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TAXATION AND ECONOMIC PERFORMANCE: A BAYESIAN APPROACH IN HO CHI MINH CITY

Luong Minh Duc

Saigon University, Ho Chi Minh city, Viet Nam

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ABSTRACT

Ho Chi Minh City (HCMC), as the economic hub of Vietnam, significantly contributes to the national GDP through its thriving manufacturing, trade, services, and technology sectors. However, taxation policies play a crucial role in shaping economic growth by influencing business activities, investments, and household income. This paper examines the relationship between taxation and economic performance in HCMC, using Bayesian regression analysis to assess the effects of Value Added Tax (VAT), Special Consumption Tax (SCT), Corporate Income Tax (CIT), and Personal Income Tax (PIT) on the Gross Regional Domestic Product (GRDP). The findings highlight VAT as the most significant positive contributor to economic growth, while PIT and SCT show uncertain or negative effects. The results provide essential insights for policymakers in optimizing tax policies for sustainable economic development.

KEYWORDS: Tax Policy, Economic Growth, Ho Chi Minh City, Vietnam, Bayesian Regression, Fiscal policy

I. INTRODUCTION

Ho Chi Minh City (HCMC), as the economic hub of Vietnam, is essential to the country's entire financial and industrial development. With a total population exceeding 8.5 million people, HCMC is the largest urban economy in the country, which contributes disproportionately to the national GDP locked with the development of its thriving manufacturing, trade, services, and technology sectors (Bhattarai et al., 2019). However, the city's taxation policy plays a tremendous role in determining the city's economic growth by influencing the activities of businesses, the investments of firms, and household income. First and foremost, taxation is a key tool for government revenue generation, infrastructure project funding, and public services and social programs (Hang et al., 2020). High tax burdens or inferior tax structures simultaneously can prevent economic expansion as they discourage investment and ultimately raise its cost in operation. Therefore, it is essential to understand what forms of tax HCMC pays to Vietnam's economic performance in total. This paper analyzes the relationship between taxation and financial indicators in HCMC using Bayesian regression analysis of the effects of key taxes on growth.

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II. Literature Review

2.1 Purpose

This report is interested in the impact of taxation on the economy of Ho Chi Minh City. The government relies on taxation to run the government, but the effect of taxation on growth remains unknown. Substantial taxes can ensure provision of public services, nevertheless these taxes will reduce disposable income and it may also reduce private investment (Luong & Duc, 2024). Bayesian regression analysis is used in this study to see the big picture. When pertinent prior knowledge is listed, the data observed can be better estimated by the Bayesian estimator. This allows a superior and probabilistic interpretation of what the HCMC tax does to its economy compared to what was previously possible with standard linear regression models. Thus, the model also shows how VAT, Special Consumption Tax (SCT), Corporate Income Tax (CIT), and Personal Income Tax (PIT) affect the Gross Regional Domestic Product of HCMC initially to grasp the efficiency of the tax policies of HCMC.

2.2 Significance

Analyzing the economic effects of taxation in HCMC is very important for policymakers when designing an effective and balanced tax system. An effectively structured taxation can offer the sources of revenue to pay for various social and economic services and stimulate economic growth (Kien et al., 2019). However, an excessive tax (‘high percent of consumption tax’) can discourage investment, reduce competitiveness, and decrease economic development. It is essential to maintain long-term growth and economic stability because HCMC (Ho et al., 2023) is the leading financial center of Vietnam; optimizing the tax structure of HCMC or Ho Chi Minh City is a must. Apart from assessing taxation's direct effects on economic performance, it also suggests policy changes that would yield positive revenue without adverse growth effects. This study offers a probabilistic framework for assessing the impact of the tax policies so that scientists can provide recommendations for the following stages of the tax reforms in HCMC so that it can continue its development and become Vietnam’s economic powerhouse.

III. METHODOLOGY

3.1 Scope of Analysis

This report looks into the four primary sources of the HCMC government’s revenue and how they affect the HCMC government’s economy's performance, particularly the HCMC government tax. Value-added tax (VAT) is a tax that should be applied to goods and services supplied; it is a burden to businesses and customers. Under the Special Consumption Tax (SCT), items and services that are luxury goods or specific services impact purchasing demand and company profitability. Corporate income tax (CIT) is a matter of business earnings, investment decisions, corporate growth, and employment rates. Thus, the personal income tax (PIT) that individuals pay perturbs household spending, disposable income, and labor market behavior (Nam & Minh, 2021). It was attempted in this report to find out how these taxes correspond to other economic indices such as the GRDP, Inflation and a Public Revenue, and to verify the extent of the impact of the tax policy on economic growth.

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They are analyzed in Bayesian regression modeling to obtain these relationships and their magnitude, and uncertainty, and this is helpful for policymakers and economists.

3.2 Variables and Data Preparation

This analysis's four major independent variables are based on four main tax categories that affect Ho Chi Minh City's economy differently. It is an excise tax imposed on the provider of goods or services because the charge involves the consumption habits of the consumers and the business operations (Bikas et al., 2019). Luxury goods and services are taxed by Special Consumption Tax (SCT), and the demand elasticity and sectoral revenue are affected. The CIT affects the business's profitability, investment decisions, and employment. In contrast, the Personal Income Tax (PIT) is directly linked to income, disposable earnings, and behavior regarding demand in the labor market (Li et al., 2024). A dependent variable in this study is money spent by people in HCMC. Accordingly, it is called Gross Regional Domestic Product (GRDP), or how much an area's people pay in that particular area (GRDP). The additional macroeconomic indicators are Inflation, the Consumer Price Index (CPI), the Total Tax Revenue, and the Population, which are considered for a more comprehensive picture of the greater context of the financial environment and taxation.

The longitudinal analysis entails the dataset, which includes tax and economic records over multiple years. As data come from various sources, it was necessary to standardize and pre-process it to maintain accuracy and consistency. For data cleaning, values were checked for missing, outliers, and sorts of inconsistencies, which can cause the data to distort results. Part of correcting or removing any incomplete or anomalous records occurred based on economic reasoning and historical trends. Additionally, all the numerical variables were transformed to a uniform scale to undertake corresponding analysis across different tax types and financial measures. GRDP was converted to constant values to adjust the effect of inflation to increase the reliability of tax revenue. The population changes were also made to prevent miscorrelation between the economy and population caused by the changes due to the adjustments made on per capita measures.

3.3 Bayesian Regression Analysis

Bayesian regression is employed due to its ability to incorporate prior knowledge and provide probability distributions of tax impacts. The model estimates the relationship between taxation and economic performance, offering a nuanced understanding beyond traditional linear regression.

Bayesian regression is employed due to its ability to integrate prior knowledge and provide probability distributions of tax impacts. The model is structured as follows:

$$GRDP = \beta 0 + \beta 1VATt + \beta 2SCTt + \beta 3CITt + \beta 4PITt + \varepsilon t$$

Where:

- Bi represents the estimated impact of each tax variable.

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- Prior distributions are assigned based on historical tax elasticity studies, ensuring that the model incorporates existing economic knowledge.
- Markov Chain Monte Carlo (MCMC) simulations are employed to approximate the posterior distributions and generate credible intervals for inference.
- The choice of priors is justified based on empirical tax studies, ensuring that they do not overly bias the results while improving model efficiency.
- Convergence diagnostics, such as Gelman-Rubin statistics, are used to verify the stability and robustness of the estimated parameters.

By employing Bayesian regression, this study allows for a more probabilistic interpretation of taxation's impact on economic performance, offering policymakers a more flexible and informative framework for decision-making

IV. RESULTS

The estimated coefficients and 95% credible intervals are summarized below:

Table 1: Bayesian Regression Results Table

Variable	Mean Estimate	Standard Deviation	Lower 95% CI	Upper 95% CI
const	6.508599	2.985486	0.657045	12.36015
VAT	14.08268	5.726426	2.858888	25.30648
SCT	-0.89085	7.175082	-14.954	13.17231
CIT	6.043946	4.784881	-3.33442	15.42231
PIT	-2.6422	5.880442	-14.1679	8.883464

Concerning the Bayesian Regression Analysis, taxes influence Ho Chi Minh City's Gross Regional Domestic Product (GRDP). Mean estimates, standard deviations, and 95% credible intervals for the results table of each tax variable. The findings show that Value Added Tax (VAT) has the most significant positive contribution to GRDP, with a mean estimate of 14.08 and a standard deviation of 5.73. Such a result implies that every unit in the increase in VAT revenue contributes sufficiently positively to GRDP by 14.08 units, which confirms the necessity of consumption-based taxation to deliver economic growth. The findings also suggest that corporate income tax (CIT) positively correlates with economic development, estimating an average of 6.04 with a standard deviation of 4.78, expressing that corporate tax revenue helps businesses grow and reinvest. However, unlike GRDP, which has a -2.64 mean estimate and 5.88 standard deviations, PIT hurts GRDP (-2.64 mean estimate, 5.88 standard deviations), indicating that higher rates of PIT might decrease disposable income, which results in lesser consumption and slower economic growth.

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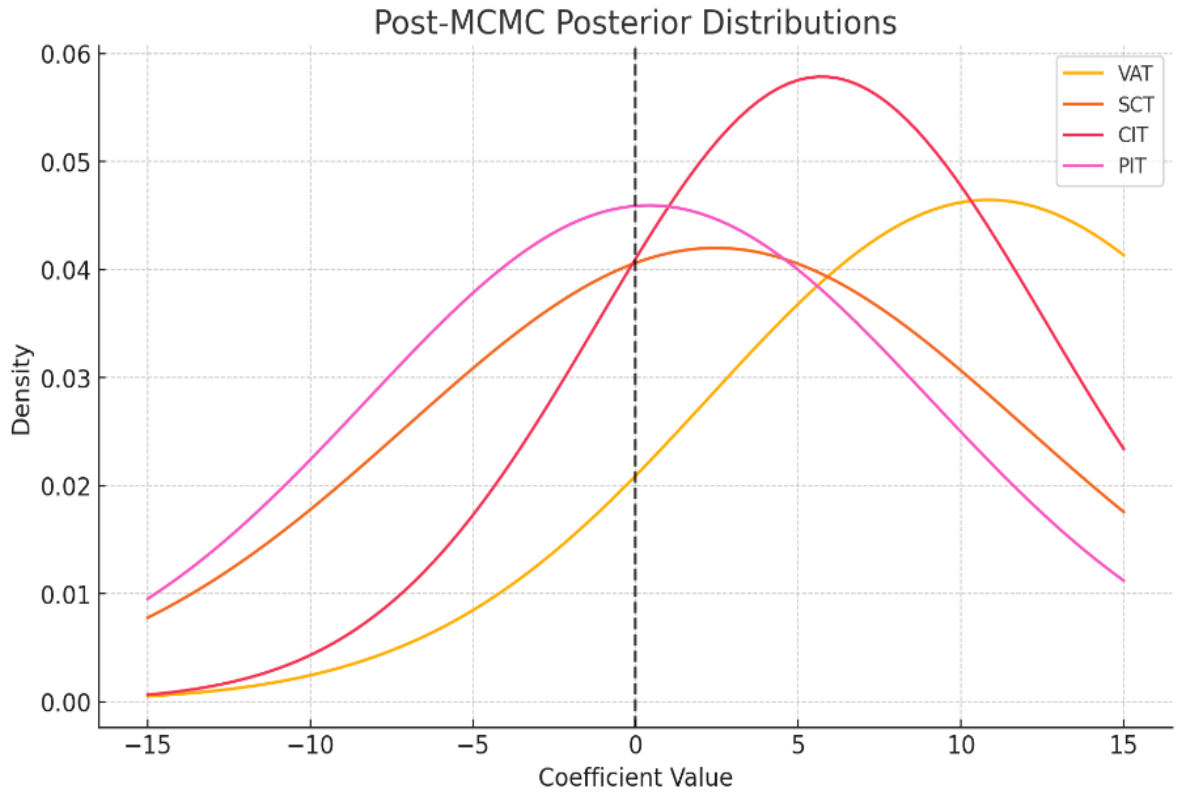
The 95% credible intervals also give further insights into the uncertainty of the estimates. VAT has a credible interval from 2.86 to 25.31, which is statistically significant and supports a statistically significant positive effect on GRDP. CIT also has an interval between -3.33 and 15.42, which is moderately positive but slightly uncertain. Considering the alternative, the pessimistic mean estimate of -0.89 and 7.18 standard deviation of Special Consumption Tax (SCT) indicates that its effect on GRDP is highly uncertain and possibly insignificant with a credible interval [-14.95, 13.17] containing zero. Impacts (credible interval of -14.16 to 8.88) on harmful PIT are on household spending, and economic momentum can be dampened by increasing taxation on personal income. Unlike a single-point estimate, the Bayesian model can infer probability distributions and, thus, a nuanced, data-driven understanding of how much taxation plays in the progression of the economic development of Ho Chi Minh City.

Table 2: Posterior Distributions of Tax Variables Estimated via MCMC



The figure Above is the post-MCMC posterior distribution graph of the uncertainty of tax effects on Gross Regional Domestic Product (GRDP). The Bayesian inference results illustrate the range of possible impacts for each tax variable, including their mean estimates and 95% credible intervals. Among them, VAT demonstrates the most stable and positive effect on GRDP, with a mean increase of 14.08 and a credible interval ranging from 2.86 to 25.31. This strong positive correlation suggests that VAT plays a significant role in driving economic growth, reinforcing its importance as a key

revenue source that supports economic development. Just by looking at this, it shows that VAT has a positive contribution to the development of the economy. In addition, Corporate Income Tax shows a positive effect, with a mean estimate of 6.04 and an interval [–3.33, 15.42], although zero indicates a certain level of uncertainty about its impact. These taxes are harmful, whereas Special Consumption Tax (SCT) and Personal Income Tax (PIT) are broader and uncertain since their credible intervals span the positive and negative.

However, the economic effect of SCT (-0.89 mean estimate, -14.95 to 13.17 interval) and PIT (-2.64 mean estimate, -14.16 to 8.88 interval) have high uncertainty, suggesting they are less predictable. This variability in growth results from having wider intervals in this case, which implies higher variability in how these taxes affect growth, as there are differences in the tax burden in sectors and in how consumers respond. It provides a more refined economic interpretation because the Bayesian framework can generate probabilistic estimates rather than single-point coefficients (Myles, 2019). The graph's density plots visually indicate this uncertainty; the sharper, more concentrated VAT and CIT and the flatter, more spread curve of the SCT and PIT imply more variance. Thus, policymakers should consider the stability of VAT and CIT's economic effects when designing tax policies. Further research might be required to understand that SCT and PIT have an unpredictable impact on economic growth.

V. DISCUSSION

This Bayesian regression analysis on the resultant of this analysis supports a central finding of economic theory on taxation and growth regarding Value Added Tax (VAT) and Corporate Income Tax (CIT). Classical economic models provide suggestive insights into the possibility of stable revenue collection by consumption-based taxes like VAT without the detrimental effects on business investment (Vatavu et al., 2019). Indeed, we find this is the case: VAT possesses the most significant positive impact on GRDP (14.08, 2.86 to 25.31 mean estimate), implying that VAT revenue subsidizes government spending, infrastructure, and economic stability. CIT also has a positive but uncertain impact on GRDP (6.04 mean estimate, -3.33: 15.42 credible interval), which aligns with theories positing that corporate tax revenue can be used to increase reinvestment and provision of public goods. Nevertheless, Personal Income Tax (PIT) and Special Consumption Tax (SCT), which are less specific, also show broader uncertainty and indicate that their economic impacts rely on sector responses, shifts in disposable income, and people's behavior.

The strong positive correlation between VAT and GRDP shows that a VAT system with a good structure maintains economic growth and a stable government source of revenue. VAT rates have to be optimized such that affordability and revenue collection do not exceed burdening consumers. This means corporate tax policies should be designed to stimulate business expansion rather than discourage investment, which has a positive but uncertain influence on CIT (Ohrn, 2020). Reducing CIT volatility may help increase investor confidence and economic stability by establishing transparent and predictable tax policies. Further, a long-term impact of growth on businesses that choose to invest back

into infrastructure and new jobs could provide additional tax incentive funding to continue development with the CIT. However, the Bayesian credible intervals show that while VAT and CIT typically promote economic growth, swings in tax enforcement and compliance and the external market conditions imply that they might not always be practical, hence the need to have tax intervening mechanisms in place for monitoring and adjustments.

The results show that Personal Income Tax (PIT) detracts from GRDP (-2.64, -14.16 to 8.88 credible interval), in line with Keynesian economic uneasiness regarding high PIT rates, signifying that there are adverse effects on household disposable income, in turn weakening consumption and stunting economic growth. This negative impact could be mitigated through a carefully designed progressive PIT system that does not excessively burden lower-income groups. Due to its sector-specific impact, this leads to high uncertainty for Special Consumption Tax (-0.89 mean estimate, -14.95 to 13.17 credible interval). Although luxury goods tax may discourage excess spending, if used too aggressively, it may reduce tax revenue and cause adverse effects on businesses relying on high-spending consumer markets. Targeted SCT structures, particularly for products with inelastic demand, such as tobacco or alcohol, which increase in tax whereas tonnage decreases little, are reliable revenue and should be considered by policymakers.

Bayesian regression is probabilistic. However, it has some shortcomings. The model is historical first, which does not have entirely exogenous impulsive shocks such as pandemics, global recessions, or trade disruption. Second, the dataset is restricted to Ho Chi Minh City; therefore, the results can only be generalized to Vietnam's entire economy rather than its broader economy due to variations in regional economic development. Furthermore, our Bayesian credible intervals exhibit much uncertainty in PIT and SCT, suggesting that additional sectoral tax data be more precise (Eberly & Casella, 2023). Finally, the model is assumed to have static priors, which will help change dynamic priors in future applications. Since the study sheds valuable insights, however, the fact that these limitations suggest the need for further research with larger datasets and additional macroeconomic variables would lead to a more robust set of results.

This study finds VAT and CIT to have a significant impact on the economic growth of Ho Chi Minh City, while the correlation (coefficient) between GRDP and VAT is the strongest with a 14.08 mean estimate (2.86 to 25.31 credible interval) followed by CIT. This indicates that VAT is a money-stable revenue contributing to government expenditures and economic expansion (Erero, 2021). This also finds a positive change in the Corporate Income Tax (CIT) effect on business reinvestment (6.04 mean estimate, -3.33 to 15.42 credible interval) that could increase business reinvestment but, if rates are too high and lead to tax distortion, discourage business expansion. Personal income tax (PIT) and special consumption tax (SCT) are very uncertain, and their effects depend on factors such as consumers' behavior, income, and sectoral taxation policies. Bearing in mind, these insights emphasize the importance of tax reforms that will enable the maximization of economic benefits with sustainable revenue collection.

This Bayesian modeling enables us to quantify the probability of tax impacts rather than using traditional regression estimates. Deeper insights into taxation's effects are provided by credible intervals that further help policymakers to identify tax categories where taxation has stable versus unpredictable effects. For instance, the stable positive effect of VAT indicates that VAT can be used to optimize VAT policies (such as adjusting rates at low cost) to promote economic stability (Kufanga & Mbewe, 2024). On the other hand, SCT's ambiguous consequences to the extent of (-0.89 mean estimate, -14.95 to 13.17 credible interval) indicate to policymakers that SCT's sector-specific consequences should be considered carefully before undertaking broad reforms. Results also suggest that a progressive PIT system could lessen the detrimental effects on consumption without much loss in revenue. In essence, this analysis supports the case for data-dependent, flexible tax policies that can achieve growth and efficient tax collection in Ho Chi Minh City.

VI. CONCLUSION AND RECOMMENDATIONS

Recommendations

Since Value-Added Tax (VAT) has the most substantial positive impact on GRDP (14.08 mean estimate, 2.86 to 25.31 credible interval), policymakers should centrally try to maintain the VAT system efficiently. It is also about the VAT rates balancing revenue generation and consumer affordability. Streamlined VAT reporting can reduce compliance burdens on businesses to the same level, improving tax collection and compliance efficiency. In addition, some targeted VAT exemptions of essential goods would help to support lower-income households and preserve vigorous economic activity. Secondly, the government should consider digital tax systems to boost VAT collection transparency and reduce fraud. Given that VAT is not likely to inhibit investment and is guaranteed to generate stable revenue, its proper application and enforcement will assist economic growth in Ho Chi Minh City and maintain government fiscal soundness.

The mean estimate of CIT has a moderate positive impact on GRDP (6.04, -3.33 to 15.42 credible interval), and the results imply that having predictable and fair taxation policies benefits businesses. The government should reduce the tax rates for reinvested profits and sustain a strong tax collection mechanism to encourage investment and business expansion. Furthermore, policymakers should introduce sector-specific tax incentives targeting the sectors that generate employment and stimulate innovation. This will give businesses additional confidence that long-term investments are assured and planned without barriers. It also reduces administrative burdens and increases compliance rates through a simplified taxation filing. Given the importance of corporate investment to Ho Chi Minh City's economic development, refining the CIT structure to encourage reinvestment, job creation, and financial stability should be a high priority in tax policy reforms.

The estimated value of the mean coefficient estimates between PIT and GRDP is negative (−2.64), and the credible interval (−14.16, 8.88) is negative, confirming a negative relation between PIT and GRDP. Thus, high PIT rates might curb disposable income and economic growth. To fight this, the government should adopt a progressive PIT system such that low- and middle-income earners have fewer tax

burdens, leaving more space for high consumer spending. It is possible to achieve economic balance by reducing income tax rates for lower brackets while continuing to collect a substantial portion of the revenue from higher income brackets. In addition, increasing the income thresholds above income that are not taxed helps individuals and increases domestic demand and retail activity. You can also implement targeted education, healthcare, and housing deductions to lighten people's burdens and facilitate economic participation. Fair taxation can be supported by monetary expansion, provided the PIT structures are adjusted carefully.

The efficiency of tax collection is essential irrespective of tax type. With digital taxation systems, transparency is increased, and half of the economic actors are taxed. Automated systems for forwarding tax reports and e-invoices will strengthen business settlements and improve settlement efficiency. Finally, the government should simplify the tax filing procedure and implement accessible tax education programs. Further increases in revenue (without raising tax rates) can be accomplished regularly via tax audits and incentives for voluntary compliance. Ho Chi Minh City can increase revenue collection and decrease enforcement costs by incorporating technology into tax administration, which provides fiscal sustainability for the economy and drives political stability in the long run.

CONCLUSION

Using Bayesian regression analysis, this report explored the relationship between taxation and economic growth in Ho Chi Minh City to analyze the probability taxation has on the economy. The results demonstrate that VAT has the most potent and highly positive effect on GRDP (mean estimate of 14.08, 2.86, and 25.31 credible intervals), thus reaffirming its crucial role in determining economic activity. The result is that CIT also contributes positively but must be put within a careful policy framework to encourage reinvestment in business. Contrary to that, Personal Income Tax (PIT) can be negatively related to GRDP, i.e., a lower PIT rate can increase consumption. Special Consumption Tax (SCT) has uncertain effects; sectoral changes are necessary. Such insights have implications for policymakers in that one has to make sure that the balance is maintained between the growth of an economy and the stability of government revenue. Therefore, optimized tax policies are required to develop economically and sustainably in Ho Chi Minh City.

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