Punctuated or incremental? Macao’s budget change and governance before and after the handover

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Abstract
As an export-oriented and developed micro-economy, Macao’s government budget has its own unique characteristics. Since 1999, Macao’s return to China represents a unique scenario of institutional and governance change from separation to unity of sovereignty and governance. This transition is different from the change of political regime, leadership turnover, and ruling party replacement on which the current literature focuses. By collecting budget expenditure data from 1976 to 2022, this study describes and compares Macao’s budgets, including total budget, operating budget, capital budget, and functional budget, to understand if different types of budgets have experienced incremental change or punctuated changes before and after the handover. The study finds that the total budget, capital budget, and most functional budgets show more incrementalism after the handover than before the handover, while the operating budget is more punctuated compared to the colonial administration budget.

Keywords
Handover of Macao, incremental budget, informational cognition, institutional friction, punctuated equilibrium budget

Received 16 May 2022; revised manuscript accepted 17 May 2022

Introduction
The budget processes and outcomes in cases of political regime change, leadership turnover, and ruling party replacement are well-documented in the public administration literature, particularly in the context of countries like the United States. However, China Macao is a micro-economy that has experienced governance changes that remain largely unexplored. Ieong (1992, 2017) and Xiao (2019) define a micro-economy as a country acknowledged by international organizations or an independently-run regional economy with a population of less than 1 million, a micro-scale of economy, and a highly reliable industry structure. In 2019, Macao SAR’s population was 679,000, with a regional GDP per capita of $79,977. In 2018, its service industry accounted for 94.2% of the regional GDP. In the fourth quarter of 2019, the gross income of gambling accounted for 63.8% of the regional GDP. In 2019, gambling and other service exports accounted for 73.4% of the regional GDP and the total trade value accounted for 116.9% of the regional GDP.1 Macao’s unique governance transition and its export-oriented micro-economy provide a unique institutional context in which to better understand the special administrative region’s budget changes before and after the handover.

To stabilize Macao’s return to China, the “One Country, Two Systems” policy was introduced by China’s central government to govern the Macao Special Administrative Region (MSAR). Under this policy, Macao has experienced rapid economic growth and significant governance changes since its official return on December 20, 1999. Macao’s average annual GDP growth rate was 12.6% from 2000 to 2018.2 After the handover, a hybrid executive-led political system was adopted to ensure social stability for a smooth
transition (Chan, 2011; Lok, 2003). There are significant differences between the Governor and Chief Executive as the political head of Macao in terms of governance power. Before the handover, Article 5 and Article 40, Item 2 of Law No.1/1976 Organic Statute of Macao confers upon the Governor of Macao both amending and veto powers (“双轨立法”) to bills passed by the Legislative Assembly. The Basic Law of the Macao Special Administrative Region of the People’s Republic of China (BLMSARPRC) states that the Chief Executive has little power to amend and veto bills and that the Legislative Assembly is the only legislative organ in Macao SAR.

Accordingly, Macao’s budgets and budgetary systems have been affected by these institutional and legislative changes. Many sections have been revised according to the Administrative Regulation No. 6/2006 Public Finance Ordinance. The Macao legislature has passed Law No.15/2017—Budget Framework Law, although the budget making process of the Macao Special Administrative Region follows Decree No. 41/83/M. Taking the aforementioned institutional and governance mode changes into consideration, this study explores budgetary change patterns before and after Macao’s handover to China. This study will specifically address the following research questions: Were the budgetary changes in Macao more incremental or punctuated before and after the handover? What factors contributed to these changes?

To answer these questions, this study conducted an empirical study that examined several types of budgets, including the total budget, operating budget, capital budget, and functional budget. The total, capital, and most functional budgets showed more incrementalism after the handover than before the handover. However, the operating budget is more punctuated compared to the colonial administration budget. The annual change to the total budget reflects the variation in resource allocation through the budget process. The changes in the capital and operating budgets show the results of fiscal resources allocation between stabilizing economic development and providing government services. Moreover, the changes to the annual functional budgets indicate the institutional friction generated among different interest groups that influence the decision-making process. This study will contribute to the literature on budget reform and related budget literature.

This study proceeds with a review of the relevant literature on budget decision-making theories such as PET to build a theoretical foundation for this empirical study. Next, the research hypotheses regarding the changes to the MSAR’s budget making and their outcomes before and after the handover are proposed. The research methods, variables, and data sources are then presented, followed by the empirical results of the MSAR’s budget based on PET. Finally, the conclusions and implications of this research are discussed, as well as suggestions for future research.

Literature review

Budget decision-making: Theoretical models and related studies

Public administration scholars have provided several theoretical models or perspectives to understand budgetary changes and budget processes. Influenced by public choice perspectives, early public administration scholars argued that policy makers and budget officials are rational and self-interested and tend to maximize budgets for governments or other public organizations (Niskanen, 1971). In contrast, Simon (1972) presented the concept of bounded rationality and argued that decision-making cannot be fully rational due to time and resource constraints, as well as humans’ cognitive limitations. In a similar vein, Lewis (1952) contended that budget decisions are affected by factors such as individual’s arrogance, bias, and political ideology. Other research has noted the limitations of being completely rational in the decision-making process for budgets (Dong & Gou, 2004). Breunig and Koski (2006) found that decision makers do not have enough time and cognition when facing allocation alternatives.

Wildavsky (1961) observed incremental changes in national budgets and used incrementalism to describe budget changes in public organizations. Advocates of incrementalism theory believe that budget outcomes are marginal changes based on the previous allocation results, and that decision makers are dependent on the previous allocation outcomes to make new decisions. However, Baumgartner et al. (2009) pointed out that incrementalism cannot be used to explain dramatic changes in budget decisions and proposed the punctuated equilibrium theory (PET) to explain the fluctuations of government expenditure. Rubin (2015) also contended that incrementalism cannot fully explain budget decision-making and outcomes in real budget reforms due to the wide variety of participants in the budget process.

Because budget incrementalism cannot explain rapid changes that occur in a relatively short time period, the punctuated equilibrium theory has been used to explain this phenomenon as the result of budget reforms or rapid social change. Breunig and Koski (2006) found that budget punctuation occurs when a high frequency of incremental extreme change values exists. Kuang (2011) and Zhu et al. (2012) uncovered several factors that lead to budget punctuation, including rapid changes to the internal and external environment, limited information cognition, attention, and institutional friction induced by inertia.

The punctuated equilibrium theory has been empirically applied to studies about the U.S. federal, state, and European governments. For example, Baumgartner et al. (2009) and Breunig et al. (2010) found the existence of punctuated equilibriums in their investigations of the U.S. federal budget. They also proposed that system costs and the complexity of the political agenda increase the institutional
conflicts in each policy cycle. As budget power becomes more concentrated in the hands of high-level government officials, the more likely the budget decision-making will be based on “limited information.” This limit may be highly correlated with budget punctuation. However, the impacts of restrictive legislative rules and diverse party members on budget punctuation are not significant (Baumgartner et al., 2009; Breunig et al., 2010).

Several studies of U.S. budget changes have examined punctuations. Kovari (2016) used U.S. Wisconsin’s expenditure data (1990–2009) and found that irregular capital projects experience more budget punctuations than operating projects. Breunig and Koski (2009) compared functional budget punctuations and equilibriums by calculating annual changes in kurtosis and L-Kurtosis based on annual inflation adjusted expenditure data among three U.S. States. By analyzing the budget data (1966–1992) covering police departments, fire departments, sanitation, parks and recreation, public buildings, and highways of different U.S. states, Jordan (2003) found that functional budgets are more punctuated. Breunig and Koski (2006) collected and analyzed 10 functional budget data sets (1982–2002), including education, government administration, health, highways, hospitals, natural resources, parks and recreation, police and law enforcement, and welfare of 50 state institutions of the U.S., and found that state budget categories are generally punctuated depending on service categories.

Most empirical studies in the institutional context of China used data of budgetary change rate of the governments to determine whether budget punctuations occurred. Li et al. (2019) investigated the central and local government expenditure changes and tested hypotheses on budget punctuations and vertical institutional conflicts. They found that income tax sharing (a proxy of intuitive conflict) has a significant impact on budget punctuations within the central government, but not for political cycles. Cao and Hao (2020) used a panel data set of 31 provinces’ functional expenditure data to empirically examine the changes to the total and functional budgets of central and local governments. They also found evidence of budget punctuations and proposed that the degree of budget punctuations varies among the different levels of governments in China, mostly due to the imbalance in resource allocations and information processing.

At the local level, Chen and Lin (2018) used the data of a city’s departmental total and functional budget (2008–2016) in Guangdong province. They found that 24 departmental budgets display the characteristics of incrementalism, whereas another 77 departments’ total and functional expenditures are punctuated. Kuang (2019) analyzed the environmental protection budgets of 30 provinces (2000–2010) and concluded that decision makers have limited information cognition during the budget decision-making process. These studies found that budget decisions are largely influenced by either external environmental or institutional changes. These changes will indirectly affect policy changes, which lead to budget punctuations. Macao, as a special administrative region of China, is different from the provincial and local governments in mainland China in terms of its political and fiscal institutions and policy formulation practices.

**Understanding the budget process and changes in the institutional context**

Public administration scholars have examined budget punctuations and equilibriums in western countries such as the United States and developing countries such as China, taking into account different political systems and institutional structures (highly centralized and democratic regimes). Baumgartner et al. (2017) examined different countries’ budget processes using data from Brazil (1964–2010), Turkey (1970–2004), Malta (1826–1921, 1922–1936, 2001–2011), and Russia (1998–2014), covering periods of highly centralized and democratic rule. The results of this study demonstrated that in periods of centralized rule, decision makers lack the electoral incentive to respond to the diverse demands of society. Due to the limited information cognition of the decision makers, it is easier to trigger budget punctuations. By analyzing budget data from 1868 to 2013, Sebök and Berki (2018) noted that the level of kurtosis in Hungarian budget expenditures in periods of democratic rule is lower than those of periods of autocratic or semi-autocratic rule.

During the budget formulation process, Baumgartner et al. (2009) found that decision makers obtained information by coordinating and interacting with different stakeholders. They also initiated policy-making processes to address different issues. If the government proposes policies and redistributes resources based upon the severity of the public issue, the process can be efficient and no institutional friction exists. However, policy and resource allocations tend to reach equilibrium without punctuation when the demands of interest groups are too diverse to attract the attention of primary decision makers on certain agendas.

The Constitution grants power to the Chief Administrative Officer (CAO) in western countries under the one-party or dominant-party systems (Alesina & Perotti, 1995; Guess & LeLoup, 2010). Under these conditions, the CAO largely controls budget and policy implementation, especially in populist countries. Previously unpopular topics may be included in the political agenda due to media promotion, which will attract the attention of the decision makers. Considering the decision maker’s limited amount of attention, his understanding of the political agenda may change, therefore the decision makers’ intentions to make better and more comprehensive budget policies based upon representatives’ requests are likely to be reduced (Kuang, 2019). The possibility of punctuated budget outcomes will increase given the relatively insufficient intuitional friction that restricts changes to budgets and policies.
In highly centralized regimes, political consensus helps to reduce the internal friction caused by the external environment (Lam & Chan, 2015). To a certain extent, highly centralized decision makers do not need to consider the needs of external representatives and policy and budget changes, making it difficult to create sufficient institutional friction. As a result, budget and policy formulation punctuations may occur. Moreover, the change of endogenous organizations in the budget process always causes punctuations. For example, the more frequent the turnover of budget decision maker is, the more punctuated budget it induces. Flink (2018) used data from Texas school districts (1993–2010) to examine the relationship between budget changes and employee turnover rates and found that as the turnover rate increased, so too did frequency of both positively and negatively punctuated budget change. Yao et al. (2021) examined data from provincial governments in China (1996–2018) and tenure of local leaderships (such as budget decision makers), finding that the longer the tenure, the greater the friction caused by institutional inertia, implying that more frequent turnover triggers more budget punctuations.

**Hypothesis development for budgets in Macao**

The decision-making process of formulating a budget involves multiple stakeholders. Budgetary decisions are affected by institutional friction and information cognition. Decision makers and stakeholders communicate and negotiate with each other regarding the proposed budgets and public policies, which may lead to changes to decisions. This process is called institutional friction. Meanwhile, decisions made by government officials are affected by factors in the external environment. Given the limited attention of decision makers, only information that is noticed and processed by the decision makers can change their cognition of certain issues, which may affect policy making and implementation. The intensity of institutional friction and the cognitive ability of the decision makers are correlated with the possibility of budget punctuations. In addition, the core principles of budget formulation that guide the decision maker may have a major impact on the distribution of budget changes, causing different levels of punctuation.

The implementation of “one country, two systems” in Macao led to changes to political institutions, budgeteers, governance and policy networks, information cognition, and the core principles of budget formulation of the Governor and Chief Executive (see Table 1).

**The total budget**

Before the handover, the Governor possessed the power to both amend and veto bills passed by the Legislature Assembly, allowing this official to dominate the processes of budget making and agenda setting. The Governor only needed to report to the President of Portugal. Thus, the Governor would propose and adopt a budget by taking foreign relations between China and Portugal into consideration, while working to not add financial burden to Portugal. Due to institutional arrangements and political institutions, governance may not take the needs of and feedback from local communities into consideration when making budget requests and adopting public policies.

In the colonial era, the institutional friction generated by interaction between different representatives was not significant. Before the signature of the Joint Declaration of the Government of the People’s Republic of China and The Government of the Republic of Portugal on the question of Macao (Sino-Portuguese Joint Declaration), the construction of infrastructure was stagnant. After the signing of the Sino-Portuguese Joint Declaration, the colonial government initiated lots of infrastructure projects, inducing budget punctuations.

Compared to the colonial-era Governor, the Chief Executive does not have the political and diplomatic motivation to invest in infrastructure, but rather works to meet the demands of society. The Chief Executive has no legislative power, as the legislature possesses the power to make laws according to the BLMARPRC. Nonetheless, Law No. 75 in BLMARPRC states, “Members of legislature can propose bills individually or as a group, which are not related to government budget, political systems, or government operations. Any bills related to public policy must obtain approval from the Chief Executive before proposing.” Thus, the MSAR maintains the feature of being “executive-lead” (Lok, 2003; Zhu & Gao, 2016). However, community organizations have developed rapidly after the handover, with approximately 9,000 community organizations in 2018, compared to 1,739 in 1999. Given that community organizations collect and represent residents’ interests, the Chief Executive as the key decision maker of the government budget must take the needs of local communities and the changes to the budget and policies into consideration. These motivate the leader to propose and adopt a comprehensive budget that takes different budget requests into consideration. This interaction increases institutional friction and affects the budget and policy stability. Thus, the following hypothesis regarding the total budget is proposed:

**Hypothesis 1**: Macao’s total budget punctuations before the handover are larger than those after the handover.

**The capital budget**

Gambling is the primary industry of Macao. According to the Basic Law A105, after the handover, the MSAR government is required to maintain the changes in annual total budget and annual regional GDP for the purpose of
stabilizing local economic development. From 1991 to 1999, gambling accounted for 24.6% of the regional GDP. This increased to 32.6% from 2000 to 2018. Gambling has become increasingly important for the MSAR’s economic development since the handover. Macao’s regional GDP data from 1982 to 2018 was collected. The kurtosis of the regional GDP is 0.4 before the handover but 3.5 after the handover, illustrating that government revenue stability is supported by a single, dominant industry.

Before the handover, economic growth was not the priority for capital budgets due to the separation of sovereignty. In the period of political and diplomatic uncertainty before the signing of the Sino-Portuguese Joint Declaration on April 13, 1987, capital budgets remained largely unchanged because the Governor had little incentive to change it. After the date of Macao’s handover was confirmed, the Governor immediately proposed many infrastructure-related capital projects to show his determination to boost local economic development.

Central government policies played a significant role in stabilizing the economy and society of the MSAR. Under the “one country, two systems” policy, the MSAR received strong support and assistance from the central government in terms of economic policies, such as the “Free and Independent Traveler (FIT) from Mainland China” policy, and the issuance of Local Treasury Bonds from Guangdong in Macao during the economic crisis. In keeping with the BLMSARPRC’s principle of a balanced budget and given the central government’s financial support, the Chief Executive might not need to dramatically change the capital budget as a response to the handover and institutional change. Thus, this study proposes the following hypothesis with regard to the capital budget:

Hypothesis 2: The MSAR’s capital budget punctuations before the handover are higher than those after the handover.

The operating budget

Since at least 70% of the total budget is the operating budget, the latter became the best tool for the Portuguese
government to obtain fiscal benefits from Macao before the handover. Macao’s Governor wanted to bring fiscal benefits to Portugal and had little incentive to meet society’s needs in Macao. Thus, few changes could be observed in the operating budget before the handover. After the handover, the MSAR government allocated huge amounts of public resources to maintain socioeconomic stability and improve people’s livelihoods. In addition, since budgeteers, especially high-level government officials, were changed from Portuguese to local Chinese residents, public service has become a major concern of the MSAR government. Although society’s needs have become more diverse, some important public projects, such as 15-year free education, the Cash Payout Scheme, and the enhancement of medical services and social welfare, are widely supported by different segments of society. It is relatively easy for the Chief Executive to overcome institutional inertia due to the consensus among the social communities’ representatives.

Hypothesis 3: The MSAR’s operating budget punctuations are lower before the handover than those after the handover.

The functional budget

Macao’s government budget is divided into eight functional budgets, including general public services, justice, order, and safety; education; health; social security; housing; social and community service; and economic services. A functional budget reflects resource allocations through policy formulation, so various punctuations in a functional budget implies the different level of breakthrough of policy inertia.

Prior to the handover, Portuguese and Chinese ethnic groups were largely segregated, and Chinese community organizations were used to collaborate among local Chinese. Some Chinese businessmen became representatives to coordinate, communicate, and provide feedback to the Macao government through the governmental institution of the “Chinese representative.” Nevertheless, community organizations functioned as a platform to unite people from different racial and ethnic groups given that the Governor of Macao dominated the whole budget and policy process, which put Portugal’s interests above all others (Chan, 2011). In the specific field of expenditure, since the Governor put much more emphasis on meeting the needs of Portuguese citizens rather than those of the local Chinese communities, the information he accepted was relatively narrow, inducing the functional budget punctuations.

After the handover, community organizations become more diverse and communicable with the government both formally and informally (He & Xu, 2014), indicating that people’s needs, community organizations’ interests, and the function of representatives are more diversified now than they were before the handover. The MSAR government and especially the Chief Executive may now obtain the most recent context of policy changes more easily. Moreover, as the idea of scientific administration spreads, policy needs from diverse communities are gradually incorporated into policy formulation. Due to the limited cognition and attention of the decision maker, functional budgets may not change significantly.

Hypothesis 4: The MSAR’s functional budget punctuations before the handover are higher than those after the handover.

Research methods and data sources

Measurements and formulas

Budget punctuations are usually measured by examining the changes to and distribution of the budget. As discussed in the literature on the PET, high levels of diversification and large amounts of information result in institutional friction, thereby increasing the difficulty of overcoming policy and budget inertia. The core principles of budget formulation that guide budgeteers determine whether incremental or punctuated changes will occur to a certain degree.

Budget change and distribution are calculated to determine the existence of budget punctuations. If the annual expenditure does not have punctuations, the distribution of the expenditure change should be random and normally distributed given the Central Limit Theorem (Zhu et al., 2012). The kurtosis of the distribution can reflect its shape. If the kurtosis is larger than 3, the distribution is Leptokurtic; Platykurtic distribution occurs when the kurtosis is smaller than 3, and normal distribution when the kurtosis is 3 (DeCarlo, 1997). When the kurtosis is higher than 3, there are many values distributed at the two tails and greater potential for extremely low or high values. These values serve as strong evidence of the existence of the Punctuated Equilibrium Process (Baumgartner et al., 2009).

This research uses a t-test to examine two groups of budget change data (before and after handover), and conducts the Shapiro-Wilk test to evaluate whether the annual change of budget expenditures is close to normality (Breunig & Koski, 2006). When $p < .05$, the null hypothesis can be rejected with a 95% confidence interval. When the change of expenditures does not follow a normal distribution, the kurtosis can be calculated to explain the annual change.

To avoid the bias caused by outliers in the calculation of kurtosis, we calculate the L-Kurtosis recommended by Breunig et al. (2010), which is based on linear combinations of order statistics. This method can reduce the sensitivity caused by outliers so that the punctuations can be estimated more accurately. L-Kurtosis is the fourth L-moment, while L-Coefficient of Variation (L-CV), and L-Skewness. L-CV primarily measures the changes among observed values, while L-Skewness gages the asymmetry of the distribution, with a value from 0 to 1. The higher the L-CV, the larger the
variation among observed values. Additionally, Breunig et al. (2010) pointed out that the data are normally distributed when the L-Kurtosis equals 0.123, whereas a Leptokurtic distribution has an L-Kurtosis larger than 0.123. This study employs the formula in the Appendix 1 (see Appendix 1 for details) to calculate the L-CV and L-Kurtosis for the change to the annual budget in the MSAR.

**Data sources**

This study uses publicly available data collected by the Macao Special Administrative Region Bureau of Statistics (MSARBS) and budget bills passed by Legislative Assembly of Macao. The data include the total, operating, and capital budgets from 1976 to 2022, as well as functional budgets from 1978 to 2022. First, MSARBS has adopted the International Monetary Fund’s 2014 Government Finance Statistics Manuals and Guides to categorize its functional budget as the expenditures of each government function. Second, given the new Budget Law No. 15/2017, which was implemented in 2018, the MSAR’s expenditures from 2019 consist of general funds and special funds. The two were aggregated to obtain the budget. When calculating the annual change to the total, operating, capital (1977–2022), and functional budgets (1979–2022), given the 1-year time lag between budget data and the real expenditure number, all budget data are inflation-adjusted using the Consumer Price Index (CPI) \(t-1\) to eliminate the upward trend caused by inflation. All data are log transformed to diminish the impacts of outliers.

**Empirical results**

This study conducts the Shapiro-Wilk test to test the hypotheses and evaluate whether the changes to the total, operating, capital, and functional budgets follow normal distribution or experience budget punctuations before and after the handover.

**Punctuated equilibrium in the total budget**

The t-test of total budget change before and after the handover resulted in a p-value of .03. There is a significant difference between the two groups’ data. Before the handover, the Shapiro-Wilk test on the MSAR’s total budget has a p-value \(p=.001\) smaller than .05 (Table 2). The normal distribution hypothesis can be rejected with a 95% confidence interval. The L-CV, L-Skewness, and L-Kurtosis are 0.79, 0.04, and 0.24, respectively. The distribution has very minor skewness with moderate variability.

As shown in Figure 1, the distribution of the total budget before the handover follows a Leptokurtic distribution, which indicates punctuations. After the handover, given that the Shapiro-Wilk p-value (.72) is larger than .05, that total budget is normally distributed cannot be rejected. The L-CV, L-Skewness, and L-Kurtosis are 1.22, 0.04, and 0.10, respectively, which implies minor skewness. The L-Kurtosis is smaller than 0.123, indicating that no budget punctuations exist.

Comparing the total budget distributions before and after the handover, the budget punctuations after the handover are significantly lower. Although the L-Kurtosis does not equal 0.123, an L-Kurtosis value of 0.10 shows that the total budget decision making is close to incrementalism in the MSAR, which is significantly different from the punctuated equilibrium seen in total budget before the handover. Thus, we find evidence to support Hypothesis 1.

**Punctuated equilibrium in the capital budget**

The t-test of the capital budget data from before and after the handover shows that the null hypothesis cannot be rejected. Figure 2 shows that the distribution of the capital budget before the handover follows a Leptokurtic distribution and contains punctuations. There is no significant difference in capital budget change before and after the handover. Table 3 shows that the L-CV, L-Skewness, and L-Kurtosis are 1.86, 0.04, and 0.27, respectively, implying that the distribution of the capital budget is slightly skewed. Conversely, the L-CV, L-Skewness, and L-Kurtosis are 1.90, 0.09, and 0.04, respectively, after the handover. However, the Shapiro-Wilk test shows that this study cannot reject that the capital budget is normally distributed for the MSAR \(p=.62\), but that it can be rejected before the handover \(p=.0001\).

| Table 2. Result of the MSAR’s total budget before and after handover (with Shapiro-Wilk test and t-test). |
|------------------------------------------------------------------------------------------------------------------|
| Total budget | After handover (2000–2022) | Before handover (1977–1999) |
| Mean | 6.69 | 15.46 |
| SD | 14.03 | 22.45 |
| Skewness | 2.62 | -0.83 |
| Kurtosis | 2.62 | 5.61 |
| L-CV | 1.22 | 0.79 |
| L-Skewness | 0.04 | 0.04 |
| L-Kurtosis | 0.10 | 0.24 |
| Shapiro-Wilk test | 0.72 | 0.00* |
| **Note:** t-Test: p-value = .028. | | |
Although it cannot be proven that the operating budget is normally distributed given that the L-Kurtosis does not equal 0.123, it is reasonable to argue that capital budget decision making is close to incrementalism after the handover (L-Kurt = 0.04). Thus, there is evidence to support Hypothesis 2.

**Punctuated equilibrium in the operating budget**

There is a significant difference between the operating budget before and after the handover ($t$-test, $p = .02$). The Shapiro-Wilk test in Table 4 on the operating budget before the handover has a $p$-value larger than .05 ($p = .10$), meaning that the study cannot fully reject the null hypothesis. L-CV, L-Skewness, and L-Kurtosis for the operating budget before the handover are 0.45, 0.02, and 0.26, respectively. Although the L-Kurtosis value is larger than 0.123, we cannot reject the null hypothesis since the $p$-value for the Shapiro-Wilk test is .1. Figure 3 shows the distribution of the operating budget change and its punctuations. After the handover, the L-CV, L-Skewness, and L-Kurtosis are 1.17, 0.01, and 0.30, respectively. The L-CV values are larger than those before the handover, showing that the variation of the MSAR budget change is larger than the change...
before the handover. Also, the operating budget has higher punctuations (0.30) compared to that before the handover (0.26). Consequently, there is some evidence to partially support Hypothesis 3.

Punctuated equilibrium in the functional budget

Macao’s functional budget consists of general services, public safety, education, public health, social security, public housing, social services, and economic development (Table 4). Except for public health ($p = .047$), there is no significant difference between the functional budget changes before and after the handover. The Shapiro-Wilk test indicates that before handover the distributions of all functional budget changes rejected the null hypothesis, meaning that those do not follow normal distribution. Conversely, after the handover, only the functional budget for education ($p = .36$), housing ($p = .30$), and economic services ($p = .09$) cannot reject the null hypothesis. Furthermore, except for public health and social and community services, the L-Kurtosis values of the other functional budgets are lower than those before the handover. Therefore, punctuated equilibrium for the functional budget exists in fewer areas after the handover, implying that most functional budgets after the handover are less punctuated. In conclusion, the fourth hypothesis is partially supported.

As shown in Table 4, most functional budgets after the handover show fewer punctuations compared to those before Macao’s return to China. Firstly, the MSAR’s functional budget for social security has financial sustainability, which led to a lower L-CV after the handover than it was before. The MSAR government increased the pensions and all types of subsidies after the handover and established a double-layered social security system, which lower

### Table 3. Result of the MSAR’s operating and capital budget before and after handover (with Shapiro-Wilk test and t-test).

|                     | After handover (2000–2022) | Before handover (1977–1999) |
|---------------------|-----------------------------|-----------------------------|
|                     | Operating budget  | Capital budget  | Operating budget  | Capital budget  |
| Mean                | 6.18            | 9.03            | 15.78            | 13.80            |
| SD                  | 13.24           | 29.37           | 13.03            | 48.09            |
| Skewness            | 0.10            | −0.33           | 0.65             | −0.85            |
| Kurtosis            | 4.32            | 2.04            | 5.50             | 6.01             |
| L-CV                | 1.17            | 1.90            | 0.45             | 1.86             |
| L-Skewness          | 0.01            | 0.09            | 0.02             | 0.04             |
| L-Kurtosis          | 0.30            | 0.04            | 0.26             | 0.27             |
| Shapiro-Wilk test   | 0.01*           | 0.62            | 0.10             | 0.00*            |

* t-Test: operating budget $p$-value = .017.
** t-Test: capital budget $p$-value = .688.

### Table 4. Result of the MSAR’s functional budget before and after handover (with Shapiro-Wilk test and t-test).

| After handover/ before handover | General public services | Justice, order and safety | Education | Public health | Social security | Housing | Social and community services | Economic services |
|---------------------------------|-------------------------|---------------------------|-----------|---------------|-----------------|---------|-------------------------------|-------------------|
| Mean                            | 2.11                    | 7.47                      | 6.84      | 8.22          | 3.79            | 8.46    | 4.83                          | 6.71              |
| SD                              | 10.54                   | 8.63                      | 19.71     | 15.55         | 14.21           | 19.77   | 23.10                         | 13.72             |
| Skewness                        | 15.44                   | 14.51                     | 11.47     | 12.08         | 33.54           | 44.36   | 29.89                         | 27.19             |
| Kurtosis                        | 33.38                   | 29.92                     | 44.57     | 19.75         | 112.02          | 88.27   | 100.53                        | 52.66             |
| L-CV                            | −1.61                   | −0.70                     | −0.21     | 1.59          | −0.57           | 0.73    | −2.23                         | −0.83             |
| L-Skewness                      | −2.41                   | −2.54                     | −1.85     | −1.01         | −2.75           | 0.19    | −0.88                         | −0.62             |
| Kurtosis                        | 7.46                    | 4.60                      | 3.44      | 9.93          | 5.57            | 4.26    | 10.39                         | 4.10              |
| L-CV                            | 9.72                    | 13.27                     | 10.19     | 6.50          | 15.12           | 4.37    | 4.47                          | 6.60              |
| L-Skewness                      | 3.65                    | 1.08                      | 0.96      | 0.72          | 4.68            | 2.89    | 3.02                          | 2.28              |
| Kurtosis                        | 1.90                    | 2.23                      | 1.23      | 0.68          | 28.20           | 5.32    | 5.60                          | 2.99              |
| L-CV                            | 0.19                    | 1.08                      | 0.96      | 0.72          | 4.68            | 2.89    | 3.02                          | 2.28              |
| L-Skewness                      | 0.37                    | 0.17                      | 0.18      | 0.03          | 0.36            | 0.07    | 0.18                          | 0.07              |
| Kurtosis                        | 0.38                    | 0.21                      | 0.17      | 0.40          | 0.34            | 0.25    | 0.37                          | 0.12              |
| L-CV                            | 0.45                    | 0.47                      | 0.45      | 0.27          | 0.74            | 0.36    | 0.20                          | 0.37              |
| L-Skewness                      | 0.38                    | 0.01                      | 0.36      | 0.00          | 0.00            | 0.30    | 0.00                          | 0.09              |
| Kurtosis                        | 0.00                    | 0.00                      | 0.00      | 0.00          | 0.00            | 0.00    | 0.01                          | 0.00              |
| Shapiro-Wilk test               | 0.32                    | 0.62                      | 0.24      | 0.05          | 0.96            | 0.63    | 0.79                          | 0.67              |
| t-Test                          | 0.32                    | 0.62                      | 0.24      | 0.05          | 0.96            | 0.63    | 0.79                          | 0.67              |
degree of budget punctuations. Secondly, the MSAR government ramped up public housing projects to adapt to rapid economic development,8 which led to a high L-CV. According to new Budget Law No. 17 Article 27, an annual budget draft is required before capital, housing, and infrastructure projects are constructed, which indirectly lowered the budget change rate in public housing.

Moreover, the MSAR’s functional budgets for general services, public safety, education, have been more stable after the handover. The MSAR government has improved substantially in education,9 public services delivery, crime prevention, and collaboration between the police and citizens.10 In addition, by benefiting from the supportive economic policies provided by the Chinese central government, the MSAR does not need to invest huge financial resources to stimulate the economy. Therefore, the economic functional budget after the handover reflects incrementalism.

**Conclusion**

Within the unique context of Macao’s unique institutional governance, this study proposes four hypotheses regarding budget patterns before and after handover and uses expenditure data from 1976 to 2022 to test the hypotheses. The empirical results indicate that the changes to the total, capital, and most functional budgets possess more incremental characteristics after the handover than before the handover. Most of the results are consistent with the existing PET literatures, proving the applicability of PET under the background of the handover of Macao.

Several previous studies (e.g. Breunig & Koski, 2006) found that budget punctuations are subject to economic waves. However, this is not applicable in the case of Macao. The kurtosis of GDP change shows that the MSAR government faces greater economic punctuation compared to the colonial-era administration. It also presents that Macao’s total government budget is less punctuated after the handover than before the handover. One explanation for this “paradox” is the implementation of the “One Country, Two Systems” governance system. With the continuous and strong support of the economic policies of China’s central, the function of MASR’s public expenditure, especially capital expenditure, in stabilizing its macro-economy is weakened, so there is no significant punctuation in the total and capital budget even in times of economic crisis.

High punctuated budget outcome in a highly centralized regime, as argued by the PET studies, has not been observed and found in the case of China Macao. This study finds that operating budget before the handover is less punctuated than it is after the handover. Although the Governor had more centralized power to overcome the institutional inertia with limited information cognition in budget process and then generate more punctuation, the Governor intentionally managed to stabilize the operating budget in order to gain fiscal benefits for Portugal. This finding indicates that complicate diplomatic relationships may have effect on the budget decision pattern in a certain regime. This research direction can be explored in the future studies.

Moreover, the study offers a better understanding of the changes of Macao’s institution and society and presents its effect on the government budget with findings about functional budgets. Under the unique industrial structure and supports from the central government, the increase of seats directly elected in the legislature does not lead to a better chance for the executive branch to game with the legislature institutionally. After the handover, community-level organizations grow quickly and play important roles in affecting the government budget and policy (Lou, 2004).
On one hand, representatives in the legislature usually have a dual identity as the leaders in community organizations and participate in the budget decision process. On the other hand, community organizations need organize events to gain support from the society and residents, and the government employ the major community events to convey the government policy. Since the community organizations act as tools to unite and integrate residents (Cai, 2016), the close relationship among the legislature, government and community organizations make the Chief Executive put more emphasis on coordinating and balancing different interests when making decisions in a certain policy area.

Author contributions
Qing Li wrote the first draft of the paper and revised the article. Wai Hong Ho collected data, designed the database, and conducted the data analysis. Yu Shi revised and edited the article.

Declaration of conflicting interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Notes
1. Macao Special Administrative Region Bureau of Statistics, Macao Economy Quarterly, 2019 Q4, p. 42.
2. Macao Special Administrative Region Bureau of Statistics: 1999 to 2018 data of Macao's annual regional GDP, https://www.dsec.gov.mo/Statistic.aspx?NodeGuid=b35ed8a-ed5c-4fab-b741-c91b75ad059
3. Decree No. 41/83/M makes rules on how to prepare statements of regional gross budget and how to prepare and implement public accounting books. It also regulates the preparation of accounting books for business and public financial activities in Macao.
4. Law No. 75 in Basic Law of the Macao Special Administrative Region of the People’s Republic of China.
5. Statistics of Community Organizations Before and After Handover. Data from Lou (2019). The development of Macao associations and the evolution of social roles after the handover. 21 Century, 176, 15 to 27.
6. Macao Special Administrative Region Bureau of Statistics, Time series database, https://www.dsec.gov.mo/mts/#!/step1/zh-MO
7. Before handover, the Macao government introduced many police officers and public safety professionals from Portugal to deal with serious public safety issues. Since they didn’t speak Chinese, many interpreters have to be employed. For details: Guo (2002), Public Finance and Gambling Taxes During Transition, Xiamen University Press, p. 46.
8. The MSAR cannot propose huge public housing construction plans each year, which is the main reason for the difference in the annual functional budget for public housing. For example, the 2008 Administrative Report of MSAR and 2018 Administrative Report of MSAR proposed to construct 19,000 and 28,000 new public housing units.
9. The MSAR allocated budget to gradually implement free education before and after the handover. In 1995, the MSAR implemented pre-school and free elementary education. In 1997, free education for junior high school was provided. After the handover, free education was provided to kindergarten and high school students. The Chief Executive made consistent efforts to provide funding support to maintain the consistent increase in education resources.
10. The MSAR initiated several new services regarding public services, including “one-stop” service, a satisfaction guarantee policy, and a digital government. These were initiated to promote government reform, provide better and quicker public services, and eventually improve citizen satisfaction.

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**Appendix I**

**Formulas**

$X$ is the budget change rate, $L_1$ to $L_4$ is the first to fourth L-Moment: L-Coefficient of Variation (L-CV), L-Skewness (L-Skew), L-Kurtosis (L-Kurt)

$$X_j = \ln \left( \frac{R_t}{R_{t-1}} \right),$$

where the data $(x_1: n)$ are first ranked in ascending order from 1 to $n$

$$\beta_0 = n^{-1} \sum_{j=1}^{n} X_j$$

$$\beta_1 = n^{-1} \sum_{j=2}^{n} X_j \left[ \frac{(j-1)}{(n-1)} \right]$$

$$\beta_2 = n^{-1} \sum_{j=3}^{n} X_j \left[ \frac{(j-1)(j-2)}{(n-1)(n-2)} \right]$$

$$\beta_3 = n^{-1} \sum_{j=4}^{n} X_j \left[ \frac{(j-1)(j-2)(j-3)}{(n-1)(n-2)(n-3)} \right]$$

$$L_1 = \beta_0$$

$$L_2 = 2\beta_1 - \beta_0$$

$$L_3 = 6\beta_2 - 6\beta_1 + \beta_0$$

$$L_4 = 20\beta_3 - 30\beta_2 + 12\beta_1 - \beta_0$$

$$L_{CV} = L_2 / L_1$$

$$L_{Skew} = L_3 / L_2$$

$$L_{Kurt} = L_4 / L_2$$