Research Article

# Earnings Management Detection for Thai Saving Cooperatives

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## ABSTRACT

In the past decade, the collapses of the saving and credit union cooperatives have led the Ministry of Agriculture and Cooperative to closely monitor the remainder cooperatives' imbalance between deposits from and loans to their members. Our study then contributes to the monitoring tools for detecting Thai saving cooperatives' earnings management through their decision making on financial stability. Saving cooperatives may be motivated to manage cash on hand, deposits, investments and loans to conceal this imbalance. Owing to Thai saving cooperatives' unique operations and the limitations of the existing accruals model, we develop the new model for doing so. To test our model, we use data of 1,385 Thai saving cooperatives with 12,250 firm-year observations during the period 2011 to 2020. Data are collected from the Thailand Cooperative Auditing Department's website (www.cad.go.th). Our model is the cross-sectional OLS regression function of discretionary working capital accruals, change in cash on hand and at banks, change in cash at other cooperatives, change in investments, changes in loans, the natural logarithm of numbers of members and return on assets. The model's performance improves when estimating parameter of equation by industry and year specific. Our new accruals model may be beneficial to use as the tool for detecting ethical behaviors and fraud.

**Keywords:** Earnings Management, Discretionary Accruals Model, Cooperatives

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**บทคัดย่อ**

ในทศวรรษที่ผ่านมา การล้มละลายของสหกรณ์ออมทรัพย์และสหกรณ์เครดิตยูเนี่ยนบางแห่ง ส่งผลให้กระทรวงเกษตรและสหกรณ์เริ่มตรวจสอบความไม่สมดุลระหว่างเงินรับฝากจากสมาชิกและสินเชื่อที่ให้กับสมาชิกของสหกรณ์ที่เหลืออยู่อย่างเข้มงวด การศึกษานี้จึงเป็นประโยชน์สำหรับการพัฒนาเครื่องมือที่ใช้ตรวจสอบการจัดการกำไรของสหกรณ์ออมทรัพย์ในประเทศไทยผ่านเสถียรภาพทางการเงิน เนื่องจากสหกรณ์ออมทรัพย์อาจมีแรงจูงใจให้มีการตกแต่งรายการบัญชีเงินสด เงินรับฝาก เงินลงทุน และเงินกู้ยืม เพื่อปกปิดความไม่ปกติรายการบัญชีดังกล่าว นอกจากนี้ การที่สหกรณ์ออมทรัพย์มีลักษณะเฉพาะในการดำเนินงานส่งผลให้แบบจำลองที่เคยมีการศึกษามาก่อนหน้ามีข้อจำกัดในการตรวจสอบการจัดการกำไรของสหกรณ์ การศึกษานี้จึงมุ่งพัฒนาแบบจำลองใหม่ เพื่อตรวจสอบการจัดการกำไรของสหกรณ์ออมทรัพย์ โดยใช้ข้อมูลจำนวนทั้งสิ้น 12,250 ตัวอย่างจากสหกรณ์ออมทรัพย์ในประเทศไทยจำนวน 1,385 แห่ง ครอบคลุมตั้งแต่ปี พ.ศ. 2554 ถึง พ.ศ. 2563 โดยรวบรวมข้อมูลจากเว็บไซต์ของกรมตรวจบัญชีสหกรณ์ (www.cad.go.th) แบบจำลองนี้ใช้การวิเคราะห์ความถดถอยด้วยวิธีกำลังสองน้อยที่สุดภาคตัดขวางในการตรวจสอบรายการคงค้างเกี่ยวกับเงินทุนหมุนเวียนที่เกิดขึ้นจากดุยพินิจของฝ่ายบริหาร ได้แก่ การเปลี่ยนแปลงเงินสดและเงินฝากธนาคาร การเปลี่ยนแปลงเงินฝากกับสหกรณ์อื่น การเปลี่ยนแปลงในเงินลงทุน การเปลี่ยนแปลงในเงินให้กู้ยืม ลอการิทึมธรรมชาติของจำนวนสมาชิก และผลตอบแทนจากสินทรัพย์ ความสามารถของแบบจำลองในการประมาณค่าพารามิเตอร์ของสมการดีขึ้น หากเมื่อเป็นการประมาณการตามกลุ่มประเภทของสหกรณ์และปี แบบจำลองที่ได้จากการศึกษานี้เป็นประโยชน์ในการใช้เป็นเครื่องมือในการตรวจสอบพฤติกรรมที่ผิดจริยธรรมและการทุจริตได้

**คำสำคัญ:** การจัดการกำไร แบบจำลองรายการคงค้างแบบใช้ดุลยพินิจ สหกรณ์

## 1. Introduction

In 2013, the collapse of the Klongchan Credit Union Cooperative shocked the public and costed its members the billion damages. The Klongchan Credit Union Cooperative had total assets approximately 20 billion Thai Baht and the number of members about 52,000 (Koawsod Online, 2020; Posttoday, 2013). Before the collapse, the Klongchan Credit Union Cooperative's annual audit in 2013 found unusual transactions amounting to 12 billion Thai Baht (Posttoday, 2013). The severe damages of the collapse have not been properly estimated. Nonetheless, as of January 2021, its creditors and members received their money back approximately 3.58 billion Thai Baht or 20% of all but have waited for the remainder (Thairath Online, 2021). The case of the Klongchan Credit Union Cooperative seems to be haunted nightmare and was the matter of the Ministry of Agriculture and Cooperative's concern. As reported by Thairath Online (2018) shortly after the case, the Ministry of Agriculture and Cooperative revealed that it had worried about the liquidity of 1,461 cooperatives with total members of 3.21 million. These cooperatives may deal with financial management issues owing to the imbalance between deposits from and loans to their members. Some of them gave their members new loans for repaying old ones. Three of saving cooperatives may follow in the Klongchan Credit Union Cooperative's footsteps as frauds had been suspected to occur. This urgently called for the Ministry of Agriculture and Cooperatives' closely monitoring saving cooperative's deposits, investments, lending, dividends, and bonuses.

Our study contributes to the monitoring tools for detecting Thai saving cooperatives' earnings management through their decision making on financial stability. Earnings management detected by our tool can be the early warning sign of unethical behaviors and even fraud which will lead to the costly damages to members of cooperatives. Importantly, the literature on cooperatives' earnings management remains overlooked (Almutairi, 2021) due to limited availability of cooperatives' data. Our study then contributes to this literature and points to the valuable sources of data published by the Thailand Cooperative Auditing Department's website (www.cad.go.th) and the Thailand Cooperative Promotion Department's website (www.cpd.go.th). These sources of data should be of future study' interest in expanding the literature on cooperatives.

The remainder of our paper is organized as follows. Section 2 gives a short description of Thai saving cooperatives, definitions of earnings management and a detail of existing accruals models. Section 3 shows the development of our accruals model, the sample selection, and the data collections. Section 4 reports the results of the tests of our model. Sections 5 and 6 show the results of the robustness tests and the generalizability tests of our model. Section 7 concludes the paper.

## 2. Literature Review

### 2.1 Thai Saving Cooperatives

According to the Royal Society of Thailand (2021), a cooperative is defined as " an economic and social organization formed by its members. All members agree to invest in the cooperative's shares. They also comanage the cooperative's productions and sales of goods or services depending on their needs or mutual benefits. Without concerning the number of shares held, each member has equally one vote in comanaging the cooperative." A cooperative is also defined as "a group of people who cooperate to operate activities for their mutually economic and social benefits and to help each other. The cooperative is legally required to register with the governance."

Like other developing countries, Thai cooperatives are formed to help the government to improve farmers' livelihood, especially to resolve debt problems resulted from economic development and natural disasters (Cooperative Promotion Department, 2021b). The first Thai cooperative was established in Phitsanulok in 1916 (Cooperative Promotion Department, 2021b). As of January 2021 , there were 6,643 active-cooperatives (Information and Communication Technology Center, 2021) which operated under the Cooperative Act and regulated by the Cooperative Promotion Department of the Ministry of Agriculture and Cooperatives (Cooperative Promotion Department, 2021a). Thai cooperatives are vertical organisations with a three-tier system: district, provincial and national levels. At the district level, individuals form and operate a cooperative. The cooperative is in turn a member of federations at provincial and national levels. The board of directors with the maximum of 15 people are elected by the members of cooperative at the general meetings. The board of directors are responsible for developing a cooperative's policies and appointing a manager and operating staff. There have been seven categories of Thai cooperatives including Agricultural Cooperatives, Fisheries cooperatives, Land settlement cooperatives, Consumer cooperatives, Service cooperatives, Saving cooperatives, Credit union cooperatives (Cooperative Promotion Department, 2021b).

Our study focuses on saving cooperatives because they are the biggest sector. As shown in Table 1, in 2019; its numbers of active cooperatives and members were 1,408 and 3,080,486, respectively. Their total value of business transactions was 1.86 trillion Thai Baht. The results of their 2019 audits indicated 163 weaknesses in their operations with total damages of 5.55 billion Thai Baht. 5.12 billion Thai Baht of these damages resulted from unethical behaviors. According to the Cooperative Auditing Department (2020), a saving cooperative is a financial institution formed by a group of people. These people might have a similar career, work in the same organization or live in the same area. In general, objectives of a saving cooperative are to encourage its members to save their money and to help those with financial difficulties or needs. Saving cooperatives are subcategorized into different forms according

**Table 1**: Data of Cooperatives and Results of Their 2019 Audits

| | Number of active Cooperatives* | Number of members* | Total value of business transactions Billion Thai Baht** | Fraud* | | Accounting* | | Finance* | | Noncompliance with objectives* | | Unethical behaviors* | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cases | Million Thai Baht | Cases | Million Thai Baht | Cases | Million Thai Baht | Cases | Million Thai Baht | Cases | Million Thai Baht | Cases | Million Thai Baht |
| Agricultural Cooperatives | 3,327 | 6,244,197 | 292.39 | 207 | 561.23 | 58 | 18.47 | 642 | 532.69 | 118 | 121.12 | 148 | 565.46 | 1,173 | 1,798.97 |
| Fisheries cooperatives | 73 | 14,418 | 1.70 | 0 | 0 | 1 | 0 | 17 | 0.72 | 2 | 0 | 2 | 0 | 22 | 0.72 |
| Land settlement cooperatives | 86 | 190,463 | 11.48 | 0 | 0 | 3 | 0 | 22 | 3.20 | 3 | 8.39 | 4 | 0 | 32 | 11.59 |
| Saving cooperatives | 1,408 | 3,080,486 | 1,863.93 | 48 | 318.52 | 10 | 0 | 43 | 111.92 | 25 | 4.17 | 36 | 5,120.36 | 162 | 5,554.97 |
| Consumer cooperatives | 130 | 643,391 | 5.25 | 8 | 0.65 | 7 | 0 | 26 | 3.41 | 2 | 4.65 | 5 | 0.41 | 48 | 9.12 |
| Service cooperatives | 1,069 | 486,163 | 16.73 | 47 | 1.70 | 48 | 0 | 103 | 3.30 | 20 | 28.69 | 25 | 10.99 | 243 | 44.68 |
| Credit union cooperatives | 577 | 797,953 | 39.39 | 44 | 2.15 | 8 | 1.01 | 41 | 18.47 | 13 | 40.46 | 15 | 62.29 | 121 | 124.38 |
| **Total** | **6,670** | **11,457,071** | **2,231** | **354** | **884.25** | **135** | **19.48** | **894** | **673.71** | **183** | **207.48** | **235** | **5,759.51** | **1,801** | **7,544.43** |

* Data were collected from http://office.cpd.go.th/itc2/index.php/79-2017-04-11-04-36-20?start=27

** Data were collected from https://webservice.cad.go.th/CAD_FINANCE_59/reports/report_business_search.php

to their members' careers, e.g., teacher cooperatives, university cooperatives, military cooperatives, police cooperatives.

### 2.2 Earnings Management Terms

Earnings management is defined as management's intervention in financial reporting process with a purpose of gaining his own benefits at the expense of other stakeholders (Schipper, 1989). In doing so, the management exercises his judgment in financial reporting with an attempt not to report neutral earnings and even to mislead other people about his company's performance (Healy & Wahlen, 1999). With his particular purpose, he may opt to use income-increasing or income-decreasing earnings management (Healy and Wahlen,1999; Schipper, 1989). He may opt to use income-increasing earnings management to avoid reporting losses or showing any decrease in the report earnings which might decrease a firm's market value (Ghazali, Shafie, & Sanusi, 2015; Habib, Bhuiyan, & Islam, 2013). Other possible motivation includes the need to respond to their performance incentives schemes such as bonus schemes, stock-based incentive, and dividend payment (Bergstresser & Philippon, 2006; Burns & Kedia, 2006; Daniel, Denis, & Naveen, 2008; Kalyta, 2009). In addition, management use income-increasing earnings management to meet or beat the analysts' earnings forecast (Burgstahler & Eames, 2006; Dechow, Ge, & Schrand, 2010; Rusmin, Scully, & Tower, 2013; Zhang, Perols, Robinson, & Smith, 2018). On the other hand, he may opt to use income-decreasing earnings management to serve his own benefits under certain situations. Prior studies point out that executives manage accruals in a way that decreases earnings the year of the executive change and then take credit for the resulting higher reported in the following year (Ali & Zhang, 2015; Cheng & Warfield, 2005; Pourciau, 1993). Moreover, income-decreasing earnings management is engaged to reduce financial statement income to achieve tax savings (Guenther, 1994; Zeng, 2014)

To capture earnings management, earnings are decomposed into cash earnings and accruals. Under accruals basis, accruals are expected to make accounting earnings to better reflect a company's performance and future cash flows, however accruals are also suspected to be managed. Accruals can be then decomposed into two components—discretionary (or normal) accruals and non-discretionary (or abnormal) accruals. In other words, the relationships between these two accruals components can be drawn as:

$$\text{Total accruals} = \text{Non-discretionary accruals} + \text{Discretionary accruals}.$$

Non-discretionary accruals, which naturally occur under the normal course of business, are accounting adjustments to the firm's cash flow accepted by accounting standards. Discretionary accruals, on the one hand, are adjustments to cash flows managed by management. Discretionary accruals are the component that can use to detect earnings management (Dechow, 1994) and can be in the form of either accruals-based earnings management or real-activities earnings management. Previous studies developed models to decompose discretionary accruals from non-discretionary accruals. The following models are generally referred in accounting and auditing study.

## 2.3 Existing Models

### 2.3.1 Accruals-Based Earnings Management

*2.3.1.1 JONES (1991) MODEL*

Jones (1991) developed the most commonly applicable accruals model (McNichols, 2000). Non-discretionary accruals are estimated by the linear function of changes in revenues and fixed assets (Jackson, 2018). Revenues are generally used as the key performance indicator which management considers before engaging in earnings management (Jones, 1991). Revenues are also inherently associated with accruals components: inventory, accounts receivable, accounts payable, other current assets, and current liabilities (Collins, Pungaliya, & Vijh, 2017). Whilst depreciation expense is controlled for nondiscretionary depreciation expense (Jones, 1991). The equation for the Jones (1991) Model is as follows:

$$\frac{ACC_t}{TA_{t-1}} = \alpha + \beta_1 \frac{\Delta REV_t}{TA_{t-1}} + \beta_2 \frac{PPE_t}{TA_{t-1}} + \varepsilon$$

where:

ACC = Total accruals;

$\Delta$REV = Change in revenue;

PPE = Gross property, plant, and equipment; and

TA = Total assets.

*2.3.1.2 MODIFIELD JONES MODEL (1995)*

This model fixed the limitation of Jones (1991) model and proposed by Dechow, Sloan, and Sweeney (1995). Change in accounts receivable is added into Jones (1991) model as Dechow et al. (1995) pointed out that management can easier manage credit sales than cash sales. The equation for the Modified Jones Model (1995) is as follows:

$$\frac{ACC_t}{TA_{t-1}} = \alpha + \beta_1 \frac{(\Delta REV_t - \Delta AR_t)}{TA_{t-1}} + \beta_2 \frac{PPE_t}{TA_{t-1}} + \varepsilon$$

where:

$\Delta AR$ = Change in accounts receivable.

*2.3.1.3 PERFORMANCE-MATCHED DISCRETIONARY ACCRUALS MODEL*

Kothari, Leone, and Wasley (2005) indicates that the Jones Model and the Modified Jones Model ignored the significant correlation between discretionary accrual and performance. Kothari et al. (2005) therefore, included return on assets into these two models. The models are called "performance-matched" discretionary accruals of the Jones Model and the Modified Jones Model. The models are as follows:

$$\frac{ACC_t}{TA_{t-1}} = \alpha + \beta_1 \frac{\Delta REV_t}{TA_{t-1}} + \beta_2 \frac{PPE_t}{TA_{t-1}} + \beta_3 ROA_{t-1} + \varepsilon \text{ and}$$

$$\frac{ACC_t}{TA_{t-1}} = \alpha + \beta_1 \frac{(\Delta REV_t - \Delta AR_t)}{TA_{t-1}} + \beta_2 \frac{PPE_t}{TA_{t-1}} + \beta_3 ROA_{t-1} + \varepsilon$$

where:

ROA = Return on assets.

**2.3.2 Real-Activity Earnings Management**

According to Roychowdhury (2006), real-activity earnings management is the manipulation of real operating activities with the result that a company's operation is deviated from its normal course of business. In comparison to accruals-based earnings management, real-activity earnings management is more difficult to be detected but more costly because it affects cash flow. Real-activity earnings management consists of sale manipulations, production manipulations and discretionary expense manipulations (e.g., advertising expense, R&D expense). The models for these three real-activity earnings managements are as follows:

$$\frac{CFO_t}{TA_{t-1}} = \alpha + \beta_1 \frac{REV_t}{TA_{t-1}} + \beta_2 \frac{\Delta REV_t}{TA_{t-1}} + \varepsilon \ ;$$

$$\frac{(COGSt + \Delta INVEN_t)}{TA_{t-1}} = \alpha + \beta_1 \frac{REV_t}{TA_{t-1}} + \beta_2 \frac{\Delta REV_t}{TA_{t-1}} + \beta_2 \frac{\Delta REV_{t-1}}{TA_{t-1}} + \varepsilon \ ; \text{ and}$$

$$\frac{DISCEXP_t}{TA_{t-1}} = \alpha + \beta_1 \frac{REV_t}{TA_{t-1}} + \varepsilon$$

where:

CFO = Cash flow from operations;

COGS = Cost of goods sold;

$\Delta$INVEN = Change in inventory; and

DISCEXP = Discretionary expense.

**2.4 Earnings Managements Among Cooperatives**

Cooperatives deal with agency problems similar to other business entities (Almutairi, 2021) and even more profound than those in other business entities (Syrjä, Sjögrén, and Tuominen (2012) As a result of the agency problem, management of cooperatives may have incentive to engage in earnings management. There is a few existing evidence that documented cooperatives' earnings management. Almutairi (2021) observed earnings management among 59 consumers cooperatives in Kuwait during the period 2015 to 2018. Almutairi (2021) indicated that cooperatives have more opportunities to engage in earnings management because of (1) lack of existing specific accounting standards and practices for this sector, (2) poor financial reporting and managing systems and (3) board of directors with poor vision and conflicts of interests. Almutairi (2021) used both accruals-based earnings management predicted by Jones (1991) model and real-activity earnings management predicted by Roychowdhury (2006) model. Almutairi (2021) found that to avoid reporting losses cooperatives with small losses are more likely to manage earnings upwards to report small profits. However, their earnings management decreased after the implementation of the Ministry of Social Affairs and Labor's 2013 law. Almutairi (2021)'s finding sheds light on the important role of government regulations in limiting earnings management among cooperatives.

Our study differs from that of Almutairi (2021) as we focus on saving cooperatives which operate significantly different from consumer cooperatives. Consumer cooperatives' operations are close to those of retail companies. Existing accruals models are therefore applicable to consumer cooperatives but not to saving cooperatives. In the later section, we will document how our new accruals model is developed.

## 3. Methodology

### 3.1 Model Specification

Detection of earnings management through accruals consists of two processes: the computation of total accruals and the estimation of discretionary accruals. DeFond and Jiambalvo (1994) investigated the accruals manipulation of 94 US firms with debt covenant violations. They observed both time-series and cross-sectionals of Jones (1991) models. They indicate that total accruals are the difference between net income and cash flow from operations. Total accruals are also decomposed into working capital accruals and nonworking capital accruals. Working capital accruals are computed by using components in statement of financial position (accounts receivable, inventory, other current assets, accounts payable, income tax payable and other current liabilities). Nonworking capital accruals are the difference between total accruals and working capital accruals. We use working capital accruals rather than total accruals because Thai saving cooperatives' statement of cash flows are unavailable. Importantly, as highlighted by DeFond and Jiambalvo (1994), in comparison to nonworking capital accruals, working capital accruals are more likely to be managed by management. To compute working capital accruals (WCA), we follow Dechow, Ge, Larson, and Sloan (2011) who used WCA as one measure of accrual quality in their predicting material accounting misstatements. Our WCA's computation is:

$$WCA_t = (\Delta CA_t - \Delta CL_t + \Delta CURPLD_t - \Delta CASH_t) / AVETA$$

where:

$\Delta$CA = Change in current assets;

$\Delta$CL = Change in current liabilities;

$\Delta$CURPLD = Change in current portion of long-term debt included in current liabilities:

$\Delta$CASH = Change in cash and cash equivalent; and

AVETA = Average total assets.

We further estimate discretionary working capital accruals (DWCA) by developing the new model. A saving cooperative's operation is totally different from other business entities. Therefore, it might have different motivations for engaging earnings management. Importantly, the existing accruals models may less capture its DWCA. Figure 1 shows the major operating transactions of a saving cooperative. We use this figure as the conceptual framework to develop our model for earnings management detections among Thai saving cooperatives.

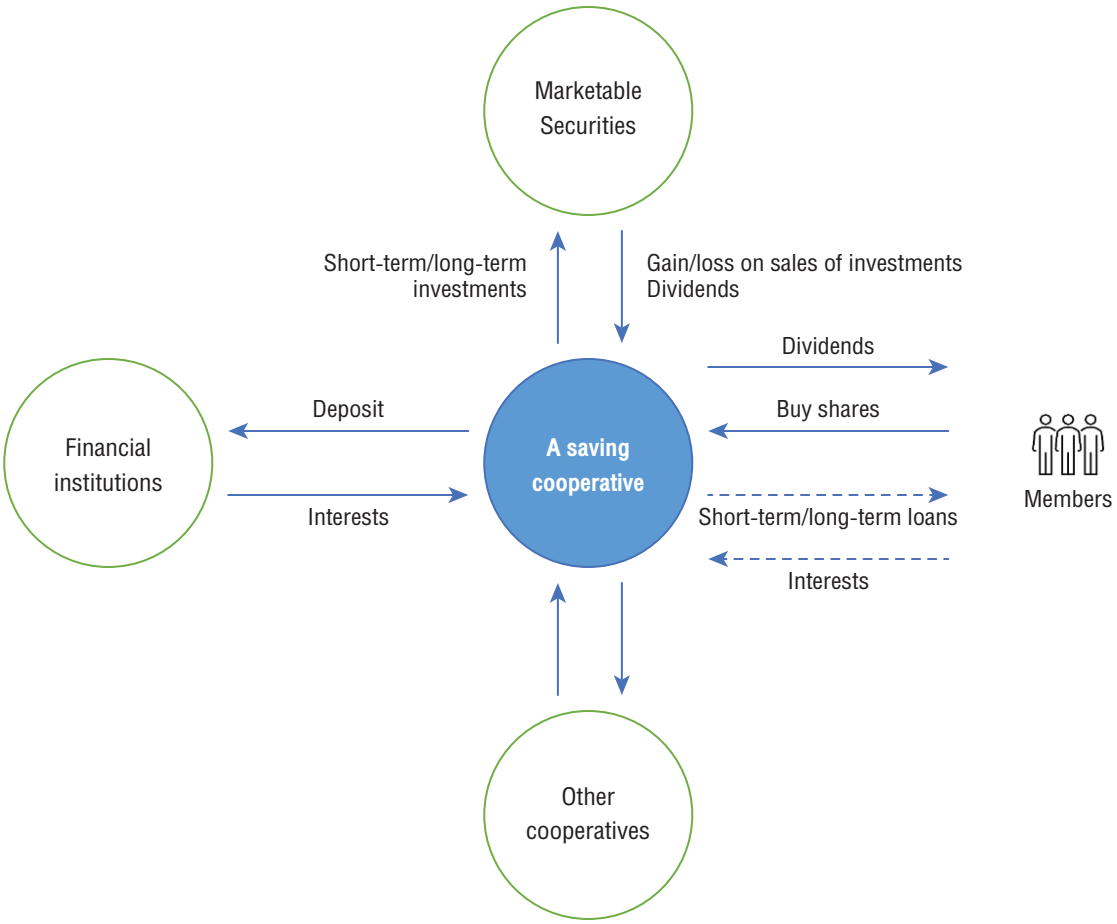


**Figure 1**: Major Transactions of a Saving Cooperative

From Figure 1, members buy shares of a saving cooperative and expect dividends as a return from the cooperative. The cooperative might have four choices to earn revenue from cash proceeded from its members. First, the cooperative might provide short-term (SLOAN) or long-term (LLOAN) loans for its members and earn interest as a return. Second, the cooperative might deposit the cash with other cooperatives (SAVCOOP) and earns interest as a return. Third, instead of depositing the cash with other cooperatives, the cooperative might deposit its cash with financial institutions (CASH&BANK). Fourth, the cooperative might invest in marketable securities as short-term (SINV) and long-term (LINV) investments to earn profit from sales on those securities and/dividends.

CASH&BANK, SAVCOOP, SINV, LINV, SLOAN and LLOAN are also key components used to assess cooperatives' financial stability[1]. With some motivations, a management of a saving cooperative is suspected to manage cash on hand and deposits, investments, and loans which in turn impact on a saving cooperative's capital structure and liquidity. Such motivation is for example to avoid being close monitored by regulators. According to the collapse of the Klongchan Credit Union Cooperative, a saving cooperative's imbalance between deposits from and loans to their members and its liquidity are the key matter of regulator's concern.

We further put ΔOPEX into our model because operating expenses can be managed to achieve the cooperative's desired net profit. In addition, Roychowdhury (2006) suspected that some expenses can be discretionary. LnMEM presents the extent to which the cooperative operates under the pressures from its member. The members demand for high dividends in return for their investments. ROA is used as a proxy for a saving cooperative's performance. Kothari et al. (2005) point to the correlation between return on assets and discretionary accruals.

[1] The Federation of Savings and Credit Cooperatives of Thailand (2018) integrated CAMELS, CFSAWss, the assessment of cooperatives' strength and Prudential Standards together to develop financial stability standards for cooperatives. 14 financial ratios are used as the benchmarks and grouped into 4 groups. First, financial structure includes 6 benchmarks: the ratio of total shares to total assets, the ratio of total deposits from members to total assets, the ratio of total loans to members and other cooperatives to total assets, the ratio of the summation of cash, cash at banks, investments, deposits at other cooperatives and notes receivables from other cooperatives to total assets, the ratio of total reserve to total assets and the ratio of loan from external parties to total capital. Second, financial liquidity includes 3 benchmarks: the ratio of total current assets to total current liabilities, the ratio of prime debtors and the ratio of liquid assets to total deposits. Third, profitability includes 2 benchmarks: the ratio of net profit to total capital and the ratio of operating expenses to earnings before operating expenses. Fourth, asset quality and hedging include 3 benchmarks: the ratio of sub-prime debtors to total debtors, the ratio of property, plant and equipment to total reserve and the ratio of loans to members to their shares. Each component is scored and weighted to generate the total score of 100. The total score is then interpreted as > 85 =A+ (excellent more than expectation), > 80–85 = A (excellent), > 75–80 = B+ (good), > 70–75 = B (pretty good), > 65–70 = C+ (higher than acceptable level), > 60–65 = C (acceptable level), > 55–60 = D+ (need some effort for the improvement) and ≤ 55 = D (need great effort for improvement).

Our new model is as follows:

$$WCA_t = \alpha + \frac{\beta_1}{AVETA} + \frac{\beta_2 \Delta CASH\&BANK}{AVETA} + \frac{\beta_3 \Delta SAVCOOP}{AVETA} + \frac{\beta_4 \Delta SINV}{AVETA} + \frac{\beta_5 \Delta SLOAN}{AVETA} + \frac{\beta_6 \Delta LINV}{AVETA}$$
$$+ \frac{\beta_7 \Delta LLOAN}{AVETA} + \frac{\beta_8 \Delta OPEX}{AVETA} + \beta_9 LnMEM_t + \beta_{10} ROA_t + \varepsilon$$

where:

$\Delta$CASH&BANK = Change in the sum of cash on hands and at banks;
$\Delta$SAVCOOP = Change in cash at other cooperatives;
$\Delta$SINV = Change in short-term investments;
$\Delta$SLOAN = Change in short-term loans;
$\Delta$LINV = Change in long-term investments;
$\Delta$LLOAN = Change in long-term loans;
$\Delta$OPEX = Change in operating expenses;
LnMEM = The natural logarithm of number of corporative members;
ROA = Return on assets ratio computed by dividing net profit by average total assets; and
AVETA = Average total assets.

### 3.2 Sample and Data

Our initial sample covers 1,447 Thai saving cooperatives registered with the Thailand Cooperative Promotion Department and disclosed their financial information on the Thailand Cooperative Auditing Department's website (www.cad.go.th). This initial sample includes 14,727 firm-year observations during the period 2010 to 2020. We further winsorize data for computing WCA at percentiles 1 and 99 to mitigate against outliers. As a result of this, our final sample includes 1,385 Thai saving cooperatives with 12,250 firm-year observations during the period 2011 to 2020. The final sample excludes data of 2010 because computing WCA requires lagged values of all variables and the financial information provided by the website begins from those of 2010.

### 3.3 Data Analysis

Data analysis included descriptive statistics, Pearson correlations and Ordinary Least Square (OLS) regression estimations. Descriptive statistics, which included analyses of Max/Min/Mean/Standard Deviation, were performed to show data distribution. Pearson correlation showed the correlation matrix for each pair of variables. Its coefficient is in the range of –1 to +1. The value greater than

zero indicates a positive correlation whilst the value lesser than zero indicates a negative correlation. The closer value to 1 indicates a strong correlation. Ordinary Least Square (OLS) regression is used to observe relation the association between a dependent variable and independent variables. According to Greene (2012, p. 55–65), the regression's assumptions are as follows. First, the regression model shows a linear relationship between a dependent variable and independent variables. Second, none of linear relationship exists among independent variables. Third, all independent variables do not have relationship with error terms. Fourth, all error terms have the same finite variance and are not correlated with each other. Fifth, the data of independent variables may be the mixing of constants and random variables. Sixth, error terms have normal distribution.

## 4. Result

### 4.1 Descriptive Statistics

Table 2 provides definitions of all variables whilst Table 3 shows their descriptive statistics. Total assets of Thai saving cooperatives is approximately 1.84 billion Thai Baht. Their working capital accruals are approximately –0.09 percent of total assets. Their property, plant and equipment are approximately 0.03 percent of total assets. This indicates that the Jones model and the modified Jones model may be inapplicable to detect Thai saving cooperatives' earnings management. This is because discretionary depreciation expenses are less prominent part in doing so. Their short-term loans increased approximately 8.3 percent of total assets whilst their long-term-loan decreased approximately 14.4 percent of total assets. The number of their members is on average 835. Their return on assets is approximately 4.1 percent of total assets.

**Table 2**: Definitions of Variables

| Variables | | Definition |
|---|---|---|
| WCA | = | Working capital accruals |
| $\Delta$CA | = | Change in current assets |
| $\Delta$CL | = | Change in current liabilities |
| $\Delta$CASH | = | Change in current portion of long-term debt included in current liabilities |
| $\Delta$CURPLD | = | Change in cash and cash equivalent |
| AVETA | = | Average total assets |
| $\Delta$CASH&BANK | = | Change in the sum of cash on hands and at banks |

**Table 2**: Definitions of Variables (Cont.)

| Variables | | Definition |
|---|---|---|
| ΔSAVCOOP | = | Change in cash at other cooperatives |
| ΔSINV | = | Change in short-term investments |
| ΔSLOAN | = | Change in short-term loans |
| ΔLINV | = | Change in long-term investments |
| ΔLLOAN | = | Change in long-term loans |
| ΔOPEX | = | Change in operating expenses |
| LnMEM | = | The natural logarithm of number of corporative members |
| ROA | = | Return on assets ratio |
| ΔINTBANK | = | Change in interest revenue from banks |
| ΔINTLOAN | = | Change in interest revenue from loans |
| ΔGLINV | = | Change in gain(loss) on sales of investments |
| PPE | = | Property, plant and equipment |
| ΔCASH&BANK | = | Change in cash on hand and at banks |
| ΔSAVCOOP | = | Change in cash at other cooperatives |
| ΔSLOAN | = | Change in short-term loans to members |
| ΔLLOAN | = | Change in long-term loans to members |
| ΔSINV | = | Change in short-term investment |
| ΔLINV | = | Change in long-term investment |
| LROA | = | The previous year's return on assets |

**Table 3**: Descriptive Statistics

**Panel A**: Descriptive Statistics of WCA and Variables for the Computation of WAC

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| WCA | 12,250 | –0.009 | 0.079 | –0.402 | 0.449 |
| ΔCA | 12,250 | 0.029 | 0.098 | –1.600 | 1.495 |
| ΔCL | 12,250 | 0.023 | 0.071 | –0.478 | 1.291 |

**Table 3**: Descriptive Statistics (Cont.)

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ΔCASH | 12,250 | 0.018 | 0.080 | −1.572 | 1.365 |
| ΔCURPLD | 12,250 | 0.003 | 0.051 | −0.428 | 0.506 |
| AVETA (million Thai Baht) | 12,250 | 1,840 | 5,900 | 1.104 | 144,000 |

**Panel B**: Descriptive Statistics of Variables for our Model

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ΔCASH&BANK | 12,250 | 0.009 | 0.070 | −1.572 | 1.111 |
| ΔSAVCOOP | 12,250 | 0.009 | 0.058 | −0.576 | 1.386 |
| ΔSINV | 12,250 | 0.000 | 0.033 | −0.647 | 0.516 |
| ΔSLOAN | 12,250 | 0.083 | 0.159 | −1.390 | 0.408 |
| ΔLINV | 12,250 | −0.037 | 0.871 | −60.497 | 1.069 |
| ΔLLOAN | 12,250 | −0.144 | 1.424 | −26.692 | 0.773 |
| ΔOPEX | 12,250 | −0.002 | 0.062 | −1.535 | 1.906 |
| LnMEM | 12,250 | 6.727 | 1.446 | 1.946 | 11.506 |
| ROA | 12,250 | 0.041 | 0.027 | −1.279 | 0.545 |

**Panel C**: Descriptive Statistics of Variables for Jones Model, Modified Jones Model and Performance-matched Discretionary Accruals Model

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ΔINTBANK | 12,250 | 0.000 | 0.041 | −4.515 | 0.162 |
| ΔINTLOAN | 12,250 | −0.002 | 0.039 | −2.273 | 0.770 |
| ΔGLINV | 12,250 | 0.000 | 0.003 | −0.186 | 0.139 |
| PPE | 12,250 | 0.003 | 0.016 | 0.000 | 0.468 |
| ΔINTBANK-ΔCASH&BANK-ΔSAVCOOP | 12,250 | −0.018 | 0.090 | −4.548 | 1.573 |
| ΔINTLOAN-ΔSLOAN-ΔLLOAN | 12,250 | 0.061 | 1.439 | −1.107 | 26.864 |
| ΔGLINV-ΔSINV-ΔLINV | 12,250 | 0.037 | 0.870 | −0.984 | 60.312 |
| LROA | 12,249* | 0.041 | 0.037 | −1.931 | 0.545 |

* One observation was dropped because of missing data on lagged return on assets.

### 4.2 Correlation

Table 3 reports Pearson correlation of all variables. None of correlation is greater than 0.800. Gujarati, Porter, and Gunasekar (2012) underscore that multicollinearity is a serious issue if correlation does not exceed 0.8. Therefore, our model, Jones model, modified Jones model and performance-matched discretionary accrual model do not have multicollinearity problem in the predictions of DWCA.

### 4.3 Earnings Management Detections

Table 4 shows the results of the estimations of WCA. Panels A, B, C and D presents the results of our model, the Jones model, the modified Jones model and the performance-matched discretionary accruals model, respectively. Interestingly, our model outperforms other models. For the regression of the pooled-data, adjusted $R^2$ is 0.0749. WCA positively associates with ΔSLOAN and ROA but negatively associates with ΔCASH&BANK, ΔSAVCOOP, ΔSINV, ΔLLOAN, ΔOPEX and LnMEM. For the cross-sectional OLS regression, adjusted $R^2$ is in the range between 0.0376 to 0.1647 with average is 0.1181. ΔSAVCOOP, ΔLLOAN, LnMEM and ROA are the high powerful predictors but ΔOPEX is the low powerful predictor.

The Jones model's adjusted $R^2$ is 0.0003 for the regression of pooled- data and is in the range between –0.0014 to 0.0213 with the average of 0.0073 for the cross-sectional OLS regression. ΔINTBANK and ΔINTLOAN negatively associate with WCA only for the cross-sectional OLS regression.

The performances of the modified Jones model and the performance-matched discretionary accruals model are not significantly different. The modified Jones model's adjusted $R^2$ is 0.0104 for the regression of pooled-data and is in the range between 0.0099 to 0.0730 with the average of 0.0372 for the cross-sectional OLS regression. ΔINTBANK-ΔCASH&BANK-ΔSAVCOOP, ΔINTLOAN-ΔSLOAN-ΔLLOAN and ΔGLINV-ΔSINV-ΔLINV positively associate with WCA. On the other hand, the performance-matched discretionary accruals model's adjusted $R^2$ is 0.0103 for the regression of pooled-data and is in the range between 0.0092 to 0.0723 with the average of 0.0365. The associations between ΔINTBANK-ΔCASH&BANK-ΔSAVCOOP, ΔINTLOAN-ΔSLOAN-ΔLLOAN, ΔGLINV-ΔSINV-ΔLINV and WCA are almost identical to those of the modified Jones model. However, LROA is found not to associate with WCA.

Panel E Table 4 reports that DWCAs predicted by our model are approximately 0.9 percent of total assets (Std. Dev. = 8.2%). Those predicted by Jones model are approximately 1.3 percent of total assets (Std. Dev. = 17.4%). Those predicted by modified Jones model and performance-matched discretionary accruals model are approximately 0.7 percent of total assets (Std. Dev. = 20.8%)

**Table 3**: Pearson Correlation

**Panel A**: Variables for our Model

| | WCA | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | ΔOPEX | LnMEM | ROA |
|---|---|---|---|---|---|---|---|---|---|---|
| WCA | 1.000 | | | | | | | | | |
| ΔCASH&BANK | 0.006 | 1.000 | | | | | | | | |
| ΔSAVCOOP | −0.104*** | −0.239*** | 1.000 | | | | | | | |
| ΔSINV | −0.019* | −0.117*** | −0.119*** | 1.000 | | | | | | |
| ΔSLOAN | 0.038*** | −0.020** | −0.039*** | 0.002 | 1.000 | | | | | |
| ΔLINV | −0.010 | −0.001 | 0.003 | −0.013 | 0.004 | 1.000 | | | | |
| ΔLLOAN | −0.083*** | −0.014 | −0.004 | −0.009 | 0.043*** | 0.299*** | 1.000 | | | |
| ΔOPEX | −0.055*** | −0.011 | −0.004 | 0.004 | 0.029 | 0.009 | 0.014 | 1.000 | | |
| LnMEM | −0.153*** | −0.046*** | 0.007 | 0.019* | 0.334*** | 0.016 | 0.066*** | 0.028*** | 1.000 | |
| ROA | 0.174*** | 0.067*** | 0.001 | 0.005 | 0.125*** | −0.005 | −0.012 | −0.198*** | −0.037*** | 1.000 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Panel B**: Variables for Jones Model

| | WCA | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN |
|---|---|---|---|---|---|
| WCA | 1.000 | | | | |
| ΔINTBANK | −0.002 | 1.000 | | | |
| ΔINTLOAN | −0.017 | 0.166*** | 1.000 | | |
| ΔGLINV | 0.007 | 0.001 | 0.144*** | 1.000 | |
| PPE | −0.015 | 0.002 | 0.006 | 0.002 | 1.000 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 3**: Pearson Correlation (Cont.)

**Panel C**: Variables for Modified Jones Model

| | WCA | ΔINTBANK-ΔCASH&BANK-ΔSAVCOOP | ΔINTLOAN-ΔSLOAN-ΔLLOAN | ΔGLINV-ΔSINV-ΔLINV | ROA |
|---|---|---|---|---|---|
| WCA | 1.000 | | | | |
| ΔINTBANK-ΔCASH&BANK-ΔSAVCOOP | 0.063*** | 1.000 | | | |
| ΔINTLOAN-ΔSLOAN-ΔLLOAN | 0.078*** | −0.019* | 1.000 | | |
| ΔGLINV-ΔSINV-ΔLINV | 0.011 | −0.007 | 0.296*** | 1.000 | |
| ROA | −0.015 | 0.015 | 0.000 | −0.006 | 1.000 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Panel D**: Variables for Performance-matched Discretionary Accrual Model

| | WCA | ΔINTBANK-ΔCASH&BANK-ΔSAVCOOP | ΔINTLOAN-ΔSLOAN-ΔLLOAN | ΔGLINV-ΔSINV-ΔLINV | PPE | ROA |
|---|---|---|---|---|---|---|
| WCA | 1.000 | | | | | |
| ΔINTBANK-ΔCASH&BANK-ΔSAVCOOP | 0.063*** | 1.000 | | | | |
| ΔINTLOAN-ΔSLOAN-ΔLLOAN | 0.078*** | −0.019 | 1.000 | | | |
| ΔGLINV-ΔSINV-ΔLINV | 0.011 | −0.007 | 0.296*** | 1.000 | | |
| PPE | −0.015 | 0.015 | 0.000 | −0.006 | 1.000 | |
| ROA | 0.008 | −0.006 | 0.011 | 0.000 | 0.003 | 1.000 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 4**: Earnings Management Estimations

**Panel A**: Variables for our Model

| | Constant | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | ΔOPEX | LnMEM | ROA | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pooled-data | 0.031*** | −0.050*** | −0.157*** | −0.087*** | 0.036*** | −0.002 | −0.004*** | −0.027*** | −0.009*** | 0.469*** | 11,250 | 0.0749 |
| 2011 | −0.004 | −0.059 | −0.130** | −0.101 | 0.004 | 0.001 | −0.001 | −0.020 | −0.004 | 0.878*** | 916 | 0.0376 |
| 2012 | 0.029* | −0.097*** | −0.088** | −0.129** | 0.039** | −0.146*** | −0.008*** | −0.009 | −0.010*** | 0.774*** | 1,174 | 0.1181 |
| 2013 | 0.014 | −0.093** | −0.169*** | −0.213*** | 0.032* | −0.125** | −0.032*** | 0.068 | −0.007*** | 0.791*** | 1,213 | 0.1175 |
| 2014 | 0.030** | −0.038 | −0.220*** | −0.101 | 0.025 | −0.190** | −0.035*** | 0.147 | −0.009*** | 0.714*** | 1,246 | 0.1305 |
| 2015 | 0.032*** | −0.036 | −0.257*** | −0.215** | 0.028* | −0.277*** | −0.021*** | −0.165 | −0.010*** | 0.588*** | 1,265 | 0.1385 |
| 2016 | 0.046*** | −0.132*** | −0.282*** | −0.335*** | 0.029* | −0.429*** | −0.122*** | 0.093 | −0.010*** | 0.455*** | 1,283 | 0.1559 |
| 2017 | 0.043*** | −0.082** | −0.156*** | −0.086 | 0.035*** | −0.060 | −0.020*** | 0.123 | −0.011*** | 0.486*** | 1,296 | 0.1068 |
| 2018 | 0.014 | −0.245*** | −0.339*** | −0.340*** | 0.032** | −0.339*** | −0.139*** | −0.196* | −0.005*** | 0.573*** | 1,309 | 0.1612 |
| 2019 | 0.056*** | −0.069* | −0.107** | −0.096 | 0.070*** | −0.159* | −0.072*** | 0.050 | −0.018*** | 0.957*** | 1,299 | 0.1647 |
| 2020 | −0.051*** | −0.012 | −0.190*** | −0.136 | 0.036** | −0.315** | −0.034*** | −0.213*** | 0.003* | 0.314** | 1,249 | 0.0505 |
| | | | | | | | | | | | Average | 0.1181 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 4**: Earnings Management Estimations (Cont.)

**Panel B**: Jones Model

| | Constant | ΔINTBANK | ΔINTLOAN | ΔGLINV | PPE | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|
| Pooled-data | −0.009*** | 0.001 | −0.036 | 0.241 | −0.073 | 11,250 | 0.0003 |
| 2011 | 0.009*** | −0.178 | −0.008 | 0.364 | −0.557*** | 916 | 0.0093 |
| 2012 | 0.000 | −0.001 | 0.009 | −12.275* | −0.162 | 1,174 | 0.0016 |
| 2013 | 0.006* | −1.429** | −1.146*** | 4.623 | −0.460*** | 1,213 | 0.0213 |
| 2014 | −0.004 | 0.305 | −0.960** | −8.927 | 0.102 | 1,246 | 0.0058 |
| 2015 | −0.012*** | −1.632** | −1.128** | 19.946** | 0.157 | 1,265 | 0.0121 |
| 2016 | −0.016*** | −2.666*** | −3.775*** | −1.847 | −0.080 | 1,283 | 0.0114 |
| 2017 | −0.012*** | −2.417** | −2.973*** | 0.219 | −0.028 | 1,296 | 0.0094 |
| 2018 | 0.000 | −0.731 | −1.546 | 0.513 | −0.044 | 1,309 | −0.0003 |
| 2019 | −0.025 | −0.707 | −0.802 | −2.163 | 0.018*** | 1,299 | −0.0014 |
| 2020 | −0.020*** | 3.735** | 0.105 | −1.457 | −0.076 | 1,249 | 0.0038 |
| | | | | | | Average | 0.0073 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 4**: Earnings Management Estimations (Cont.)

**Panel C**: Modified Jones Model

| | Constant | ΔINTBANK-ΔCASH&BANK-ΔSAVCOOP | ΔINTLOAN-ΔSLOAN-ΔLLOAN | ΔGLINV-ΔSINV-ΔLINV | PPE | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|
| Pooled-data | −0.008*** | 0.057*** | 0.005*** | −0.001 | −0.079 | 12,250 | 0.0104 |
| 2011 | 0.006 | 0.041 | 0.001 | −0.001 | −0.545*** | 916 | 0.0125 |
| 2012 | 0.000 | 0.022*** | 0.008*** | 0.136 | −0.124 | 1,174 | 0.0554 |
| 2013 | 0.010*** | 0.143*** | 0.027*** | 0.153*** | −0.451*** | 1,213 | 0.0617 |
| 2014 | 0.002 | 0.093*** | 0.026*** | 0.184** | 0.020 | 1,246 | 0.0322 |
| 2015 | −0.007*** | 0.068** | 0.018*** | 0.316*** | 0.153 | 1,265 | 0.0357 |
| 2016 | −0.008*** | 0.173*** | 0.021* | 0.440*** | −0.128 | 1,283 | 0.0493 |
| 2017 | −0.008*** | 0.081** | 0.013*** | 0.137** | −0.009 | 1,296 | 0.0245 |
| 2018 | 0.010*** | 0.244*** | 0.045*** | 0.376*** | −0.074 | 1,309 | 0.0730 |
| 2019 | −0.025*** | 0.071** | −0.014 | 0.246*** | 0.016 | 1,299 | 0.0099 |
| 2020 | −0.021*** | 0.061** | −0.027** | 0.230*** | −0.109 | 1,249 | 0.0180 |
| | | | | | | Average | 0.0372 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 4**: Earnings Management Estimations (Cont.)

**Panel D**: Performance-matched Discretionary Accruals Model

| | Constant | ΔINTBANK-ΔCASH&BANK-ΔSAVCOOP | ΔINTLOAN-ΔSLOAN-ΔLLOAN | ΔGLINV-ΔSINV-ΔLINV | PPE | LROA | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|
| Pooled-data | −0.008 | 0.057*** | 0.005*** | −0.001 | −0.079 | 0.016 | 12,249 | 0.0103 |
| 2011 | 0.009 | 0.040 | 0.001 | −0.001 | −0.543*** | −0.069 | 916 | 0.0116 |
| 2012 | −0.001 | 0.022 | 0.008*** | 0.136*** | −0.125 | 0.030 | 1,174 | 0.0547 |
| 2013 | 0.010*** | 0.143*** | 0.027*** | 0.153*** | −0.452** | −0.006 | 1,213 | 0.0609 |
| 2014 | 0.001 | 0.093*** | 0.026*** | 0.184** | 0.021 | 0.019 | 1,246 | 0.0315 |
| 2015 | −0.008* | 0.069** | 0.018*** | 0.316*** | 0.152 | 0.023 | 1,265 | 0.0350 |
| 2016 | −0.009** | 0.173*** | 0.021* | 0.440*** | −0.129 | 0.022 | 1,283 | 0.0488 |
| 2017 | −0.008*** | 0.081** | 0.013*** | 0.137** | −0.009 | 0.005 | 1,296 | 0.0238 |
| 2018 | 0.011*** | 0.245*** | 0.045*** | 0.376*** | −0.074 | −0.023 | 1,309 | 0.0723 |
| 2019 | −0.026*** | 0.071** | −0.014 | 0.246*** | 0.015 | 0.020 | 1,299 | 0.0092 |
| 2020 | −0.021*** | 0.061** | −0.027** | 0.230*** | −0.109 | 0.003 | 1,249 | 0.0172 |
| | | | | | | | Average | 0.0365 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

[a] One observation was dropped because of missing data on lagged return on assets.

**Panel E**: Estimated DWCA

| | Obs | Mean | Std. Dev. | Maximum | Percentiles | | | Minimum |
|---|---|---|---|---|---|---|---|---|
| | | | | | 75th | 50th | 25th | |
| Our model | 12,250 | 0.009 | 0.082 | 0.333 | 0.045 | 0.014 | −0.026 | −0.319 |
| Jones model | 12,250 | 0.013 | 0.174 | 16.942 | 0.045 | 0.014 | −0.024 | −0.888 |
| Modified Jones model | 12,250 | 0.007 | 0.208 | 1.018 | 0.044 | 0.013 | −0.023 | −13.590 |
| Performance-matched discretionary accruals model | 12,249* | 0.007 | 0.208 | 1.018 | 0.044 | 0.013 | −0.023 | −13.591 |

* One observation was dropped because of missing data on lagged return on assets.

## 5. Robustness Test

### 5.1 Regression by Industry and by Year

As shown in Panel A Table 5, we categorize our sample into ten industries according to the organizations which are the owners of the saving cooperatives. Most of data are from saving cooperatives of private sector and government agencies. Panel B Table reports the regression by industry and year. The average adjusted $R^2$ is in the range between 0.0574 to 0.4395. The lowest average adjusted $R^2$ is of the group of polices' saving cooperatives while the highest average adjusted $R^2$ is of the group of state enterprises' saving cooperatives.

We further check the performance of our predictors for WCA. For pooled-data regression, we found that WCA negatively associates with ΔCASH&BANK, ΔSAVCOOP, ΔSINV, ΔLINV, ΔLLOAN and LnMEM but positively associates with ΔSLOAN and ROA. ΔCASH&BANK, ΔSAVCOOP, ΔSLOAN, ΔLLOAN, LnMEM and ROA are good predictors for teachers' saving cooperatives. ΔSAVCOOP, ΔSLOAN, ΔLLOAN, LnMEM and ROA are good predictors for universities' saving cooperatives. ΔCASH&BANK, ΔSAVCOOP, ΔSLOAN, ΔLINV, ΔLLOAN, LnMEM and ROA are good predictors for WCA of government agencies' saving cooperatives. ΔCASH&BANK and ROA are good predictors for WCA of polices' saving cooperatives. ΔCASH&BANK, ΔSAVCOOP, ΔSLOAN, ΔLLOAN, LnMEM and ROA are good predictors for WCA of militaries' saving cooperatives. ΔSAVCOOP, LnMEM and ROA are good predictors for WCA of hospitals' saving cooperatives. ΔCASH&BANK, ΔSAVCOOP, ΔSLOAN and LnMEM are good predictors for WCA of public health's saving cooperatives. ΔCASH&BANK, ΔSAVCOOP, ΔSLOAN, ΔLINV, ΔLLOAN and LnMEM are good predictors for WCA of state enterprises' saving cooperatives. ΔSAVCOOP, ΔSINV, ΔSLOAN, ΔLLOAN and LnMEM are good predictors for WCA of private sectors' saving cooperatives. ΔCASH&BANK, ΔSAVCOOP, ΔSINV, ΔSLOAN, ΔLINV, ΔLLOAN and ROA are good predictors for WCA of the remainder saving cooperatives.

For cross-sectional regression by industry and by year, we found that ΔSLOAN is a good predictor for WCA of teachers' saving cooperatives and universities' saving cooperatives. ΔSAVCOOP, ΔSLOAN and ΔLLOAN are good predictors for WCA of government agencies' saving cooperatives. ΔCASH&BANK, ΔSAVCOOP, ΔSLOAN and ΔLLOAN are good predictors for WCA of militaries' saving cooperatives. ΔSAVCOOP, ΔSLOAN, ΔLINV and ΔLLOAN are good predictors for WCA of hospitals' saving cooperatives. ΔLLOAN is a good predictor for WCA of public health's saving cooperatives. ΔSAVCOOP, ΔSLOAN, ΔLINV and ΔLLOAN are good predictors for WCA of state enterprises' saving cooperatives. ΔCASH&BANK, ΔSAVCOOP, ΔSLOAN, ΔLINV, ΔLLOAN and ROA are good predictors for WCA of private sectors' saving cooperatives. ΔSLOAN, ΔLLOAN and ROA are good predictors for WCA of the remainder saving cooperatives. However, all our variables have low power prediction for polices' saving cooperatives.

Panel C Table 5 reports predicted DWCAs. Unlike the pooled- data with the average of DWCAs of 0.9 percent of total assets (Std. Dev. = 8.2%), the regression by industry and by year generates the average of DWCAs of –4.0 percent of total assets (Std. Dev. = 45.9%). Regression by industry and by year improves our model's adjusted $R^2$. This indicates that our model has better performance when we regress our data by industry and by year. Panel C Table 5 also provides evidence that polices' cooperatives (mean = –6.4%, Std. Dev. = 56.6%), teachers' saving cooperatives (mean = –6.1%, Std. Dev. = 41.6%) and hospitals' saving cooperatives (mean = –5.1%, Std. Dev. = 41.9%) reported high magnitude of earnings management. On the other hand, state enterprises' saving cooperatives (mean = –2.8%, Std. Dev. = 45.2%)) reported the lowest magnitude of earnings management.

### 5.2 Regression by Cooperative Size

We categorize our sample according to their size measured by total assets. According to The Federation of Savings and Credit Cooperatives of Thailand (2018), a cooperative with total assets greater than 5 billion Thai Baht is defined as a large size cooperative. Untabulated results indicate that 11,223 of 12,343 firm-year observations (91%) are from small saving cooperatives. The average adjusted $R^2$ of regressing data of small saving cooperatives is 0.1893 whilst that of regressing data of large saving cooperatives is 0.2729. ΔCASH&BANK, ΔSAVCOOP, ΔSLOAN, ΔLINV, ΔLLOAN, LnMEM and ROA are good predictors for WCA of small size cooperatives. On the other hand, ΔCASH&BANK, ΔSAVCOOP, ΔLINV and ΔLLOAN are good predictors for WCA of large size cooperatives. For the prediction of DWCAs, large size cooperatives have positive average of DWCAs (Mean = 0.7% of total assets, Std. Dev. = 20.6%) whilst small size cooperatives have the negative average of DWCAs (Mean = –2.2% of total assets, Std. Dev. = 60.4%). By comparing with the regression by industry and by year, the regression by cooperative size is less likely to be able to militate against the variation among groups of samples.

**Table 5**: Regression by Industry and by Year

**Panel A**: Data Distribution

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Teachers | 69 | 93 | 95 | 92 | 92 | 90 | 93 | 93 | 89 | 87 | 893 |
| (2) Universities | 34 | 38 | 37 | 39 | 42 | 45 | 45 | 48 | 44 | 44 | 416 |
| (3) Government Agencies | 154 | 238 | 246 | 248 | 248 | 250 | 250 | 252 | 246 | 236 | 2,368 |
| (4) Polices | 84 | 111 | 107 | 109 | 109 | 110 | 111 | 108 | 110 | 112 | 1,071 |
| (5) Militaries | 64 | 90 | 91 | 91 | 92 | 93 | 92 | 92 | 91 | 92 | 888 |
| (6) Hospitals | 62 | 82 | 82 | 85 | 84 | 84 | 83 | 84 | 82 | 82 | 810 |
| (7) Public Health | 42 | 75 | 73 | 74 | 75 | 76 | 75 | 77 | 77 | 77 | 721 |
| (8) State Enterprises | 39 | 52 | 51 | 51 | 50 | 49 | 48 | 49 | 50 | 45 | 484 |
| (9) Private Sector | 244 | 342 | 359 | 375 | 390 | 395 | 402 | 408 | 408 | 375 | 3,698 |
| (10) Others | 61 | 93 | 94 | 101 | 107 | 110 | 109 | 108 | 110 | 101 | 994 |
| Total | 853 | 1,214 | 1,235 | 1,265 | 1,289 | 1,302 | 1,308 | 1,319 | 1,307 | 1,251 | 12,343* |

* 157 observations were dropped because we were unable to categorize them into these ten categories.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel B**: Regression Results

| | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | LnMEM | ROA | Constant | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Teachers | | | | | |
| Pooled-data | −0.334** | −0.306*** | −0.077 | 0.221*** | −0.121 | −0.012** | −0.009*** | 0.323*** | 0.049 | 893 | 0.0933 |
| 2011 | 0.195 | −0.525 | −1.783*** | 0.097 | 0.001 | 0.002 | −0.008 | −0.207 | 0.097 | 69 | 0.1642 |
| 2012 | −0.446 | −0.155 | −1.167 | 0.725*** | −1.646 | 0.030 | −0.006 | −0.618 | 0.046 | 93 | 0.0940 |
| 2013 | −0.196 | −0.419*** | −0.040 | 0.664*** | 1.308 | −0.431*** | −0.005 | 0.866*** | 0.046 | 95 | 0.3677 |
| 2014 | −0.522 | −0.706 | 0.410 | 0.560 | −1.443 | −0.024 | −0.008 | 0.525* | 0.048 | 92 | 0.2248 |
| 2015 | −1.133 | −1.128 | −1.071 | −0.178 | −1.496 | −0.190 | −0.002 | 1.003*** | −0.010 | 92 | 0.0620 |
| 2016 | −0.230 | −0.509 | −0.854*** | 1.012* | −0.706 | −0.314 | −0.008 | 0.181 | 0.043 | 90 | 0.2855 |
| 2017 | −0.994 | 0.031 | −0.852 | 0.317 | 0.254 | 0.187 | −0.015 | 0.099 | 0.082 | 93 | 0.0867 |
| 2018 | −0.776 | −0.298 | 0.828*** | 1.143*** | −0.072 | −0.032 | 0.006 | −0.487** | −0.050 | 93 | 0.6053 |
| 2019 | −0.351 | 0.220 | −0.395 | 1.119*** | −0.682 | −0.207 | −0.031*** | 0.535 | 0.181*** | 89 | 0.2554 |
| 2020 | 0.321 | −0.567** | 0.474 | 0.517 | 1.260 | −0.471*** | 0.004 | −0.696 | −0.027 | 87 | 0.2150 |
| | | | | | | | | | | Average | 0.2361 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel B**: Regression Results (Cont.)

| | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | LnMEM | ROA | Constant | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Universities** | | | | | | | | | | | |
| Pooled-data | −0.059 | −0.137* | −0.165 | 0.143*** | 0.059 | −0.034*** | −0.012*** | 0.406* | 0.051** | 416 | 0.0966 |
| 2011 | −0.137 | −0.242 | −0.286 | 0.017 | 0.184 | −0.008 | −0.003 | 3.689 | −0.132 | 34 | 0.0393 |
| 2012 | −0.441 | −0.225 | −0.235 | 1.822*** | −0.166 | −0.342 | 0.008 | 0.980 | −0.076 | 38 | 0.2958 |
| 2013 | −0.020 | −0.292 | −0.388 | 0.891*** | −0.043 | −0.175 | −0.006 | 0.391 | 0.015 | 37 | 0.5079 |
| 2014 | −0.004 | −0.433 | −0.063 | 0.933*** | −0.897 | −0.222 | −0.013 | −0.851 | 0.099 | 39 | 0.3498 |
| 2015 | −0.401* | −0.187* | −0.505 | 0.696*** | 0.086 | −0.176* | −0.021* | −0.018 | 0.132 | 42 | 0.3525 |
| 2016 | 0.041 | −0.386 | −1.377* | 0.791*** | −0.376 | −0.185*** | −0.005 | 1.106*** | −0.022 | 45 | 0.5300 |
| 2017 | −0.099 | −0.452 | −0.615 | 1.294*** | −0.574 | −0.252* | 0.006 | −1.045 | 0.005 | 45 | 0.2427 |
| 2018 | −0.015 | −0.303 | −0.048 | 0.705*** | −0.747 | −0.194 | 0.005 | 0.017 | −0.025 | 48 | 0.2607 |
| 2019 | −0.388 | −0.155 | −0.799 | 0.978*** | −0.473 | −0.251 | −0.014 | 0.341 | 0.044 | 44 | 0.3511 |
| 2020 | −0.114 | −0.611*** | −0.407 | 0.924*** | −0.170 | −0.126 | 0.002 | 0.665 | −0.048 | 44 | 0.4868 |
| | | | | | | | | | | Average | 0.3417 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel B**: Regression Results (Cont.)

| | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | LnMEM | ROA | Constant | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Government Agencies** | | | | | | | | | | | |
| Pooled-data | −0.114*** | −0.344*** | −0.262*** | 0.108*** | −0.007* | −0.016*** | −0.006*** | 0.312*** | 0.018** | 2,368 | 0.0686 |
| 2011 | 0.259 | 0.053 | −0.394* | −0.007 | 0.003 | 0.000 | 0.002 | 1.432** | −0.077 | 154 | 0.0696 |
| 2012 | −0.563*** | −0.141 | 0.029 | 0.493*** | 0.052 | −0.040* | −0.004 | 0.378 | 0.004 | 238 | 0.1373 |
| 2013 | 0.011 | −0.453*** | −0.843*** | 0.191** | −0.033 | −0.178*** | −0.003 | −0.469 | 0.060 | 246 | 0.1578 |
| 2014 | −0.303* | −0.226 | −0.137 | 0.851*** | −0.457** | −0.201*** | −0.007** | −0.279 | 0.056 | 248 | 0.3170 |
| 2015 | −0.173 | −0.569*** | −0.548* | 0.763*** | −0.384 | −0.162*** | −0.007** | 0.435*** | 0.028 | 248 | 0.3379 |
| 2016 | −0.341** | −0.602*** | −0.326 | 0.742*** | −0.657*** | −0.312*** | −0.004 | 0.517** | −0.001 | 250 | 0.3799 |
| 2017 | −0.145 | −0.407*** | −0.470* | 0.779*** | −0.314 | −0.275*** | −0.004 | 0.207 | 0.009 | 250 | 0.2377 |
| 2018 | −0.133 | −0.380 | −0.522 | 0.288*** | 0.035 | −0.071 | −0.006* | 0.328 | 0.033 | 252 | 0.0960 |
| 2019 | 0.071 | −0.451*** | −0.608 | 0.881*** | −0.821*** | −0.295*** | −0.005* | 0.680** | −0.001 | 246 | 0.3591 |
| 2020 | −0.405*** | −0.349*** | −0.096 | 0.797*** | −0.545*** | −0.365*** | −0.002 | 0.077 | 0.013 | 236 | 0.5176 |
| | | | | | | | | | | **Average** | **0.2610** |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel B**: Regression Results (Cont.)

| | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | LnMEM | ROA | Constant | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Polices | | | | | | |
| Pooled-data | −0.470*** | −0.264 | 1.055 | 0.031 | 0.000 | −0.003 | −0.006 | 0.751** | −0.007 | 1,071 | 0.0154 |
| 2011 | −0.108 | −0.591 | 20.102 | −0.004 | 0.001 | 0.001 | 0.009 | 0.901 | −0.131 | 84 | 0.0314 |
| 2012 | −0.917 | −0.415 | −0.724 | 0.684 | −0.794** | −0.203** | 0.011 | −0.201 | −0.018 | 111 | 0.1524 |
| 2013 | −0.358 | −0.471 | 0.453 | 0.975* | −0.170 | −0.166 | 0.024 | −0.507 | −0.125 | 107 | 0.0348 |
| 2014 | −1.502** | 0.295 | −1.196 | 0.448 | 1.346 | −0.119 | −0.014 | −0.403 | 0.134 | 109 | 0.0241 |
| 2015 | −0.406 | −0.070 | 0.973 | 1.014** | −0.587 | −0.116 | −0.004 | 1.224 | −0.049 | 109 | 0.0693 |
| 2016 | −0.310 | 0.500 | −2.716 | 0.680* | −4.224* | −0.162 | −0.012 | 1.775 | 0.001 | 110 | 0.1101 |
| 2017 | −0.385 | 0.196 | 2.083 | 0.323 | −0.040 | −0.125 | 0.002 | 1.081 | −0.085 | 111 | −0.0271 |
| 2018 | −0.268 | −0.555 | 15.661 | 0.523 | 15.810 | −0.243 | −0.012 | −1.054 | 0.156 | 108 | 0.0200 |
| 2019 | −0.061 | 0.339 | 3.069 | 0.813 | 2.246 | −0.221 | −0.012 | 2.432** | −0.104 | 110 | 0.0535 |
| 2020 | −0.732 | 0.085 | 1.569 | 0.603 | −0.510 | −0.528*** | −0.005 | −0.562 | 0.059 | 112 | 0.1050 |
| | | | | | | | | | | Average | 0.0574 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel B**: Regression Results (Cont.)

| | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | LnMEM | ROA | Constant | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Militaries | | | | | |
| Pooled-data | −0.266*** | −0.626*** | 0.111 | 0.055** | 0.006 | −0.011* | −0.007*** | 0.748*** | 0.008 | 888 | 0.1176 |
| 2011 | −0.138 | −0.588*** | −0.263 | −0.022 | 0.008 | 0.005 | −0.004 | 1.048 | −0.026 | 64 | 0.2022 |
| 2012 | −0.233 | −0.002 | 0.086 | 0.417 | −0.016 | −0.221*** | −0.010 | 0.753 | 0.037 | 90 | 0.2289 |
| 2013 | −0.267* | −0.226 | −0.244 | 0.004 | 4.599 | −0.411*** | −0.006 | 0.941 | 0.011 | 91 | 0.2362 |
| 2014 | −0.137 | −0.181 | 0.068 | 1.147*** | 0.819 | −0.254*** | −0.017*** | 0.331 | 0.102 | 91 | 0.4808 |
| 2015 | −0.270 | −0.792*** | 0.140 | 0.652*** | 0.049 | −0.324*** | 0.002 | 0.774 | −0.042 | 92 | 0.4171 |
| 2016 | −0.607*** | −1.046*** | −1.406 | 0.555*** | 1.038 | −0.258*** | −0.006 | 0.287 | 0.031 | 93 | 0.4135 |
| 2017 | −0.553*** | −0.558 | 1.479* | 0.985*** | −0.579 | −0.504*** | −0.003 | 0.358 | 0.006 | 92 | 0.5230 |
| 2018 | −0.744*** | −0.460 | −0.574 | 0.695** | −1.299** | −0.416*** | 0.002 | 1.175 | −0.054 | 92 | 0.3554 |
| 2019 | −0.679*** | −0.776*** | −1.159 | −0.242 | −1.914 | −0.237** | −0.003 | 0.717 | −0.002 | 91 | 0.1847 |
| 2020 | −0.229* | −1.042*** | 0.361 | 0.824*** | −0.477*** | −0.174*** | 0.005 | 1.194** | −0.080** | 92 | 0.7151 |
| | | | | | | | | | | Average | 0.3757 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel B**: Regression Results (Cont.)

| | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | LnMEM | ROA | Constant | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Hospitals | | | | | |
| Pooled-data | −0.098 | −0.261*** | 0.036 | 0.022 | −0.016 | −0.006 | −0.013*** | 0.940*** | 0.029 | 810 | 0.0810 |
| 2011 | −0.062 | −0.085 | 0.306 | −0.093** | 0.007 | 0.015** | 0.021 | 2.783*** | −0.259 | 62 | 0.1103 |
| 2012 | −0.377 | −0.543** | −0.472 | 0.253 | −0.776* | −0.520*** | −0.025* | 1.066 | 0.156 | 82 | 0.3603 |
| 2013 | −0.243 | −0.257 | −0.083 | 0.860*** | −0.432 | −0.313*** | 0.009 | 0.902 | −0.092 | 82 | 0.2724 |
| 2014 | −0.132 | −0.636*** | −0.437 | 0.681*** | −1.133*** | −0.295*** | −0.008 | 0.658 | 0.026 | 85 | 0.5067 |
| 2015 | −0.354 | −0.540*** | −1.109*** | 0.228 | 0.130 | −0.436*** | −0.010 | 2.159*** | −0.024 | 84 | 0.3899 |
| 2016 | −0.041 | −0.600*** | −1.508*** | 0.137 | −0.830*** | −0.285*** | −0.014 | 1.402 | 0.029 | 84 | 0.4205 |
| 2017 | −0.537** | −0.524*** | −0.439 | 0.767** | −0.411 | −0.711*** | −0.020 | 0.244 | 0.144 | 83 | 0.3221 |
| 2018 | −0.738*** | −0.531*** | −0.394 | 1.171*** | −0.576*** | −0.442*** | −0.013 | −0.519 | 0.135 | 84 | 0.2417 |
| 2019 | −0.083 | −0.150 | 0.269 | 0.909 | −0.736** | −0.480** | −0.011 | 1.329 | −0.001 | 82 | 0.2008 |
| 2020 | −0.413*** | −0.570*** | −0.621*** | 0.393*** | −0.658*** | −0.549*** | −0.001 | 0.326 | 0.005 | 82 | 0.8345 |
| | | | | | | | | | | Average | 0.3659 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel B**: Regression Results (Cont.)

| | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | LnMEM | ROA | Constant | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Public Health** | | | | | | | | | | | |
| Pooled-data | −0.482*** | −0.354*** | 0.239 | 0.110** | −0.004 | −0.005 | −0.007* | 0.601 | −0.001 | 721 | 0.0414 |
| 2011 | −1.984*** | 0.069 | 1.510 | 0.063 | −0.004 | 0.003 | 0.025 | 0.996 | −0.261 | 42 | 0.3460 |
| 2012 | 0.391 | −0.254 | −0.416 | 1.030*** | −0.307 | −0.160 | −0.019 | −0.309 | 0.161 | 75 | 0.2215 |
| 2013 | −0.810 | −1.122** | 2.141 | 0.779 | −0.455 | −0.242 | −0.013 | −2.596* | 0.242 | 73 | 0.1474 |
| 2014 | −0.385 | 0.082 | −0.547 | 0.787* | −0.319 | 0.014 | −0.007 | −1.656 | 0.075 | 74 | 0.0659 |
| 2015 | −0.418 | −0.903** | −0.197 | 0.288 | −0.259 | −0.423*** | −0.022* | 1.476 | 0.106 | 75 | 0.2536 |
| 2016 | −0.392 | −0.484 | −0.343 | −0.123 | −0.353 | −0.261 | −0.007 | 1.691 | −0.027 | 76 | 0.1143 |
| 2017 | 0.002 | 0.270 | 1.124 | 1.002*** | 0.073 | −0.103 | −0.015 | 1.299 | 0.022 | 75 | 0.1997 |
| 2018 | −0.142 | −0.013 | 0.752 | 0.528 | −0.081 | −0.296*** | 0.008 | 0.286 | −0.084 | 77 | 0.1022 |
| 2019 | −0.466 | −0.179 | −0.236 | 0.148 | −1.010 | −0.355*** | −0.007 | 3.835*** | −0.131 | 77 | 0.2897 |
| 2020 | −0.910*** | −0.426 | −0.883 | 0.167 | −0.532* | −0.369* | −0.007 | 0.549 | 0.033 | 77 | 0.1257 |
| | | | | | | | | | | Average | 0.1866 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel B**: Regression Results (Cont.)

| | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | LnMEM | ROA | Constant | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **State Enterprises** | | | | | | | | | | | |
| Pooled-data | −0.257*** | −0.495*** | −0.106 | 0.457*** | −0.078** | −0.055*** | −0.006*** | 0.150 | 0.015 | 484 | 0.2462 |
| 2011 | −0.103 | 0.032 | 0.419 | 0.163 | −0.111* | 0.008 | −0.008 | −0.534 | 0.062 | 39 | 0.0169 |
| 2012 | −0.797*** | −0.491*** | −0.546** | 0.817** | −0.490** | −0.384*** | −0.009 | 0.843 | 0.046 | 52 | 0.5690 |
| 2013 | −0.061 | −0.535*** | −0.397 | 0.879*** | −0.580** | −0.659*** | −0.005 | 0.530 | 0.060 | 51 | 0.5270 |
| 2014 | −0.701** | −0.781*** | −0.235 | 0.340 | −0.713*** | −0.505*** | 0.005 | 0.987 | −0.062 | 51 | 0.4779 |
| 2015 | −0.141 | −0.701*** | −0.345 | 0.457 | −0.364 | −0.375** | −0.003 | 0.134 | 0.013 | 50 | 0.3853 |
| 2016 | −0.516 | −0.866*** | −0.679* | 0.263 | −0.609*** | −0.532*** | 0.005 | 0.615 | −0.066 | 49 | 0.6728 |
| 2017 | −0.876*** | −0.596** | −0.619* | 0.578*** | −0.199 | −0.510*** | 0.004 | 0.938 | −0.062 | 48 | 0.6791 |
| 2018 | −0.409 | −0.491*** | −0.131 | 0.535 | −0.675* | −0.091 | 0.001 | −0.193 | −0.016 | 49 | 0.2363 |
| 2019 | −0.429 | −0.276 | −0.246 | 0.518* | −0.589* | −0.373* | −0.002 | 1.284 | −0.052 | 50 | 0.338 |
| 2020 | −0.107 | −0.598*** | −0.433 | 0.586*** | −0.286 | 0.082 | −0.003 | −0.217 | 0.009 | 45 | 0.4923 |
| | | | | | | | | | | Average | 0.4395 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel B**: Regression Results (Cont.)

| | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | LnMEM | ROA | Constant | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Private Sector** | | | | | | | | | | | |
| Pooled-data | 0.000 | −0.063*** | −0.089*** | 0.086*** | −0.003 | −0.032*** | −0.003** | 0.635*** | −0.001 | 3,698 | 0.0913 |
| 2011 | 0.006 | −0.028 | 0.013 | 0.010 | 0.007 | −0.007 | −0.003 | 0.890*** | 0.006 | 244 | 0.0218 |
| 2012 | 0.001 | −0.023 | −0.030 | 0.200*** | −0.075*** | −0.091*** | 0.002 | 0.628*** | −0.021 | 342 | 0.1964 |
| 2013 | 0.025 | −0.064 | −0.105 | 0.123*** | 0.061 | −0.072*** | −0.007 | 0.780*** | 0.033 | 359 | 0.1310 |
| 2014 | −0.103*** | −0.211*** | −0.123 | 0.496*** | −0.137 | −0.121*** | −0.001 | 0.636*** | −0.001 | 375 | 0.3783 |
| 2015 | −0.065 | −0.273*** | −0.426*** | 0.385*** | −0.512*** | −0.227*** | −0.002 | 0.903*** | −0.003 | 390 | 0.2800 |
| 2016 | −0.215*** | −0.250*** | −0.369** | 0.090*** | −0.510*** | −0.083*** | 0.002 | 0.305** | −0.003 | 395 | 0.1144 |
| 2017 | −0.157*** | −0.135** | −0.284*** | 0.200*** | −0.354*** | −0.142*** | −0.006 | 0.493*** | 0.033 | 402 | 0.1488 |
| 2018 | −0.224*** | −0.337*** | −0.426*** | 0.324*** | −0.569*** | −0.136*** | −0.002 | 0.911*** | −0.006 | 408 | 0.3040 |
| 2019 | −0.083* | −0.144** | −0.145 | 0.339*** | −0.172* | −0.229*** | −0.003 | 1.284*** | −0.031 | 408 | 0.2435 |
| 2020 | −0.079** | −0.079 | −0.055 | 0.692*** | −0.116 | −0.170*** | 0.000 | 0.732*** | −0.035 | 375 | 0.4935 |
| | | | | | | | | | | **Average** | **0.2312** |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel B**: Regression Results (Cont.)

| | ΔCASH&BANK | ΔSAVCOOP | ΔSINV | ΔSLOAN | ΔLINV | ΔLLOAN | LnMEM | ROA | Constant | N | Adj $R^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Others | | | | | |
| Pooled-data | −0.099*** | −0.232*** | −0.220** | 0.040*** | −0.014** | −0.011** | −0.002 | 0.200*** | 0.009 | 994 | 0.0534 |
| 2011 | −0.218 | −0.363 | −0.306 | 0.007 | −0.012* | −0.001 | −0.007 | 2.004*** | −0.045 | 61 | 0.2878 |
| 2012 | −0.416*** | −0.059 | −0.618** | 0.520*** | −0.726* | −0.293*** | −0.004 | 0.921* | 0.018 | 93 | 0.2613 |
| 2013 | 0.022 | −0.441** | −0.301 | 0.032 | −0.018 | −0.262*** | 0.005 | 0.388*** | −0.013 | 94 | 0.2881 |
| 2014 | −0.262** | −0.243** | −0.299 | 0.732*** | −0.340 | −0.208*** | −0.002 | 1.482*** | −0.041 | 101 | 0.6113 |
| 2015 | −0.179 | −0.093 | −0.772 | −0.004 | −0.493 | −0.163** | −0.006 | 1.569*** | −0.009 | 107 | 0.1788 |
| 2016 | 0.010 | −0.441** | −0.337 | −0.112* | −0.407 | 0.050*** | 0.005 | 0.548 | −0.053 | 110 | 0.1157 |
| 2017 | −0.142 | −0.407** | −0.418 | 0.764*** | −0.396 | −0.556*** | −0.010 | 0.207 | 0.079 | 109 | 0.4306 |
| 2018 | −0.126 | −0.223 | −0.195 | 0.823*** | 0.331 | −0.283*** | 0.003 | 0.422 | −0.027 | 108 | 0.4643 |
| 2019 | −0.423*** | −0.169 | −0.664 | 0.913*** | −0.717*** | −0.394*** | −0.003 | 0.826*** | −0.002 | 110 | 0.5031 |
| 2020 | 0.114* | −0.176 | −0.170 | 0.909*** | −0.080 | −0.209*** | 0.005 | 0.562 | −0.068 | 101 | 0.3684 |
| | | | | | | | | | | Average | 0.3509 |

***, ** and * refer to significance at 0.01, 0.05 and 0.10 level, two-tailed test, respectively.

**Table 5**: Regression by Industry and by Year (Cont.)

**Panel C**: Estimated DWCA

| | Obs | Mean | Std. Dev. | Maximum | Percentiles | | | Minimum |
|---|---|---|---|---|---|---|---|---|
| | | | | | 75th | 50th | 25th | |
| Total | 12,343 | −0.040 | 0.459 | 1.806 | 0.064 | 0.014 | −0.036 | −13.801 |
| (1) Teachers | 893 | −0.061 | 0.416 | 1.138 | 0.041 | −0.003 | −0.051 | −4.857 |
| (2) Universities | 416 | −0.033 | 0.367 | 1.253 | 0.060 | 0.002 | −0.061 | −5.277 |
| (3) Government Agencies | 2,368 | −0.041 | 0.492 | 1.151 | 0.046 | 0.009 | −0.029 | −13.801 |
| (4) Polices | 1,071 | −0.064 | 0.566 | 0.510 | 0.070 | 0.026 | −0.022 | −7.498 |
| (5) Militaries | 888 | −0.047 | 0.397 | 0.414 | 0.039 | 0.008 | −0.027 | −5.525 |
| (6) Hospitals | 810 | −0.051 | 0.419 | 0.590 | 0.043 | 0.008 | −0.038 | −5.485 |
| (7) Public Health | 721 | −0.033 | 0.484 | 0.697 | 0.056 | 0.015 | −0.030 | −6.820 |
| (8) State Enterprises | 484 | −0.032 | 0.261 | 0.574 | 0.037 | −0.005 | −0.054 | −3.548 |
| (9) Private Sector | 3,698 | −0.028 | 0.452 | 1.249 | 0.093 | 0.028 | −0.035 | −9.085 |
| (10) Others | 994 | −0.037 | 0.484 | 1.806 | 0.077 | 0.017 | −0.046 | −8.203 |

## 6. Test of the Generalizability of the Model

To test the generalization of our model, we use data of 606 credit unions with 5,546 firm-year observations during the period 2010 to 2020. We use this group to do this test because its operation is similar to saving cooperatives. ΔOPEX is excluded from our model because of its low predictability power as shown in Table 4 Panel A. Untabulated results indicate that our model outperforms the Jones model, the modified Jones model and the performance-matched discretionary accruals model. Its average adjusted $R^2$ significantly increases from 0.1181 for our main analysis to 0.5772 for generalizability test. ΔCASH&BANK, ΔSAVCOOP, ΔSLOAN, ΔLLOAN and ROA are good predictors for WCA. DWCAs predicted by our model are approximately 0.6 percent of total assets (Std. Dev. = 16.2%) whilst those by other models are approximately 3.0 percent of total assets (Std. Dev. = 19.0%).

## 7. Conclusion

The collapse of the Klongchan Credit Union Cooperative has led the Ministry of Agriculture and Cooperative to closely monitor other saving cooperatives' imbalance between deposits from and loans to their members. Management may be motivated to engage in earnings management to conceal the imbalance arising from unethical behaviors and fraud. Our study therefore contributes to the monitoring tools for detecting Thai saving cooperatives' earnings management through their decision making on financial stability.

With their unique operations, the existing accruals model may be unable to capture discretionary accruals among Thai saving cooperatives. We then develop the new model for capturing the cooperatives' earnings management through their decision making on cash on hand, deposits, investments and loans. We use data of 1,385 Thai saving cooperatives with 12,250 firm-year observations during the period 2011 to 2020. Our model outperforms the Jones model, the modified Jones model and the performance-matched discretionary accruals model because its adjusted $R^2$ is higher than those of these three models.

Our new accruals model is the cross-sectional OLS regression function of discretionary working capital accruals, change in cash on hand and at banks, change in cash at other cooperatives, change in investments, changes in loans, the natural logarithm of numbers of members and return on assets. Its performance improves when estimating parameter of equation by industry and year specific. Our model is beneficial for auditing of saving cooperatives. Auditors will be able to use our model as the tool for detecting the saving cooperatives' earnings management through their decision making on cash on hand, deposits, investments and loans. The auditors should thus pay more focus on those who report high discretionary working capital accruals in terms of either income-increasing or income-decreasing

earnings management. If the saving cooperatives are suspected to engage in earnings management, the auditors should pay more focus on the audit of cash on hand, deposits, investments and loans.

Our findings are also beneficial to improve the programme for assessment of cooperatives' financial stability. For the assessment of a cooperative' financial structure, instead of scoring the ratio of total loans to members to total assets, it should be separately scored between short-term and long-term loans to members/other cooperatives because these two types of loans have different levels of risks. Also, it should be separately scored between cash on hand, cash at banks, cash at other cooperatives, short-term investments and long-term investments as these items have different levels of risks and returns. We believe that the separation between short-term and long-term components of these items may help the regulators better score the saving cooperatives' financial stability.

Saving cooperatives operate under strict laws and enforcements. Thus, they may have less motivations for engaging in earnings management in comparison to normal business entities. This places limitations to our model as it may capture less earnings management and may face misspecification problems. Further study shall develop accruals models, by based on ours, which will better capture earnings management of the saving cooperatives and other types of cooperatives (e.g., agricultural cooperatives, service cooperatives, good cooperatives).

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