

Estimation and Forecasting of Revenues and Financing Sources of Hamedan Municipalities

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Abstract

Municipalities depend on stable and predictable revenue streams to fulfill statutory obligations and implement urban development strategies. Hamadan Municipality, a rapidly growing metropolitan area, has experienced challenges such as construction sector stagnation, economic volatility, inflationary pressures, and declining private investment. This study aims to analyze historical revenue trends (2009–2023), evaluate the stability of revenue sources, and forecast the municipal revenue structure for 2029. This applied, descriptive–analytical study and revenues were categorized into seven primary classes: general taxes, specific taxes, service fees and income from profit-oriented institutions, municipal funds and assets, government grants, donations, and revenue from the disposal of capital and financial assets. Time-series regression models and Ordinary Least Squares (OLS) were employed to assess trends. Specific taxes and service fees/income from profit-oriented institutions showed average annual growth rates of 34.2% and 35.9%, respectively, with substantial volatility. Municipal funds and assets exhibited the highest growth at 61.3%, whereas government grants, with 24.2% average growth, were highly unstable. Capital asset disposals grew by 43.8%, primarily during fiscal constraints. OLS-based projections indicate that by 2029, the revenue structure will largely maintain its current composition, with dominant contributions from general taxes, municipal funds and assets, and capital asset disposals. Hamadan Municipality remains heavily reliant on unstable revenue sources, and the share of stable urban revenues is limited. These findings underscore the need for strategic financial planning, revenue diversification, and the development of resilient municipal fiscal policies to ensure sustainable urban financial management.

Keywords: Capital Assets, Hamedan Municipality, Municipal Revenue Structure, Ordinary Least Squares (OLS), Revenue Forecasting

1. Introduction

Municipalities, as the most important institutions of urban management and the executive arm of local government, play a fundamental role in providing public services, physical organization of the city, and supporting economic and social development (Madadi et al., 2020; Bayat et al., 2024). In the literature of urban management, municipalities are considered one

of the main pillars of local governance, whose efficiency is directly dependent on financial capacity, budgetary transparency, and data-driven planning capabilities. Global experience shows that the more stable and predictable the financial structure of municipalities, the higher the rate of development plan realization, the quality of urban service delivery, and the capacity for infrastructure investment; therefore, the stability and efficiency of the revenue system is a fundamental condition for fulfilling the legal missions of municipalities and ensuring the sustainable growth of cities (Dashti & Pakmaram, 2024).

In Iran, the financial structure of municipalities over recent decades has been affected by factors such as the instability of revenue sources, recession in the construction sector, chronic inflation, changes in financial laws, and increasing costs of city administration (Regulations on Sustainable Revenue for Municipalities and Village Administrations, 2024). Numerous studies indicate that excessive reliance on unstable revenues, particularly those derived from the sale and transfer of capital assets, has resulted in a significant portion of municipal budgets lacking the necessary stability for long-term planning. On the other hand, the share of sustainable revenues (such as general duties and service fees) has remained low due to weaknesses in the urban taxation system, the absence of modern financial tools, and a lack of effective citizen participation. These challenges have caused many municipalities to suffer from structural budget imbalances and face serious limitations in implementing development projects and providing public services (Kordestani & Shahbazi, 2025).

At the research level, although studies have been conducted on the revenue structure of the country's municipalities, a significant portion of this research has either had a limited focus on one or two types of revenue, or has examined a short period, and has less frequently addressed long-term and forecast-oriented analysis. Furthermore, research that comprehensively examines the revenues of Hamedan Municipality based on econometric models is very limited; a matter that indicates a research gap in the field of urban finance for this metropolis. This is while Hamedan Municipality, as one of the most important population, historical, and tourism centers of the country, has faced rising costs, increasing service needs, and economic pressures in recent years, and its revenue structure has encountered fluctuations and inadequacy of resources.

In such a context, a comprehensive analysis of Hamedan Municipality's revenue trends and the scientific forecasting of funding sources acquires double importance. Examining long-term data and analyzing revenue behavior can provide a basis for reforming the financial structure, reducing dependence on unstable sources, increasing asset productivity, and improving the urban budgeting system. Hence, the present study was conducted with the aim of analyzing the trend of revenues and funding sources of Hamedan Municipality during the years 2009 to 2023 and forecasting the revenues for the year 2029 based on the Ordinary Least Squares (OLS) econometric model. The innovation of the research lies in the comprehensiveness of the time period, the complete classification of revenue groups, the utilization of quantitative methods for estimating the financial future, and the focus on a city that has received less attention in urban finance studies. The findings of this research can pave the way for more accurate decision-making in the field of financial policymaking, diversification of revenue sources, and strengthening the financial sustainability of Hamedan Municipality. In the following, first, the theoretical foundations and research background are reviewed, then the research model and findings will be presented.

2. Theoretical Foundations and Research Background

Municipalities worldwide, as institutions responsible for urban service management, play a crucial role in the administration, development, and organization of citizens' lives (Nitoslawski et al, 2019). The ever-increasing urban population, the complexity of urban issues, the necessity of infrastructure modernization, and responding to the diverse needs of citizens have

turned municipalities into one of the main pillars of urban governance and sustainable development. In this regard, securing the necessary financial and credit resources to perform duties is considered one of the most important managerial and executive challenges for municipalities (Slack & Tassonyi, 2017). The concept of urban finance in economic and management literature examines how revenue is secured, resource allocation, budget structure, revenue sources, and the accounting system of urban entities. Within the theoretical framework of public finance, three fundamental principles—financial independence, accountability, and transparency—are considered the foundations of efficiency in the municipal financial system (Shah, 2006). The realization of these principles depends on creating a coherent financial structure, diversifying revenue sources, establishing legal mechanisms for collecting local taxes and duties, and utilizing modern financing tools including participation bonds, joint ventures, and the capital market.

One of the most important theories applicable in explaining the position of municipalities in the process of securing financial resources is the Fiscal Decentralization Theory. Emphasizing the transfer of financial power and decision-making to local levels, this theory believes that local governments, including municipalities, have a more precise understanding of the needs and priorities of the local community and can allocate resources more efficiently and effectively (Tran & Nguyen, 2024; Wang et al, 2024; and Li & Li, 2024). In this view, delegating financial and revenue resources to municipalities as part of the decentralization process leads to increased productivity, transparency, and public participation in the administration of urban affairs. Comparative studies indicate that in many developed countries, municipalities enjoy relative financial independence and can create and manage diverse financial resources by applying local taxes, receiving urban service fees, revenues from the rental and sale of public properties, exploitation of urban facilities, and attracting private sector investment (OECD, 2022 and World Bank, 2023). In these countries, institutional and legal structures are designed such that municipalities, while possessing legal authority in the financial sphere, are also accountable to citizens, local councils, and regulatory bodies.

On the other hand, in developing countries, the weakness of the legal system, excessive reliance of municipalities on unstable sources or government aid, the inefficiency of the local tax system, and the lack of technical and institutional capacities for financial management are considered the most significant obstacles to financial independence and improving productivity in urban service delivery (Bahl & Linn, 2014). Additionally, the absence of a coherent database of urban properties, the lack of an efficient tax audit system, weakness in revenue planning, and heavy dependence on construction-related revenues make the budgeting system of municipalities fragile, unstable, and vulnerable to economic fluctuations.

Based on the United Nations theoretical framework for sustainable urban development, urban financing must be based on three key principles: social justice (emphasizing the balanced distribution of resources among urban areas and different social strata), economic efficiency (meaning the optimal allocation of resources toward productivity and effectiveness), and environmental sustainability (securing financial resources with consideration for environmental principles and reducing damage to nature). Realizing these principles requires a shift in the traditional approach of municipalities toward revenue generation and moving toward an integrated and smart financial system. In Iran, municipalities are recognized as non-governmental public institutions that possess relative independence from the government in terms of budget and finance; however, in practice, due to insufficient attention to their financial and economic structure, they face numerous challenges regarding revenue sources. A major portion of municipal revenue is secured from unstable sources such as the issuance of building permits and density sales, which not only threatens the financial sustainability of the city but also leads to unbalanced urban growth and the emergence of physical and environmental problems (Parliamentary Research Center, 2022; Ministry of Interior, 2023).

Furthermore, the low share of local taxes and inadequacies in the budgeting and oversight process have caused many municipalities to face chronic budget deficits and increasing reliance on government aid. In such circumstances, reforming the financial structure of municipalities, creating supportive laws to diversify revenue sources, institutionalizing financial transparency, strengthening the urban accounting system, using modern technologies to monitor and forecast revenues, and designing participatory mechanisms to attract private sector investment are among the essential measures to strengthen the financial foundations of local governments in Iran. Additionally, expanding institutional capacity, training human resources, implementing accrual accounting systems, and enhancing the level of oversight by Islamic City Councils can pave the way for improving the financial system in municipalities. In fact, a review of theoretical foundations shows that municipal financing is a complex, multi-layered matter linked to institutional, legal, managerial, and social dimensions. Relying solely on limited and unstable revenue sources will hinder the realization of urban development goals and effective accountability to citizens. Accordingly, establishing a coherent, predictable, justice-oriented, and efficient revenue system within the framework of good urban governance principles is considered an undeniable necessity for the optimal management of cities. In the following, the research background and a review of the experiences of municipalities in various countries are addressed; the research background is examined in two sections, internal and external studies, as detailed in Table (1):

Table 1: literature review

Authors	Statistic al Populati on	Independent Variables	Results
Laufs et al (2020)	-	New Smart Security Technology	New security technologies have a significant impact on creating security, urban management, and providing the financial resources of cities.
Altecz & Behnich (2017)	German Municipa lity	Tax Payment System	The research findings show that the tax payment system is one of the most important foundations for financing local administrations in this country. According to their findings, in states where municipalities receive a smaller share of tax revenues (especially the states located in eastern Germany), the level of the annual budget of these municipalities is also noticeably lower. This difference shows that taxation still plays a central and decisive role in shaping the financial capacity and planning ability of municipalities; in such a way that reducing dependence on taxes or weakness in tax resources can lead to limitations in the provision of urban services, infrastructure development, and the implementation of public projects. Consequently, this study emphasizes that strengthening tax revenue bases is among the essential factors in improving the efficiency and financial sustainability of German municipalities.
Githinji and et al (2014)	kenya	Information and communicatio n technology	Taxation is one of the sources of revenue that plays an important role in improving the governance of countries. The method of collecting tax revenues in most states of Kenya is relatively weak, and information and communication technology can address this weakness.
Odoyo et al (2013)	Local Authoriti es of Homa Bay and Kenya	Information Systems	There is a positive and significant relationship between information systems, efficiency, and effectiveness in the collection of urban revenues.

Kurdistan and Shahbazi (2025)	Hamedan Municipality	-	Hamedan Municipality's revenue system in its current state is relatively unsustainable and based on fees received from density sales, land-use change fines, or the removal of parking spaces and infrastructure violations. Subsequently, the presentation of a sustainability model emphasizing "increasing sustainable revenues and managing and improving the role of sustainable revenue sources, as well as providing modern solutions and financing methods from financial and monetary markets" has been highlighted.
Mirzaei et al (2022)	Tehran Municipality	-	Based on the findings of this study, the collected revenue sources of district municipalities are mainly dependent on the building boom with considerable intensity and the status of the resident population in the district (population density); therefore, considering that the share of building permit issuance costs in northern districts out of the total housing production costs, compared with this same share in southern districts, is very small, and also given the existence of a significant deviation in the regional property price from the corresponding index based on market price.
Hajiloo et al (2017)	Shabestar Municipality, 2004–2014	-	About 39.25 percent of the municipality's revenues have been provided from general fees (30 percent share of fees on buildings and lands) and 25.36 percent from other sources of financing; that is, the sale of municipal properties.
Akbari and Hamidzadeh-Khiavi (2016)	Ahar Municipality	-	By quantification, the relative within-group weight of each of the internal factors (strengths and weaknesses) and external factors (opportunities and threats) was determined, and based on them, each of the internal and external factors was ranked, and finally, according to the internal and external factors and using the SWOT technique, the four strategies of SO, WO, ST, and WT were presented in order to increase the revenue sources of Ahar Municipality.
Nesari et al (2015)	Tehran Municipality	-	A major part of the main revenues of municipalities is not compatible with the concepts of sustainability and does not possess continuity and desirability; therefore, municipalities should, by studying the revenue structure based on the resistance economy, have new solutions for providing sustainable and continuous revenue sources in order to deliver desirable services to citizens.
Danesh-Ja'fari et al. (2014)	Tehran Municipality	Revenue Sustainability	The most sustainable revenue in Tehran is the tax transferred from the government to the municipality, in the form of value-added tax or the transfer of a percentage of national tax. The receipt of service charges and various local fees are also other sustainable revenue sources that can be used.

Considering the research background, most existing studies have examined the revenue sources of municipalities in major Iranian cities or foreign countries and have mainly been limited to identifying revenue sources and general revenue management strategies. However, little research has addressed the precise estimation and forecasting of revenues and funding sources for municipalities, particularly in cities like Hamedan. Therefore, the necessity of this research arises from the fact that municipalities require accurate estimation and forecasting of revenue sources for effective planning and the design of sustainable financial policies. The innovation of this study lies in its focus on Hamedan Municipality and the use of quantitative methods to

forecast revenues and funding sources, which can contribute to improving financial management efficiency and the sustainability of the municipality's revenue sources.

3. Research Methodology

The aim of this research is to forecast the revenues of Hamedan Municipality for the next 5 years (2025–2029). Each of the quantitative or qualitative techniques for forecasting has its own drawbacks; futures studies, by applying the influence of qualitative forecasting techniques to results obtained from quantitative techniques, attempts to align the forecast results more closely with reality. There has always been a difference of opinion between two groups of experts in the fields of forecasting and futures studies regarding whether quantitative methods relying on historical data provide appropriate estimates of the future, or qualitative methods based on judgment. One of the fundamental goals in estimating a regression model is to be able to forecast changes in the endogenous variable with a specific value of the exogenous variable. Forecasting is a process in which an objective or subjective model is used to estimate a variable for the past or the future. Forecasting a variable can be conducted using two methods:

- Forecasting via objective models such as mathematical, statistical, and econometric models.
- Forecasting via subjective models such as Delphi methods, expert judgment, and utilizing the experience and information of experts.

In the subjective method, there is no need to present a mathematical model, and the variable in question is estimated qualitatively; however, mathematical and statistical models are typically used to perform the forecasting process for economic variables, i.e., the approximate estimation of an economic variable in the future. In other words, in the objective method, presenting a model is essential; the best scenario for forecasting a variable is to use all methods, and after forecasting, the methods can be compared using forecast measurement scales to select the best method and use it for forecasting. To analyze information and forecast the revenue sources of Hamedan Municipality, time series fitting models based on annual budget data and the OLS model have been used to fit the regression between independent and dependent variables, as well as to forecast dependent and independent variables in Eviews software. The reason for choosing this econometric method for forecasting revenues is the existence of research limitations.

This research faced a fundamental limitation regarding the scarcity of historical data for both dependent and independent variables; specifically, revenue and expenditure data for Hamedan Municipality were only available from 2009 onwards, and even in some years, information related to all revenue codes was not fully recorded. Therefore, using Excel software, the totals for headquarters, districts, and organizations were considered and recalculated for each revenue code for the given year. This limited volume of data eliminated the possibility of employing advanced lag-based econometric models such as ARIMA or other dynamic models, as the use of lags results in the removal of more data points and the emergence of autocorrelation issues—a problem that cannot be controlled with the OLS model. Furthermore, the lack of official and reliable data to forecast the future of independent variables, such as the number of building permits, vehicle production volume, and other macroeconomic indicators, limited the possibility of multi-stage forecasting for independent variables. Attempting to forecast these variables based on exogenous variables also led to problems such as heteroscedasticity and autocorrelation, consequently reducing the significance of the coefficients; therefore, removing a portion of the independent variables and relying on retrospective trends was inevitable. In this regard, the use of SPSS software was also not feasible, as this software is primarily designed for descriptive analysis and simple regressions and lacks the necessary capability to perform econometric analysis, time-series modeling,

testing classical regression assumptions, and controlling for problems like autocorrelation and heteroscedasticity. It is worth noting that for forecasting revenues for the next 5 years, other forecasting models, including scenario-building with a 10 percent increase in variables and revenues, were used; ultimately, among all these models, the OLS model was selected as the proposed model for forecasting revenues due to providing more accurate and reliable forecasting results.

3.1 Model Specification

Given the mentioned limitations for predicting the revenue sources of Hamedan Municipality, the OLS model has been utilized. OLS analysis is recognized as the most widely used and dominant method among various linear regression techniques. In statistics, Ordinary Least Squares is a method for estimating unknown parameters or dependent variables in a linear regression model by minimizing the difference between the observed response variables in the dataset. Investigating the most important influential factors (explanatory variables) on the dependent variable may seem simple at a superficial glance, but it is one of the most difficult and crucial stages of regression modeling. In other words, the statistical significance of the relationship between the unknown or dependent variable and the known or independent variable is a necessary condition for modeling using this analysis.

The Ordinary Least Squares (OLS) model is also referred to as linear regression; as it is a common technique for estimating the coefficients of linear regression equations that describe the relationship between one or more independent variables and a dependent quantity (simple or multiple linear regression).

$$Y = \beta_0 \sum_{i=1}^p \beta_i X_i + \varepsilon \quad (1)$$

Where Y is the dependent quantity, β_0 is the constant coefficient, X_i is the independent quantity ($i=1$ to p), β_i is the regression coefficient of the i -th quantity, and ε is the random error with a mean of zero and variance σ^2 .

The distinguishing feature of OLS regression is that the estimation of the regression model parameters, i.e., the β_i , is performed in such a way that ε , meaning the random error of the OLS regression, has a mean of zero and a variance of σ^2 . The goal of the OLS method is to minimize the sum of squared differences between observed and predicted values, i.e., minimizing $\sum_{j=1}^n (y_j - \hat{y}_j)^2 = \sum_{j=1}^n e_j^2$.

In this study, to predict the municipality's revenue sources, information from the years 2009 to 2023 of Hamedan Municipality has been used, including: realized revenue data from budget settlements (2009–2023) for 6 main revenue codes (from the set of revenue codes) and revenue from the disposal of capital and financial assets extracted from the statistical yearbook of Hamedan city and municipality, as well as independent variables such as inflation rate, total population, the number of building permits issued for the city of Hamedan, exchange rate, tax revenues of Hamedan city, etc., from 2009 to 2023 extracted from the Central Bank and the Statistical Center of Iran. The data related to the dependent variables, which are the main revenue codes of Hamedan Municipality, have been extracted from the budget settlement of Hamedan Municipality. It should be noted that since the basis for predicting revenues is for the 5 years following 2023, and because changes occurred in the revenue codes after 2009, this entire time period has been adjusted based on correspondence with the 2023 revenue codes. All variables used in the equations, along with their abbreviations and the statistical sources of these data, are mentioned in Table (2). Additionally, the independent variables were selected based on the studies of Motaghian Nasab et al (2022), Shahrokhiyan (2021), Gholizadeh et al (2016), and the opinions of a number of experts and specialists of Hamedan Municipality. Furthermore, in accordance with the theoretical foundations and studies conducted by Lyytimäki et al (2020), Nitoslowski et al (2019), Althoff and Bahnich (2017), Bifulco et al

(2016), Gjering et al (2014), Hajiloo et al (2017), Akbari and Hamidzadeh-Khiavi (2016), and Nesari et al (2015) on the subject, the present research has estimated the following models for predicting the revenues of Hamedan Municipality:

$$Public_t = \alpha + \beta_1 Car_t + \beta_2 licence_t + \beta_3 POP_t + \beta_4 House_t + \beta_5 Tax_t + \beta_6 Inf_t + \beta_7 GDP_t + \varepsilon_t \quad (2)$$

$$excl_t = \alpha + \beta_1 POP_t + \beta_2 Inf_t + \beta_3 GDP_t + \beta_4 income_t + \varepsilon_t \quad (3)$$

$$Service_t = \alpha + \beta_1 Car_t + \beta_2 licence_t + \beta_3 House_t + \beta_4 POP_t + \beta_5 Inf_t + \beta_6 income_t + \varepsilon_t \quad (4)$$

$$Fund_t = \alpha + \beta_1 Price_t + \beta_2 GDP_t + \beta_3 Car_t + \beta_4 POP_t + \beta_5 Exch_t + \varepsilon_t \quad (5)$$

$$Aid_t = \alpha + \beta_1 tax_t + \beta_2 Taraz_t + \beta_3 GDP_t + \beta_4 Oil_t + \beta_5 inf_t + \beta_6 Exch_t + \varepsilon_t \quad (6)$$

$$Donations_t = \alpha + \beta_1 Inf_t + \beta_2 POP_t + \beta_3 GDP_t + \beta_4 income_t + \varepsilon_t \quad (7)$$

$$Rev_t = \alpha + \beta_1 Inf_t + \beta_2 Car_t + \beta_3 licence_t + \beta_4 POP_t + \beta_5 House_t + \beta_6 Tax_t + \beta_7 GDP_t + \varepsilon_t \quad (8)$$

$$NRev_t = \alpha + \beta_1 Inf_t + \beta_2 Car_t + \beta_3 licence_t + \beta_4 POP_t + \beta_5 House_t + \beta_6 Tax_t + \beta_7 GDP_t + \varepsilon_t \quad (9)$$

$$Asset_t = \alpha + \beta_1 Loan_t + \beta_2 Price_t + \beta_3 GDP_t + \beta_4 Inf_t + \beta_5 Oil_t + \varepsilon_t \quad (10)$$

$$Fin_t = \alpha + \beta_1 Loan_t + \beta_2 Price_t + \beta_3 GDP_t + \beta_4 Inf_t + \beta_5 Oil_t + \varepsilon_t \quad (11)$$

In Table (2), the variables used in equations (2) to (11) are introduced:

Table 2: Description of Variables

Variable	Unit	Abbreviation	Statistical Sources
Revenue from general fees in Hamedan Municipality in year t	rials	$Public_t$	Statistical Sources Hamedan Municipality budget settlement offices
Volume of vehicle production in the country in year t	Number of machines	Car_t	Ministry of Industry and Mine website Hamedan Municipality statistical
Number of building permits issued for the city of Hamedan in year t	Item - thousand square meters	$licence_t$	yearbooks Statistical Center of Iran Hamedan Municipality statistical
Total population of the country in year t	million people	POP_t	Hamedan Municipality statistical yearbooks
Average selling price of one square meter of residential floor area in Hamedan city in year t	thousand rials	$House_t$	Statistical Center of Iran
Tax revenues of Hamedan province in year t	Million rials	Tax_t	Hamedan Municipality statistical yearbooks
Annual inflation rate announced by the Central Bank in the whole country in year t	Percentage	Inf_t	Tax statistics yearbooks
Gross domestic product of Hamedan province (with oil) at constant 2011 prices in year t	Million rials	GDP_t	Statistical Center of Iran
Revenue from specific fees in Hamedan Municipality in year t	rials	$excl_t$	Statistical Center of Iran
Average annual total income of an urban household in year t	A thousand rials	$income_t$	Statistical yearbook of Hamedan city and municipality
Revenue from service charges and income of profitable institutions in Hamedan Municipality in year t	rials	$Service_t$	Statistical yearbooks

Revenue from municipal funds and properties in Hamedan Municipality in year t	rials	$Fund_t$	Hamedan Municipality budget settlement offices
Stock price index (overall stock exchange price index) in year t	unit	$Price_t$	Hamedan Municipality budget settlement offices
Average exchange rate in the free market in year t	rials	$Exch_t$	Stock Exchange website
Revenue from grants and aid from the government and government organizations in year t	rials	Aid_t	Central Bank website
Operational balance, operational deficit, or current budget deficit in year t	billion rials	$Taraz_t$	Hamedan Municipality budget settlement offices
Oil revenues of the country in year t	billion rials	Oil_t	Budget deficit review reports
Revenue from donations, gifts, and assets in year t	Rial	$Donations_t$	Central Bank website
Total revenues of Hamedan Municipality in year t	Rial	Rev_t	Hamedan Municipality budget settlement offices
Total revenues of Hamedan Municipality excluding specific revenue in year t	Rial	$NRev_t$	Hamedan Municipality budget settlement offices
Disposal of capital assets in Hamedan Municipality in year t	Rial	$Asset_t$	Hamedan Municipality budget settlement offices
Disposal of financial assets in Hamedan Municipality in year t	Rial	Fin_t	Hamedan Municipality budget settlement offices
Facilities paid by Bank Maskan in year t	billion rials	$Loan_t$	Hamedan Municipality budget settlement offices
Model error term		ε_t	Central Bank website

4. Research Data Analysis

In this section of the research, the statistical analysis of the revenue trends of Hamadan Municipality during the years 2009 to 2023 is addressed. The information presented in this research is extracted based on comprehensive statistical tables of Hamadan Municipality revenues, and all numerical values and annual growth percentages of various revenue sources have been documented. A statistical overview is included in Table (4) to enable the observation of the change trends for each revenue source separately and to provide a clearer understanding of the municipality's revenue structure. Therefore, before to the statistical analysis, the definitions of each revenue source of Hamadan Municipality—which include: revenue from general tolls, revenue from specific tolls, revenue from service fees and profit-making institutions, revenue from municipal funds and property, revenue from government grants and state organizations, revenue from donations, contributions, and gifted assets, revenue from the disposal of capital assets, and revenue from the disposal of financial assets—are addressed as dependent variables, which are presented in Table (3).

Table 1: Main Revenue Sources of Iranian Municipalities

1	Revenue from general fees	They include fees on passenger cars and vehicles, fees on petroleum products and cigarettes, fees on official documents, fees on building permits, etc. These fees, which provide the highest amount of municipal revenue, are mainly considered as taxes on consumption or sales of goods and are part of the municipality's recurring revenues.
2	Revenue from specific fees	These include waste management service fees, revenue from cultural centers, revenue from other organizations affiliated

		with the municipality, etc. Among the revenue sources, these fees provide the lowest amount of municipal revenue.
3	Service charges and revenue from municipal profitable institutions	It refers to safety and firefighting service fees, expert service fees, contracting service fees, revenue from commercial advertisements and ambient advertising, etc.
4	Revenue from municipal funds and property	Revenue and rent from municipal structures, revenue from public parking lots, revenue from investments, revenue from dividends of organizations and companies, etc.
5	Grants and aid from the government and government organizations	Grants from the government or other government organizations and institutions, and ticket subsidies.
6	Donations, gifts, and assets	Article 100 Commission fines, revenue from the sale of tender documents, citizen self-help and received gifts, etc.
7	Resources from the disposal of capital assets	Sale of immovable property, sale of movable and scrapped property, sale of goodwill.
8	Resources from the disposal of financial assets	Loans received from the Ministry of Interior and facilities received from banks and financial and credit institutions.

The trend chart of revenues, displayed in Figure (1) and Table (4), serves as the basis for subsequent analytical interpretations and allows for the identification of growth patterns, fluctuations, and the sustainability of each source. Based on this analysis, the changes in each of these sources are heavily influenced by macro-economic conditions, urban management decisions, and changes in financial policymaking; their role as dependent variables in the examined relationships allows for the identification of sustainable and vulnerable sources. This analytical framework creates a solid foundation for data interpretation and subsequent inferences. The results of the investigations show that, in the period from 2009 to 2023, the revenues of Hamedan Municipality from various sources have had an increasing trend, but this growth has not been uniform and has been accompanied by fluctuations.

Table 2: Revenues by Main Municipal Code Categories, Hamedan Municipality, 2009–2023 (billion rials)

year	Revenue from General Tolls	Revenue from Specific Tolls	Service Fees and Revenues of Municipal Profit-making Institutions	Revenues from Municipal Funds and Property	Grants from Government and State Organizations	Donations, Gifted Contributions, and Assets	Revenue from the Disposal of Capital Assets	Revenue from the Disposal of Financial Assets
2009	229,149	14,600	18,369	3,880	25,500	162,807	65,448	6,200
2010	419,393	14,441	44,513	3,881	116,820	107,585	64,492	0
2011	530,780	53,705	30,122	7,072	1,737	131,535	88,847	23,000
2012	717,601	135,287	52,348	7,670	219,936	192,836	245,875	20,000
2013	1,173,530	201,600	34,372	11,406	1,262	358,451	170,581	50,000
2014	1,860,000	264,443	248,693	91,719	23,238	547,832	274,701	30,000
2015	1,290,000	183,871	172,920	63,774	16,158	380,916	167,020	0
2016	1,670,000	237,790	223,627	82,475	20,896	492,617	207,197	59,000
2017	1,989,750	214,084	507,535	189,688	51,272	560,275	192,956	43,700
2018	2,599,570	5,710	527,401	203,389	91,048	788,241	600,029	72,300
2019	3,158,660	128,590	811,141	345,256	219,257	1,318,360	682,521	0
2020	3,858,530	654,034	336,017	351,961	150,200	2,317,440	4,369,700	500,000
2021	5,420,200	398,402	729,684	1,013,820	151,893	3,246,580	4,026,860	35,800
2022	9,040,480	561,103	716,471	1,946,470	762,305	1,762,990	7,435,020	94,500
2023	13,700,000	902,000	1,340,000	3,160,000	528,000	3,480,000	10,600,000	300,000

Revenue from General Tolls: The largest share and an average annual growth of approximately 34%; it is the main pillar of sustainable revenue. Additionally, based on the Sustainable

Revenue Law of Hamadan Province Municipalities, renovation tolls have seen a 1.5% growth from 2023 onwards.

Revenue from Specific Tolls: Similar growth of around 34.2 percent but high volatility due to dependence on macroeconomic conditions; a vulnerable source.

Revenue from Service Fees and Profit-making Institutions: 36% growth; there has been a significant increase since 2017 onwards, which indicates an increase in citizen participation in financing urban services.

Revenue from municipal funds and property: The highest growth (more than 61%); there is a greater focus by the municipality after 2017, but reliance on this source can threaten financial sustainability because asset sales are not always repeatable.

Revenue from government grants and state organizations: Average revenue growth of 24.2%; it is unstable, highly volatile, and weak. This instability makes the municipality vulnerable in crisis situations.

Revenue from donations, gifted contributions, and assets: 20% growth; despite the increasing trend, there was a sharp drop in 2022 resulting from social developments and economic recession.

Revenue from the disposal of capital assets: High growth (44%) along with spikes in the years 2013, 2022, and 2023, but mostly as a compensatory tool in budget deficit conditions; therefore, it is a temporary and unsustainable source.

Revenue from the disposal of financial assets: Borrowing reached approximately 50 billion Tomans in 2020; average growth of less than 1%; an unstable source used only periodically during crises.

Total revenues of Hamadan Municipality: In total, the municipality's total revenue increased from approximately 454 billion Rials in 2009 to over 23,000 billion Rials in 2023 (average annual growth of 32.4%); however, this growth has mostly relied on asset sales and unstable sources.

The research findings indicate that Hamadan Municipality, in order to compensate for budget deficits—particularly during crisis periods—has increasingly turned to asset sales and borrowing, which is not sustainable and may have negative impacts on the quality of urban life. Furthermore, the revenue structure of Hamadan Municipality in recent years shows that although there has been significant quantitative growth, heavy dependence on unsustainable sources such as asset sales and government grants threatens its financial stability. Macroeconomic fluctuations (inflation, construction stagnation, and exchange rates) have had a direct impact on these revenues and have reduced the municipality's financial independence. Additionally, the focus on asset sales, rather than creating value-added, has weakened the city's future capital. In contrast, general tolls and service fees have the capacity to become more sustainable and reliable sources, provided that regulations are reformed and citizen participation is attracted. Therefore, the main challenge for the municipality is moving away from temporary sources and shifting towards financial diversification, transparency, and the use of modern financing tools.

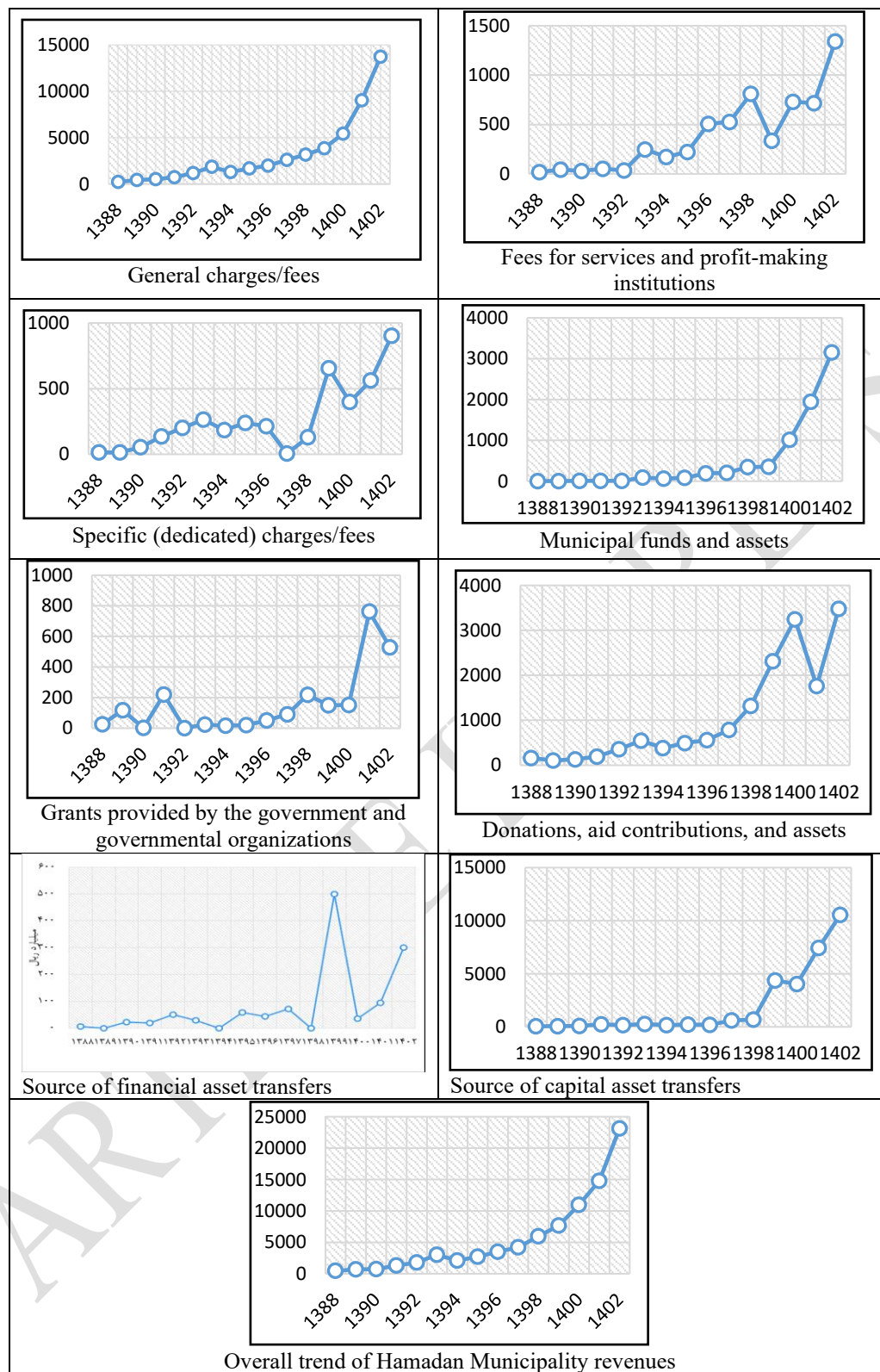


Figure1: Trend of Hamedan Municipality revenues during the years 2009–2023 (billion rials), (Hamedan Municipality)

*Figures are in billion rials.

5. Model Estimation, Analysis, and Interpretation of Results

Modeling, Model Estimation, and Forecasting for the 2029 Horizon

Prior to estimating the research models and forecasting the revenues of Hamadan Municipality, it is necessary to conduct a stationarity test on the variables to ensure that the variables have a

long-term relationship with each other. The results of the stationarity test for the variables are presented in Table (5). As observed in Table (5), most of the variables in the research are non-stationary and become stationary with one round of differencing; these variables are technically referred to as I(1) or integrated of order one. In fact, except for the variables "revenues from specific municipal tolls," "revenue from the disposal of capital assets," "operating balance or current budget deficit," and "automotive production volume," the other variables are integrated of order one and non-stationary.

Table 5: Results of Variables' Stationarity Test

Variables	Test Statistic		Critical Value	result
	At Level	At First Difference		
Revenues from general tolls	-0.499	-3.667	-3.120	I(1)
Revenues from specific municipal tolls	-3.512	-	-3.829	I(0)
Service fees and revenues of municipal profit-making institutions	2.244	-4.664	-3.829	I(1)
Revenues from municipal funds and property	-0.131	-3.884	-3.829	I(1)
Grants from government and state organizations	2.059	-5.349	-3.829	I(1)
Donations, gifted contributions, and assets	1.928	-4.464	-3.829	I(1)
Sum of the first 6 revenue codes	-0.196	-4.879	-3.829	I(1)
Sum of 5 revenue codes excluding specific tolls and disposal of financial and capital assets	-0.096	-5.266	-3.829	I(1)
Revenue from the disposal of capital assets	2.299	-4.679	-3.829	I(1)
Revenue from the disposal of financial assets	-3.854	-	-3.829	I(0)
Loans provided by Bank Maskan	-0.045	-4.083	-3.829	I(1)
Operating balance, operating balance deficit, or current budget deficit	-5.039	-	-3.829	I(0)
Oil revenues	-1.689	-4.350	-3.829	I(1)
Unofficial exchange rate	-0.234	-4.452	-3.829	I(1)
Stock price index	-0.296	4.025	-3.829	I(1)
Building permits issued for the city of Hamadan	-1.589	-3.302	-3.829	I(1)
Average annual total income of an urban household	-2.552	-4.188	-3.829	I(1)
Population	-2.965	-3.943	-3.829	I(1)
Average sales price of one square meter of residential floor area in the city of Hamadan	-1.918	-4.441	-3.829	I(1)
Share of provincial tax revenues in total national tax revenues	-0.902	-4.987	-3.829	I(1)
Inflation rate	-2.650	-7.482	-3.829	I(1)
Gross Domestic Product (GDP) of Hamadan at constant prices	-3.495	-6.586	-3.829	I(1)
Automotive production volume	-8.664	-	-3.829	I(0)

Given the non-stationarity of the variables, before estimating the research models, it is necessary to perform a cointegration test to ensure the existence of long-term equilibrium relationships. For this purpose, the Granger causality test has been utilized. The results of this test are presented in Table (6).

Table 6: Results of the Engle–Granger Cointegration Test

Dependent Variables	Test Statistic	Significance Level	Result
Revenues from general tolls	-58.85	0.000	Confirmation of Cointegration
Revenues from specific municipal tolls	-41.27	0.000	Confirmation of Cointegration
Service fees and revenues of municipal profit-making institutions	-23.67	0.000	Confirmation of Cointegration
Revenues from municipal funds and property	-50.11	0.000	Confirmation of Cointegration
Grants from government and state organizations	-19.134	0.034	Confirmation of Cointegration
Donations, gifted contributions, and assets	-71.47	0.000	Confirmation of Cointegration
Sum of the first 6 revenue codes	18.99	0.000	Confirmation of Cointegration
Sum of 5 revenue codes excluding specific tolls and disposal of financial and capital assets	23.16	0.000	Confirmation of Cointegration
Revenue from the disposal of capital assets	-26.80	0.000	Confirmation of Cointegration
Revenue from the disposal of financial assets	-20.11	0.006	Confirmation of Cointegration

As shown in Table (6), based on the Granger causality test, cointegration is confirmed in all models, and consequently, a long-term equilibrium relationship exists between the variables. In order to forecast the revenues of Hamadan Municipality for the 2029 horizon, first, a model is proposed for each revenue code and estimated based on existing data from 2009 to 2023, and the effect of each variable on the revenue code will be determined. All variables used in the following equations, along with their abbreviations, are mentioned in Table (2). To forecast revenues from general duties in Hamadan Municipality, Equation (12) is used:

$$Public_t = \alpha + \beta_1 Car_t + \beta_2 licence_t + \beta_3 POP_t + \beta_4 House_t + \beta_5 Tax_t + \beta_6 Inf_t + \beta_7 GDP_t + \varepsilon_t \quad (12)$$

Table 3: General Duties Model Estimation Results

	Variable Coefficient	Significance Level
α	-0.0675	0.7338
<i>Car</i>	-0.1648	0.0001
<i>licence</i>	0.0114	0.0003
<i>POP</i>	0.0182	0.1591
<i>House</i>	-0.4267	0.0000
<i>Tax</i>	-0.3253	0.0000
<i>Inf</i>	0.0438	0.0274
<i>GDP</i>	0.7330	0.0003

As shown in Table (7), at the 95% confidence level, all variables (except population) have a significant effect on the level of revenues from general duties in Hamadan Municipality. Based

on the estimated coefficients, the variables of inflation, number of construction permits, and Gross Domestic Product have a positive effect, and other variables have a negative effect on the amount of revenues from the general duties of Hamadan Municipality.

The adjusted coefficient of determination for this model during the estimation period of 2009 to 2023 is equal to 0.985, which indicates that the estimated model has an acceptable predictive power. Given that the economic conditions of the country are largely similar to the year 2013, to forecast general duties for the 2029 horizon, it is assumed that the model variables (except population) change based on the existing trends from 2013 to 2017. Also, population estimates have been extracted from the Statistical Center of Iran. Based on this, it is forecasted that the revenues from general duties in Hamadan Municipality will reach 50,957.2 billion Rials in the 2029 horizon.

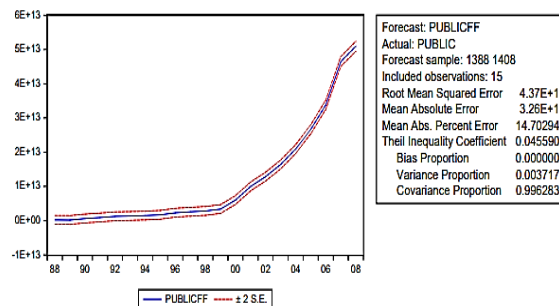


Figure 2: Forecasting revenues from general duties in Hamadan city in the 2029 horizon

To forecast revenues from specific duties in Hamadan Municipality, Equation (13) is used:

$$excl_t = \alpha + \beta_1 POP_t + \beta_2 Inf_t + \beta_3 GDP_t + \beta_4 income_t + \varepsilon_t \quad (13)$$

Table 8: Specific Duties Model Estimation Results

	Variable Coefficient	Significance Level
α	-3.1233	0.0000
Inf	0.0580	0.0398
GDP	-0.6223	0.0204
POP	-4.3232	0.0001
$income$	0.6643	0.0000

As shown in Table (8), at the 95% confidence level, all variables have a significant effect on the level of revenues from specific duties in Hamadan Municipality. Based on the estimated coefficients, the variable of Gross Domestic Product has a negative effect, and other variables have a positive effect on the amount of revenues from the specific duties of Hamadan Municipality.

The adjusted coefficient of determination for this model during the estimation period of 2009 to 2023 is equal to 0.756, which indicates that the estimated model has a high predictive power. It is forecasted that the revenues from specific duties in Hamadan Municipality will reach more than 1,435 billion Rials in the 2029 horizon.

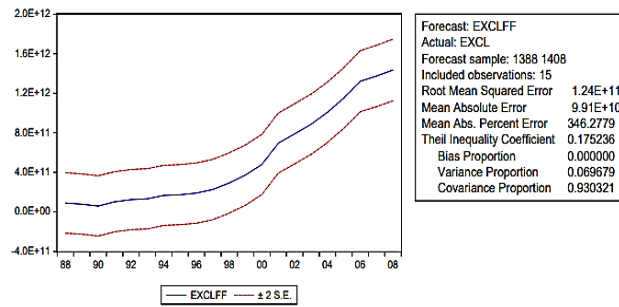


Figure 3: Forecasting revenues from specific duties in Hamadan city in the 2029 horizon

To forecast revenues from service fees and revenues of profit-making institutions in Hamadan Municipality, Equation (14) is used:

$$Service_t = \alpha + \beta_1 Car_t + \beta_2 licence_t + \beta_3 House_t + \beta_4 POP_t + \beta_5 Inf_t + \beta_6 income_t + \varepsilon_t \quad (14)$$

Table 9: Results of model estimation for revenues from service fees and revenues of profit-making institutions in Hamadan Municipality

	Variable Coefficient	Significance Level
α	-16.4665	0.0000
Car	0.4515	0.0007
licence	0.0521	0.0001
House	-0.7387	0.0000
POP	16.5920	0.0000
Inf	0.4281	0.0001
income	0.6813	0.0000

As shown in Table (9), at the 95% confidence level, all variables have a significant effect on the level of revenues from service fees and revenues of profit-making institutions in Hamadan Municipality. Based on the estimated coefficients, the variable of housing price has a negative effect, and other variables have a positive effect on the amount of revenues from service fees and revenues of profit-making institutions in Hamadan Municipality.

The adjusted coefficient of determination for this model during the estimation period of 2009 to 2023 is equal to 0.877, which indicates that the estimated model has a high predictive power. It is forecasted that the revenues from service fees and revenues of profit-making institutions in Hamadan Municipality will reach more than 1,833 billion Rials in the 2029 horizon.

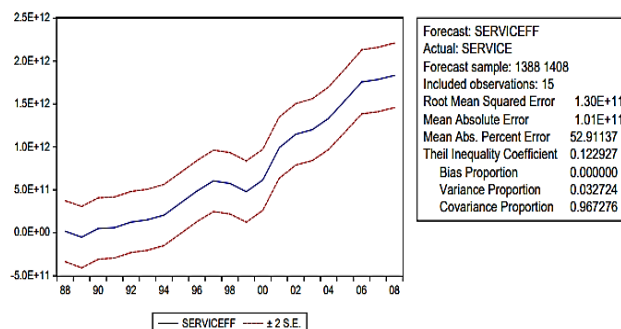


Figure 4: Forecasting revenues from service fees and revenues of profit-making institutions in Hamadan city in the 2029 horizon

To forecast revenues from funds and property in Hamadan Municipality, Equation (15) is used:

$$Fund_t = \alpha + \beta_1 Price_t + \beta_2 GDP_t + \beta_3 Car_t + \beta_4 POP_t + \beta_5 Exch_t + \varepsilon_t \quad (15)$$

Table 10: Results of model estimation for revenues from funds and property in Hamadan Municipality

	Variable Coefficient	Significance Level
α	3.3402	0.0000
<i>Price</i>	-0.2873	0.0001
<i>GDP</i>	0.9467	0.0002
<i>Car</i>	1.0734	0.0000
<i>POP</i>	-5.8961	0.0000
<i>Exch</i>	1.8231	0.0000

As shown in Table (10), at the 95% confidence level, all variables have a significant effect on the level of revenues from funds and property in Hamadan Municipality. Based on the estimated coefficients, the variables of housing price and population have a negative effect, and other variables have a positive effect on the amount of revenues from funds and property in Hamadan Municipality.

The adjusted coefficient of determination for this model during the estimation period of 2009 to 2023 is 0.921, which indicates that the estimated model has a high predictive power and has been able to explain more than 92 percent of the changes in revenues from funds and property in Hamadan Municipality.

It is forecasted that the revenues from funds and property in Hamadan Municipality will reach more than 1,171 billion Rials in the 2029 horizon.

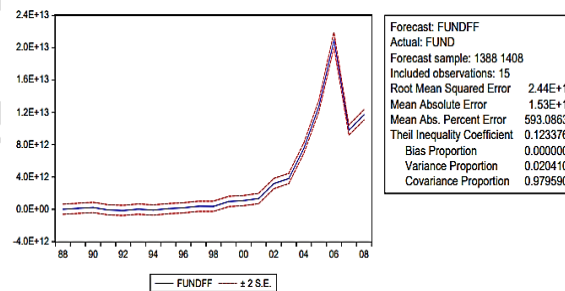


Figure 5: Forecasting revenues from funds and property of Hamadan Municipality in the 2029 horizon

To forecast revenues from government grants and government organizations in Hamadan Municipality, Equation (16) is used:

$$Aid_t = \alpha + \beta_1 tax_t + \beta_2 Taraz_t + \beta_3 GDP_t + \beta_4 Oil_t + \beta_5 inf_t + \beta_6 Exch_t + \varepsilon_t \quad (16)$$

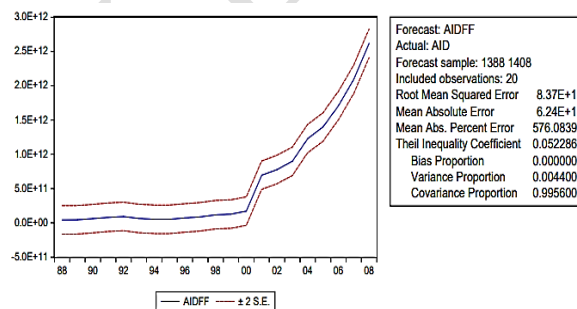
Table 11: Results of model estimation for revenues from government grants and government organizations in Hamadan Municipality

	Variable Coefficient	Significance Level
α	0.0535	0.6619
<i>tax</i>	1.5295	0.0000
<i>Taraz</i>	0.0814	0.0000
<i>GDP</i>	-0.3782	0.0120
<i>Oil</i>	0.2784	0.0000
<i>inf</i>	1.0919	0.0000
<i>Exch</i>	-1.0997	0.0000

As shown in Table (11), at the 95% confidence level, all variables have a significant effect on the level of revenues from government grants and government organizations in Hamadan Municipality. Based on the estimated coefficients, the variables of market exchange rate and Gross Domestic Product have a negative effect, and other variables have a positive effect on the amount of revenues from government grants and government organizations in Hamadan Municipality.

The adjusted coefficient of determination for this model during the estimation period of 2009 to 2023 is 0.919, which indicates that the estimated model has a high predictive power and has been able to explain more than 91 percent of the changes in revenues from government grants and government organizations in Hamadan Municipality.

It is forecasted that the revenues from government grants and government organizations in Hamadan Municipality will reach more than 2,617 billion Rials in the 2029 horizon.

**Figure 6: Forecasting revenues from government grants and government organizations in Hamadan Municipality in the 2029 horizon**

To forecast revenues from donations, gifted assistance, and assets in Hamadan Municipality, Equation (17) is used:

$$Donations_t = \alpha + \beta_1 Inf_t + \beta_2 POP_t + \beta_3 GDP_t + \beta_4 income_t + \varepsilon_t \quad (17)$$

Table 12: Results of model estimation for revenues from donations and gifted assistance, and assets in Hamadan Municipality

	Variable Coefficient	Significance Level
α	-9.9535	0.0000

<i>Inf</i>	0.5167	0.0000
<i>POP</i>	12.6654	0.0000
<i>GDP</i>	-2.6086	0.0000
<i>income</i>	0.3800	0.0000

As observed in Table (12), at a 95% confidence level, all variables have a significant effect on the level of revenues from donations, gifted assistance, and assets in Hamadan Municipality. Based on the estimated coefficients, the Gross Domestic Product (GDP) variable has a negative effect, while other variables have a positive effect on the amount of revenues from donations, gifted assistance, and assets in Hamadan Municipality.

The adjusted coefficient of determination (R-squared) for this model during the estimation period from 2009 to 2023 is 0.852, which indicates that the estimated model possesses high predictive power and has been able to explain more than 85 percent of the changes in revenues derived from donations, gifted assistance, and assets in Hamadan Municipality.

It is forecasted that revenues from donations, gifted assistance, and assets in Hamadan Municipality will reach over 3,851 billion Rials in the 2029 horizon.

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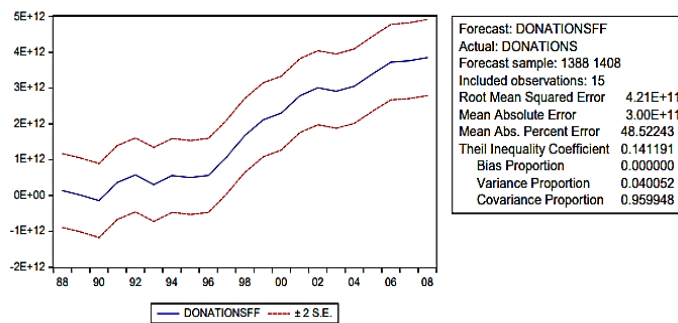


Figure 7: Forecasting revenues from donations, gifted assistance, and assets in Hamadan Municipality in the 2029 horizon

To forecast the total revenues of Hamadan Municipality, Equation (18) is used:

$$Rev_t = \alpha + \beta_1 Inf_t + \beta_2 Car_t + \beta_3 licence_t + \beta_4 POP_t + \beta_5 House_t + \beta_6 Tax_t + \beta_7 GDP_t + \varepsilon_t \quad (18)$$

Table 13: Results of total revenue estimation for Hamadan Municipality

	Variable Coefficient	Significance Level
α	0.6130	0.0001
<i>Inf</i>	-0.0827	0.0000
<i>Car</i>	-0.2567	0.0000
<i>licence</i>	0.0177	0.0000
<i>POP</i>	-1.4382	0.1884
<i>House</i>	-0.0056	0.0000
<i>Tax</i>	0.9756	0.0000
<i>GDP</i>	1.1769	0.0000

As observed in Table (13), at a 95% confidence level, all variables have a significant effect on the level of total revenues of Hamadan Municipality. Based on the estimated coefficients, the variables of Gross Domestic Product (GDP) and housing price have a negative effect, while other variables have a positive effect on the total revenues of Hamadan Municipality.

The adjusted coefficient of determination (R-squared) for this model during the estimation period from 2009 to 2022 is 0.990, which indicates that the estimated model possesses high predictive power and has been able to explain more than 99 percent of the changes in revenues derived from the total revenues of Hamadan Municipality.

It is forecasted that the total revenues of Hamadan Municipality will reach over 38,650 billion Rials in the 2027 horizon.

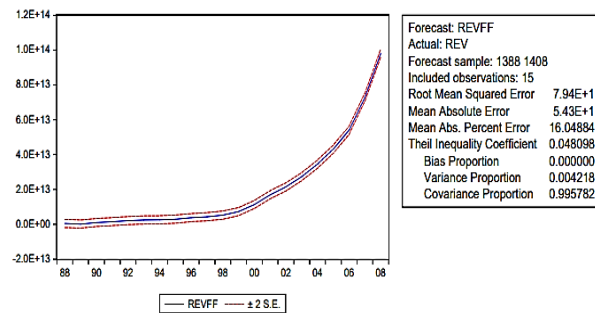


Figure 8: Forecasting the total revenues of Hamadan Municipality in the 2029 horizon

To forecast the total revenues of Hamadan Municipality, excluding specific revenues, Equation (19) is used:

$$NRev_t = \alpha + \beta_1 Inf_t + \beta_2 Car_t + \beta_3 licence_t + \beta_4 POP_t + \beta_5 House_t + \beta_6 Tax_t + \beta_7 GDP_t + \varepsilon_t \quad (19)$$

Table 14: Results of estimating the total revenues of Hamadan Municipality, excluding specific revenues

	Variable Coefficient	Significance Level
α	-0.2050	0.3514
<i>Inf</i>	-0.0070	0.6897
<i>Car</i>	-0.1947	0.0001
<i>licence</i>	0.0189	0.0001
<i>POP</i>	-0.4945	0.1559
<i>House</i>	-0.0915	0.0001
<i>Tax</i>	1.0124	0.0000
<i>GDP</i>	0.9615	0.0002

As observed in Table (14), at a 95% confidence level, all variables (except for population and inflation) have a significant effect on the level of total revenues of Hamadan Municipality, excluding specific revenues. Based on the estimated coefficients, the variables of Gross Domestic Product (GDP), housing price, and the number of produced vehicles have a negative effect, and other variables have a positive effect on the total revenues of Hamadan Municipality, excluding specific revenues.

The adjusted coefficient of determination (R-squared) for this model during the estimation period from 2009 to 2023 is 0.983, which indicates that the estimated model possesses high predictive power and has been able to explain more than 98.3 percent of the changes in total revenues of Hamadan Municipality, excluding specific revenues. It is forecasted that the total revenues of Hamadan Municipality, excluding specific revenues, will reach over 70,966 billion Rials in the 2029 horizon.

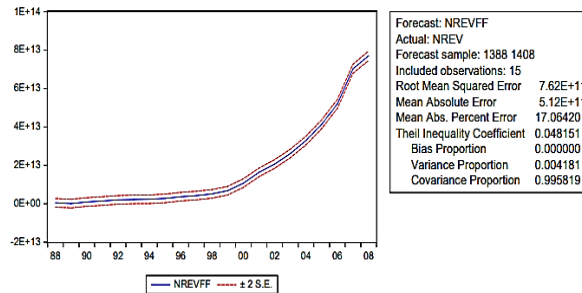


Figure 9: Forecasting total revenues of Hamadan Municipality, excluding specific revenues, in the 2029 horizon

To forecast the financing of Hamadan Municipality through the disposal of capital assets, Equation (20) is used:

$$Asset_t = \alpha + \beta_1 Loan_t + \beta_2 Price_t + \beta_3 GDP_t + \beta_4 Inf_t + \beta_5 Oil_t + \varepsilon_t \quad (20)$$

Table 15: Results of estimation for financing through the disposal of capital assets in Hamadan Municipality

	Variable Coefficient	Significance Level
α	0.6048	0.0000
<i>Loan</i>	0.7472	0.0000
<i>Price</i>	0.7409	0.0000
<i>GDP</i>	-0.9623	0.0000
<i>Inf</i>	-0.2111	0.0000
<i>Oil</i>	0.0805	0.0000

As observed in Table (15), at a 95 percent confidence level, all variables have a significant effect on the level of financing through the disposal of capital assets in Hamadan Municipality. Based on the estimated coefficients, the variables of Gross Domestic Product (GDP) and inflation rate have a negative effect, and the variables of facilities paid by Bank Maskan, oil revenue, and stock price index have a positive effect on financing through the disposal of capital assets in Hamadan Municipality.

The adjusted coefficient of determination for this model during the estimation period from 2009 to 2023 is 0.975, which indicates that the estimated model possesses high predictive power and has been able to explain more than 97 percent of the changes in financing from the disposal of capital assets in Hamadan Municipality. It is forecasted that the total financing from the disposal of capital assets in Hamadan Municipality will reach over 33,757 billion Rials in the 2029 horizon.

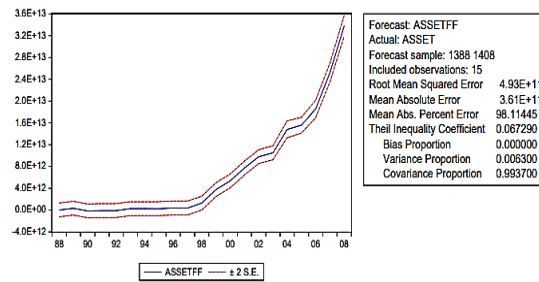


Figure10: Forecasting financing through the disposal of capital assets in Hamadan Municipality in the 2029 horizon

To forecast the financing of Hamadan Municipality through the disposal of financial assets, Equation (21) is used:

$$Fin_t = \alpha + \beta_1 Loan_t + \beta_2 Price_t + \beta_3 GDP_t + \beta_4 Inf_t + \beta_5 Oil_t + \varepsilon_t \quad (21)$$

Table 16: Results of estimation for financing through the disposal of financial assets in Hamadan Municipality

	Variable Coefficient	Significance Level
α	-1.4645	0.0000
<i>Loan</i>	-0.9596	0.0000
<i>Price</i>	1.7246	0.0000
<i>GDP</i>	2.674	0.0000
<i>Inf</i>	-0.1939	0.0000
<i>Oil</i>	-0.3947	0.0000

As shown in Table (16), at a 95% confidence level, all variables have a significant effect on the level of financing through the disposal of financial assets in Hamedan Municipality. Based on the estimated coefficients, the variables of Bank Maskan loans, inflation rate, and oil revenue have a negative effect, while the variables of Hamedan city's Gross Domestic Product (GDP) and the overall stock price index have a positive effect on financing through the disposal of financial assets in Hamedan Municipality.

The adjusted coefficient of determination for this model during the estimation period from 2009 to 2023 is 0.596, which indicates that the estimated model possesses moderate predictive power and has been able to explain more than 59 percent of the changes in financing through the disposal of financial assets in Hamedan Municipality. It is predicted that the total financing through the disposal of financial assets in Hamedan Municipality will reach more than 2,492 billion Rials by the 2029 horizon.

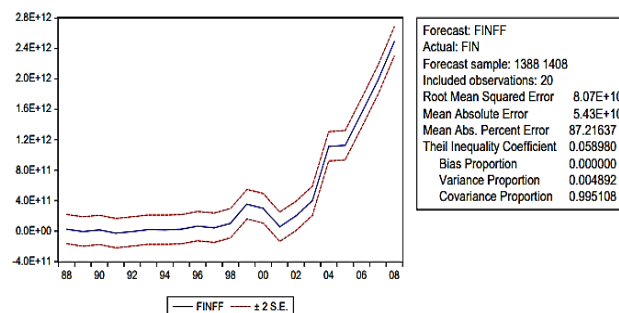


Figure 11: Forecast of financing from the disposal of

financial assets in Hamedan Municipality for the 2029 horizon.

The final results obtained from forecasting each revenue code for Hamedan Municipality's revenues for the next 5 years are presented in Table (13) for the decision-making and policy-making of managers. Given that the efforts of the Municipality's revenue unit are also effective in budget realization, time series data of budget liquidation from 2009 to 2023 for Hamedan Municipality has been used for these forecasts. According to the results obtained, the Municipality's revenues have followed a growing trend, such that the revenue codes for taxes derived from general revenues, revenues from the disposal of capital assets, and revenues from municipal properties and funds have accounted for the highest amounts for these 5 forecast years, and for the year 2025, the amounts for these revenue codes are predicted to reach 20,926, 14,789, and 7,533 billion Rials, respectively. Following that, the codes for grants, donations, and assets; service charges and revenues from for-profit institutions; grants from the government and government organizations; revenues from the disposal of financial assets; and revenues from specific taxes have accounted for the highest predicted revenue amounts for these years, with minor fluctuations. Therefore, considering the results obtained from these forecasts in Table (13) and Figure (11), in the 2025 to 2029 horizon, it is clear that the highest revenues earned by the municipality are from taxes derived from general revenues, but the codes for general taxes, disposal of capital assets, and municipal funds and properties will still be the three main sources of revenue for Hamedan Municipality. This composition shows that the Municipality's financial structure still relies on unsustainable sources; because a significant part of these revenues either depend on macroeconomic changes and the housing market (such as municipal funds and properties) or are inherently non-repeatable (such as the sale of capital assets). While the exponential growth of the forecast figures is a sign of potential capacity, if the municipality settles for this same pattern, in the long run, it will face a reduction in productive assets, an increase in financial risk, and a threat to the sustainability of urban services. On the other hand, the lower share of resources such as service charges and for-profit institutions or specific taxes indicates that public capacities and sustainable urban revenue generation have not yet been well activated. Global experiences show that the greater the weight of these resources in the budget, the more the municipality's financial independence increases and the ability to withstand economic fluctuations rises.

A review of the regression results for the various revenue models of Hamedan Municipality shows that the influence of variables on revenue sources varies, and in each model, certain variables play a more prominent role than others. In the model for revenues derived from general taxes, Gross Domestic Product (GDP) has the most positive impact, followed by taxes and inflation, which play significant roles, while housing prices, the number of vehicles, and building permits have a significant negative effect, and population has no significant effect. In the specific taxes model, household income has the most positive effect and population has the most negative effect, while Gross Domestic Product also has a limited negative effect. In the model for revenues from service charges and for-profit institutions, population and the number of vehicles have the most positive effect, and housing prices have a prominent negative effect. For municipal funds and properties, financial indices and assets have a significant impact, while population and housing prices have a negative effect. In financing from the disposal of capital assets, bank loans and the stock price index have the most positive effect, while Gross Domestic Product and inflation have the most negative effect. In financing from the disposal of financial assets, Gross Domestic Product and the stock index show the most positive effect, while bank loans, inflation, and oil revenue have a negative effect. A general comparison of the models shows that some variables, such as Gross Domestic Product and housing prices, have a significant impact in several models, while population and some sector-specific indices play a secondary role. This analysis indicates that the direction and intensity of the impact of

variables differ for each revenue source, and the prominence of the impact of certain variables highlights the importance of paying attention to them in the planning and forecasting of urban revenues.

Therefore, the data in Table (17) clarifies that Hamedan Municipality requires a serious revision of its revenue portfolio. If the focus is not placed on diversification and increasing the share of sustainable sources—such as reformed general taxes, local taxes, and urban services—even significant revenue growth will not be able to prevent financial fragility in the future.

Table 17: Forecast of Hamadan Municipality Revenue Codes for 1404–1408 (Rials)

Revenue forecast	Revenues from general charges	Revenues from specific (dedicated) charges	Service fees and revenues of profit-making institutions	Revenues from municipal property and funds	Grants provided by the government and governmental organizations	Donations, contributed aid, and assets	Revenue from transfer of capital assets	Revenue from transfer of financial assets	Total
year									
2025	20,925,847,577,670	1,007,016,755,240	1,334,119,054,841	7,532,569,591,056	1,201,161,289,972	3,053,808,191,629	14,789,462,861,386	1,058,348,669,589	50,982,617,805,897
2026	26,653,875,208,473	1,152,739,186,799	1,541,989,054,397	12,756,390,867,301	1,452,472,571,426	3,400,075,648,432	15,563,953,429,206	1,120,705,104,905	63,642,201,070,939
2027	33,816,401,554,313	1,321,022,355,987	1,756,243,558,551	20,958,755,248,266	1,749,032,205,948	3,722,428,353,935	18,560,539,667,926	1,585,875,590,378	83,470,298,535,304
2028	46,488,620,867,846	1,374,589,343,819	1,785,021,861,300	9,807,390,102,281	2,053,162,604,757	3,760,139,913,185	25,154,864,686,199	2,010,814,259,765	92,434,603,639,153
2029	50,957,235,524,452	1,434,996,802,058	1,833,522,956,228	11,706,921,408,003	2,617,310,441,276	3,850,796,218,027	33,757,325,902,020	2,492,417,163,827	108,650,526,415,889

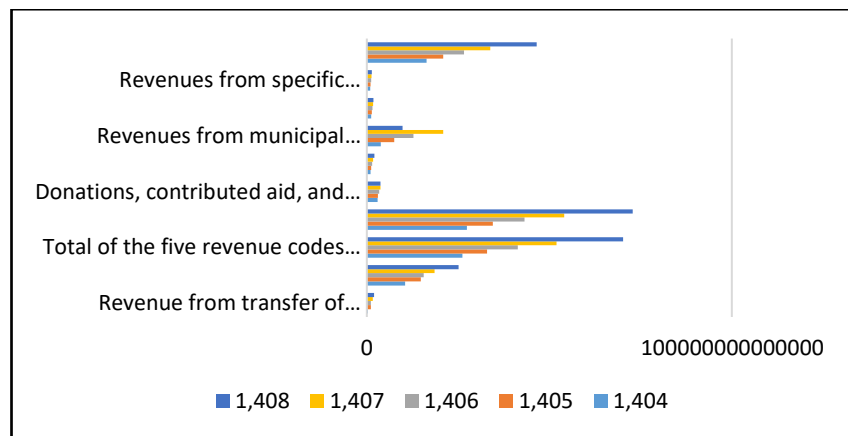


Figure 12: Forecast of Hamadan Municipality Revenue Codes (1404–1408)

6. Results and Suggestions

Examining the financial situation of municipalities is of great importance, because their financial resources affect the quality of urban services and managerial decision-making. The present study analyzed the revenue trend of Hamedan Municipality in the years 2009 to 2023 and, using the Ordinary Least Squares (OLS) method, forecast revenues for the next five years up to the 2029 horizon. The research results indicate that revenues from specific taxes, also with more severe fluctuations than general taxes due to being affected by macroeconomic conditions, experienced an average growth of 34.2%, and revenues from service charges and revenues of for-profit institutions indicated a growth of 35.9%. Revenues from municipal funds and properties, which increased in all the years under review (except the year 2015), had a growth of 61.3%, and show that Hamedan Municipality has placed greater focus on municipal funds and properties for revenue creation from 2017 onward. Revenues from grants provided by the government and governmental organizations have also faced severe fluctuations and in some years (2016) had no performance, and this indicates that it has been one of the factors of instability in Hamedan Municipality's revenue and had a growth of 24.2% over the period under review. The trend of revenues from grants, donated aids, and assets in Hamedan Municipality was increasing in most years, but in 2022 compared to 2021 it had a sharp decline due to social and economic developments, and overall it experienced an average growth of 33% over the period under review.

Furthermore, Hamedan Municipality's financing from the disposal of capital assets underwent severe ups and downs alongside a 43.8 percent growth over the period, which indicates that whenever the municipality's budget faces a severe squeeze, the use of this financing method increases sharply. Finally, financing from the disposal of financial assets in Hamedan Municipality experienced an average growth of less than one percent during the period under review, regardless of occasional shocks. Subsequently, in order to forecast the revenues of Hamedan Municipality for the 2029 horizon, after reviewing the trends of the variables and introducing a proposed model for each revenue code, the effect of each variable on each revenue code was determined. The high adjusted coefficients obtained for each revenue code indicate that the estimated models possess acceptable predictive power; consequently, based on these models, the revenues from each revenue code were forecast for the 2029 horizon (the next 5 years). In the 2025 budget forecast for Hamedan Municipality, revenue sources are estimated at approximately 50,983 billion Rials. The major sources are provided by revenues from general taxes (41.7 percent), revenue from the disposal of capital assets (29 percent), and revenues from municipal funds and properties (15 percent). Grants, donations, and assets (6 percent), service charges and revenues from for-profit institutions (2.3 percent), and grants from the government and government organizations (2.4 percent) contribute to the sourcing of

this budget. Additionally, a very negligible portion (2 percent for the code) of Hamedan Municipality's public resources is provided through revenues from the disposal of financial assets and revenue from specific taxes (2 percent).

Executive recommendations for improving the financial sustainability of the municipality can be categorized into three time horizons. In the short-term (1 to 2 years), actions such as reforming and revising taxes and tariffs, improving revenue collection systems through digitalization and system integration, and strengthening public participation by enhancing the quality of urban services can lead to increased efficiency and the rapid realization of revenues. During this same period, pursuing immediate legal reforms is also important; specifically, the allocation of a fixed and sustainable share of traffic fines to municipalities, which can create a reliable financial source for funding equipment, maintenance, and traffic control costs. In the medium-term (3 to 5 years), focusing on diversifying revenue sources through the development of sustainable revenues—such as local taxes, service charges, and income from for-profit institutions—along with investing in productive projects and the smart management and prioritization of assets, will help reduce the municipality's dependence on unsustainable sources. In the long-term (5 years and more), the primary goal is to create a sustainable and resilient financial structure achieved through reducing dependence on government aid and one-off revenues, developing modern financial tools, multi-year planning, strengthening debt management, and institutionalizing legal reforms related to revenue sources (including the stabilization of the municipalities' share of traffic fines), which will ultimately lead the municipality toward financial independence and sustainable urban development.

6.1. Suggestions for future research

Considering the occurrence of the 12-day war in Iran and its impact on economic and financial structures, future studies can focus on examining the effect of short-term crises on the revenue sustainability of municipalities. Revising revenue forecasting models, evaluating the financial resilience of municipalities, and analyzing short-term changes in revenues are among the key axes of future research. In addition, given that some regression coefficients in the present study were relatively unsatisfactory, the use of data mining (including time-series analysis, clustering of revenue sources, and identification of payment patterns) can increase the accuracy of the models. Future studies may pursue topics such as “redesigning municipal revenue forecasting models under crisis conditions,” “analysis of the financial resilience of urban management,” and “examining the effect of the 12-day war on the sustainability of urban revenues,” which will provide more precise tools for financial planning.

Authors' Contribution

The contribution percentage of the authors in this study is equal.

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Conflict of Interest

No conflict of interest has been declared by the authors.

Resources

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