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Analyzing the Fiscal Health of Local Governments in Taiwan: Evidence from Quantile Analysis

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***Abstract*—**This paper develops the fiscal health index of 21 local governments in Taiwan over the 1984 to 2010 period. A quantile regression analysis was used to explore the extent that economic variables, political budget cycles, and legislative checks and balances, impact different quantiles of fiscal health index for a country over a sample period of time. Our findings suggest that local governments at the lower quantile are significantly benefited from political budget cycles and the increase in central government revenues, while legislative effective checks and balances and the increase in central government expenditures have a significantly negative effect on local fiscal health. When local governments are in the upper tail of the distribution, legislative checks and balances and growth in macroeconomics have significant and adverse effects on the fiscal health of local governments. However, increases in central government revenues have significant and positive effects on the health status of local government in Taiwan.

***Keywords*—**Fiscal health, political budget cycles, legislative checks and balances, quantile regression.

I. Introduction

THE fiscal health of local governments is important as it is an indication of the ability of local governments to meet its financial and service obligations. Fiscal health may not be the ultimate measure of success for local governments, but without a healthy financial condition, the level and quality of public services will suffer. Additionally, there are many disparate factors affecting the fiscal health of local governments. Local governments generally benefit from a booming national economy. More specifically, in addition to the general economic performance, demographic factors, nature disasters, central and local elections factors, local administrative efficiency, as well as the effective local legislative checks and balances, all affect the fiscal health of a local government.

There are some commonly used terms found in the fiscal health literature that describe the fiscal health of local government. Fiscal stress, fiscal strain, fiscal crisis, fiscal health, fiscal distress, financial condition, and financial position, are all used and have different meanings attached to them. Ladd and Yinger [1] define fiscal health as the underlying or structural ability to deliver public services to its residents, independent of the budgetary decision made by city officers. They further explain that local health is the difference between revenue-raising capacity and expenditure need, expressed as a revenue-raising capacity and expenditure need, expressed as a percentage of capacity. Clark and Appleton [2] define fiscal strain as an institutional lack of adaption to a changing environment. Meanwhile, Berry's [3] definition of fiscal health describes the extent to which a government's financial resources exceed its spending obligations.

According to Lin and Raman [4], local government's fiscal health is related to its financial condition, which they describe as having to do primarily with fiscal effort for the relative level of taxation and spending. They point out that a government could be in good financial position but are in poor financial condition. In their study, a poor financial condition meant that local governments are less likely to sustain the current level of service at acceptable levels of taxation. Groves et al. [5] state that a local government's financial condition is the result of a number of very diverse factors and can be measured by looking at cash solvency, budgetary solvency, long-run solvency and service level solvency. Kloha et al. [6] define fiscal distress in terms of whether a local government is sufficiently meeting the needs of its community. Badu and Li [7] define fiscal stress as the imbalance between the revenue raising capacity and expenditure needs of a local government. Badu and Li's definition is very much associated with the concept of tax effort, which shows the ratio of actual yield to that obtained by the standard tax system.

The variety of definitions around fiscal health has inevitably led to the development of a diverse amount of mechanisms for measuring or predicting local government's fiscal health. Brown [8] provides a concise and easy-to-use 10-point test of financial condition, where he suggests that 10 ratio measures be computed, equally weighted, and aggregated to provide an overall picture of a government's financial condition. Kleine et al. [9] discuss some of the limitations of Brown's test, and developed a more simplified 10 -point scales of fiscal distress index based on nine variables to assess the performance of local government. Kloha et al. [6] applied the model to predict local fiscal stress in a sample of Michigan local governments. They found that the 10 point scale of fiscal distress appears to perform considerably better than Brown's 10 point test and provides function as an early warning system of fiscal difficulties.

Hendrick [10] presents a theoretic framework for assessing local government fiscal health based on dimensions of properties of government's environment, balance of fiscal structures with environment, properties of the government's fiscal structure, and population and institutional factors. Hendrick points out that the dimensions are related but often in indirect or nonlinear ways, and hence must be measured

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separately rather than combined into a comprehensive indicator of fiscal health.

Wang et al. [11] define financial condition as the level of financial solvency. They develop and test a measure of financial condition for state governments. The measure includes the dimensions of cash solvency, budget solvency, long term solvency, and service levels solvency, and eleven indictors. Their findings show that the measure they used is relatively reliable and valid.

Krueathep [12] uses the Ladd and Yinger's [1] procedure for calculating fiscal health index and expenditure need and Martinez-Vazquez et al.'s [13] regression based revenue-raising capacity measure for predicting amount of revenue, to analyze the fiscal health of fourteen municipals' fiscal condition in Thailand. The results show that municipalities in the large central cities and in the semi-rural based areas tend to have financial difficulties in meeting their service obligation, as compared to the suburbs and industry based cities.

Raju [14] employs the deficit indicators approach in the Hakkio-Rush [15] framework to assess fiscal health on sustainability of State-level finances in India. Cohen et al. [16] utilizes six measures, including the ratio of total liabilities to total assets, ratio of own revenues to total liabilities, ratio of short term liabilities to own revenues, ratio of operating expense to own revenues, ratio of subsidies to population, and ratio of own revenues to population, and combines a simulation analysis approach (stochastic multi-criteria acceptability analysis) to evaluate the financial viability of local governments in Greece.

Political budget cycles (PBCs) was first demonstrated by Rogoff and Sibert [17], who proposed a model of adverse selection that emphasizes the idea of competency (ability to handle the economy) coupled with asymmetric information. In this model, voters elect the more competent politician and form rational expectations regarding the incumbent's abilities based on current, observable fiscal policy outcomes. This leads to a pre-election increase in the government deficit when a competent politician is in office.

From a theoretical point of view, PBCs arise in equilibrium when rational voters are imperfectly informed about an incumbent's competency and the incumbent enjoys discretionary power over the budget. Without discretionary power, asymmetric information alone is not sufficient for PBCs. Persson and Tabellini [18], [19] find that constitutional provisions shaping electoral rules play a key role in determining fiscal outcomes, both directly and indirectly, through their impact on the form of government. Streb and Torrens [20] argue that when there is separation of powers, appropriate checks and balances may work as a commitment device that eliminates electoral cycles in fiscal policy, making all players better off. Streb et al. [21] find that stronger effective checks and balances explain why PBCs are weaker in developed and established democracies.

As mentioned above, scholars have provided several techniques to measure a local government's fiscal health. It is difficult to argue that one particular indicator (or one set of indicators) is the best sign of fiscal health without knowing the intended purpose, the target audience, the practical constraints on the analysis, and the availability of account information. This study is designed to add to the existing body of work, by exploring factors affecting local government fiscal health. Firstly, we develop the fiscal health index for 21 local governments in Taiwan over the 1984 to 2010 period, based on existing work of Kleine et al. [9] and Kloha et al. [6]. Secondly, we use a quantile regression analysis to explore the extent that economic variables, political budget cycles, and legislative checks and balances, impact different quantiles of fiscal health index for a country over a sample period of time.

This paper is organized as follows. Section two describes the data used and our methodology, section three discusses the empirical findings, and section four presents the conclusions.

II. Data

In this study, Kleine et al.'s [9] 10-point scale of fiscal distress are applied to a sample of 21 local governments in Taiwan over the 1984 to 2010 period. An indicator score of "10" indicates severe fiscal distress and a score of "0" indicates little or no distress. The nine variables used to compute the health score (hereafter, PHI) of a local government includes population growth, real net tax amount growth, decrease in real net tax amount growth, fiscal expenditures as a percentage of net tax amount, fiscal deficit, prior fiscal deficit, taxation revenues as a percentage of fiscal expenditures, intergovernmental grants as a percentage of fiscal expenditures and government liabilities as a percentage of net tax amount. All the data are obtained from Year Book of Population Statistics of Taiwan and Year Book of Financial Statistics of Taiwan. The Local health indicator (PHI) is then used as a dependent variable in the quantile regression analysis.

The independent variables include macroeconomic growth rate (EGR), central government revenues (TREV) and expenditures (TEXP), dummy for political budget cycles (PBC) and effective legislative checks and balances (CHECKS). The data of EGR is taken from Statistics Bureau of Directorate-General of Budget, Accounting and Statistics of Taiwan. Data of TREV and TEXP are taken from Year Book of Financial Statistics of Taiwan. Following Streb et al. [21], PBC takes value 1 in central election year, -1 in the following year, and 0 otherwise. The election data is obtained from the Central Election Commission of Taiwan.

A measure of effective checks and balances of the Legislative Institutions in Taiwan is constructed based on the work of Streb et al. [21]. We also use the Henisz [22], [23] Political Constraints Index (POLCON) to measure the veto player variable (VETOPLAY), and the International Country Risk Guide (ICRG) Law and Order index (LAWORD) to measure compliance with the law for Taiwan. The combination of the legislative veto player with the law dummy (LAWDUM) for compliance with the law is used as a proxy for the effective checks and balances (CHECKS) on the executive budgetary

process in Taiwan. As in Streb et al. [21], the VETOPLY takes value 1 if POLCON ≧ 2/3 and 3/2×POLCON otherwise. The DLAW takes value 1 for a country if LAWORD ≧ 4/6 and 0 otherwise. The effective checks and balances, CHECKS equals to the product of the values of VETOPLY and LAWDUM in year t-1. The variable PBC_CHECKS measures the influence of effective checks and balances on PBCs, which is the product of PBC and CHECKS.

III. Methodology

To avoid the problem of spurious regressions discussed by Granger and Newbold [24], we employ ADF, PP, KPSS and Zivot-Andrews unit root tests to examine the stationary property of all the variables used in the model. The quantile regression is then used to investigate the role of the effective checks and balances of the legislature in the budgetary process.

Engle and Granger [25] argue that any regression analysis that uses non-stationary series will be "spurious". Thus the purpose of using the unit roots test is to ascertain whether each individual time series in this study is stationary in level form. The common unit root tests used in this study are ADF test [26], PP test [27], and KPSS test [28]. It has been reported that the ADF test may have lower power when compared with near-unit-root but stationary alternatives. Phillips and Perron [27] proposed an alternative (nonparametric) method of controlling for serial correlation when testing for a unit root. In contrast, Kwiatkowski et al. [28] present a complement test for the ADF test where the null hypothesis is that a series is stationary.

A number of authors have pointed out that the standard ADF, PP and KPSS tests are not appropriate for variables that may have undergone structural changes. For example, Perron [29], [30] has shown that the existence of structural changes tends to bias the standard ADF tests towards non-rejection of the null of a unit root. Hence, it might be misleading to conclude that the variables are non-stationary just on the basis of the results from the standard ADF tests. Perron [30] also developed a procedure to test the hypothesis that a given series has a unit root with an exogenous structural break. Zivot and Andrews [31] criticized this assumption of an exogenous break point and developed a unit-root test procedure that allows an estimated break in the trend function under the alternative hypothesis. Therefore, it seems appropriate to treat the structural break as endogenous and test the order of integration by the Zivot-Andrews procedure.

Quantile regression as introduced in Koenker and Bassett [32] may be viewed as a natural extension of classical ordinary least squares (OLS) estimation of conditional mean models to the estimation of an ensemble of models for conditional quantile functions. In this study we are concerned with the problem of estimating the conditional quantiles of a response variable distribution in the linear model that provides a more complete view of possible causal relationships between variables in analyzing the fiscal health of a local government. Typically, we are desire to know what explanatory variables are important to the different levels of fiscal health score quantile (e.g., 0.1 quantile or 0.9 quantile). Therefore a suitable policy can be launched to mitigate the fiscal distress of a local government. The quantile regression model is as follows:

$$PHI = \alpha_{\theta 0} + \beta_{\theta 1} PBC + \beta_{\theta 2} CHECKS + \beta_{\theta 3} PBC\_CHECKS + \beta_{\theta 4} EGR + \beta_{\theta 5} TREV + \beta_{\theta 6} TEXP + \varepsilon$$

where, PHI is the fiscal health indicator of the 21 local governments from 1966 to 2009. PBC is a dummy variable for central political budget cycles, ERG is the economics growth rate, TREV and TEXP are the central government revenues and expenditures respectively. Variable CHECKS is a proxy for legislative effective checks and balances on executive discretion. Notice that in this model, the PHI in year t is modeled as a function of effective checks and balances in year t-1. This specification is not meant to imply that PHI do not respond to current checks and balances; rather, it is intended to reflect the reality of budgetary decision making, which happens largely over the course of the previous fiscal year. Finally, coefficient $\beta_{\theta i}$ captures the impact effects of the i^{th} economics and political factors to the θ^{th} quantile of PHI, while ε represents an error term. In addition to the traditional ordinary regression result, for comparison we also used the 0.1 quantile, the 0.25 quantile, the 0.5 quantile, the 0.75 quantile and the 0.9 quantile of PHI as the dependent variables to analyze the effects of economics and political variables

IV. Empirical Results

This section reports the estimated results of the changes in economic growth rate, government expenditures and government revenues on the changes of the fiscal health of local government in Taiwan over the 1984 to 2010 period by using quantile regression. The estimated influence of legislative checks and balances on political budget cycles is also reported.

Tables I and II show the results of the non-stationary tests for economic growth rate (EGR), government revenues (TREV), and government expenditures (TEXP) using ADF, PP, KPSS, and ZA tests. Results of Table I show that EGR data series are stationary in terms of level for all ADF, PP, KPSS, and ZA tests. Data series of TREV and TEXP are non-stationary in terms of levels but are stationary with respect to first differences on Table II, suggesting that TREV and TEXP data series are integrated of order one. The results of ZA tests on Table I provide further evidence of the existence of a unit root when breaks are allowed. The plausible breaks in the series occur for 2007 and 2007, respectively for TREV and TEXP. Meanwhile, the plausible break for stationary series of EGR occurs on 2004. To avoid spurious regression, in this study we use the first difference stationary series of TREV and TEXP along with the other stationary levels series to estimate the quantitle regression model.

TABLE I
ADF, PP, KPSS AND ZA UNIT ROOT TESTS (LEVEL)

Variable	ADF	PP	KPSS	ZA
EGR	-4.279***	-4.279***	0.651**	-7.323*** (2004)
TREV	-1.666	-1.666	0.645***	-4.357 (2007)
TEXP	-1.702	-1.976	0.537***	-3.325 (2007)

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% level. Plausible breaks are in parentheses.

TABLE II
ADF, PP, AND KPSS UNIT ROOT TESTS (LEVEL)

Variable	ADF	PP	KPSS
EGR	-4.279***	-4.279***	0.651**
TREV	-1.666	-1.666	0.645***
TEXP	-1.702	-1.976	0.537***

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% level

As demonstrated by Table III, the OLS results show that macroeconomic growth, public budget cycles and the interaction of PBC and CHECKS, PBC_CHRCKS, have no significant influence on local fiscal health in Taiwan during our sample period. While increase in government revenues significantly improve the fiscal health of Taiwan's local government, increase in government expenditures and strengthen in checks and balances from Central Legislature have a significant opposite effects on local fiscal health in Taiwan. Our conjecture is that as central government spends the more on central affairs the less amounts of the subsidies will be on the local government. In general when legislators request matching grants to meet the needs of their constituents so as to win in the reelection and this will further worsen local governments' financial condition.

Quantile regression results of Table III indicate that political budget cycles significantly improve the fiscal status of those fiscal healthy governments (i.e. with the 0.1quantile and 0.25 quantile of the PHI); however for those with fiscal stress, political budget cycles have no significant improvement effects. The results also show that interaction of PBC and CHECKS have adverse effects on fiscal health of the local government at 0.1 and 0.25 quantile of the PHI. As with the results of OLS, quantile analysis also shows that effective checks and balances from Legislature have significantly adverse effects on the local fiscal health of Taiwan. Local governments with more healthy fiscal status (i.e. with a lower quantile of PHI) will be less affected by checks and balances. The quantile analysis results in Table III also indicates that macroeconomics growth will significantly worsens the status of the fiscal health of the governments with stressful financial conditions (i.e. with 0.9 quantile of the PHI) simply because the constituents have fiscal illusions and demand more public goods and services which are unaffordable by their local governments. In addition, based on quantile regression results, we also find that increase in government revenues significantly improves the fiscal health of Taiwan's local governments of any quantiles of the PHI, however increase in expenditures will worsen the fiscal health of those governments at lower quantile of the PHI.

TABLE III
OLS AND QUANTILE REGRESSION RESULTS

	OLS	10%	25%	50%	75%	90%
Intercept	0.97* (1.8892)	-0.517* (-1.6567)	-0.10 (-0.1402)	1.15 (1.2290)	1.71*** (3.1942)	1.55*** (3.0271)
PBC	-0.44 (-1.55)	-0.39** (-2.09)	-0.60*** (-3.90)	-0.48 (-0.96)	-0.21 (-0.57)	-0.41 (-1.11)
CHECKS	4.12*** (6.87)	1.01* (1.66)	3.07*** (4.74)	4.55*** (4.06)	5.230*** (7.33)	6.68*** (9.14)
PBC_CHECKS	0.80 (1.51)	1.01** (2.21)	0.91** (1.98)	0.57 (0.58)	0.40 (0.65)	1.30 (1.63)
EGR	-2.48 (-0.66)	0.66 (0.80)	-6.09 (-1.40)	-6.98 (-0.99)	3.83 (1.18)	11.60*** (2.71)
TREV	-9.57*** (-6.13)	-5.35*** (-7.95)	-8.23*** (-2.93)	-11.06*** (-3.42)	-14.68*** (-9.04)	-12.39*** (-8.44)
TEXP	4.340*** (2.84)	6.75*** (4.60)	7.56*** (4.36)	4.09 (1.26)	2.77 (1.48)	2.89 (1.36)

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% level. Plausible breaks are in parentheses. Numbers in parentheses are t values.

V. CONCLUSIONS

This study examines the effect of political budget cycles and legislative checks and balances on the fiscal health of 21 municipalities in Taiwan, employing a quantile regression analysis first used by Koenker and Basset [32]. The fiscal health indicator for local governments in Taiwan over the 1984 to 2010 period was developed based on Kleine et al.'s [9] approach.

Quantile regression results show that when local governments in Taiwan are fiscally healthy, local governments are significantly benefited from political budget cycles and the increase in central government revenues, while legislative effective checks and balances and the increase in central government expenditures have a significantly negative effect on local fiscal health. Meanwhile, when local governments are fiscally poor, legislature effective checks and balances and economic growth rate have significant and positive effects on

the fiscal health of local governments. However, an increase in central government revenues adversely affected local fiscal health.

In addition, economic growth rate adversely affects the fiscal health of local governments that have high quantiles of health indicator. As a previous study of Chang and Ho [33] has indicated, Taiwan has always experienced a unidirectional causality running from government revenues to government expenditures. This suggests that higher tax revenues induced by higher economic growth will eventually lead to higher expenditure, which subsequently leads to a deterioration of fiscal health of the local governments.

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