ . The independent variables are *ROA change*, *Investment to asset ratio change*, *Dividend to asset ratio change*, *Equity issuance ratio*, and one-

year lagged *Debt issuance ratio*.  $d ROA_{i,t}$  is measured by  $ROA_{i,t} - ROA_{i,t-1}$ , and it is the same for  $d Investment\ to\ asset$  and  $d Dividend\ to\ asset$ . This model also use one-year lagged dependent variable *Debt issuance ratio*  $_{i,t-1}$  to represent the influence of dynamic effect, and we will check the autocorrelation for AR(1) and AR(2). This model also uses  $u_i$  to represent firm fixed effects.  $\varepsilon_{i,t}$  is mean zero, but contains heteroscedasticity and possible autocorrelation.  $\alpha_0$  is a constant, and those coefficients are estimated with Two-step GMM. The hypotheses are listed as follows:

The null hypothesis ( $H_N: \beta_0 = 0$ ) is that firm net debt issuance is not influenced by changes in the other financial policies.

The alternative hypothesis for *Debt issuance ratio*  $_{i,t-1}$  ( $H_{A0}: \beta_0 > 0$ ) is that firms with higher debt issuance in year  $t-1$  tend to issue more debt in year  $t$ , because firms tend to maintain their value and financial strategy.

The alternative hypothesis for *ROA change* ( $H_{A1}: \beta_1 < 0$ ) is that firms with an increase in profitability tend to issue less debt, due to a lower demand for external capital.

The alternative hypothesis for investment change ( $H_{A2}: \beta_2 > 0$ ) is that firms with higher new investment tend to issue more debt, due to a higher demand for capital.

The alternative hypothesis for dividend change ( $H_{A3}: \beta_3 > 0$ ) is that firms with higher dividend payment change will issue more debt, due to a higher demand for external capital.

The alternative hypothesis for *equity issuance ratio*  $_{i,t}$  ( $H_{A4}: \beta_4 < 0$ ) is that firms with higher equity issuance tend to issue less debt, due to a lower demand for extra capital.

Two-step GMM estimation is based on two assumptions (Wintoki, et al., 2012). First, the unobservable heterogeneity is firm fixed, because time-variant effect is not controlled and it might cause mis-specification. Hoque and Kashefi Pour (2016) suggest that year fixed effects does not contribute much to explain the variation in book leverage ratio. Therefore, this paper use book leverage ratio to measure firm capital structure, and employs a long time period (still under the condition  $T < N$ ); and it is reasonable to state that this model does not violate the first assumption. Secondly, instrumental variables are assumed to be exogenous. This paper follows literature (such as Blundell and Bond, 1998, Antoniou et al., 2008, and Wintoki, et al., 2012), and uses one-year lagged explanatory variables as instrumental variables, assuming they are not correlated with the error term.

#### 4.1.2 Variables selection

Models developed in this paper are different from those in literature, because we use a new list of variables. Unlike most previous studies pooling deterministic variables in one model, the regression models in this paper are based on the capital flow within the firm. Fama and French (2012) put forward the cash flow constrained model, linking capital inflow and outflow within the firm. According to Fama and French (2012), firms generate cash flow by issuing debt or equity and making profit. During the operation process, generated cash flow is transferred into firm investment and distributed dividend. Therefore, this paper follows Fama and French (2012)'s cash flow constrained model by taking firm equity policy, profitability, investment policy and dividend policy into consideration. This also covers Lambrecht and Myers (2012)'s suggest that firm dividend policy, leverage policy and investment policy need to be modelled together.

Except for those financial policies considered in DPD models, firms' retained earnings and cash holdings are also characteristics affecting firm capital flow; however, employing retained earnings and cash holdings in a capital structure model would lead to a multi-collinearity problem. Firstly, according to pecking order theory (Myers, 1984; Fama and French, 2002), firm retained earnings are the residual of net profit and dividend payment, and firms would raise extra debt, especially short term debt as is shown in Figure 5, once retained earnings are not sufficient for capital requirements. Therefore, it could be summarized that firm dividend policy would affect leverage decisions through deciding retained earnings. That is the reason for the multicollinearity problem by taking retained earnings into capital structure model. Secondly, Riddick and Whited (2009) suggest that firm cash holdings are more heavily influenced by investment policy and profit fluctuation, than external financing behaviours. This indicates that firm cash holding is more likely the residual among all those financial policies, than leverage policy. Therefore, this paper does not employ retained earnings and firm cash holdings in DPD models for capital structure. Additionally, it might be fruitful to check whether firm cash holdings are more likely the residual than leverage policy.

We use book leverage ratio as the dependent variable, rather than market leverage ratio, because firms tend to make financial decisions based on the book value of asset (Graham et al., 2014), and we need to control the influence of year-fixed effects for market leverage ratio. Market leverage ratio uses the market value rather than book value of total equity, which absorbs stock price volatility. Therefore, year-fixed effects would explain a large fraction of variation in market leverage ratio, and this is empirically tested in Hoque and Kashefi Pour (2016). This paper uses two-step GMM estimation, based on the assumption that unobservable heterogeneity is firm fixed. A time-variant error

term would lead to a biased estimator. Additionally, similar to Graham et al. (2014), this paper is also restricted by the stock price data availability. Using market leverage ratio as the dependent variable would sharply reduce the number of observations.

There is a list of variables which are concluded as the determinants of firm capital structure, such as Total assets (Flannery, et al., 2006), Tax rate (Booth et al., 2001), and M/B (Antoniou, et al., 2008). However, these ratios are not employed in DPD models. Variables such as Total Asset, Tax rate, and M/B are likely correlated with variables in DPD models. For example, tax payment is determined by laws and regulations, but the amount of tax paid is highly correlated with firm profitability. M/B ratio is highly correlated with equity issuance, according to market timing theory. Total asset is also correlated with firm investment level. As this paper is not focusing on the long run determinants of firm capital structure, country level characteristics and industry level characteristics are not taken into consideration, either. Therefore, those variables are not considered in DPD models, and this paper mainly focuses on explaining the influential roles of the other financial policies, typically investment policy, dividend policy, and equity issuance policy.

#### 4.1.3 Endogeneity and control

Wintoki et al. (2012) highlight the existence of endogeneity among corporate finance studies, due to the struggle in finding exogenous variables. Antoniou et al. (2008) and Wintoki et al. (2012) summarize four sources of endogeneity, which result from the omission of dynamic effect, unobservable heterogeneity, simultaneity and heteroscedasticity. Antoniou et al. (2008) suggest that two-step GMM dynamic panel data model is so far the most decent method for capital structure study. Wintoki et al. (2012) also employ two-step GMM

dynamic model in firm board structure study. As is stated in Antoniou et al. (2008) and Wintoki et al. (2012), two-step GMM estimation is superior to OLS estimation in controlling endogeneity problems caused by serial-correlation, heterogeneity, simultaneity and heteroscedasticity. Therefore, this section discusses those problems and shows how endogeneity is controlled in DPD models.

#### A. Dynamic effect

Wintoki et al. (2012) suggest that the omission of dynamic effects would cause serial correlation and endogeneity. There is possible serial correlation that firm leverage policy is influenced by the other financial policies of previous years. Titman and Tsyplakov (2007) develop the dynamic leverage model, using previous leverage policy to account for the dynamic effect, and to represent the influence of previous financial policy. The result suggests that current leverage ratio is positively influenced by the previous leverage ratio, and firms are continuously following a target leverage ratio. This indicates that firms tend to keep the original leverage attitude and leverage policy over years, due to consistent firm culture and stable management structure. This is consistent with Lemmon et al. (2008) and Graham and Leary (2011) who state that firms tend to maintain firm fixed effects in debt ratios (cited in DeAnglo and Roll, 2015).

As the aim of this paper is to investigate the influence of the other financial policies on firm leverage policy, we cannot ignore that financial policies of previous years are likely to influence current leverage policy. Using one-year lagged leverage ratio helps in controlling serial correlation. Additionally, previous leverage policy could also be interpreted as an accumulated result of previous financial policies and influences from cross-country level, cross-

industry level and cross-firm level. Therefore, the inclusion of lagged leverage policy tends to substantially increase  $R^2$  (as is shown in Antoniou et al., 2008), which indicates that the model has more explanatory power. In line with most previous papers (such as Fama and French, 2002, Flannery and Rangan, 2006, Titman and Tsyplakov, 2007, and Antoniou et al. 2008), this paper uses one-year lagged dependent variable to represent the dynamic effect. Whether there is higher level serial correlation will be tested.

Antoniou et al. (2008) suggest that two-step GMM estimation could generate consistent estimators on the condition that there is only first-order autocorrelation. Therefore, following Antoniou et al. (2008) and Wintoki et al. (2012), this paper tests the significance level of AR(1) and AR(2), in order to eliminate possible endogeneity caused by higher level serial-correlation. For auto-regression test, the null hypothesis ( $H_0$ ) is that there is no serial correlation; and the alternative hypothesis ( $H_1$ ) is that there is serial correlation at the specific level.

#### B. Unobservable heterogeneity

Wintoki et al. (2012) subdivide unobservable heterogeneity into firm-fixed effects (time-invariant) and time-variant effects. Firm-fixed effects are caused due to different characteristics of firms, and this could be controlled when firms are treated individually. Graham and Leary (2011) highlight the importance of cross-sectional variation. This paper only uses data collected from the CRSP database, and there is cross-country level variation. This paper controls cross-firm variation by conducting panel data analysis and using  $u_i$  to represent firm fixed effects.

One important assumption in Wintoki et al. (2012) is that unobservable heterogeneity is firm fixed. Two-step GMM estimation controls unobservable



heterogeneity by taking first differences of variables, and estimating the first-differenced model. In this situation, time-invariant effects could be eliminated from model, and it would not cause endogeneity problem; however, time-variant effect is not controlled. Hoque and Kashefi Pour (2016) suggest that time-fixed effects do not contribute much in explaining the variation in book leverage. Hence, this paper uses book value of total assets, rather than market value, to measure firm leverage ratio. Additionally, this paper employs a long time period to minimize the time variant effects. Therefore, it is reasonable to accept the assumption that unobservable heterogeneity is firm fixed, it could be eliminated from the model, and it would not cause an endogeneity problem.

### C. Simultaneity

Simultaneity is also known as reverse causality. Firm profitability is known to be one of the determinants of capital structure (Titman and Wessel, 1988); and at the same time, firm capital structure decisions also affect profitability (DeAngelo and Masulis, 1980). If not controlled, reverse causality would lead to a biased estimator (Wintoki, et al., 2012).

In DPD models, simultaneity could be controlled by using lagged explanatory variables as instrumental variables (Wintoki, et al., 2012), based on the assumption that firm current leverage policy does not affect financial policies in previous years. This paper use one-year lagged explanatory variables as the instrumental variables, which is consistent with Antoniou et al. (2008) and Wintoki et al. (2012). Following Antoniou et al. (2008), this paper uses the Sargan test to check if those instrumental variables used in DPD models would cause the over-identification problem. For the Sargan test, the null hypothesis

( $H_0$ ) is that the over-identifying restrictions are valid, whereas the alternative hypothesis ( $H_1$ ) is that there is an over-identification problem.

#### D. Heteroscedasticity

Heteroscedasticity happens when a long time period is employed in empirical study, and the variance of error term would change over time (Antoniou et al., 2008). This violates the Gauss-Markov assumption of consistent variance, and would cause endogeneity problem.

Antoniou et al. (2008) suggest that the two-step GMM method is better than the one-step GMM method, especially when heteroscedasticity exists. In DPD models, we take the first difference, and use instrumental variables to eliminate heteroscedasticity, based on the assumption that those instruments are exogenous, and the instrumental variable for  $d \text{ Total leverage}_{i, t-1}$  is not correlated with  $d \varepsilon_{i,t}$  (Antoniou et al., 2008) in the first-differenced model.

In summary, the two-step GMM used in DPD models could help addressing serial correlation, unobservable heterogeneity, simultaneity and heteroscedasticity problems; and this paper controls the endogeneity problem by using two-step GMM, based on the assumptions that unobservable heterogeneity is firm fixed, and that instrumental variables are strictly exogenous.

### 4.2 Mean reversion and adjustment speed

This section firstly develops a mean reversion model to estimate whether firm capital structure tends to reverse after deviation, and secondly develop partial adjustment models to estimate the speed of adjustment.

#### 4.2.1 Mean reversion

Fama and French (2002) test the mean-reverting effect of firm leverage ratio. The change in firm capital structure is used as the dependent variable, and total leverage ratio in year  $t-1$  is used as one of the independent variables. Changes in firm level characteristics and firm characteristics in year  $t-1$  are used as control variables. Following Fama and French (2002), this paper firstly develops mean reversion model, aiming to test the mean-reverting effect in firm capital structure fluctuations.

$$\begin{aligned} \text{Leverage change}_{i,t} = & \alpha_0 + \beta_0 * \text{Total leverage}_{i,t-1} + \beta_1 * d \text{ROA}_{i,t} + \beta_2 * d \text{Investment} \\ & \text{to asset}_{i,t} + \beta_3 * d \text{Dividend to asset}_{i,t} + \beta_4 * d \text{equity issuance}_{i,t} + \beta_5 * \text{ROA}_{i,t-1} + \\ & \beta_6 * \text{Investment to asset}_{i,t-1} + \beta_7 * \text{Dividend to asset}_{i,t-1} + \beta_8 * \text{equity issuance}_{i,t-1} + \\ & u_i + \varepsilon_{i,t}, \end{aligned} \quad (3)$$

The definition of leverage change is consistent with Fama and French (2002)'s equation (7), and we use the difference between leverage ratio at year  $t$  and year  $t-1$  to measure leverage change ( $\text{Total leverage}_{i,t} - \text{Total leverage}_{i,t-1}$ ). In alternative specification, we use debt issuance as the dependent variable. For independent variables,  $\text{Total leverage}_{i,t-1}$  is employed to measure how firm leverage change reacts to previous leverage ratio. We use changes in the other financial policies as the control variables, because they are likely factors affecting firm annual leverage change.  $d \text{ROA}_{i,t}$ ,  $d \text{Investment to asset}_{i,t}$ ,  $d \text{Dividend to asset}_{i,t}$ ,  $d \text{equity issuance}_{i,t}$  are employed to estimate the leverage deviation caused by changes in the other firm financial policies. In order to control unobservable heterogeneity, we use  $u_i$  to account for firm fixed effects.  $\varepsilon_{i,t}$  is mean zero but contains heteroscedasticity. Equation (3) is estimated with fixed effects linear regression, with robust standard error term.

The null hypothesis ( $H_0$ ) is that firm leverage changes in year  $t$  is not affected by previous leverage ratio, which indicates that firm leverage change is irrelevant with previous leverage ratio.

The alternative hypothesis ( $H_{1a}: \beta_0 < 0$ ) is that firm leverage changes are negatively affected by previous year leverage ratio, which indicates the existence of mean reversion.

The alternative hypothesis ( $H_{1b}: \beta_0 > 0$ ) is that firm leverage changes are positively affected by previous year leverage ratio, which indicates the existence of mean deviation.

#### 4.2.2 Partial adjustment model and SOA

As the general hypothesis suggests, firms tend to adjust leverage ratio to a target level, this section develops partial adjustment models, to estimate the speed of adjustment (SOA) for firm leverage targeting, following Flannery and Rangan (2006), Antoniou et al. (2008), and DeAngelo and Roll (2015).

$$\text{Leverage}_{i,t} - \text{Leverage}_{i,t-1} = \lambda (\text{Leverage}_{i,t}^* - \text{Leverage}_{i,t-1}) + u_i + \varepsilon_{i,t}, \quad (4)$$

$$\text{Leverage}_{i,t} = \lambda * \text{Leverage}_{i,t}^* + (1 - \lambda) \text{Leverage}_{i,t-1} + u_i + \varepsilon_{i,t}, \quad (5)$$

Partial adjustment model is commonly used to measure the SOA to the target ratio (Graham and Leary, 2011).  $\text{Leverage}_{i,t}^*$  is the target leverage ratio at time  $t$  for firm  $i$ , and  $\lambda$  represents leverage adjustment speed.  $u_i$  stands for firm fixed effects.  $\varepsilon_{i,t}$  is the error term with mean zero, but containing heteroscedasticity. According to equation (4), the intuition behind partial adjustment model is that firm leverage change absorbs parts of leverage deviation from target, and the area  $\lambda$  falls in has following meanings:

$\lambda \in (1, +\infty)$  indicates more adjustment than back to the target,

$\lambda = 1$  indicates immediate adjustment and low adjustment cost,

$\lambda \in (0,1)$  indicates the SOA at  $\lambda$ , and a higher  $\lambda$  indicates a higher SOA,

$\lambda = 0$  indicates no adjustment,

$\lambda \in (-\infty, 0)$  indicates a deviation.

DeAngelo and Roll (2015) estimates SOAs and simulates the results of Time-Varying Target (TVT) model, and stationary target, concluding that TVT model fits best but both stationary target model and TVT model perform well. Therefore, this paper develops both stationary target model and TVT model, based on assumptions for *Leverage*  $_{i,t}^*$ .

#### A. Stationary target model

Stationary target model is based on the assumption that firms are targeting a stationary leverage target. In this situation, we treat firm leverage target *Leverage*  $_{i,t}^*$  as a constant and develop the econometric model:

$$\text{Total leverage}_{i,t} = \alpha_0 + \beta_0 \text{Total leverage}_{i,t-1} + u_i + \varepsilon_{i,t}, \quad (6)$$

In this model, firm total leverage at year  $t$  is used as the dependent variable and total leverage at year  $t-1$  is used as the independent variable.  $\alpha_0 = \lambda * \text{Leverage}_{i,t}^*$ , and  $\lambda = 1 - \beta_0$ .  $u_i$  represent firm fixed effects,  $\varepsilon_{i,t}$  is mean zero but containing heteroscedasticity. Equation (6) is estimated with fixed effects linear regression,  $\varepsilon_{i,t}$  is robust standard error term.

#### B. Time-Varying Target (TVT) model

TVT model is based on the assumption that firms are targeting a time-varying leverage target. In this situation, firm leverage is treated as a function of the other firm level characteristics (Shyam-Sunder and Myers, 1999, and Antoniou et al., 2008), rather than a constant. Therefore, this paper follows Shyam-

Sunder and Myers (1999) and Antoniou et al. (2008), and formulate  $Leverage_{i,t}^*$  with firm level characteristics at year  $t$ .

$$Leverage_{i,t}^* = \alpha_0 + \beta_1 * ROA_{i,t} + \beta_2 * Investment\ to\ asset_{i,t} + \beta_3 * Dividend\ to\ asset_{i,t} + \beta_4 * equity\ issuance_{i,t} + v_{i,t}, v_{i,t} \sim i.i.d. N(0, \sigma_v^2) \quad (7)$$

where  $v_{i,t}$  is assumed a random error term with mean zero and constant variance. By substituting equation (7) into equation (5), we developed the econometrics model (8), which is similar with equation (1), where we estimate how firm leverage policy is influenced by the other financial policies and previous leverage policy.

$$Total\ leverage_{i,t} = \lambda \alpha_0 + \beta_0 * Total\ leverage_{i,t-1} + \lambda \beta_1 * ROA_{i,t} + \lambda \beta_2 * Investment\ to\ asset_{i,t} + \lambda \beta_3 * Dividend\ to\ asset_{i,t} + \lambda \beta_4 * Equity\ issuance\ ratio_{i,t} + \lambda v_{i,t} + u_i + \varepsilon_{i,t}, v_{i,t} \sim i.i.d. N(0, \sigma_v^2) \quad (8)$$

where error term  $\varepsilon_{i,t}$  is mean zero but contains heteroscedasticity. Adjustment speed  $\lambda = 1 - \beta_0$ . The similarity between Equation (8) and Equation (1) indicates the implication to take one-year lagged leverage ratio into capital structure studies, and the coefficient ( $\beta_0$ ) for  $Total\ leverage_{i,t-1}$ , indicates leverage adjustment speed. Therefore, we use two-step GMM to estimate equation (8).

As target adjustment speed requires the situation when  $0 < \beta_0 < 1$ , we run two tests based on equation (6) and equation (8). For  $\beta_0$  in equation (6) and equation (8), the null hypothesis ( $H_{N1}$ ) is  $\beta_0 = 0$ , which indicates full adjustment, and leverage ratio is 'very sticky'. The alternative hypothesis ( $H_{A1}$ ) is  $\beta_0 > 0$ , which indicates an adjustment to leverage target. Additionally, based on the coefficients  $\beta_0$  estimated in partial adjustment models (6) and (8), we use T-test to estimate how  $\beta_0$  is significantly less than 1. The null hypothesis ( $H_{N1}$ ) is

$\beta_0 = 1$ , which indicates no adjustment. The alternative hypothesis ( $H_{A1}$ ) is  $\beta_0 < 1$ , which indicates an adjustment to leverage target.

### C. Dividend target

This paper estimates the SOA for dividend targeting behaviour with Lintner's model. Lintner (1956) and Myers (1984) suggest that firms are following a long run dividend target. Fama and French (2002) add that firm dividend policy would not vary due to investment variation. Therefore, this paper uses ROA as the only control variable. For the dependent variable, this paper uses both dividend to net income ratio (following Leary and Michaely, 2011) and dividend to asset ratio (following Fama and French, 2002) to measure dividend payout.

$$\text{Dividend payout}_{i,t} = \alpha_0 + \beta_0 * \text{Dividend payout}_{i,t-1} + \beta_1 * \text{ROA}_{i,t} + u_i + \varepsilon_{i,t} \quad (9)$$

In the dividend target model (9), firm dividend payout ratio (dividend to net income or dividend to asset) at year  $t$  is used as the dependent variable and dividend payout ratio at year  $t-1$  is used as the independent variable.  $\alpha_0 = \lambda * \text{Dividend}_{i,t}^*$ , and  $\lambda = 1 - \beta_0$ .  $u_i$  represent firm fixed effects,  $\varepsilon_{i,t}$  is mean zero but contains heteroscedasticity. Equation (6) is estimated with fixed effects linear regression, and  $\varepsilon_{i,t}$  is robust standard error.

### D. Cash flow residual

In order to check whether firm cash holdings are more likely the residual among financial policies than leverage policy, this paper tests whether firm cash to asset ratio is following an optimal target, using both stationary target model (10) and TVT model (11).

$$\text{Cash to asset}_{i,t} = \alpha_0 + \beta_0 \text{Cash to asset}_{i,t-1} + u_i + \varepsilon_{i,t} \quad (10)$$

$$\begin{aligned}
\text{Cash to asset}_{i,t} = & \lambda \alpha_0 + \beta_0 * \text{Cash to asset}_{i,t-1} + \lambda \beta_1 * \text{ROA}_{i,t} + \lambda \beta_2 * \text{Investment to} \\
& \text{asset}_{i,t} + \lambda \beta_3 * \text{Dividend to asset}_{i,t} + \lambda \beta_4 * \text{Equity issuance ratio}_{i,t} + \lambda \beta_5 * \text{Total} \\
& \text{leverage}_{i,t} + u_i + \lambda v_{i,t} + \varepsilon_{i,t}, v_{i,t} \sim i.i.d. N(0, \sigma_v^2)
\end{aligned} \tag{11}$$

where firm cash to asset ratio at year  $t$  is used as the dependent variable and cash to asset ratio at year  $t-1$  is used as the independent variable.  $\alpha_0 = \lambda * \text{Cash to asset}_{i,t}^*$ , and  $\lambda = 1 - \beta_0$ .  $u_i$  represent firm fixed effects,  $\varepsilon_{i,t}$  is mean zero but contains heteroscedasticity. Similar with estimating leverage target, we use fixed effects linear regression with robust standard error to estimate stationary target model (10), and use two-step system GMM to estimate TVT model (11).

In summary, this paper firstly develops two Dynamic Panel Data models, to estimate how firm leverage policy is affected by the other firm financial policies, as well as firm historical leverage policy. Secondly, this paper develops mean reversion model to test the mean-reverting effect in firm capital structure, and run partial adjustment models to estimate leverage SOA. Additionally, this paper use Lintner's model to estimate dividend SOA, and use both stationary target model and TVT model to check whether firm cash holdings are also following an optimal target.

## 5. Results and discussion

Regression results are consistent with the general hypothesis that firm leverage policy is not a residual of the other financial policies, even though leverage policy is significantly affected by the other financial policies. This section presents regression results and discussions. Section 5.1 discusses how firm leverage policy is affected by the other financial policies. Section 5.2 shows empirical evidence for leverage targeting. Section 5.3 shows evidence for dividend target and cash holdings residual. Section 5.4 discusses empirical



evidence supporting or not supporting trade off theory, pecking order theory and market timing theory.

### 5.1 How is leverage policy affected by the other financial policies?

Empirical evidence is consistent with the general hypothesis that firm leverage policy is influenced by the other financial policies. According to Table 2, firms with higher investment levels and higher dividend payments tend to use more debt financing; on the contrary, firms with higher profitability and higher equity issuance speed tend to relax debt financing. Results in Table 3 are in line with results in Table 2. On an annual basis, firms with more new investment and increasing dividend payment tend to issue more debt; and firms with more equity issuance and more profit increase tend to issue less debt. This is consistent with the financial deficit explanation (Shyam-Sunder and Myer, 1999) that firms with higher financial deficits tend to issue more debt, and vice versa. Firms raise capital by issuing debt or equity, and making a profit; and the generated capital is distributed to investment and dividend payment. Investment requirements and dividend payments would raise the demand for external debt, and equity issuance and higher net profit would reduce the reliance on debt financing. Therefore, we conclude that firms' leverage decisions are influenced by the other financial policies, and firms tend to sacrifice leverage targeting to accommodate financial deficit and capital requirements caused by the other financial policies. This also indicates that firm capital structure is not of first-order importance.

Besides the influence of the other financial policies, result also shows that firm current leverage decisions are affected by previous leverage decisions. Table 2 shows that firms with high leverage ratio in year  $t-1$  tend to maintain high leverage ratio in year  $t$ . Table 3 indicates that firms with higher debt issuance

in year  $t-1$  continue issuing more debt in year  $t$ . Evidences show that the inclusion of previous leverage policy could substantially increase the explanatory power in capital structure model. In table 2,  $R^2$  increases from 20.4% in column (1) to 78.2% in column (2); and increases from 20.9% to 34.3% in table 3. Both DPD models suggest that the leverage policy in year  $t-2$  does not affect leverage policy in year  $t$ , because we cannot reject AR(2) at 5% level. This is consistent with Antoniou et al. (2008), who suggest that two-step GMM estimation could generate consistent estimators on the condition that there is only first-order autocorrelation. The Sargan test p-value equalling 1 shows that we cannot reject the null hypothesis that over-identifying restrictions are valid, and this suggests that those instrumental variables used in this model would not cause over-identifying problem.

Comparing our results with Graham et al. (2014), the explanation for leverage policy with the other financial policies has lower power (78.2%, based on the  $R^2$  in OLS estimation in Table 2) than the explanation with country level variables (more than 94% in Graham et al., 2014). However, variables of the other financial policies could explain more variation in short run leverage variation ( $R^2$  equals to 34.3% in Table 3, higher than 19.8% in Graham et al., 2014). This might reveal the extraordinary roles of the other financial policies in explaining annual leverage decisions. Additionally, the differences between OLS estimation result (Column (2)) and two-step GMM estimation (Column (3)) result in Table 2 and Table 3 indicate the bias and inefficiency caused by the endogeneity problem we controlled in two-step GMM estimation.

## 5.2 Mean reversion and leverage targeting

This paper records the mean reversion effect in firm capital structure. Table 4 suggests that firms with higher leverage ratio in year  $t-1$  tend to reduce

leverage ratio or net debt issuance in year  $t$ . This indicates the existence of a leverage reversion, because firms tend to revert from a high leverage level or a low leverage level. However, the explanatory power of the mean-reversion model is not strong, and *Total leverage*  $_{t-1}$  could individually explain 6.9% of variation in *leverage change*, and explain nearly 0 in *debt issuance*. This is consistent with Fama and French (2002), who state that firm leverage targeting is not the first-order consideration, even though a soft leverage target is recorded. This might indicate that the majority of variation in firm capital structure is caused by the other factors such as variations in country level characteristics or in the other firm financial policies, rather than mean reversion or leverage targeting.

This paper estimates the SOAs for firm leverage target, with both stationary target model and time-varying target model, and the results are reported in Table 5. According to Table 5, firm leverage SOA is significantly higher than 0 and lower than 1. This is consistent with trade-off theory (Kraus and Litzenberg, 1973) and capital structure targeting theory (Hovakimian et al., 2001). The SOA for total leverage ratio is slow (0.243 for Stationary target model, and 0.284 for TVT model), which is consistent Kayhan and Titman (2007) and DeAngelo and Roll (2015). The fact that the SOA estimated in TVT model is faster than that in stationary target model indicates that firms are adjusting leverage target based on the other financial policies, and current leverage ratio would move slightly faster to the time-varying optimal level. The moderate adjustment speed is also consistent with the qualitative evidence (Graham and Harvey, 2001), which reports that 71% of sample firms have flexible or somewhat strict target leverage ratio, while rare of them have strict leverage target.

In summary, the partial adjustment model results are consistent with the mean reversion model results, which suggest that firm capital structure is mean reverting, and is moving back to a target level with a slow adjustment speed. The target level could be either stationary or time-varying, and the SOA in TVT model (0.284) is slightly higher than that in stationary target model (0.243). It takes approximately four years for firm leverage ratio to move back to the target level from a deviation, on average.

### 5.3 Dividend target and cash holdings residual

Empirical evidences show that firms are targeting a dividend to asset ratio faster than a leverage ratio, and firm cash holdings are more likely the residual than leverage policy.

Consistent with Lintner (1956), Fama and French (2002) and Lambrecht and Myers (2012), column (2) in Table 6 suggests that firms are closely targeting a dividend to asset ratio, and the dividend target speed (0.758) is higher than the leverage target speed (0.243 for stationary target or 0.284 for time-varying target) . In table 6, column (2) has a higher  $R^2$  (22%) than that of column (1) (0%). This indicates that the dividend to asset ratio has more explanatory power than the dividend to net income ratio. One of the explanations is that the dividend to net income ratio cannot control observation problems caused by the extreme values in net income. For example, losses or small value of net income would lead to an extreme value in *Dividend to net income* ratio (Fama and French, 2002). The result in column (2) suggests that firms are following a tight dividend target, and it seems that firms are giving higher priority to dividend target than leverage target. We cannot reject the null hypothesis of  $\beta_0 = 0$  in column (1). This indicates the SOA for dividend to net income ratio is 1, which could be interpreted as 'very sticky, and immediate adjustment'.

Therefore, it is reasonable to accept that firms would sacrifice leverage targeting to accommodate dividend targeting, because dividend targeting is given higher priority (higher SOA). This is also consistent with the hypothesis that firm leverage policy is affected by dividend policy.

Evidence indicates that firm cash holdings are more likely the residual among financial policies than leverage policy. Column (1) and column (2) in table 7 suggest that firms are not adjusting back to an optimal cash holdings ratio. A  $\beta_0$  less than 0 suggests that there is more reversion than towards a target level. Additionally, as is revealed in column (2), firm cash holdings ratio is positively affected by profitability, equity issuance and debt issuance, and negatively affected by firm investment and dividend payment. It seems firms tend to maintain cash holdings in a certain range, but there is no evidence for an optimal cash level. Therefore, firm cash holdings are more likely a residual among firm financial policies than leverage policy.

#### 5.4 Reflections on trade off theory, pecking order theory and market timing theory

Regression results contain evidence supporting or not supporting trade-off theory, pecking order theory and market timing theory. For trade-off theory, this paper records the existence of a leverage target, which might indicate an optimal leverage ratio. However, evidence shows that firms would adjust leverage policy according to the other financial policies, rather than closely following the optimal leverage ratio. Evidence shows that firm leverage policy is positively affected by investment requirements and dividend payments, which is in line with pecking order theory. However, the fact that firm equity policy also affects leverage policy rather than working as a last resort after debt financing violates pecking order theory. For market timing theory,

evidence is in line with the statement that firms are timing the market, and equity issuance and repurchase would affect the leverage ratio. However, the mean reversion and SOA indicate that firm leverage ratio would move back to a target level in approximately four years, rather than become an accumulated result of market timing behaviour. Evidence indicates that firm leverage policy can be explained by those theories to some extent, but none of those theories can explain the whole leverage variation independently.

In summary, empirical evidence is consistent with the general hypothesis that firm capital structure is not a residual of the other financial policies, even though firm leverage policy is significantly affected by the other financial policies. According to empirical evidence, firm investment policy, dividend policy, equity issuance policy and profitability would lead to variations in firm capital structure and annual debt issuance. However, firm leverage ratio would reverse to the target level in approximately four years. Moreover, evidence shows that firms' cash holdings are more likely the residual among financial policies than leverage policy, because firm cash holdings are significantly affected by the other financial policies, and there is no evidence that firms are targeting an optimal cash level. Additionally, the regression result is in line with the conclusion we draw from the figures. Firm leverage policy can be explained by trade off theory, pecking order theory and market timing theory to some extent, but none of those theories can explain the whole leverage variation independently.

## 6. Conclusion

This paper aims to answer DeAngelo and Roll (2015)'s question of whether firm capital structure is a residual of the other financial policies. Results in this paper show that firm capital structure is not a pure residual. Even though firm

leverage policy is significantly affected by the other financial policies, firm leverage ratio tends to revert to the target level over a longer period. Moreover, we find that firm cash holdings are more likely the residual among financial policies than leverage policy. Additionally, we find that firm leverage policy can be explained by trade off theory, pecking order theory and market timing theory to some extent, but none of those theories can explain the whole leverage variation independently.

This paper develops two dynamic panel data models, and evidences show that firm leverage policy is significantly affected by the other financial policies. Evidence shows that firms with higher investment requirement and dividend payments tend to employ more debt capital, but firms with higher profitability and equity issuance tend to relax debt financing. Additionally, firm previous leverage policy explains a large fraction of variance in current leverage policy. This paper uses two-step GMM estimation to control the endogeneity problem resulting from the omission of dynamic effects, unobservable heterogeneity, simultaneity, and heteroscedasticity.

This paper tests leverage mean-reversion, and estimates leverage adjustment speed with both the stationary target model and the time-varying target model. Results show that even though the other financial policies would cause variation in leverage ratio, firm leverage ratio tends to reverse to the target level in approximately four years, on average. This paper also provides a direct answer to Lambrecht and Myers (2012)'s question on how firms could accommodate several financial policies at the same time. According to results in this paper, firms tend to sacrifice leverage policy to accommodate the other financial policies with higher priority, such as investment policy and dividend policy, after which firm leverage ratio would revert from a deviation and move

back towards the target level. This paper records the fact that firms are targeting dividend payout ratio and leverage ratio at the same time. During this time, firms are sticky to dividend target, and move back to leverage target with a slower SOA. Additionally, results suggest that firm cash holdings are more likely the residual among financial policies. Evidence shows that firm cash holdings are significantly affected by the other financial policies, and there is no evidence for an optimal cash target.

Figures and regression results show evidences supporting or not supporting trade-off theory (Kraus and Litzenberg, 1973), pecking order theory (Myers, 1984), and market timing theory (Baker and Wurgler, 2002) at the same time. This paper records the existence of leverage target, which is consistent with trade off theory and leverage target theory (Hovakimian et al., 2001). However, the net issuance of equity exceeds the net issuance of debt, which does not help rebalancing leverage ratio. Evidence shows equity policy is highly dependent on firm market timing activities, rather than the method to balance leverage ratio. Additionally, the market timing and equity issuance further reduce leverage ratio rather than rebalancing leverage ratio. For pecking order theory, we record that firms rely more on retained earnings and less on equity financing, and maintain leverage on a stable level from 1950 to 2014. Additionally, firms tend to raise debt when retained earnings are not sufficient for capital demands. However, evidence shows that firm equity policy would affect leverage policy, rather than working as the last resort after retained earnings and debt financing. Moreover, the net issuance of equity often exceeds investment requirement. These facts violate pecking order theory. There is clear evidence that firms are timing the market by issuing equity when market leverage ratio is low (and stock price is high). However, firm leverage ratio tends to revert to the target level over years, rather than being an



accumulated result of firm market timing behaviours. These suggest that firm leverage policy can be explained by trade off theory, pecking order theory and market timing theory to some extent, but none of those theories can explain the whole leverage variation independently.

This paper contributes to literature in at least the following ways. Firstly, this paper shows that firm leverage policy is significantly affected by the other financial policies. Firms tend to accommodate financial policies with higher priority by sacrificing leverage policy, which answers Lambrecht and Myers (2012)'s questions on how firms accommodate several financial policies at the same time and how firm dividend target and leverage target could coexist.

Secondly, as an answer to DeAngelo and Roll (2015), this paper suggests that firm capital structure is not a pure residual, even though firm leverage policy is significantly affected by the other financial policies. This paper records leverage mean reversion and estimates SOA of firm leverage ratio, which shows that firm leverage ratio would revert to the target level in a longer period. Additionally, results suggest that firm cash holdings are more likely the residual among financial policies than firm leverage policy, due to lack of evidence for a clear optimal cash target.

Thirdly, this paper contributes to studies on determinants of capital structure by using the other financial policies as explanatory variables. This finding particularly helps explaining annual leverage variation that can hardly be explained by country level variables in Graham et al. (2014). This paper opens the door for modelling leverage policy with the other financial policies for future researches. Additionally, this paper extends the financial deficit explanation (Shyam-Sunder and Myers, 1999), by looking at the influences of individual firm financial policies.

Last but not least, this paper shows evidences supporting or not supporting trade-off theory, pecking order theory and market timing theory at the same time. This indicates that firm leverage policy can be explained by trade off theory, pecking order theory and market timing theory to some extent; but none of those theories can explain the whole leverage variation independently.

This paper is not focusing on country level variables that explain the long run variation in firm capital structure, as this has been largely covered by Graham et al. (2014). This paper mainly focuses on explaining firm level determinants, especially the deterministic roles of the other financial policies. The reason that firm financial policies vary in priority could be that either those financial policies are of different importance, or the adjustment costs are different. In this paper, we try to filter out financial policies that would influence firm leverage policy. However, the determinants of SOA and why firms give different priority is beyond the scope of this paper. Chang and Dasgupta (2009) suggest that it is still unclear whether firm level characteristics are influencing firm capital structure decisions directly, or through influencing capital flows within a firm. In this paper, we estimate the deterministic roles of the other financial policies on firm leverage policy. However, whether those firm level characteristics in literature are influencing capital structure because they are influencing any financial policy could be further discussed.

## 7. Further directions.

As this paper concludes that firm financial policy is affected by the other financial policies, it might be interesting to check the influence of expected financial policy changes on leverage decisions. For example, if firms anticipate a higher demand for capital in year  $t+1$ , because they are planning to invest more, or they are planning to distribute more dividend to shareholders, or they

have anticipated a lower net profit. Would firms start to adjust leverage ratio by issuing debt or equity in year  $t$ ?

One important assumption for partial adjustment model is that all those sample firms are following the same adjustment speed. However, it is very likely that firms tend to have individual target speed. Therefore, it might be fruitful to test the determinants of SOA, such as the difference between large firms and small firms, which might lead to the conclusion that smaller firms are focusing more on the cost of financing method, while larger firms are focusing more on targeting the optimal ratio. Additionally, are there other characteristics affecting SOA, at either firm level, industry level or country level? It is also interesting to check the cross firm variation for SOAs, for example, whether firms with higher leverage SOA tend to have a higher dividend SOA.

It is also helpful to check whether the model developed in this paper is also appropriate for small-size firms and medium-size firms, and what is the reason for difference. Medium firms and small firms tend to employ different financial policies from large firms, and they may have different preference on financing sources. It is also interesting to see, how these differences lead to a different accommodation among firm financial policies, as well as a different leverage adjustment speed.

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## Appendix 1. Definitions and sources of variables

Variables	Definitions	Sources and Reasons for inclusion
Total leverage ratio	Total debt / Total asset (book value)	To measure firm total leverage level (Graham et al., 2014)
Leverage change	$(\text{Total debt}_t / \text{Total Asset}_t) - (\text{Total debt}_{t-1} / \text{Total Asset}_{t-1})$	To measure firm annual leverage variation (Fama and French, 2002)
Long term leverage	Long Term Debt / Total asset	To measure firm long term leverage ratio, and it stands for the main part of firm total leverage ratio (Graham et al., 2014)
Short term leverage	Current debt / Total asset	To show firm short term leverage level (Fan et al. 2012)
Market leverage ratio	Total debt / Market value of total asset	To measure firm market leverage ratio (Flannery and Rangan, 2006)
Debt Issuance (repurchase)	$(\text{Total debt}_t - \text{Total debt}_{t-1}) / \text{Total Asset}_{t-1}$	To measure annual debt net issuance (or repurchase if <0), following Graham et al. (2014)
ROA	Net income / Total asset	To measure firm profitability (Fan et al., 2012)
Investment to asset	$(\text{Long Term Asset} + \text{Inventory}) / \text{Total Asset}$	To measure firm total investment level, as Graham et al. (2014) use the sum of new long term asset and new inventory to show annual investment.
Retained earnings ratio	Retained earnings / Total asset	To measure the proportion of retained earnings to total asset, as Myers (1984) suggest firms to raise capital firstly through retained earnings.
Dividend to asset ratio	Dividend payment / Total asset	To measure firm dividend policy, as Fama and French (2002) scale dividend with total asset rather than net income in case of observation problem
Dividend to net income ratio	Dividend payment / Net income	An alternative to measure dividend payout ratio in many papers, such as Leary and Michaely (2011)
Cash to asset	Cash/Total Asset	To measure the proportion of cash holdings to total asset held by firms (DeAngelo et al., 2011)
Common equity to asset	Common equity / Total Asset	To measure the proportion of common equity to total asset, used to compare with debt capital and retained earnings financing, as pecking order theory suggest firms using equity financing as the last choice. (Myers, 1984)
equity issuance (repurchase) ratio	$(\text{Common Equity}_t - \text{Common Equity}_{t-1}) / \text{Total asset}_{t-1}$	Being consistent with the measurement for debt issuance(Graham et al., 2015), we use the annual common equity increase (decrease) scaled by total asset in previous year to measure equity issuance (repurchase) speed

## Appendix 2. Summary statistics

Table 1. Summary of variables

<b>Variables</b>	<b>N</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev</b>	<b>p5</b>	<b>p95</b>
Total leverage	13685	0.223	0.202	0.172	0	0.513
Long term leverage	13685	0.183	0.159	0.158	0	0.451
Short term leverage	13685	0.040	0.020	0.063	0	0.152
Market leverage	5650	0.183	0.162	0.172	0	0.534
Leverage change	13180	0.044	0.004	0.230	-0.083	0.252
Debt issuance ratio	13180	0.044	0.004	0.230	-0.083	0.252
ROA	13685	0.065	0.071	0.120	-0.031	0.168
Investment / Asset	13685	0.705	0.723	0.196	0.328	0.943
Investment change	12663	0.133	0.062	0.708	-0.066	0.459
Dividend / Asset	13685	0.022	0.016	0.034	0	0.066
Dividend to net income	13647	0.308	0.240	1.827	0	0.798
Common Equity / Asset	12473	0.452	0.461	0.236	0.124	0.777
Equity issuance ratio	12057	0.120	0.051	0.923	-0.083	0.352
Cash / Asset	13685	0.010	0	0.065	-0.050	0.092
Retained earnings / Asset	13685	0.234	0.283	0.579	-0.148	0.672
Retained earnings change	11915	0.033	0.042	0.126	-0.088	0.139

Table 1 summarizes the statistics of firm financial policy variables. The data are collected from CRSP Compustat database. The sample includes unregulated S&P 500 component firms, with financials, utilities, railroads and telecommunications excluded; the available time period is from 1950 to 2014, and the data are collected on annual basis. The firm list was updated on 12/10/2015. The data include 378 unregulated firms. We report the number of observations, the mean, the median, standard deviation, and the value of variables at 5% and 95% level in case of extreme values. Asset stands for the book value of total asset. The definitions and explanations of variables are summarized in Appendix 1.



### Appendix 3. Regression results report

Table 2. Firm leverage ratio and the other financial policies

	(1)		(2)		(3)	
Estimating method	OLS		OLS		Two-step GMM	
Variables	Coefficient	T-Stat	Coefficient	T-Stat	Coefficient	Z-Stat
ROA	-0.31***	-25.8	-0.16***	-25.18	-0.163***	-564.27
Investment to asset	0.326***	46.32	0.063***	15.9	0.124***	239.75
Dividend to asset	0.231***	5.4	0.397***	17.68	0.521***	299.49
Equity Issuance ratio	-0.13***	-8.25	-0.009***	-10.82	-0.006***	-80.07
Leverage <sub>t-1</sub>			0.825***	178.69	0.716***	7456.11
Constant	0.016***	2.97	0	0.11	-0.021***	-40.31
AR(1) (p-value)						0
AR(2) (p-value)						0.069
Sargan (p-value)						1
Wald test (p-value)						0
Observation		12054		12052		12052
Adjusted R-sq		0.204		0.782		

Table 2 shows the regression result for equation (1).

$$\text{Total leverage}_{i,t} = \alpha_0 + \beta_0 * \text{Total leverage}_{i,t-1} + \beta_1 * \text{ROA}_{i,t} + \beta_2 * \text{Investment to asset}_{i,t} + \beta_3 * \text{Dividend to asset}_{i,t} + \beta_4 * \text{Equity issuance ratio}_{i,t} + u_i + \varepsilon_{i,t}$$

The dependent variable is Total leverage at year t, and the independent variables are Total leverage<sub>t-1</sub>, ROA, Investment to asset ratio, dividend to asset ratio, and equity issuance ratio. Wald test is to test the joint significance of those coefficients. All variables are defined and explained in Appendix one. Column (1) and column (2) are estimated in Ordinary Least Square, to be compared with Two-step GMM estimators in column (3). The coefficient and t value (or p value) are reported. \*\*\* indicates the coefficient is significant at 1% level; \*\* indicates the coefficient is significant at 5% level; \* indicates the coefficient is significant at 10% level. The difference between OLS estimation (2) and Two-step GMM estimation (3) indicates the bias caused by the controlled endogeneity.

Table 3. Firm debt issuance and changes in the other financial policies

	(1)		(2)		(3)	
Estimating method	OLS		OLS		Two-step GMM	
Variables	Coefficient	T-Stat	Coefficient	T-Stat	Coefficient	Z-Stat
d ROA	-0.148***	-10.01	-0.01	0.48	-0.06***	-43.08
d Investment to asset	0.188***	51.46	0.359***	72.59	0.429***	4923.79
d Dividend to asset	0.227***	4.62	0.173***	3.7	0.181***	285.44
Equity Increase ratio	-0.08***	-27.78	-0.268***	-56.17	-0.332***	-2381.07
debt issuance <sub>t-1</sub>			0.051	0.05	0.044***	1020.37
Constant	0.027***	14.67	0.02***	12.09	0.018***	225.63
AR(1) (p-value)						0
AR(2) (p-value)						0.991
Sargan (p-value)						1
Wald test (p-value)						0
Observation		11395		11134		11134
Adjusted R-sq		0.209		0.343		

Table 3 shows the regression result for equation (2).

$$\text{Debt issuance ratio}_{i,t} = \alpha_0 + \beta_0 * \text{Debt issuance ratio}_{i,t-1} + \beta_1 * d \text{ ROA}_{i,t} + \beta_2 * d \text{ Investment to asset}_{i,t} + \beta_3 * d \text{ Dividend to asset}_{i,t} + \beta_4 * \text{equity issuance ratio}_{i,t} + u_i + \varepsilon_{i,t}$$

The dependent variable is Debt issuance, and the independent variables are Debt issuance<sub>t-1</sub>, d ROA, d Investment to asset, d Dividend to asset ratio, and equity issuance. Wald test is to test the joint significance of those coefficients. All variables are defined and explained in Appendix one. Column (1) and column (2) are estimated in Ordinary Least Square, to be compared with Two-step GMM estimators in column (3). The coefficient and t value (or p value) are reported. \*\*\* indicates the coefficient is significant at 1% level; \*\* indicates the coefficient is significant at 5% level; \* indicates the coefficient is significant at 10% level. The difference between OLS estimation (2) and Two-step GMM estimation (3) indicates the bias caused by the controlled endogeneity.

Table 4. Mean reversion model result report

Dependent variable	L t- Lt-1				Debt issuance			
	(1)		(2)		(3)		(4)	
	FE		FE		FE		FE	
	coefficient	T-stat	coefficient	T-stat	coefficient	T-stat	coefficient	T-stat
Leverage <sub>t-1</sub>	-0.243	-17.03***	-0.25***	-14.97	-0.303	-7.65***	-0.19***	-4.64
d ROA			-0.16***	-3.68			-0.019	-0.36
d Investment			0.076***	4.55			0.355***	4.99
d Equity issuance			-0.074***	-3.89			-0.268***	-3.84
d Dividend			0.444***	4.18			0.158	1.18
ROA			-0.181***	-6.06			-0.051	-0.61
Investment			0.026**	2			-0.056	-1.04
Equity issuance			-0.079***	-4.15			-0.264***	-3.87
Dividend			0.432***	3.5			0.126	1.02
constant	0.056	17.71***	0.042***	4.22	0.111	12.65***	0.105**	2.29
Firm fixed effects		Yes		Yes		Yes		Yes
N		13310		11082		13180		11038
R-sq within		0.132		0.299		0.03		0.359
R-sq between		0.005		0		0.192		0.118
R-sq overall		0.069		0.232		0.002		0.335
Variance due to Fe		0.198		0.246		0.155		0.189

Table 4 shows the regression result for equation (3).

$$\text{Leverage change}_{i,t} = \alpha_0 + \beta_0 * \text{Total leverage}_{i,t-1} + \beta_1 * d \text{ ROA}_{i,t} + \beta_2 * d \text{ Investment to asset}_{i,t} + \beta_3 * d \text{ Dividend to asset}_{i,t} + \beta_4 * d \text{ equity issuance}_{i,t} + \beta_5 * \text{ROA}_{i,t-1} + \beta_6 * \text{Investment to asset}_{i,t-1} + \beta_7 * \text{Dividend to asset}_{i,t-1} + \beta_8 * \text{equity issuance}_{i,t-1} + u_i + \varepsilon_{i,t}$$

The dependent variable is leverage change, and we use debt issuance as the alternative. One-year lagged total leverage ratio is used as one of the independent variables. Column (2) and column (4) show the result with d ROA, d Investment to asset, d Equity issuance, d Dividend to asset and firm level characteristics in year *t-1* as control variables. All variables are defined and explained in Appendix one. Equation (3) is estimated in fixed effects linear regression, with robust standard error. \*\*\* indicates the coefficient is significant at 1% level; \*\* indicates the coefficient is significant at 5% level; \* indicates the coefficient is significant at 10% level.

Table 5. Partial adjustment model for leverage target

assumption	Stationary target		TVT	
Estimating method	FE, robust		Two-step GMM	
Variables	Coefficient	T-stat	Coefficient	Z-Stat
ROA			-0.163***	-564.27
Investment to asset			0.124***	239.75
Dividend to asset			0.520***	299.49
Equity Issuance ratio			-0.006***	-80.07
Leverage <sub>t-1</sub>	0.757***	52.96	0.716***	7456.11
$\lambda = 1 - \beta_0$	0.243		0.284	
Constant	0.056***	17.71	-0.021***	-40.31
Variance due to FE		0.198		
AR(1)				0
AR(2)				0.069
Sargan (p-value)				1
Wald test (p-value)				0
Observation		13310		12052
Adjusted R-sq		0.7649		

Table 5 shows the regression results for equation (6) and equation (8).

$$\text{Total leverage}_{i,t} = \alpha_0 + \beta_0 \text{Total leverage}_{i,t-1} + u_i + \varepsilon_{i,t} \quad (6)$$

$$\text{Total leverage}_{i,t} = \lambda \alpha_0 + \beta_0 * \text{Total leverage}_{i,t-1} + \lambda \beta_1 * \text{ROA}_{i,t} + \lambda \beta_2 * \text{Investment to asset}_{i,t} + \lambda \beta_3 * \text{Dividend to asset}_{i,t} + \lambda \beta_4 * \text{Equity issuance ratio}_{i,t} + \lambda v_{i,t} + u_i + \varepsilon_{i,t} \quad v_{i,t} \sim i.i.d. N(0, \sigma_v^2) \quad (8)$$

The dependent variable is total leverage, and one-year lagged dependent variable is used as one of the independent variables. ROA, Investment to asset ratio, Dividend to asset ratio, Equity issuance ratio are independent variables in TVT model. We use  $\lambda = 1 - \beta_0$  to report the speed of adjustment, if  $\lambda \in (0, 1)$ . All variables are defined and explained in Appendix one. \*\*\* indicates the coefficient is significant at 1% level; \*\* indicates the coefficient is significant at 5% level; \* indicates the coefficient is significant at 10% level. We also test the coefficients for Leverage<sub>t-1</sub>, and they are both significantly less than 1 at 1% level.

Table 6. Partial adjustment model for dividend target

	1		2	
Dependent variable	Dividend to income		Dividend to asset	
estimating method	FE		FE	
<b>Variables</b>	Coefficient	T-stat	Coefficient	T-stat
$Y_{t-1}$	-0.017	-1.43	0.242***	3.73
$\lambda = 1 - \beta_0$			0.758	
ROA	0.009	0.1	0.016***	2.7
Constant	0.312***	50.28	0.016***	11.03
Variance due to Fe		0.062		0.225
Observation		13168		13310
R-sq within		0		0.07
R-sq between		0.33		0.93
R-sq overall		0		0.22

Table 6 shows the regression results for Equation (9).

$$Dividend\ payout_{i,t} = \alpha_0 + \beta_0 Dividend\ payout_{i,t-1} + \beta_1 * ROA_{i,t} + u_i + \varepsilon_{i,t} \quad (9)$$

In table 6, column (1) and column (2) reports regression result for equation (9). Dividend to income ratio and dividend to asset ratio are used as the dependent variables respectively. One-year lagged dependent variable  $Y_{t-1}$  is used as the independent variable, and  $ROA$  is used as the control variable. We use  $\lambda = 1 - \beta_0$  to report the speed of adjustment, if  $\lambda \in (0, 1)$ . All variables are defined and explained in Appendix one. \*\*\* indicates the coefficient is significant at 1% level; \*\* indicates the coefficient is significant at 5% level; \* indicates the coefficient is significant at 10% level. We also test the coefficient for Dividend to asset ratio  $_{t-1}$ , and it is significantly less than 1 at 1% level.

Table 7. Partial adjustment model for cash holdings

	(1)		(2)	
Dependent variable	Cash to asset		Cash to asset	
assumption	Stationary target		TVT	
estimating method	FE, robust		Two-step GMM	
<b>Variables</b>	Coefficient	T-stat	Coefficient	Z-Stat
Cash to asset <sub>t-1</sub>	-0.151***	-4.78	-0.172***	-5178.13
Constant	0.011***	34.05	0.216***	2955.1
ROA			0.067***	764.67
Investment to asset			-0.317***	-3303.28
Dividend to asset			-0.086***	-146.11
Equity Issuance ratio			0.015***	2543.35
total leverage			0.072***	903.33
Variance due to Fe		0.208		
AR(1) (p-value)				0
AR(2) (p-value)				0.066
Sargan (p-value)				1
Wald test (p-value)				0
Observation		13310		12052
Adjusted R-sq		0.006		

Table 6 shows the regression results for cash flow target.

$$\text{Cash to asset}_{i,t} = \alpha_0 + \beta_0 \text{Cash to asset}_{i,t-1} + u_i + \varepsilon_{i,t} \quad (10)$$

$$\text{Cash to asset}_{i,t} = \lambda \alpha_0 + \beta_0 * \text{Cash to asset}_{i,t-1} + \lambda \beta_1 * \text{ROA}_{i,t} + \lambda \beta_2 * \text{Investment to asset}_{i,t} + \lambda \beta_3 * \text{Dividend to asset}_{i,t} + \lambda \beta_4 * \text{Equity issuance ratio}_{i,t} + \lambda \beta_5 * \text{Total leverage}_{i,t} + u_i + \lambda v_{i,t} + \varepsilon_{i,t} \quad v_{i,t} \sim i.i.d. N(0, \sigma_v^2) \quad (11)$$

In table 7, estimation (1) follows stationary target model (10), and estimation (2) follows TVT model (11). *Cash to asset* ratio is used as the dependent variable. One-year lagged cash to asset ratio is used as one of the independent variables. ROA, Investment to asset ratio, Dividend to asset ratio, Equity issuance ratio, and Total leverage are employed as independent variables. All variables are defined and explained in Appendix one. \*\*\* indicates the coefficient is significant at 1% level; \*\* indicates the coefficient is significant at 5% level; \* indicates the coefficient is significant at 10% level.

## Appendix 4. VIF test results for regressions

### Panel A.

Variables	VIF	1/VIF
ROA	1.03	0.975
Investment to asset	1.01	0.987
Dividend to asset	1.02	0.976
Equity Issuance	1.02	0.985
Mean VIF	1.02	

Panel A provides Variance Inflation Factor (VIF) test for variables used in Equation (1). The mean VIF of 1.02 suggests that there is no multicollinearity problem. We accept that there is no serious multicollinearity problem if VIF value is less than 10, or 1/VIF is higher than 0.1.

### B.

Variables	VIF	1/VIF
d ROA	1.00	0.997
d Investment to asset	2.29	0.437
d Dividend to asset	1.00	0.999
Equity issuance	2.29	0.436
Mean VIF	1.65	

Panel B provides Variance Inflation Factor (VIF) test for variables used in Equation (2). The VIF values of d Investment and Equity issuance shows slight multicollinearity, but it is still acceptable. The mean VIF of 1.65 suggests that there is no serious multicollinearity problem. We accept that there is no serious multicollinearity problem if VIF value is less than 10, or 1/VIF is higher than 0.1.

### C.

Variables	VIF	1/VIF
ROA	1.08	0.923
Investment to asset	1.19	0.838
Dividend to asset	1.03	0.973
Equity issuance	1.02	0.980
Total leverage	1.26	0.796
Mean VIF	1.12	

Panel C provides Variance Inflation Factor (VIF) test for control variables used in Equation (11). The mean VIF of 1.12 suggests that there is no multicollinearity problem. We accept that there is no serious multicollinearity problem if VIF value is less than 10, or 1/VIF is higher than 0.1.