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The Impact of Inflation on Inequality and Income Distribution in Iran by Emphasizing Expenditure Centile

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ABSTRACT

This paper assesses the significance of the impact of seigniorage (the income generated by the government through money printing, which is a crucial pathway for inflation due to budget deficits covered by money printing, leading to inflationary taxation) and inflationary tax on inequality, using a combined model from 1996 to 2023. It highlights the varying effects of inflation on different income groups, particularly the role of government income from money creation in exacerbating inequality. The results indicate that seigniorage increases inequality, as it affects income groups differently, with lower-income groups being more vulnerable than higher-income groups. Consequently, an increase in inflationary taxation further heightens inequality.

1. Introduction

Reducing income inequality has become a crucial goal and strategy for governments' economic and social development in recent years, representing one of their primary responsibilities. Consequently, attention to income distribution in developing countries like Iran, which suffers from deep inequalities, is undeniably necessary. Inflation is recognized as a significant factor influencing income distribution, as it diminishes the purchasing power of incomes. As a result, inflation can lead to increased income gaps and a deterioration of income distribution. Given that different income groups experience varying impacts from inflation due to differences in their consumption baskets, we have examined these effects by assessing inflation on household

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consumption expenditure components. However, more important than inflation, there are the consequences that arise from it.

Additionally, governments in developing countries face numerous challenges due to the lack of an efficient tax system, making it difficult to finance government expenditures through taxation. In such circumstances, governments in these countries often seek immediate solutions to their problems, and money creation (printing currency) is one of the easiest ways to finance expenditures. In reality, what the government gains from money creation is not merely an inflationary tax, but there is a close relationship between the two. Considering the inflation rate equal to the growth rate of the money supply, these two concepts are often viewed as identical. Due to the importance of this issue and the significant role the government plays in creating inequality, this study will analyze seigniorage and inflationary tax at the national level.

In the present study, due to the lack of mechanisms in developing countries to ensure the accuracy of household income data, and to clarify the direction and trajectory of changes in welfare, we have used household expenditure data (gross) categorized by commodity groups (nine groups) as the closest alternative to income statistics. For this purpose, we utilized the Consumer Price Index, which is divided into nine sectors, to convert current expenditure distribution based on the quantity composition of household consumption baskets into constant prices by taking the price index of the base year into account. Additionally, to ensure comparability of household expenditures considering differences in size and composition, and to relate expenditures to the household head, household expenditure data has been adjusted and processed using an equivalent scale.

Our main objective in this research is to directly estimate inflation, inflationary tax, and seignior age across different expenditure categories, as well as the inequality in household expenditure distribution in Iran, disaggregated by urban regions, for the years 1996-2023. In this context, this article has been prepared. Following this section, a review of the literature impacting inequality and income distribution, seignior age, and studies from Iran and other countries has been collected and organized [12,13]

In the next section, the Gini coefficient will be estimated, and then the factors affecting income distribution will be assessed. Finally, the last section will present conclusions and recommendations.

2. Literature review

2.1. Related Studies

The absence of a comprehensive theory explaining the factors that influence income distribution has been a long-standing challenge in economics. Although many models and frameworks exist to explore specific elements such as economic growth, inflation, technological progress, and globalization, no single theory encapsulates all the variables that drive changes in income distribution. Recent research has pointed to several key factors, though the complexity and interconnectedness of these drivers make it difficult to form a unified theory.

Technological Change: One of the most influential factors in income distribution, technological advancements often increase productivity but can disproportionately benefit skilled workers. The "skill-biased technological change" (SBTC) hypothesis argues that technology increases the demand for skilled labor while reducing the demand for unskilled labor, thereby widening income inequality. This trend has accelerated with the rise of automation, artificial intelligence, and digital platforms.

Globalization: The integration of global markets has significantly impacted income distribution. While globalization has lifted millions out of poverty in developing nations, it has also contributed to wage stagnation and job displacement in developed economies. Research by the IMF [1] suggests that trade and financial globalization contribute to rising income inequality, particularly in advanced economies, where capital and high-skilled labor benefit disproportionately.

Institutional and Policy Frameworks: Governments, labor unions, and social institutions play a crucial role in shaping income distribution. Countries with stronger labor protections, progressive taxation, and robust social welfare systems tend to have more equitable income distribution. However, deregulation, tax cuts for the wealthy, and weakening unions in many advanced economies have contributed to growing inequality over the past few decades [2].

Inflation and Monetary Policy: Inflation has a complex relationship with income inequality. While some studies suggest that moderate inflation can reduce debt burdens and promote wealth redistribution, high inflation disproportionately affects lower-income households, as they spend a larger share of their income on basic necessities (Easterly & Fischer, 2001). More recently, the COVID-19 pandemic-induced inflation in 2021-2023 disproportionately affected low-income households, leading to what some economists term “inflation inequality” [3].

Demographic and Social Factors: Population aging, changes in family structures, and education levels are additional factors that affect income distribution. For instance, as the population in advanced economies ages, the demand for healthcare and pensions increases, placing pressure on public finances and widening the gap between workers and retirees.

Market Power and Elitism: Increasing market concentration and the rise of monopolistic or oligopolistic firms have allowed many corporations and their owners to capture a larger share of economic gains. This market power, combined with political influence, further exacerbates income inequality, as policies favor the wealthy [4].

In explaining inequality, it can be said that inequality can manifest as disparities in education, healthcare, legal services, life opportunities, social positions, income, and more. Many of these inequalities lead to income inequality; conversely, income inequality can serve as a catalyst for increasing these disparities.

The impact of inflation on income and wealth distribution and the cost of living for individuals in society depends on both the type and severity of inflation, as well as the socio-economic conditions of the community. In inflationary conditions, income and wealth distribution becomes distorted; that is, income is transferred from lower-income groups to higher-income groups. The negative effects of reduced purchasing power for most people are carried over into subsequent periods, causing this majority to gradually lose the ability to purchase basic goods, leading to a decrease in overall demand for such products. Rising inflation rates have significant effects on the decisions of public enterprises. Instead of allocating resources to employment-generating activities that could play a vital role in income distribution, many businesses and economic agents concentrate resources on activities that yield large profits for a select few, thereby worsening income distribution [14].

The government uses its legal right to issue money to finance its budget deficit through the issuance of money and the increase of the monetary base. This financing allows governments to acquire certain amounts of resources available in the economy by issuing money, and since the cost of issuing new money (banknotes) is less than its nominal value, governments earn profits from this process [19].

The printing of money by the central bank leads to an increase in the money supply and liquidity. Part of the increase in the money supply is not justifiable as a response to the increased demand of the people due to economic growth. The excess increase in the money supply (which is not due to

economic growth) serves as a means for the government to appropriate resources from the private sector, goods, and services. In this process, the money issued is made available to the public. This situation allows the government to cover its expenses and deficits through inflation, as no additional goods and services have been supplied, leading to price increases. Inflation, or the decrease in the purchasing power of money, acts as a tax imposed on money holders in society and is transferred to the public sector; for this reason, this portion of the issued money is referred to as "inflation tax" [11].

Today, inflation is considered one of the common phenomena in less developed countries, and as income levels decrease, the inflation rate tends to increase relative to the share of seigniorage in government financing expenses. Generally, inflation is negatively correlated with the level of development.

3. Research Methodology

In this study, we first calculate the research variables such as inequality (Gini coefficient), inflation rate, inflation tax, and the multiplier for various consumption quintiles (determined based on household consumption expenditures). Using a panel data model, we then assess the significance or insignificance of the effects of the inflation rate, inflation tax, and multiplier on inequality during the study period. A noteworthy aspect of this study is the consideration of the share of different quintiles and how they are affected by the independent and external variables of the research. To achieve these objectives, we will first introduce the abbreviations for the variables used in this research:

LHS: Logarithm of household consumption expenditures.

LG: Logarithm of the Gini coefficient.

LInf: Logarithm of the inflation rate.

LInT: Logarithm of the inflation tax.

LS: Logarithm of the multiplier.

3.1. The Method of Calculating Variables

3.1.1. Household Consumption Expenditure

In many countries, especially developing ones, household consumption expenditures are used to assess income distribution. The main reason for this approach is that income statistics are often inaccurate or incomplete, as individuals may, for various reasons, avoid reporting their exact income or reporting it incorrectly. Additionally, consumption expenditures often provide a more

accurate picture of a household's level of welfare and living patterns as they reflect the actual resources consumed by households, whether these resources are funded through income, savings, or loans.

Specifically in Iran, the use of household consumption expenditures as an indicator for evaluating income distribution is common due to the issues with income statistics.

In addition, "household size" refers to the number of individuals in the household, while "household composition" refers to the differences in age, gender, and other characteristics of household members. Considering the household's size and composition, comparing the welfare level requires adjusting their income or expenditures based on these differences. In other words, household expenditures increase with the number of household members, but not proportionally; due to economies of scale from collective consumption, the expenses of a three-person household for clothing, housing, electricity, and other needs will not be three times those of a single-person household. Furthermore, analyzing household expenditures over various years shows that the expenditure levels of adults and children are not the same, and their scales differ. In other words, in the total household expenditure series, all members of the household are considered as equivalent to an adult, which is not accurate since the expenses of an adult and a child are naturally not the same.

Thus, to more accurately attribute expenditures to the household head, or in other words, to adjust the household size, the total household expenditures must be divided by the number of household members and then adjusted. Therefore, considering the objectives of the present study, it is necessary to adjust for these differences in scales for the purpose of analysis. This adjustment (equation 1) for consumption expenditures across various groups of goods (nine categories) and total expenditures over the examined years is obtained from the following equation (Organization for Economic Co-operation and Development (OECD)):

$$eq = (adult + 0.4 \times children)^{0.85} \quad (1)$$

By calculating the adjustment coefficient, in order to adjust the aforementioned scale, the consumption expenditures of different commodity groups and total consumption expenditures are divided by the adjustment coefficient (eqation1), and based on this, the expenditures of the household head for the sample period in each of the various commodity groups and total expenditures are obtained. The advantage of using an equivalence scale for calculating the Gini coefficient is that it divides the household's gross expenditure or income among household

members. After this stage, the inequality index will be calculated based on the adjusted expenditure or income. In other words, instead of simply dividing the household expenditure by the number of household members, we account for the economies of scale in distributing the expenditures among household members. Therefore, the calculated inequality index (Gini coefficient) will assess income distribution among all individuals in society by accurately allocating expenditures among members.

From 1985 to 2004, the questionnaires for food and non-food expenditures were divided into nine categories. However, starting in 2004, they were presented in 14 categories. Therefore, in order to create suitable conditions for comparing different years, efforts were made to condense the data from 2004 onwards into nine categories. These food and non-food expenditure categories are as follows:

Expenditures on food, beverages, and tobacco in the past month.

Expenditures on household clothing and footwear in the past month.

Expenditures on housing, water, sewage, fuel, and lighting in the past month.

Expenditures on furniture, household appliances, and routine maintenance in the past month.

Expenditures on healthcare and medical services in the past month.

Expenditures on transportation and communications in the past month.

Expenditures on cultural services, recreation, education, and training in the past month.

Miscellaneous household goods and services in the past month.

Purchases and sales of durable household goods, other household expenditures, and transfers in the past 12 months.

3.1.2. Inflation Tax

To calculate inflation in different deciles, we use the inflation of the nine groups of goods (as mentioned above). For each group of goods and each decile, it is necessary to estimate the appropriate share in household consumption expenditures. This means that for each year, we first determine the share of each group of goods in total household expenditures. Then, by calculating the share of each decile in total expenditures for each group of goods in each year and multiplying it by the annual inflation rate for each group (inflation rate announced by the Central Bank), we calculate the inflation rate for each group of goods corresponding to different deciles. By summing the inflation rates across different groups of goods for each decile, the inflation rate for each decile

in each year will be estimated. Based on this, we will have five inflation rates for the different deciles in each year.

The calculation of inflation tax for different deciles is also quite simple, and (based on the formula explained below) using the inflation calculated for the different deciles, as explained above, the inflation tax for the five deciles in each year will be calculated.

The theory of inflation tax proposed by economist Gordon [18] offers a framework for understanding how inflation functions as a tax on money balances held by the public. Unlike traditional taxation, which involves explicit payments to the government, inflation tax operates through the erosion of the purchasing power of money due to rising price levels. This theory is particularly relevant in fiscal policy and monetary economics discussions, especially in times of persistent inflation.

3.1.2.1. Gordon's Model of Inflation Tax:

Gordon's model posits that the government can generate revenue through the inflation tax by increasing the money supply, leading to inflation. As inflation rises, the real value of money balances decreases, which can be viewed as an implicit tax on those who hold money. The essence of Gordon's theory is encapsulated in the following equation:

$$Inflation\ Tax = \frac{\pi}{1+\pi} \quad (2)$$

Gordon's theory of inflation tax remains relevant in modern economic discourse. It provides critical insights into how inflation can function as a source of government revenue while also highlighting the potential pitfalls associated with excessive reliance on this method [16].

3.1.3. Seigniorage

Seigniorage, the profit derived by a government from issuing currency, plays a complex role in influencing income distribution and is closely connected to several macroeconomic variables, including the demand for money, per capita income, GDP per capita, central bank independence, and political stability. Studies by economists such as Fisher, Dornbusch, and Bruno have highlighted these interdependencies, though contemporary research brings new insights into these relationships [15, 17, 20].

- **Seigniorage and the Demand for Money:**

The ability of a government to generate revenue through seigniorage depends on the public's demand for money. When the demand for money is elastic, governments can issue more currency without triggering excessive inflation. However, if the demand is inelastic, increasing the money

supply can lead to rapid inflation, eroding real income, especially for lower-income households. This relationship was a key focus in Fisher's analysis, where he demonstrated that high inflation, driven by seigniorage, disproportionately harms the poor by reducing the real value of their savings and wages [20]. More recent studies support this, suggesting that high inflation exacerbates income inequality, particularly in developing economies where the informal sector is large [3].

- **Per Capita Income and GDP per Capita:**

The impact of seigniorage on income inequality is also influenced by a country's level of economic development, typically measured through per capita income and GDP per capita. Reliance on seigniorage can be more pronounced in lower-income countries due to limited alternative tax revenues. This often leads to higher inflation, disproportionately affecting the poor (Easterly & Fischer, 2001). Conversely, in higher-income economies with more developed financial systems, governments rely less on seigniorage, and central banks are better equipped to control inflation. A recent study by Catao and Terrones [5] also indicates that inflation tends to stabilize as per capita income rises, reducing the regressive effects of seigniorage on income distribution.

- **Central Bank Independence:**

The central bank's independence is critical in managing inflation and reducing the negative effects of seigniorage. Dornbusch et al. [15] emphasized that countries with independent central banks tend to have lower inflation, as monetary policy is less influenced by political pressures to finance government deficits through money creation. Recent research affirms that central bank independence correlates with lower inflation and more stable income distribution [6]. Independent central banks are better at controlling inflation, limiting the regressive effects of inflationary finance on income inequality.

- **Political Stability:**

Political stability plays a significant role in determining the extent to which seigniorage can be used without damaging income distribution. Bruno and Easterly [17] highlighted that in politically unstable environments, governments are more likely to resort to seigniorage as a quick revenue source, often leading to high inflation and economic instability. In contrast, politically stable countries tend to have more robust fiscal policies, reducing the need to finance government expenditures through money creation. More recent analyses show that politically stable nations with strong institutions tend to have better income distribution, as they can implement policies that protect lower-income groups from inflation's worst effects [7].

3.1.3.1. Analysis of Seigniorage Estimation and Gini Coefficient Calculation

To estimate seigniorage and the Gini coefficient for different deciles, after estimating total seigniorage and the Gini coefficient for each year (based on the formula explained below), we calculate the share that each decile holds in the total seigniorage and Gini coefficient. By multiplying this share by the total values of these variables, the seigniorage and Gini coefficient for each decile can be obtained.

Bofondi and Rocco [18] defined seignior age as a percentage of GDP. The formula is as follows

$$S_t = \frac{H_t - H_{t-1}}{Y_t} = \frac{\pi_t * H_{t-1}}{Y_t} + \frac{H_t - (1+\pi_t)H_{t-1}}{Y_t} \quad (3)$$

Where:

H_t Is the monetary base at time t

π_t is the inflation rate at time t−1, t

Y_t Is the Gross Domestic Product (GDP) at time t

This method has been used in the current study to calculate seigniorage.

3.1.3.2. Methodology

To estimate seigniorage and the Gini coefficient for different income deciles, the following steps are taken:

Estimation of Total Seigniorage and Gini Coefficient: Initially, total seigniorage and the Gini coefficient are calculated for each year using the provided formula.

Decile Shares Calculation: The share of total seigniorage and Gini coefficient that each income decile holds is determined.

Decile Estimation: By multiplying these shares by the total values, the specific seigniorage and Gini coefficient for each decile can be derived.

Recent studies have expanded on the implications of seigniorage and its relationship with income distribution:

Seigniorage and Economic Inequality: Research indicates that countries with higher levels of seigniorage often face challenges related to income inequality. A study by Vitali & Fioretti [8] highlighted how excessive reliance on seigniorage can exacerbate economic disparities by disproportionately benefiting wealthier classes (Journal of Economic Policy).

Inflation and Gini Coefficient: Recent analyses, such as those conducted by Karimovet al. [9], have shown that inflation, while sometimes providing short-term relief for debtors, generally

contributes to higher Gini coefficients, indicating increased income inequality (Economic Review).

The Role of Central Banks: An article by Smith [10] discusses the impact of central bank policies on seigniorage and income distribution, suggesting that independent central banks can mitigate the adverse effects of inflationary policies on income inequality.

4. Model Specification

Before modeling, it is necessary to examine the characteristics and descriptive statistics of household consumption expenditure series across different income quintiles as the fundamental variables of the research. This will enable us to conduct reliable modeling that is consistent with the existing data structure.

Table (4-1): Descriptive Statistics of the Dependent Variables

Variable	Skewness	Kurtosis	Jarque-Bera	Box-Ljung Q (5)
Log of Gini Coefficient (LG)	0.5479	1.6371	44.575 (0.0000)	-
Log of Household Consumption (LHS)	0.5666	2.0747	5.260 (0.0000)	-

From the table above, it can be observed that all variables exhibit positive skewness and kurtosis less than that of a normal distribution. Additionally, the normality test results indicate homogeneity; based on the Jarque-Bera test, the probability density function of all variables is normal, and the null hypothesis stating, "the probability density function of the series is normal" is accepted. On the other hand, observing the Liang-Box statistic (with five lag periods) for all variables allows us to reject the null hypothesis of this test, which posits "the absence of serial correlation among the series residuals." In this case, a significant lag coefficient for the dependent variable in their modeling can be anticipated.

Therefore, since modeling a variable without ensuring its stationarity is fundamentally incorrect and heightens the suspicion of spurious regression, we will examine the stationarity of the research variables and then present the modeling results. In other words, the non-stationarity of the variables not only increases the likelihood of spurious regression in estimating the models but also has other

implications, including the unreliability of t and F statistics and the dependability of model parameters.

Consequently, in this research, to ensure comprehensive results, we will employ the Levin, Lin, and Chu (LLC) tests, Im-Pesaran, and Shin (IPS) tests, the Augmented Dickey-Fuller (ADF) Fisher test, and the Phillips-Peron (PP) Fisher test. Moreover, all these tests can be examined under two conditions: "cross-sectional data with a constant mean" and "cross-sectional data with a constant mean and trend variable." In this study, the condition of "cross-sectional data with a constant mean" alone provides acceptable results, making considering the other condition (i.e., including trend effects) unnecessary.

Table (4-2): Results of Stationarity Tests for the Level of Research Variables

Variable	LLC	IPS	ADF	PP
LHS	-2.75 (0.003)	-2.64 (0.004)	-25.92 (0.002)	-43.95 (0.000)
LG	-2.82 (0.003)	-2.87 (0.004)	-23.63 (0.002)	-39.58 (0.000)
LInf	-3.92 (0.000)	-3.29 (0.001)	-27.99 (0.002)	-42.85 (0.000)
LInT	-3.83 (0.000)	-3.72 (0.000)	-31.60 (0.001)	-54.75 (0.000)
LS	-5.36 (0.000)	-4.19 (0.000)	-35.59 (0.000)	-35.08 (0.000)

Based on the results obtained, indicating that all variables are stationary and that the test results are consistent for all variables, there is no need to perform integration tests between this research's independent and dependent variables. In other words, all research variables are integrated of order zero. The conclusion from this analysis is that the research variables can be modeled without any restrictions, and thus, in the next step, we will estimate the research models.

In the first section, we estimate models related to testing the hypothesis that "the Gini coefficient increases with higher inflationary taxes." To estimate the appropriate panel model, it is necessary first to estimate panel models for the Gini coefficient variable based on "cross-sectional fixed effects," "cross-sectional and period fixed effects," and "cross-sectional random effects." The best model among the estimated models can be selected using likelihood ratio tests and the Haussmann test. The results of these estimates are provided below.

Table (4-3): Results of Fixed and Random Effects Tests in the Gini Coefficient Model

Model	Test	Cross-Section Fixed Effects	Cross-Section and Time-Fixed Effects	Cross-Section Random Effects

Likelihood Ratio	575.07 (0.000)	165.31 (0.000)	-	-
Haussmann Test	-	-	26.76 (0.000)	-

Based on the results of these tests, which confirm the existence of "cross-sectional fixed effects," "cross-sectional and time fixed effects," and "cross-sectional random effects" in the panel models related to the Gini coefficient, it is more appropriate to use the model based on cross-sectional random effects. This model is more accurate and comprehensive compared to the other models.

Table (4-4): Results of Estimation of the Random Effects Gini Coefficient Model

Variable Name	**Coefficient**	**t-Statistic**	**Prob**
C	2.11	18.77	0.000
LInT	0.57	2.43	0.016
LS	0.35	5.02	0.000
_B1	0.49	-	-
_B2	-0.38	-	-
_B3	-0.54	-	-
_B4	-0.37	-	-
_B5	0.78	-	-

Effect Specification:

Specification	**S.D.**	**Rho**
Cross-Section Random	0.22	0.93
Idiosyncratic Random	0.06	0.07

R^2: 0.73, **F**: 51.14, **F-Prob**: 0.000, **Durbin-Watson**: 1.20

As can be seen from the results in the above table, the Gini coefficient variable has been estimated based on cross-sectional random effects, and the findings reveal several noteworthy points. First, the relationship between the inflationary tax variable and the Gini coefficient is positive and significant, emphasizing that as inflationary taxes increase, the Gini coefficient (inequality) also rises. Another important point is the direct relationship between seigniorage and the Gini coefficient, which is also significant at the 95% confidence level.

Additionally, the results of the table, according to the Rho statistic, suggest that the random effects present in the panel model mainly relate to the differences between income quintiles (between groups), accounting for approximately 93% of the effects. In comparison, only about 7% of the random effects exist within each quintile (within-group).

It is also worth mentioning that the F-test results for the model's overall significance are confirmed given the P-value of zero. However, the Durbin-Watson test results indicate the presence of autocorrelation in the error terms, suggesting that the current specification of the model has not sufficiently explained the behavior of the dependent variable. Therefore, the most appropriate solution is to add a lag of the dependent variable to the right side of the model, and the results of this adjustment are presented in the following table.

Table (4-5): Results of the Gini Coefficient Panel Model with AR (1)

Variable	Coefficient	t-statistic	Prob
C	6.14	0.43	0.669
LInT (Inflationary Tax)	0.39	3.38	0.001
LS (Seigniorage)	0.28	2.66	0.006
AR(1)	0.79	8.67	0.000

R^2: 0.89, **F**: 90.99, **F-Prob**: 0.000, **Durbin-Watson**: 2.16

Therefore, overall, this model is superior to the previous one in explaining the behavior of the Gini coefficient. In this section, we first determine the type of relationship between the independent variables (inflation rate and seigniorage) and different income quintiles, followed by estimating the necessary models to test another hypothesis of the research. In this regard, various panel models based on "cross-sectional fixed effects," "cross-sectional and period fixed effects," and "cross-sectional random effects" are estimated to determine the type of relationship between the independent variables and different income quintiles (household expenditures). The best model among the estimated models can be selected using likelihood ratio tests and the Haussmann test. The results of these estimates are presented below.

Table (4-6): Results of Fixed and Random Effects Tests in the Household Expenditure Model

Model	Test	Cross-Sectional Fixed Effects	Cross-Sectional and Period Fixed Effects	Cross-Sectional Random Effects
Likelihood Ratio	(0.008) 13.57	(0.000) 1590.55	-	-
Haussmann	-	-	(0.115) 3.53	-

The review of all these tests' results indicates that the best panel model for the household expenditure variable is the "cross-sectional fixed effects" model (although the "cross-sectional and period fixed effects" model is also significant; it cannot be used for reasons previously discussed). Next, panel models for the household expenditure variable will be estimated in two states: without and with an autoregressive variable.

Table (4-7): Results of the Fixed Effects Model for Household Expenditure

Variable	Coefficient	t-statistic	Prob
C	18.79	44.12	0.000
LINF (Inflation)	0.11	2.39	0.012
LS (Seigniorage)	0.27	3.73	0.000
_B1	-0.50	-	-
_B2	-0.23	-	-
_B3	-0.05	-	-
_B4	0.16	-	-
_B5	0.62	-	-

R^2: 0.69, **F**: 50.71, **F-Prob**: 0.000, **Durbin-Watson**: 1.28

The above table results show that the relationship between inflation and household expenditure (for different income quintiles) is positive and direct. The relationship between seigniorage and household expenditure (for different income quintiles) is also direct and significant at the 95% confidence level. However, the results of the Durbin-Watson test indicate the presence of autocorrelation in the error terms, suggesting that this specification has not fully explained the behavior of the dependent variable. Therefore, the most appropriate solution is to add a lag of the dependent variable to the right-hand side of the model, with the results presented in the following table

Table (4-8): Results of the Panel Model Estimation for Household Expenditure with AR (1)

Variable	Coefficient	t-statistic	Prob
C	20.22	63.53	0.000
LINF (Inflation)	0.29	6.11	0.000
LS (Seigniorage)	0.51	8.34	0.000
AR(1)	0.76	26.41	0.000

R^2: 0.87, **F**: 89.36, **F-Prob**: 0.000, **Durbin-Watson**: 2.15

The results in the above table, while confirming the general findings of the model without the autoregressive variable, indicate two important points: First, the issue of autocorrelation has been resolved in this model, with the Durbin-Watson statistic being around 2, which is optimal. Second, the F-statistic in this model is higher than in the previous model, and the adjusted R-squared is also greater. Therefore, overall, this model is preferable to the previous one in explaining the behavior of the Gini coefficient.

After determining the relationship between the independent variables (inflation rate and seigniorage) and different income quintiles, the next step involves estimating the necessary models to test the other hypothesis (i.e., the impact of seigniorage on lower-income quintiles is greater than on higher income quintiles). Based on the nature of this hypothesis, it is necessary to estimate two separate panel models to assess the impact of seigniorage on the lower income quintiles (first and second quintiles) and the higher income quintiles (fourth and fifth quintiles). These two models are presented in Tables (4-9) and (4-10).

Table (4-9): Results of the Fixed Effects Model for Household Expenditure in the Two Lower Income Quintiles

Variable	Coefficient	t-statistic	Prob
C	18.94	18.97	0.000
LINF (Inflation)	0.22	4.37	0.000
LS (Seigniorage)	0.33	5.34	0.000
_B1	-0.06	-	-
_B2	-0.06	-	-

R^2: 0.58, **F**: 7.98, **F-Prob**: 0.000, **Durbin-Watson**: 1.99

Table (4-10): Results of the Fixed Effects Model for Household Expenditure in the Two Higher Income Quintiles

Variable	Coefficient	t-statistic	Prob
C	19.14	37.85	0.000
LINF (Inflation)	0.08	7.35	0.000
LS (Seigniorage)	0.21	2.67	0.006
_B4	-0.25	-	-
_B5	0.25	-	-

R^2: 0.62, **F**: 14.04, **F-Prob**: 0.000, **Durbin-Watson**: 2.02

First of all, the results in the tables above are consistent with the overall results in Tables (4-7) and (4-8). Secondly, the variable "seigniorage" in the results of the fixed effects model for household expenditure in the two lower-income quintiles has a greater effect than its impact on household expenditure in the two higher-income quintiles.

5. Conclusion and Recommendations

The main objective of this study is to model consumption inequality (Gini coefficient), focusing on factors like inflation, inflation tax, and seigniorage (since the government earns income from it) that have been less considered but have an impact on inequality. The study also emphasizes that the average household expenditure comprises both food and non-food expenditures (purchased and unpurchased). The goal is to examine the impact of inflation on different consumption groups (different consumption quintiles), calculating the inflation rates for different commodity baskets across these groups. Additionally, the study investigates how inflation tax and seigniorage influence this economic variable.

In this context, the study first models consumption inequality across various consumption quintiles. It then examines the relationship between inflation tax and seigniorage with the Gini coefficient across these quintiles. Finally, the study models household consumption expenditure about inflation and seigniorage, and estimates their effects on consumption across different income quintiles.

The findings of this research indicate "Inflation tax increases income inequality." This shows that governments, to cover their expenses, have indirectly taken part of people's purchasing power. Directly, this is done through taxation, and indirectly, through inflation caused by government borrowing from the central bank. In general, one of the main causes of inflation is deficit financing through printing money, which acts as government debt to the people. Seigniorage, or the revenue that the government earns from issuing money, consists of two parts: the first part is revenue obtained without creating inflation (pure seigniorage), and the second part is inflation tax, or the revenue obtained through inflation caused by money issuance.

Inflation, in effect, operates like a tax, diminishing the purchasing power of those holding cash. At the same time, it reduces the government's debt to the people, lowering the real value of money and causing various inflation-related problems. One of the most significant issues is the emergence of an inflation tax. Real expenditures increase as individuals need to spend more to cover their expenses, which, in turn, exacerbates inequality in society.

Another finding of this research is that the impact of seigniorage on different income groups varies. Lower-income groups have fewer assets, while higher-income groups can convert some of their cash into goods or hedge against inflation. As inflation rises, the value of their assets adjusts upward, benefiting them. However, for lower-income groups with fewer assets, inflation worsens their situation. As a result, printing money by the government affects income groups differently, with lower-income groups suffering more, leading to increased inequality in society.

To make the results of this research more practical, it is essential to propose strategies and recommendations to reduce consumption inequality, including:

Identifying the reasons for the government's failure to control inflation and revising fiscal policies and budget deficits: By correctly enforcing tax collection laws on higher income quintiles (fourth and fifth quintiles) based on real income, the government can improve income distribution.

Addressing factors that influence inflation: Reducing the impact of inflation on inequality also requires addressing economic corruption and combating underground economies, rent-seeking, and financial and economic corruption.

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