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The Effects of Taxes on Income Distribution Justice

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ABSTRACT

One of the most important economic problems that countries have faced from the past to the present is income inequality. Income distribution is an important indicator that allows us to understand the social and political structures of societies by revealing how the income gap between the rich and the poor in a country changes. Thus, income redistribution or income justice is one of the important goals of fiscal policy. Taxes are also important intervention tools that economic management has in achieving this goal. In this context, this study aims to examine the relationships between different types of taxes and income distribution in the Turkish economy during the period from 2002 to 2022 by using markov regime switching analysis method. The analysis results indicate that, during the period covered by the study, indirect taxes have a positive effect on income distribution, while taxes based on declaration have a detrimental effect on income distribution.

Keywords: Income Distribution, Gini Coefficient, Tax Types, Markov Regime Analysis
JEL Classifications: D31, H20, H23

1. INTRODUCTION

The distribution of resources in the economy depends on the activities carried out by the economic units and the income they earn in return. In this respect, the problem of income distribution is one of the basic elements of economic analysis. Since the 1970s, the decline in income inequalities, particularly in developed economies, followed by their subsequent increase, has made it crucial to understand the reasons behind the initial decrease and the later resurgence. Rapid growth in poor and developing countries like China has the potential to reduce income inequalities on average across the globe. Piketty (2021) states that when considering these rapid growth rates along with the volatile fluctuations in real estate, commodities and financial markets, it is difficult to predict where the majority of the wealth will be collected in the long run (wealth holders, tax havens, oil countries or the Bank of China) and how global sharing will be shaped. In this respect, income distribution is one of the most noticeable problems of today not anly for developing countries but perhaps even more so for developed countries.

Different policies for lower, middle and upper income groups must be implemented to reduce income distribution inequalities. For example, it may be possible for lower income groups to influence the number of poor, the depth of poverty, and the distribution of resources among the poor (relative deprivation) through basic services such as health, education, social transfers, tax breaks, and practices for full employment (DeFina and Thanawala, 2004). Public expenditure such as higher education for the middle income level and regulatory policies such as working life and social security; For the upper income group, the emphasis should be on fiscal policies such as wealth taxes and progressive taxation (Blanchard and Rodrik, 2022). As can be seen, it is possible to achieve a more balanced distribution of income through various policy instruments that can be summarized as increasing the income of the lower income group and reducing its financial obligations or increasing the financial obligations of the upper income group.

Despite the many factors that influence the redistribution of income, such as public expenditures, regulations, employment, and inflation, this study focuses on taxes, one of the important fiscal policy tools used to address income distribution inequalities. Do progressive income taxes and wealth taxes play a role in improving income distribution? Does the increase in revenue from consumption taxes worsen income distribution? The study aims to answer these questions and provide a better understanding of the role taxes play in income distribution.

The redistributive effect of taxation depends on the degree of increasing proportionality of personal income taxes and the level and structure of taxes imposed on capital revenues and wealth. The impact of indirect taxes, which tend to have a conversely incremental effect on income, on income redistribution is not as significant as that of direct taxes; however, in developing countries, the share of these taxes in public revenues is generally higher. Accordingly, in terms of the subject of the tax, taxes on income, expenditure and wealth are included in the work by determining the taxes with higher weights and levels of influence in the tax system. In addition, with the markov regime change analysis method adopted in the study, it was tried to increase the contribution of the study to the literature by determining the effectiveness of taxes on income, expenditure and wealth in periods when the income distribution improved or deteriorated. Thus, the analysis results from the study are expected to help identify the areas in the tax system that need to be regulated due to their disruptive effects in terms of income distribution. In the first part of the study prepared in this context, the injustice of income distribution, in the second part, the redistribution functions of income of taxes were discussed; In the last section, the effects of taxes on income distribution in the Turkish tax system are subjected to an empirical analysis.

2. INEQUALITY OF INCOME DISTRIBUTION

According to the World Inequality Report (2022), the wealthies 10% of the global population receives 52% of global income, while the poorest half of the population earns only 8.5%. An individual in the top 10% of the global income distribution earns an average of €87,200 per year, compared to €2,800 fon an individual in the poorest half. Global wealth inequalities appear to be greater than income inequalities. While the poorest half of the global population holds only 2% of total wealth, the richest 10% of the world's population owns 76% of global wealth.

Income inequality is a phenomenon that leads to social problems as much as economic problems. Social inequality and social problems manifest themselves in areas such as trust level, mental illness, addiction, life expectancy and infant mortality, obesity, children's educational performance, crime rates. Wilkinson and Pickett (2010), who show that indicators of health and social problems are worse in countries with high income inequality, emphasize in particular that the prevalence of these problems is due to the levels of inequality rather than the income levels of countries. While health and social problems are more common among the low- income groups in every society, but the aforementioned study reveals that the overall burden of these problems is significantly higher. The increase in these social issues also contributes to income inequality leading to political instability.

There are different views on the economic consequences of income inequality. Barro (2000), suggests that, while there is generally little relationship between income inequality and growth rates, inequality tends to slow growth in poor countries but promote it in wealthy ones. Accordingly, growth tends to decline when GDP per capita is below about US $2000, with greater inequality, and increases when above it, with inequality. Based on Kuznets' analysis, there are also opinions that argue that income inequality is necessary for economic growth. Accordingly, with governments prioritizing growth, it will eventually be possible for the benefit to seep into the poor. Accordingly, higher inequality means higher savings and investment and higher growth rates in the future, as the savings trend of the upper income group is high. Poverty and a resilient labor market will encourage investment by keeping wage levels low. In this respect, the limitation of taxation on higher income groups is necessary in order to maximize the retained income for investment (Ortiz and Cummins, 2011).

Contrary to the idea that income inequality supports economic growth and is therefore necessary, there are other studies show that countries with high levels of inequality tend to have lower growth rates. According to Birdsall (2004), inequality is important not only because it directly affects the economic variables such as growth and poverty, but also because it has intrinsic significance. Inequality, especially in developing countries where market and policy failures are common, interacts with these failures to have a much more negative impact on growth. In this respect, redistribution policies not only help achieve equality; but also increase efficiency, especially to the extent that they regulate market disruptions. For example, the inability of poor households to access credit is a major market failure that prevents borrowing to finance education. Providing education through government can strengthen both equity and the effective accumulation of human capital (Clements et al., 2015).

In relation to inequality, it is important to distinguish between absolute poverty, whicn is defined in terms of meeting certain basic needs and relative poverty, which is determenide as a fixed proportion of certain income standards within the population (Bourguignon, 2004). Graham (2004) reveals that while economic growth can be as beneficial fort he poor as it is fort he rich, when considering overall well-being, the middle-lower income group, even with rising incomes, may feel frustrated and perceive themselves to be worse off. Because of the relative income differences, people find that even large percentage increases in income when comparing themselves with others are not enough to reach the level of wealthier groups. Income inequality, social insecurity, and perceived economic uncertainties, along with the tendency to compare one's situation with others-can heighten this frustration, particularly due to fears of future unemployment.

Even where a fairer distribution of income is not the main objective, a fair distribution of income is necessary to ensure economic efficiency. According to Ortiz and Cummins (2011), most of the developed economies have expanded their domestic markets as a strategy of increasing demand and economic growth, thereby increasing the production of more goods and services and therefore job opportunities to meet consumer demands. In this respect, the concentration of consumption in the top income bracket is economically inefficient and dysfunctional, as it narrows down the country's markets. As a result, it can be said that long-term growth and improvements in income distribution are the main factors in increasing the well-being of the lower income group. The growth and distribution flexibilities of poverty have different effects on development and inequality. Distribution for middle-income and less equal countries; it is possible that growth is relatively more important for low-income and income-distributed countries (Bourguignon, 2004). A more equitable distribution can have a faster impact on reducing poverty than growth, but economic growth is also essential to sustain the process. Briefly, a more even distribution tends to encourage consumption, increase productivity, and help sustain growth (Ortiz and Cummins, 2011).

3. THE ROLE OF TAXES IN THE REDISTRIBUTION OF INCOME

There is no specific, single set of policies in reducing income disparities; it can be said that there are many different ways to achieve the same goal. There are several options that the state can pursue in the redistribution of income. These include altering fundamental factors that determine income distribution, such as wealth educational opportunities and factor prices; utilizing income policy tools like price and wage controls or direct income support; and employing fiscal policy tools, including taxes and public expenditures.

Greater equality can be achieved either by using taxes and social benefits to redistribute highly unequal incomes or by achieving greater equality in gross income before taxes and social benefits, leaving less need for redistribution. Sweden, for example, achieves equality through redistributive taxes and social benefits and widespread welfare state practices. In contrast, Japon has the lowest level of public social spending as a percentage of national income among major developed countries. Japan achieves high levels of equality not through redistribution, but through more equal, market incomes before taxes and benefits, meaning that earnings are closer to each other (Wilkinson and Pickett, 2010). Among the different implementation options, fiscal policy is one of the most powerful tools a government has for achieving redistribution goals. In countries with more equitable income distribution, it is well-known that public expenditures such as social transfers, free education, and healthcare services along with tax regulations like progressive taxation, tax deduction and exemption, are heavily utilized. Fiscal tools can be employed not only to ensure a fairer distribution of income but also to mitigate the issue arising from an unfair distribution of income.

It may be misleading to refer to standard assumptions about the direction and extent of the effects of tax-related adjustments; The effects of customs duties are difficult to assess, for example, since they affect not only those who purchase imported goods, but also those who are forced to buy more expensive domestic goods (Clements et al., 2015). A tax regulation may not have a one-way effect and the economic impacts may be lower than expected. Benedek et al. (2015) addressed the reflection of VAT changes on consumer prices and found that the reflection was 100% for changes in the standard rate of VAT; They concluded that 30% at discounted rates and zero in reclassifications. The effects of tax policies on the economy may vary depending on factors such as time, market conditions, level of competition, and elasticity of demand. However, it can generally be stated that the distributive impact of taxes increases with progressivity. Martínez-Vazquez et al. (2012) found that progressive income taxes have a positive effect on the distribution of income; and this effecet becomes more pronounced as the degree of progressivity and the share of individual income tax in GDP increase. Although corporate tax is a flat-rate tax, it can show the opposite feature of increasing proportionality as the level of economic openness increases. This tax is relatively less important in terms of its weight in total tax revenue. Consumption taxes are generally considered to exacerbate worsen inequality due to their regressive nature. If lower income groups spend a large portion of their income on consumption, they are likely to pay a higher average tax rate compared to higher income groups. But the effects of these taxes vary from country to country, depending on whether they apply to luxury or basic needs, and on citizens "consumption preferences" (Martínez-Vazquez et al.). The adoption of lower rates for essential goods and services can mitigate the regressive impact of the tax. Exluding small shops and markets which are more frequently used by lower-income groups, from tax collection can also increase the progressivity of these taxes (Jenkins et al., 2006). This is because the cost of collecting taxes from small businesses may exceed the amonth of tax collected. In summary, different degrees of tax compliance among different income groups can reverse the regressive nature of the tax.

It can be said that the level of development of a country's economy shapes its the tax system. As the ratio of median income to average income falls, the median voter tends to favor higher taxes and more greater redistribution (Gupta and Jalles, 2022). The public revenues in developing countries mostly rely on consumption taxes. These taxes have broader tax base and are easier to collect compared to others. Although income taxes in these countries (especially those levied on wage income) are mostly applied progressively, the overall share of income taxes in total revenue is low. Low tax compliance and a large informal economy make it difficult to collect direct taxes. Capital and wealth taxes also have a limited share in these countries. Shortly, due to low share or progressive increase of direct taxes, and the predominance of indirect taxes, the redistributive effect of tax systems in developing countries tends to remain limited. (Chu et al., 2000).

One of the most practical methods for examining the impact of taxes on income distribution is to analyze them by tax type. In this contex, it is useful to distinguish between general categories such as indirect and direct taxes, as well as by the spesific tax base, such as income, consumption and wealth taxes. When examining the effects of taxes on income distribution in Turkey, it can be observed that since the liberalization process began in the 1980s, direct taxes have made a positive contribution to income distribution equity, in other words, they have helped to compensate for income injustice. In many studies, it has been observed that indirect taxes in Turkey cause income injustice and increase the Gini coefficient. Accordingly, indirect taxes in Turkey tend to favor capital over labor income distribution, place a disproportionate tax burden on lowen-income groups, undermine the principle of fairness in taxation, and negatively affect the equitable distribution of income (Albayrak, 2010, Demirgil, 2018, Günel, 2019, Karabulut, 2020, and Ay and Haydanli, 2018, Susam and Oktayer 2007).

4. DATA SET, MODEL, ECONOMETRIC METHOD AND RESULTS

In this study, annual data from the period 2002 to 2022, as outlined in Table 1, was used to examine the impact of tax revenues on income distribution in Turkey. The date for these variables was complied using the databases of the Ministry of Treasury and Finance and TUIK (Turkish Statistical Institute) were used and descriptive statistical information and graphs of series about the variables used in the study is presented in Table 2 and Appendix 1.

The Markov regime change analysis method has been adopted to determine the effect of tax revenues on income distribution in Turkey. The Markov regime change analysis method has been used in the study because it provides information on how the relationships of variables are formed in different periods. In this sense, regime change models are defined as models that allow the parameters in a specified model to take different values in a certain number of regimes. Regime change models, which are preferred especially in determining the dynamic behavior of series of macroeconomic and financial variables, are divided into two as threshold value models and Markov regime change models. In the threshold value models developed by Tong (1983), regime changes are assumed to be triggered by the level of observed variables in relation to an unobserved threshold. In the Markov regime change models introduced to econometrics by Goldfeld and Quandt (1973), Cosslett and Lee (1985) and Hamilton (1989), regime changes are assumed to occur according to a Markov chain (Piger, 2007). Accordingly, the Markov regime change analysis developed by Hamilton (1989) is expressed in equation (1) as follows:

$$y_t = \alpha_{st} + x_t^{'}\beta_{st} + \varepsilon_t \; \varepsilon_t \sim i.i.d.N(0, \sigma^2_{\varepsilon.s_t}) \qquad (1)$$

(1) denotes the *Yt dependent* variable*, x the independent* variables, and s_t the regime variable. However, the regime periods in the model are determined by the s_t variable, which is considered an accidental variable. Thus, the probability value of the s_t regime variable is calculated by equation (2) with respect to the probability value of the previous period.

$$P\{\{s_t = j \mid s_{t-1} = i\} = \{s_t = j \mid s_{t-1} = i.s_{t-2} = k.\} = p_{ij} \qquad (2)$$

The equation numbered (2), which is estimated by the maximum likelihood method, expresses the transition probabilities from the regime that fits the first order markov process to the regime j. In the light of these explanations, the models shown in the equations (3), (4), (5), (6), (7), (8), (9), (10), (11), (12), (13) and (14) are created for estimation by mark ov regime change analysis.

In order to predict the models in Table 3, the priorities are determined whether the series of variables contain a unit root. RALS-LM two-breaks unit root test is preferred for unit root testing. In his work Perron (1989) proposed the idea that if the series of variables involved structural break, the strength of traditional unit root tests would be weakened, and developed unit root testing under the assumption that the date of the break was known in advance. Following the work of Perron (1989), Zivot and Andrews (1992), Perron (1989) criticized the external determination of the break date in the structural break unit root test and introduced the unit root test, in which the break time is determined internally. The Zivot and Andrews (1992) test, performed under the presence of a single structural break, was later advanced by Lumsdaine and Papell (1992) to allow for two breaks. However, in both the Zivot and Andrews (1992) and Lumsdaine and Papell (1997) tests, it is assumed that there is no structural

Table 1: Variables and data set used in the study

Variables	Definitions of variables
Gini	Gini coefficient
P20	Share of the 20% group receiving the lowest share of income
P80	Share of the 20% group receiving the highest share of income
VAT	Share of VAT revenues in total tax revenues
MTV	Share of MTV in total tax revenues
Stoppage	The share of tax revenues collected through withholding method in total tax revenues
Declaration	The share of tax revenues collected by declaration method in total tax revenues

VAT: Value added tax, MTV: Motor vehicle tax

Table 2: Descriptive statistics

The statistics	Gini	P20	P80	VAT	MTV	Stoppage	Declaration
Mean	0.406095	6.214286	46.08095	54.12108	2.054949	18.91291	1.065416
Median	0.404000	6.300000	45.90000	54.79115	2.180751	19.16516	1.075767
Maximum	0.440000	6.500000	50.00000	60.83011	2.607117	22.52535	1.443223
Minumum	0.380000	5.300000	44.40000	44.28645	1.003923	13.98634	0.801644
SD	0.012767	0.293744	1.319325	3.894898	0.434885	1.857741	0.150213
Skewness	0.728330	−1.477698	1.389083	−0.590555	−1.115762	−0.487736	0.534368
Kurtosis	4.236066	5.444876	4.906582	3.268496	3.276384	3.716609	3.287732
Jarque-Bera	3.193505	12.87282	9.934101	1.283722	4.424079	1.281940	1.071865
	(0.2025)	(0.0016)	(0.0069)	(0.5263)	(0.1094)	(0.5267)	(0.5812)

Time Series: 2002-2022, number of observations: 21. Values in parentheses represent probability values. VAT: Value added tax, MTV: Motor vehicle tax, SD: Standart deviation

Table 3: Models Used in the Study

$Gini_t=\alpha_{st}+VAT\beta_{st}+\varepsilon_t$	(3)	$P20_t=\alpha_{st}+VAT\beta_{st}+\varepsilon_t$	(7)	$P80_t=\alpha_{st}+VAT\beta s_t+\varepsilon_t$	(11)
$Gini_t=\alpha_{st}+MTV\beta_{st}+\varepsilon_t$	(4)	$P20_t=\alpha_{st}+MTV\beta_{st}+\varepsilon_t$	(8)	$P80_t=\alpha_{st}+MTV\beta s_t+\varepsilon_t$	(12)
$Gini_t=\alpha_{st}+stoppage\beta_{st}+\varepsilon_t$	(5)	$P20_t=\alpha_{st}+stoppage\beta_{st}+\varepsilon_t$	(9)	$P80_t=\alpha_{st}+stoppage\beta s_t+\varepsilon_t$	(13)
$Gini_t=\alpha_{st}+declaration\beta_{st}+\varepsilon_t$	(6)	$P20_t=\alpha_{st}+declaration\beta_{st}+\varepsilon_t$	(10)	$P80_t=\alpha_{st}+declaration\beta s_t+\varepsilon_t$	(14)

break in the basic hypothesis indicating the existence of the unit root, and the critical values of the tests are established according to this assumption. Finding this deficiency, Lee and Strazicich (2003; 2004) proposed that the alternative to the basic hypothesis in these tests should not be "structural breakd stationary," in other words, that the rejection of the basic hypothesis does not require the rejection of the unit root, and that it means the same as the rejection of the unit root, which does not involve structural break. In line with these ideas, they put forward unit root tests in which two breaks are taken into account and the break dates are determined internally. Accordingly, the hypotheses in Lee and Strazicich (2003; 2004) unit root test are established as follows.
H_0: Contains a serial unit root under structural breaks ($\beta = 1$)
H_1: Contains no serial unit root under structural breaks ($\beta < 1$)

The test statistics required to test the hypotheses formulated above are calculated using equation (15).

$$\Delta y_t = \delta' \Delta Z_t + \phi \tilde{S}_{t-1} + e_t \tag{15}$$

In equation (15), $\tilde{S}_{t-1} = y_t - \tilde{\psi}_x - Z_t \tilde{S}_{t-1}, t: 2,.....T$ and $\tilde{\delta}$ shows the coefficients resulting from the regression of Δy_t on ΔZ_t and is formed $\tilde{\psi}_x$, $y_1 - Z_1\tilde{\delta}$. Where y_1 and Z_1 denote the first observations of y_t and Z_t variables, respectively. Accordingly, the LM test statistic is calculated with the help of t the $\tilde{\tau}$ statistic that tests the basic hypothesis of unit root. The values at which the test is minimum are accepted as break dates. The RALS (residual augmented leasts quares) methodology, first proposed by Im and Schmidt (2008), is an estimation method in which the information on the non-normal distribution of error terms is taken into account. This method was later used by Meng et al. (2014) in developing the RALS-LM unit root test. However, Meng et al. (2017) claimed that the inclusion of RALS information in unit root tests would make unit root tests stronger, and they determined that the power of the RALS-LM unit root test decreases when structural breaks are not taken into account, and they presented the RALS-LM unit root test with two breaks, which is taken into account. In this sense, the RALS-LM break unit root test, in which the break dates are determined endogenously and the RALS information is used as in the Lee and Strazicich (2003; 2004) test, is specified in equation (15).

$$\Delta y_t = \delta' \Delta Z_t + \phi \tilde{S}^*_{t-1} + \gamma' \hat{w}_t + \mu_t \tag{16}$$

(In equation (16), the term $\hat{w}_t$ terimi is presented in equation (17).

$$\hat{w}_t = \left[\hat{e}_t^2 - \hat{m}_2, \hat{e}_t^3 - \hat{m}_3 - 3\hat{m}_2\hat{e}_t\right]' \tag{17}$$

In equation (17), $\hat{e}_t$ is the error term obtained from equation (15). In order to obtain information about error terms that do not show normal distribution properties, the second and third moments of $\hat{e}_t$ are shown in the form of $h(\hat{e}_t) = \left[\hat{e}_t^2, \hat{e}_t^3\right]'$. In equation number (17), $\hat{m}_2$ represents the average of the squares of the error terms and $\hat{m}_3$ represents the average of the cubes of the error terms. In equation (16), the null hypothesis $\phi = 0$ is tested against the alternative hypothesis y $\phi < 0$. Equation (18), where $\tau_{RALS\text{-}LM}$ is the RALS-LM test statistic and ρ^2 is the correlation coefficient, is used to perform this test.

$$\tau_{RALS-LM} \rightarrow \rho\tau_{LM} + \sqrt{1-\rho^2}Z \tag{18}$$

The RALS-LM test statistic calculated according to equation (18) is compared with the critical values in Meng et al. (2017) to determine whether the series contains a unit root. Finally, in the RALS-LM unit root test with breaks, the unit root test can be applied according to Model AA (model allowing two breaks in the level) and Model CC (model allowing two breaks in the level and trend) as in the Lee and Strazicich (2003; 2004) unit root test.

According to the results in Table 4, it was determined that the series related to the variables in the study does not contain a unit root. After the unit root test, the share of the group with the lowest share of the tax revenues collected according to VAT, MTV, stoppage and declaration methods, The share of the group of 20% with the lowest share of income and its effects on the Gini coefficient were examined by markov regime change analysis method and the results of the analysis obtained and the transition probabilities matrix and period characteristics were reported in the relevant tables.

According to the results in Table 5, a one-unit change in the VAT variable affected the share of the group 20% with the lowest share of income by 0.047 units in Regime 2.

According to the results in Table 6, when the share of the group 20% with the lowest income is in Regime 1, the probability of staying in Regime 1 is 100% and the probability of moving to Regime 2 is 0%. When the share of the group 20% with the lowest income is in Regime 2, the probability of staying in Regime 2 is 83.316% and the probability of moving to Regime 1 is 16.684%.

According to the results in Table 7, a one-unit change in the VAT variable affected the share of the group 20% receiving the highest share of income in Regime 2 by −0.121 unit.

According to the results in Table 8, while the share of the group with the highest share of the income is in Regime 1, the probability of remaining in Regime 1 is 67.171% and the probability of passing to Regime 2 is 32.829%. While the 20% group with the highest share of income is in Regime 2, the probability of remaining in

Table 4: Residual augmented leasts quares-LM unit root test results

Variables	ρ^2	τRALS-LM	Breaking dates	Critical Values		
				Percentage 1	Percentage 5	Percentage 10
VAT	0.726	−6.504	2011-2019	−4.423	−3.897	−3.611
MTV	0.461	−6.232	2012-2015	−4.095	−3.417	−3.213
Stoppage	0.562	−9.002	2012-2015	−4.232	−3.684	−3.384
Declaration	0.467	−9.136	2013-2016	−4.105	−3.445	−3.225
P20	0.562	−9.002	2012-2015	−4.232	−3.684	−3.384
P80	0.831	−5.015	2013-2016	−4.526	−4.012	−3.736
Gini	0.430	−10.466	2013-2017	−4.051	−3.283	−3.156

VAT: Value added tax, MTV: Motor vehicle tax

Table 5: Markov regime change analysis results-1

Model: $P20_t=\alpha_{st}+VAT\beta_{st}+\varepsilon_t$		
Variables/regimes	Regime 1	Regime 2
Constant term	−5.142*	3.187*
VAT	0.022	0.047*
Diagnostic tests		
Davies test P-value: 0.0000		
LR linearity test Chi-square statistic value: 24.8790 (0.0000)		
Portmanteau autocorrelation test χ^2: 11.6830 (0.0199)		
ARCH 1-1 heteroscedasticity test F statistic value: 6.3367 (0.0257)		
Normality test Chi-square statistic value: 1.3228 (0.5161)		

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion. VAT: Value added tax

Table 6: Transition probabilities matrix and period classification-1

Transition probabilities matrix		
Periods	Regime 1 (t)	Regime 2 (t)
Regime 1 (t+1)	1.00000	0.16684
Regime 2 (t+1)	0.00000	0.83316
Period classification		
Regimes	Number of Observations	Average duration (annual)
Regime 1	16	16
Regime 2	5	5
Regimes	Regimes Dates	
Regime 1	2007-2022	
Regime 2	2002-2006	

Regime 2 again is 100% and the probability of passing to Regime 1 is 0%.

According to the results in Table 9, a one-unit change in the MTV variable affected the share of the group 20% with the lowest share of income by 0.207 units in Regime 1 and by 0.663 units in Regime 2.

According to the results in Table 10, when the group 20% with the lowest share of income is in Regime 1, the probability of staying in Regime 1 is 100%, and the probability of moving to Regime 2 and Regime 3 is 0%. When the share of the group 20% with the highest share of income is in Regime 2, the probability of staying in Regime 2 is 1.5441%, the probability of moving to Regime 1 is 0%, and the probability of moving to Regime 3 is 98.4560%. When the share of the group 20% with the highest share of income is in

Table 7: Markov regime change analysis results - 2

Model: $P80_t=\alpha_{st}+VAT\beta_{st}+\varepsilon_t$		
Variables/regimes	Regime 1	Regime 2
Constant term	55.607*	52.371*
VAT	−0.126	−0.121**
Diagnostic tests		
Davies test P-value: 0.0019		
LR linearity test Chi-square statistic value: 14.895 (0.0019)		
Portmanteau autocorrelation test χ^2: 1.5645 (0.8152)		
ARCH 1-1 heteroscedasticity test F statistic value: 2.0307 (0.1777)		
Normality Test Chi-Square statistic value: 1.9824 (0.3711)		

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion. VAT: Value added tax

Table 8: Transition probabilities matrix and period classification-2

Transition probabilities matrix		
Periods	Regime 1 (t)	Regime 2 (t)
Regime 1 (t+1)	0.67171	0.00000
Regime 2 (t+1)	0.32829	1.00000
Period classification		
	Number of observations	Average duration (annual)
Regime 1	2	2
Regime 2	19	19
Regimes	Regimes Dates	
Regime 1	2002-2003	
Regime 2	2004-2022	

Regime 3, the probability of staying in Regime 3 is 25.284%, the probability of moving to Regime 1 is 25.182%, and the probability of moving to Regime 2 is 49.533%.

According to the results in Table 11, a one-unit change in the MTV variable affected the share of the 20% group with the highest share of income by −0.980 units in Regime 1, −1.396 units in Regime 2 and −7.043 units in Regime 3.

According to the results in Table 12, when the group 20% with the highest share of income is in Regime 1, the probability of staying in Regime 1 is 33.346%, the probability of moving to Regime 2 is 66.654% and the probability of moving to Regime 3 is 0%. When the share of the group 20% with the highest share of income is in

Table 9: Markov regime change analysis results-3

Model: $P20_t=\alpha_{st}+MTV\beta_{st}+\varepsilon_t$			
Variables/regimes	**Regime 1**	**Regime 2**	**Regime 3**
Constant term	5.887*	4.526*	6.432*
MTV	0.207**	0.663*	−0.281
Diagnostic tests			
Davies test P-value: 0.0163			
LR linearity test Chi-square statistic value: 16.280 (0.0227)			
Portmanteau autocorrelation test χ^2: 2.9576 (0.2279)			
ARCH 1-1 heteroscedasticity test F statistic value: 0.89777 (0.3681)			
Normality test Chi-square statistic value: 2.9576 (0.2279)			

Notes: *Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion. MTV: Motor vehicle tax

Table 10: Transition probabilities matrix and period classification-3

Transition probabilities matrix			
	Regime 1 (t)	**Regime 2 (t)**	**Regime 3 (t)**
Regime 1 (t+1)	1.00000	0.000000	0.25182
Regime 2 (t+1)	0.00000	0.015441	0.49533
Regime 3 (t+1)	0.00000	0.984560	0.25284
Period classification			
	Number of observations	**Average duration (annual)**	
Regime 1	16	16	
Regime 2	2	1	
Regime 3	2	1.50	
Regimes	**Regimes Dates**		
Regime 1	2007-2022		
Regime 2	2002-2002, 2005-2005		
Regime 3	2003-2004, 2006-2006		

Table 11: Markov regime change analysis results-4

Model: $P80_t=\alpha_{st}+MTV\beta_{st}+\varepsilon_t$			
Variables/regimes	**Regime 1**	**Regime 2**	**Regime 3**
Constant Term	4.584*	48.328*	58.272*
MTV	−0.980**	−1.396*	−7.043*
Diagnostic tests			
Davies test P-value: 0.0002			
LR linearity test Chi-square statistic value: 26.195 (0.0005)			
Portmanteau autocorrelation test χ^2: 7.4896 (0.1122)			
ARCH 1-1 heteroscedasticity test F statistic value: 0.21593 (0.6532)			
Normality test Chi-square statistic value: 8.4347 (0.0147)			

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. (1) The values in parentheses represent the probability values of the relevant test statistics. (2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. (3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion. MTV: Motor vehicle tax

Table 12: Transition probabilities matrix and period classification-4

Transition probabilities matrix			
Periods	**Regime 1 (t)**	**Regime 2 (t)**	**Regime 3 (t)**
Regime 1 (t+1)	0.33346	0.44305	0.00000
Regime 2 (t+1)	0.66654	0.55695	0.26839
Regime 3 (t+1)	0.00000	0.00000	0.73161
Period classification			
	Number of observations	**Average Duration (Annual)**	
Regime 1	7	1.40	
Regime 2	11	2.20	
Regime 3	3	3	
Regimes	**Regimes Dates**		
Regime 1	2006-2006, 2009-2009, 2016-2018, 2020-2020, 2022-2022		
Regime 2	2005-2005, 2007-2008, 2010-2015, 2019-2019, 2021-2021		
Regime 3	2002-2004		

Regime 2, the probability of staying in Regime 2 is 55.695%, the probability of moving to Regime 1 is 44.305%, and the probability of moving to Regime 3 is 0%. When the share of the group 20% with the highest share of income is in Regime 3, the probability of staying in Regime 3 is 73.161%, the probability of moving to Regime 1 is 0%, and the probability of moving to Regime 2 is 26.839%.

According to the results in Table 13, a one-unit change in the stoppage variable affected the share of the group 20% with the lowest share of income by −0.216 units in Regime 2.

According to the results in Table 14, when the share of the group 20% with the lowest income is in Regime 1, the probability of staying in Regime 1 is 100% and the probability of moving to Regime 2 is 0%. When the share of the group 20% with the lowest income is in Regime 2, the probability of staying in Regime 2 is 83.316% and the probability of moving to Regime 1 is 16.684%.

According to the results in Table 15, a one-unit change in the stoppage variable affected the share of the group 20% with the highest share of income by −0.173 units in Regime 1 and 0.631 units in Regime 3.

According to the results in Table 16, when the share of the group 20% with the highest share of income is in Regime 1, the probability of staying in Regime 1 is 100%, and the probability of moving to Regime 2, Regime 3, Regime 4 and Regime 5 is 0%. When the share of the group 20% with the highest share of income is in Regime 2, the probability of staying in Regime 2 is 71.694%, the probability of moving to Regime 1 is 10.705%, the probability of moving to Regime 3 is 0% and the probability of moving to Regime 4 is 17.601%. When the share of the group 20% with the highest share of income is in Regime 3, the probability of staying in Regime 3 is 66.666%, the probability of moving to Regime 1 and Regime 2 is 0%, and the probability of moving to Regime 4 is 33.334%. The probability of the group 20% with the highest share of income staying in Regime 4 is 0%, the probability of moving to Regime 1 and Regime 3 is 0%, and the probability of moving to Regime 2 is 100%.

According to the results in Table 17, a one-unit change in the declaration variable affected the share of the 20% group with the lowest share of income by −1.598 units in Regime 2.

Table 13: Markov regime change analysis results-5

Model: $P20_t=\alpha_{st}+Stoppage\beta_{st}+\varepsilon_t$		
Variables	**Regime 1**	**Regime 2**
Constant term	5.949*	9.873*
Stoppage	0.020	−0.216**
Diagnostic tests		
Davies test P-value: 0.0019		
LR linearity test Chi-square statistic value: 24.672 (0.0000)		
Portmanteau autocorrelation test χ^2: 5.1144 (0.2758)		
ARCH 1-1 heteroscedasticity test F statistic value: 0.0057 (0.9405)		
Normality test Chi-square statistic value: 1.2557 (0.5337)		

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion

Table 14: Transition probabilities matrix and period classification-5

Transition probabilities matrix		
Periods	**Regime 1 (t)**	**Regime 2 (t)**
Regime 1 (t+1)	1.00000	0.16669
Regime 2 (t+1)	0.00000	0.83331
Period classification		
	Number of observations	**Average duration (annual)**
Regime 1	16	16
Regime 2	5	5
Sub-periods of regimes		
Regimes	**Regimes Dates**	
Regime 1	2007-2022	
Regime 2	2002-2006	

Table 15: Markov regime change analysis results-6

Model: $P80_t=\alpha_{st}+Stoppage\beta_{st}+\varepsilon_t$				
Periods	**Regime 1**	**Regime 2**	**Regime 3**	**Regime 4**
Constant term	49.713*	41.888*	36.770*	47.016
Stoppage	−0.173*	0.169	0.631*	−0.039
Diagnostic Tests				
Davies test P-value: 0.0000				
LR linearity test Chi-square statistic value: 35.775 (0.0000)				
Portmanteau autocorrelation test χ^2: 6.0233 (0.1974)				
ARCH 1-1 heteroscedasticity test F statistic value: 0.0025 (0.9612)				
Normality test Chi-square statistic value: 2.5219 (0.2834)				

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion

According to the results in Table 18, when the share of the group 20% with the lowest share of income is in Regime 1, the probability of staying in Regime 1 is 100%, and the probability of moving to Regime 2 and Regime 3 is 0%. When the share of the group 20% with the lowest share of income is in Regime 2, the probability of staying in Regime 2 is 0%, the probability of moving to Regime 1 is 33.310%, and the probability of moving to Regime 3 is 66.690%. When the share of the group 20% with the highest share of income is in Regime 3, the probability of staying

Table 16: Transition probabilities matrix and period classification-6

Transition probabilities matrix				
Periods	**Regime 1 (t)**	**Regime 2 (t)**	**Regime 3 (t)**	**Regime 4 (t)**
Regime 1 (t+1)	1.00000	0.10705	0.00000	0.00000
Regime 2 (t+1)	0.00000	0.71694	0.00000	1.0000
Regime 3 (t+1)	0.00000	0.00000	0.66666	0.00000
Regime 4 (t+1)	0.00000	0.17601	0.33334	0.00000
Period classification				
	Number of observations		**Average duration (annual)**	
Regime 1	7		7	
Regime 2	9		3	
Regime 3	2		2	
Regime 4	3		1	
Sub-periods of regimes				
Regimes	**Regimes Dates**			
Regime 1	2016-2022			
Regime 2	2005-2005, 2007-2008, 2010-2015			
Regime 3	2002-2003			
Regime 4	2004-2004, 2006-2006, 2009-2009			

Table 17: Markov regime change analysis results-7

Model: $P20_t=\alpha_{st}+declaration\beta_{st}+\varepsilon_t$			
Variables	**Regime 1**	**Regime 2**	**Regime 3**
Constant term	6.072*	7.681*	6.572*
Declaration	0.253	−1.598**	−0.442
Diagnostic tests			
Davies test P-value: 0.2140			
LR linearity test Chi-square statistic value: 4.4811 (0.2140)			
Portmanteau autocorrelation test χ^2: 2.5982 (0.6271)			
ARCH 1-1 heteroscedasticity test F statistic value: 1.1896 (0.2987)			
Normality test Chi-square statistic value: 1.0183 (0.6010)			

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion

Table 18: Transition probabilities matrix and period classification-7

Transition probabilities matrix			
Periods	**Regime 1 (t)**	**Regime 2 (t)**	**Regime 3 (t)**
Regime 1 (t+1)	1.00000	0.33310	0.00000
Regime 2 (t+1)	0.00000	0.00000	1.00000
Regime 3 (t+1)	0.00000	0.66690	0.00000
Period classification			
	Number of observations		**Average duration (annual)**
Regime 1	16		16
Regime 2	3		1
Regime 3	2		1
Regimes	**Regimes Dates**		
Regime 1	2007-2022		
Regime 2	2002-2002, 2004-2004, 2006-2006		
Regime 3	2003-2003, 2005-2005		

in Regime 3 is 0%, the probability of moving to Regime 1 is 0%, and the probability of moving to Regime 2 is 100%.

According to the results in Table 19, a one-unit change in the declaration variable affected the share of the 20% group with the highest share of income by −3.890 units in Regime 1, 3.135 units in Regime 2 and 15.219 units in Regime 3.

According to the results in Table 20, when the share of the group 20% with the highest share of income is in Regime 1, the probability of staying in Regime 1 is 100%, and the probability of moving to Regime 2 and Regime 3 is 0%. When the share of the group 20% with the highest share of income is in Regime 2, the probability of staying in Regime 2 is 90.084%, the probability of moving to Regime 1 is 9.9161%, and the probability of moving to Regime 3 is 0%. When the share of the group 20% with the highest share of income is in Regime 3, the probability of staying in Regime 3 is 79.804%, the probability of moving to Regime 1 is 0%, and the probability of moving to Regime 2 is 20.196%.

According to the results in Table 21, a one-unit change VAT variable affected the Gini variable by −0.00172 units in Regime 1, −0.000492 units in Regime 2 and −0.0168 units in Regime 4.

Table 19: Markov regime change analysis results-8

Model: $P80_t=\alpha_{st}+declaration\beta_{st}+\varepsilon_t$			
Variables	Regime 1	Regime 2	Regime 3
Constant term	50.477*	42.180*	28.206*
Declaration	−3.890*	3.135**	15.219*
Diagnostic tests			
Davies test P-value: 0.0000			
LR linearity test Chi-square statistic value: 31.061 (0.0000)			
Portmanteau autocorrelation test χ^2: 1.9862 (0.7383)			
ARCH 1-1 heteroscedasticity test F statistic value: 0.20368 (0.6614)			
Normality test Chi-square statistic value: 3.3635 (0.1861)			

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion

Table 20: Transition probabilities matrix and period classification-8

Transition probabilities matrix			
Periods	Regime 1 (t)	Regime 2 (t)	Regime 3 (t)
Regime 1 (t+1)	1.00000	0.09916	0.00000
Regime 2 (t+1)	0.00000	0.90084	0.20196
Regime 3 (t+1)	0.00000	0.00000	0.79804
Period classification			
	Number of observations	Average duration (annual)	
Regime 1	7	7	
Regime 2	10	10	
Regime 3	4	4	
Regimes	Regimes Dates		
Regime 1	2016-2022		
Regime 2	2006-2015		
Regime 3	2002-2005		

According to the results in Table 22, when Gini variable is in Regime 1, the probability of staying in Regime 1 is 0.73461%, the probability of staying in Regime 2 is 26.539%, and the probability of moving to Regime 3 and Regime 4 is 0%. When Gini variable is in Regime 2, the probability of staying in Regime 2 is 16.466%, the probability of moving to Regime 1 is 83.534%, and the probability of moving to Regime 3 and Regime 4 is 0%. When Gini variable is in Regime 3, the probability of staying in Regime 3 is 3.754%, the probability of moving to Regime 1 is 48.132%, the probability of moving to Regime 2 is 0% and the probability of moving to Regime 4 is 48.114%. When Gini variable is in Regime 4, the probability of staying in Regime 4 is 50.818%, the probability of moving to Regime 1 and Regime 2 is 0%, and the probability of moving to Regime 3 is 49.182%.

According to the results in Table 23, a one-unit change in the MTV variable affected the Gini variable by 0.035 units in Regime 1, −0.01180 units in Regime 2, −0.01183 units in Regime 3 and −0.040 units in Regime 4.

Table 21: Markov regime change analysis results-9

Model: $Gini_t=\alpha s_t+VAT\beta_{st}+\varepsilon_t$				
Variables	Regime 1	Regime 2	Regime 3	Regime 4
Constant term	0.499*	0.421*	0.482*	1.404*
VAT	−0.00172*	−0.000492**	−0.000953	−0.0168*
Diagnostic tests				
Davies test P-value: 0.0002				
LR linearity test Chi-square statistic value: 31.497 (0.0009)				
Portmanteau autocorrelation test χ^2: 3.5869 (0.4648)				
ARCH 1-1 heteroscedasticity test F statistic value: 0.031007 (0.8671)				
Normality test Chi-square statistic value: 1.6362 (0.4413)				

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion. VAT: Value added tax

Table 22: Transition probabilities matrix and period classification-9

Transition probabilities matrix				
Periods	Regime 1 (t)	Regime 2 (t)	Regime 3 (t)	Regime 4 (t)
Regime 1 (t+1)	0.73461	0.83534	0.48132	0.00000
Regime 2 (t+1)	0.26539	0.16466	0.00000	0.00000
Regime 3 (t+1)	0.00000	0.00000	0.03754	0.49182
Regime 4 (t+1)	0.00000	0.00000	0.48114	0.50818
Period classification				
	Number of observations	Average duration (annual)		
Regime 1	12	3		
Regime 2	4	1.33		
Regime 3	2	1		
Regime 4	3	3		
Regimes	Regimes Dates			
Regime 1	2007-2013, 2016-2018, 2020-2020, 2022-2022			
Regime 2	2002-2002, 2006-2006			
Regime 3	2002-2002, 2006-2006			
Regime 4	2003-2005			

According to the results in Table 24, when Gini variable is in Regime 1, the probability of staying in Regime 1 is 73.868%, and the probability of moving to Regime 2 is 20.132%, Regime 3 and Regime 4 is 0%. When the Gini variable is in Regime 2, the probability of staying in Regime 2 is 100%, the probability of moving to Regime 1, Regime 2 and Regime 3 is 0%. When the Gini variable is in Regime 3, the probability of staying in Regime 3 is 0%, the probability of moving to Regime 1 is 50.091%, the probability of moving to Regime 2 is 0%, the probability of moving to Regime 4 is 49.909%. When the Gini variable is in Regime 4, the probability of staying in Regime 4 is 50.231%, the probability of moving to Regime 1 and Regime 2 is 0%, and the probability of moving to Regime 3 is 50.231%.

According to the results in Table 25, a one-unit change in the stoppage variable affected the Gini variable by 0.014 units in Regime 1.

Table 23: Markov regime change analysis results-10

Model: $Gini_t=\alpha_{st}+MTV\beta_{st}+\varepsilon_t$				
Variables	**Regime 1**	**Regime 2**	**Regime 3**	**Regime 4**
Constant term	0.320*	0.426*	0.453*	0.473*
MTV	0.035***	−0.01180*	−0.01183***	−0.040*
Diagnostic Tests				
Davies test P-value: 0.0001				
LR linearity test Chi-square statistic value: 28.974 (0.0007)				
Portmanteau autocorrelation test χ^2: 8.4390 (0.0768)				
ARCH 1-1 heteroscedasticity test F statistic value: 0.85632 (0.3856)				
Normality test Chi-square statistic value: 2.9576 (0.2279)				

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion. MTV: Motor vehicle tax

Table 24: Transition probabilities matrix and period classification-10

Transition probabilities matrix				
Periods	**Regime 1 (t)**	**Regime 2 (t)**	**Regime 3 (t)**	**Regime 4 (t)**
Rejim 1 (t+1)	0.79868	0.00000	0.50091	0.00000
Rejim 2 (t+1)	0.20132	1.00000	0.00000	0.00000
Rejim 3 (t+1)	0.00000	0.00000	0.00000	0.49769
Rejim 4 (t+1)	0.00000	0.00000	0.49909	0.50231
Period classification				
	Number of observations		**Average duration (annual)**	
Regime 1	5		5	
Regime 2	11		11	
Regime 3	2		1	
Regime 4	3		3	
Sub-periods of regimes				
Regimes	**Regimes Dates**			
Regime 1	2007-2011			
Regime 2	2012-2022			
Regime 3	2002-2002, 2006-2006			
Regime 4	2003-2005			

According to the results in Table 26, when the Gini variable is in Regime 1, the probability of staying in Regime 1 is 80.219% and the probability of moving to Regime 2 is 19.781%. When the Gini variable is in Regime 2, the probability of staying in Regime 2 is 89.884% and the probability of moving to Regime 1 is 10.116%.

According to the results in Table 27, a one-unit change in the declaration variable affected the Gini variable by −0.040 units in Regime 1, 0.061 units in Regime 2 and 0.032 units in Regime 3 and 0.161 units in Regime 4.

Table 25: Markov regime change analysis results-11

Model: $Gini_t=\alpha_{st}+stoppage\beta_{st}+\varepsilon_t$		
Variables	**Regime 1**	**Regime 2**
Constant term	0.139**	0.424*
VAT	0.014*	−0.001
Diagnostic tests		
Davies test P-value: 0.0063		
LR linearity test Chi-square statistic value: 15.765 (0.0034)		
Portmanteau autocorrelation test χ^2: 1.9741 (0.7405)		
ARCH 1-1 heteroscedasticity test F statistic value: 0.38784 (0.5451)		
Normality test Chi-square statistic value: 0.044631 (0.9779)		

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion. VAT: Value added tax

Table 26: Transition probabilities matrix and period classification-11

Transition probabilities matrix		
Periods	**Regime 1 (t)**	**Regime 2 (t)**
Regime 1 (t+1)	0.80219	0.10116
Regime 2 (t+1)	0.19781	0.89884
Period classification		
	Number of observations	**Average duration (annual)**
Regime 1	5	5
Regime 2	16	16
Regimes	**Regimes Dates**	
Regime 1	2002-2006	
Regime 2	2007-2022	

Table 27: Markov regime change analysis results-12

Model: $Gini_t=\alpha_{st}+declaration\beta_{st}+\varepsilon_t$				
Variables	**Regime 1**	**Regime 2**	**Regime 3**	**Regime 4**
Constant term	0.446*	0.340*	0.392*	0.207*
Declaration	−0.040***	0.061*	0.032***	0.161*
Diagnostic tests				
Davies test P-value: 0.0000				
LR linearity test Chi-square statistic value: 43.413 (0.0000)				
Portmanteau autocorrelation test χ^2: 1.9249 (0.7496)				
ARCH 1-1 heteroscedasticity test F statistic value: 0.88154 (0.3840)				
Normality test Chi-square statistic value: 0.062494 (0.9692)				

*Significance at 1%, **Significance at 5%, ***Significance at 10% level. 1) The values in parentheses represent the probability values of the relevant test statistics. 2) According to the LR and Davies test results, a non-linear relationship was identified in the model at 1% significance level. 3) There is no heteroscedasticity and autocorrelation at the 1% significance level and the error terms follow a normal distribution in the model 4) Regime periods are determined according to the Akaike Information Criterion

Table 28: Transition probabilities matrix and period classification-12

Transition probabilities matrix				
Periods	Regime 1 (t)	Regime 2 (t)	Regime 3 (t)	Regime 4 (t)
Regime 1 (t+1)	0.62274	0.38963	0.78841	0.00000
Regime 2 (t+1)	0.37726	0.61037	0.00000	0.00000
Regime 3 (t+1)	0.00000	0.00000	0.00000	0.22580
Regime 4 (t+1)	0.00000	0.00000	0.21159	0.77420
	Number of observations		Average duration (annual)	
Regime 1	8		2	
Regime 2	8		2,67	
Regime 3	1		1	
Regime 4	4		4	
Regimes	Regimes Dates			
Regime 1	2007, 2011-2012, 2017, 2019-2022			
Regime 2	2008-2010, 2013-2016, 2018-2018			
Regime 3	2006-2006			
Regime 4	2002-2005			

According to the results in Table 28, when Gini variable is in Regime 1, the probability of staying in Regime 1 is 62.274%, the probability of staying in Regime 2 is 37.726%, and the probability of staying in Regime 3 and Regime 4 is 0%. When Gini variable is in Regime 2, the probability of staying in Regime 2 is 61.037%, the probability of moving to Regime 1 is 38.963%, and the probability of moving to Regime 3 and Regime 4 is 0%. When Gini variable is in Regime 3, the probability of staying in Regime 3 is 0%, the probability of moving to Regime 1 is 78.84%, the probability of moving to Regime 2 is 0% and the probability of moving to Regime 4 is 21.159%. When Gini variable is in Regime 4, the probability of staying in Regime 4 is 77.420%, the probability of moving to Regime 1 and Regime 2 is 0%, and the probability of moving to Regime 3 is 22.580%.

According to the results obtained;

- VAT variable positively affected the income of the group 20% with the lowest share of income in 23.80% of the total period
- VAT variable negatively affected the income of the group 20% with the highest share of income in 90.47% of the total period
- MTV variable positively affected the income of the group 20% with the lowest share of income in 85.71% of the total period
- MTV variable negatively affected the income of the group 20% with the highest share of income in 85.71% of the total period
- Stoppage variable negatively affected the income of the group 20% with the lowest share of income in 23.80% of the total period
- Stoppage variable affected the income of the group 20% with the highest share of income negatively in 33.33% of the total period and positively in 9.52% of the total period
- Declaration variable negatively affected the income of the group 20% with the lowest share of income in 14.28% of the total period
- Declaration variable variable affected the income of the group 20% with the highest share of income negatively in 33.33% and positively in 66.66% of the total period
- VAT variable negatively affected the Gini variable in 90.47% of the total period
- MTV variable affected the Gini variable negatively in 61.90% of the total period and positively in 23.80% of the total period
- Stoppage variable positively affected the Gini variable in 23.80% of the total period
- Declaration variable affected the Gini variable negatively in 38.09% of the total period and positively in 61.90% of the total period.

5. CONCLUSION

In this study, the effect of income, wealth, goods and services taxes on income inequality in Turkey is analyzed. In the analysis using 2002-2022 data, the Gini coefficient and the impact on the top and bottom income groups were evaluated. Thus, the effect of different tax types on different income groups was wanted to be revealed. The results reached are important in terms of determining which taxes policymakers should regulate for groups whose income level they want to correct. As a result of today's social state understanding, the main goal in terms of income distribution is not the absolute equal distribution of income, but the fairer distribution and realization of consumption welfare at the highest level (Ulusoy, 2018). There is a close relationship between income redistribution and the tax system. Financing public investments in social programs, infrastructure, education and health care also requires a taxation system with sufficient resource-generating capacity. (Mooij, 2015). At this point, countries can implement a fairer tax system, such as increasing taxes on income and wealth, for a more equitable income distribution. Countries can also opt to focus on well-established social spending by expanding the tax base (regardless of the type of tax) to increase the efficiency of the tax system and generate additional income. This preference requires consideration of specific circumstances, such as the structure of countries' tax administrations and tax regimes.

One of the major problems with income inequality is the difficulty in determining the income and wealth of the highest income group in particular. It is known that the data on income and wealth do not fully reflect the truth due to the use of the household survey method in measurement, the retention of assets in overseas accounts, informal factors such as tax evasion, etc. This can be expressed as one of the limitations of the study. In the study prepared within the framework of these limitations, the increase in the share of VAT and MTV's expenditure taxes in total tax revenues decreased the share of the 20% who received the highest share of the income in more periods than the share of the 20% who received the lowest share of the income; Reduce the share of tax revenues based on withholding basis by the 20% who receive the lowest and highest share of income; The increases in the share of tax revenues based on declaration in total tax revenues, on the other hand, decrease the share of the segment that receives the lowest share of income, but increase the share of the 20% who receives the highest share of income in more periods; Increases in the share of VAT in total tax revenues negatively affect the Gini coefficient, which is an indicator of income distribution in more periods, compared to increases in MTV's share in total tax revenues; It has been determined that increases in the share of tax revenues based on declaration in total tax revenues have a positive effect on the Gini coefficient in more periods than the share of tax revenues based on withholding in total tax revenues. These results show that the increase in taxes collected in Turkey on the basis of expenditure, especially VAT and MTV, has an effect on improving income distribution, whereas the increase in tax revenues obtained on the basis of declaration has a disruptive effect on income distribution. In order to improve this situation, it is necessary to more effectively control the declarations of taxpayers in their taxes collected on a declaratory basis in Turkey and to take measures that limit the tax avoidance behaviors of taxpayers.

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APPENDIX 1

Appendix 1: Series of Data. (a) Gini coefficient series, (b) Share of the 20% group receiving the lowest share of ıncome, (c) Share of the 20% group receiving the highest share of ıncome, (d) Share of value added tax (Vat) revenues in total tax revenues, (e) Share of motor vehicle tax (MTV) in total tax revenues, (f) The share of tax revenues collected through withholding method in total tax revenues, (g) The share of tax revenues collected by declaration method in total tax revenues