

Fluctuations in macroeconomic variables on the funding of pension funds in Iran (combined data pattern method with different frequency (MIDAS))

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Abstract

The current paper investigates the fluctuations of macroeconomic variables on the resilience of pension funds in Iran. Thus, using the combined data model method with different frequencies (Midas), the present issue was investigated for different seasonal and annual time periods. In the forecasted model, the annual data of government debt, unemployment, and total Social Security expenditures and quarterly data of oil price fluctuations, exchange rate jumps, money supply and consumer price index for the years 1991-2016 have been used. Data related to 2019 were not used in the initial estimation of the relationship in order to test the predictive power of the model outside the estimation range. Based on the results; inflation rate, money supply, exchange rate jumps and crude oil price fluctuations have a statistically significant effect on the Social Security expenditures. In other words, in terms of economic structure and according to the principles of economics, a steady increase in the exchange rate causes economic prosperity in society, but if this increase is temporary, economic prosperity can not be observed. A floating and managed exchange rate increase will cause relative stability in the foreign exchange market, which in turn will increase the total Social Security expenditures in the long run. Exchange rate fluctuations lead to an increase in debt by companies and the government, and an increase in debt will lead to a general lack of liquidity, which in general, the lack of liquidity of enterprises has a negative effect on the situation of the Social Security and increase the total Social Security expenditures. Also, by comparing the predicted values with the realized values, the prediction accuracy of the model is higher and is closer to the real values.

Keywords: Macroeconomic Variables, Pension Fund Resilience, Currency Jump, Panel Data with Different Frequency

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1 Introduction

Social Security is designed as one of the pension funds based on social insurance. Emphasis on the nature of social insurance means that according to the principles governing this strategy, the expenses of the organization should be provided from the sources defined in the law. Therefore, policies and decisions need to be such that financial balance is always maintained in the relevant structure. Otherwise, government intervention is needed to cover the costs. In most countries, pension funds are taken as the most important financial intermediaries and they are different from other intermediaries due to the special nature of their resources, the most important of which is the long-term horizon of fundraising and of course the related obligations in the form of pension payments. This has made the widespread presence of the huge resources of these funds in most finance and investment domains. And, of course, any challenge to their resources and spending increases the risk of financial instability throughout the financial system. The financial balance of the funds is first and foremost. Internal factors of the funds increase the expenditure on resources, which requires the management of expenditure resources, which is decided by the board and managers of the fund. Other factors such as economic, social and cultural issues are raised that have stronger effects on increased resource consumption. The current paper examines economic and macroeconomic issues, and how changes in macroeconomic variables affect pension funds to the extent that they cause crises and bankruptcy of pension funds. The impact of macroeconomic variables on pension funds is in the form of a two-way relationship, both of which affect each other. The impact of macroeconomics on pension funds is undeniable. Macroeconomic variables include oil price fluctuations, inflation, exchange rate fluctuations, liquidity, unemployment and government debt. Studies in different societies have shown that these variables have different consequences on pension funds with the political and social consequences. Economic fluctuations as an important factor have had a great impact on funds. For example; since the pension fund system in Iran is DB-PAYG, meaning that they do not save significant assets like savings, inflation can be significant and risky, as it affects the number of premiums collected and the cost of paying pensions. Employment and social security are also closely linked; unemployment creates risky and substandard jobs. Without the creation of new job opportunities, social security funds become unstable and lose the ability to support their stakeholders. On the other hand, without social security, the labor force faces uncertainty about the future, and the boom and bust in the labor market severely affect the performance of the funds by changing the sources of income and expenses of the social security organization. Government debt also has different consequences for pension funds, depending on their size and type. The biggest effect of government debt on pension funds is to reduce the share of funds in investments (outsourcing of funds). One of the functions of pension funds is to create social security. The total expenditures of the government increase with the weakening and non-promotion of pension funds. The presence of this variable in the model is important due to the decisive role of the government in the total expenditures of the Social Security Organization. The current paper examines the fluctuations of macroeconomic variables on the resilience of pension funds in Iran using the Combined Data Pattern Method with Different Frequency (MIDAS). This will be discussed in the section on theoretical foundations and interpretation of results.

2 Theoretical foundations and research background

Studies in pension funds show that at present these funds are facing liquidity deficits and gaps for various reasons, in the short term overflow has appeared under pressure on government resources in the budget, but in the medium term due to the intense tension of these funds with other components of the financial system leads to financial instability. Social security has spread around the world and is not limited to developed countries. Today, government-based social security systems are in place in more than 172 countries. However, it is forecasted that more than 2 billion people around the world are not covered by any social security protections in the form of social insurance, social assistance, etc. Governments usually provide social security services through the provision of social security services, social assistance, the provision and transfer of funds and capital in the form of low-interest loans or transfer payments, and the allocation of subsidies to goods and services. In government-based systems, the method of operation is top-down; this means that organizations providing social security services in the community are first formed on the basis of government power and expand the body of their executive activity throughout the community. The social security services provided in such systems are mostly mandatory. Social security systems based on market principles are very important in the world. With the exception of prominent examples in South America, where some countries have begun reforming government-based social security systems; market-based systems play a very limited role in providing social security services. Reform in Latin America is largely a shift to private pension funds. The experience of Chile, Argentina and other countries in the region has attracted much attention and has led to controversial debates in the social security literature.

3 The Relationship between Macroeconomic Variables and the Financing of Pension Funds

3.1 The effect of inflation on the proportionality of pensions

Pension funds are a mechanism for intergenerational transfers and the change in inflation rate affects the receipt of pensions and their benefits. The role and effect of inflation are highlighted in Articles 96 and 111 of the Social Security Law. Article 96 of the Social Security Law deals with the need to reconcile pensions with the cost of living. According to Article 96 of the Social Security Law, the organization is obliged to increase the amount of all pensions, retirement, disability and total pensions of survivors at intervals of not less than once a year due to the increase in the cost of living with the approval of the Cabinet. Statistics on price index and inflation in the country's economy indicate that inflation in the Iranian economy has become stable and chronic. The most important impulse for Iran's economy before the revolution can be the oil shock of 1974. It was 7% and reached 25.1% in 1977. However, from this year onwards, a decreasing trend begins and in 1977, 1978 and 1979, it has negative growth. Iran's economy in the period (1991-1993) by applying inappropriate policies paved the way for a new crisis in the Iranian economy. Maturity of foreign borrowing and inefficiency in the productive sectors reduced production growth, while the expansion of monetary and fiscal policies increased inflationary pressures. Resumption of inflation in 2012 by 30.5 percent and in 2013 by 34.7 percent. Since 2012, following the intensification of foreign sanctions and in the context of the accumulated imbalances caused by the implementation of incompatible and uncoordinated economic policies for several years, the exchange rate has multiplied and subsequently inflation has increased. According to the Central Bank, the inflation rate in 2017 as a result of rising import price index and foreign exchange market turmoil and liquidity growth and reducing the share of quasi-money in liquidity growth and also a limited decrease in bank interest rates have been among the factors affecting inflation. The current situation in Iran is exposed to inflation again. An inflation rate equal to 9.6 percent in 2017 has been reported.

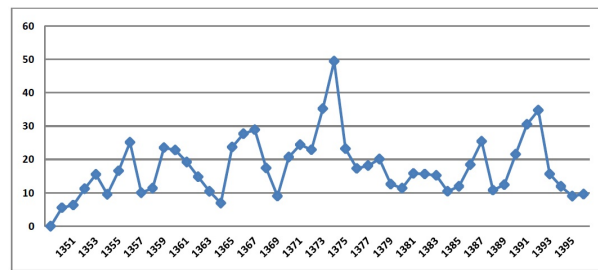


Figure 1: Inflation behavior to the Social Security Organization during the period 1971-2017

3.2 Unemployment and social security

Employment and social security are closely linked. Without the creation of new job opportunities, social security funds become unstable and lose the ability to support their members. On the other hand, without social security, the workforce faces uncertainty and feels hostile about the future and the company in which it works. In the absence of social security, unemployment, poverty and instability will prevail in the labor market. Which will exacerbate inequality and accumulate social dissatisfaction. In addition, pension funds are an important investment financing tool, helping to create new jobs by helping to increase production capacity. The labor market situation has a profound effect on the social security system. Prosperity and stagnation in the labor market severely affect the performance of Social Security by changing its sources of income and expenses. In the literature of business cycles, boom periods reduce the number of unemployed and increase the number of employees. It strengthens the financial capacity of Social Security and provides a suitable ground for investing funds. The time period studied in this paper, when the unemployment rate in 1971 is equal to 9.85 and by the end of 2017 is equal to 12.1 percent, has fluctuations and changes, which indicates that with the increase in population in the 80s and at its peak, the job demand of young people, was not met by enough job opportunities. In fact, in other words, in many years, the unbalanced supply and demand trend in the labor market has become an important factor in unemployment rate fluctuations. The problem persists in the country's labor market. The unemployment rate reflects the household situation.

3.3 Total government expenditures and social security

Given that in the seventies, the Social Security was a fledgling organization and its input was more than its output, the cost of treatment was the largest share of 58% and the long-term cost was 23%, and after events such

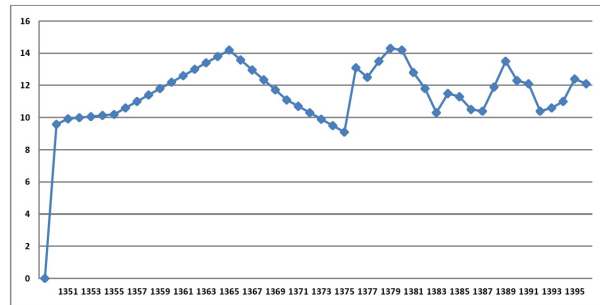


Figure 2: Unemployment behavior to the Social Security Organization during the period 1971-2017

as the revolution and 8 years of war, in the 80s the rate of treatment was 40% and the long-term cost was 49%, and until the last year of this study, 2017, the share of long-term cost had the highest share. Expenditures made by the Social Security in the 70s include; 1- Treatment is 58%, 2- Long-term 23%, 3- Office personnel 14% and 4- Short-term 5%. Since 2004, the total expenditures of the Social Security have been modified with a new classification in the form of salaries and other retirement benefits; treatment costs; transfer premiums to other plans and project management costs. For example; the situation of 2014 shows the salaries and other retirement benefits of the members, the costs of treatment, the costs of managing the project, the transfer insurance premium to other projects equal to 65%, 29.2%, 5.4% and 4%, respectively. At the beginning of 2016, the salaries and other retirement benefits of members reached 62.8% with a decreasing trend and the treatment costs increased to 31.2%. also, the costs of managing the project with very minor changes equals 5.8 percent and the transfer premium to other projects have been equal to 2 percent. What happened in 2016 was accompanied by slight fluctuations in costs, such as 63.4% of members' salaries and other retirement benefits, 31.3% of medical expenses, and 5.1% of project management expenses, while the transfer premium remained the same equivalent to 2%. According to the report of the Bureau of Statistics and Economic and Social Accounts in 2017, the salaries and retirement benefits of members increased by 65.5 percent with a decrease in treatment costs by 30.1 percent and the costs of managing the project by 4.5 percent with transfer insurance to other projects is still fixed at 2%. In 2017, given the cost of treatment, direct treatment costs of the contracted hospitals with 30.1% has the highest share and the costs of direct treatment of insurance and treatment with 1.6% have the lowest share. Given the cost of retirement salaries and benefits, pension members have the highest share of 62.1% and the lowest share goes for wage compensation equal to 1.6%. The following chart 3 shows the growth of total expenditures of the Social Security Organization from 1971 to 2017.

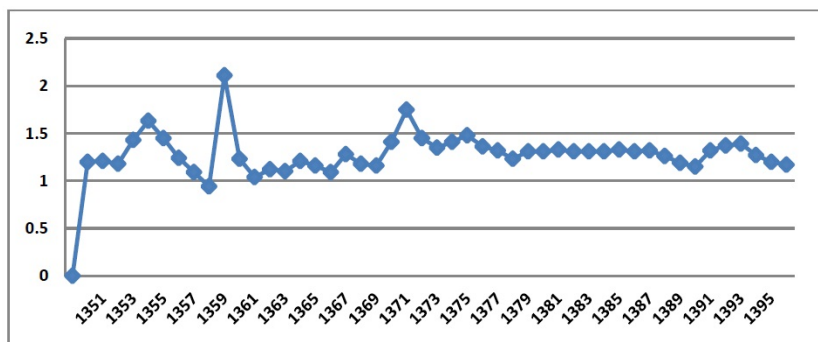


Figure 3: Behavior of total government expenditures to the Social Security from 1971 to 2017

3.4 Government debt and social security

Social Security is one of the largest creditors of the government debt, and government debt to the Social Security accounts for a total of a quarter of all government debt (banks, the largest government creditor). In a situation where the government is facing severe resource constraints, due to the enactment of protectionist laws and insurance exemptions, government arrears to pension funds are increasing exponentially and are projected to reach "uncollectible" levels over the next five years, unless the laws are amended as soon as possible and stop the growth of these debts. The biggest effect of government debt on pension funds is the smaller share of funds in investments.

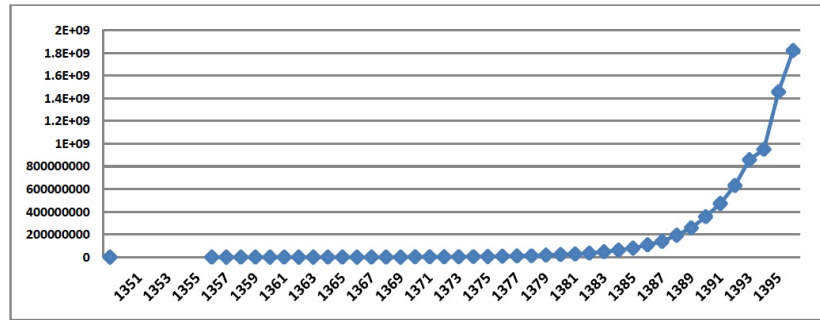


Figure 4: Behavior of accumulated government debt to the Social Security from 1971 to 2017

The government's debt to Social Security has increased from 1971 to 2017, despite various economic and political developments such as the first oil shock, revolution, war, etc. with a completely predictable trend. From 1993 to 2004, the behavior of the mentioned debts has increased with a gentle slope. In 1993, the implementation of economic adjustment policies began, in which the principles and laws were observed and the government debt was based on the insurance law, and a comprehensive social security plan was envisaged at the end of the construction government that was not followed for the not assigned budget. Government debt in 2001, which was equivalent to 400 billion tomans, has increased in the following years due to the beginning of wrong policies including government continuous use of Social Security resources to cover government obligations from 2005 to 2013, an increase of liabilities from 2 to 21, the mismanagement in the Social Security, failure to hire managers within the framework of professional principles and relevant education, and multiple CEOs of the Social Security with engineering education. The main reasons for the increase in these debts during the mentioned period are the increase in government arrears to the Social Security Fund, the continuation of the adoption of laws that increase government debts to the Social Security. inadequacy of the credits provided in the annual budgets for the gradual reduction of these debts, non-payment of government debts in cash and in an effective annual amount.

Reports show that the amount of government debts to this organization has increased from about 60,000 billion rials in 2005 to more than 600,000 billion rials in 2013. About 30 percent of these liabilities are related to the exemption of supportive insurance premiums and 18 percent are related to government obligations arising from early retirement. While both types of legal obligations have been adopted without regard to insurance calculations and scientific requirements of social insurance. On May 6, 2014, The 11th government approved the health system transformation plan. The health system transformation plan was approved by the tenth government but was not implemented. Due to the implementation of the "Health Transformation Plan" with a focus on treatment, treatment costs increased and government commitments in this area increased with grown government debt. In 2014, the debt of government accumulation was about 90 thousand billion Rials, in 2015, this debt amounted to 95 thousand billion Rials, in 2016 to 145 thousand billion Rials, and finally in 2017 to an astronomical figure of 181 thousand billion Rials. Government debt accumulation is projected to reach "uncollectible" levels over the next five years. Of course, a large part of the accumulation of debts is due to the profit and its real value, which due to the high power of the compound interest causes this amount of debt to be large. If we calculate the accumulated amount of debts without calculating interest, it will be a small amount.

4 Literature Review

Mousavian Anaraki et al. [11] in a study examined the impact of macroeconomic variables on pension funds and the strategy of proper asset management. The data used in the econometric model are time series data and the results of model processing show that the growth of operating profit of the state pension fund as an indicator for measuring the status of the fund is affected by three factors of GDP (economic growth), growth of the economic participation and the growth of the number of companies in which the fund invests favourably. Also, the number of important and influential companies is determined in such a way that every year among the fund portfolio companies, the companies in which the fund owns more than 34% (one-third of the seats are owned by the fund and the fund's opinion is considered for the assembly, (Their market value), listed companies (or their cost) over-the-counter companies, (more than five percent of the fund's operating profit) are included in this variable, and the fund must in these investments shift ownership from these companies to assets with high liquidity.

Jafari [9] in a study examined the macroeconomic effects of structural reforms in the Iranian pension system.

The simulation results of the designed model show that with the applied reforms, the consumption of all generations increases and the savings of individuals and consequently the accumulation of capital in the economy decreases; The end result of these developments is a reduction in production at the level of the economy as a whole. Based on these results and in view of the widespread recession in the country's economy, it is suggested that policymakers in the field of pension system reform do not take hasty structural reforms and transfer them to the savings system.

Izadbakhsh et al. [8] studied asset and debt management in pension funds with a systemic approach in a fuzzy environment. In this study, the key factors affecting asset and debt management in pension funds are identified and analyzed by systems dynamics. Using a fuzzy inference system, important risks affecting management are evaluated and added to the model in order to make management risk-oriented. The effect of each factor and risk on asset and debt management in retirement funds is determined by testing different strategies and scenarios. The results confirm that the keys to the position of asset and debt management are an integrated view of assets and liabilities and the interests of the project stakeholders and attention to demographic risks and in particular risk orientation.

In an article, the effects of ageing and retirement reform on a general equilibrium model of generations overlapping with the imperfect labor market and endogenous early retirement decisions had been examined. According to the research findings, changes such as increasing life expectancy and reforming pension systems, such as plans to improve pension fund reserves, lead to lower interest rates and unemployment. Reducing capital expenditures stimulates labor demand and encourages firms to create vacancies, which in turn increases employment and increases the participation of older workers. They argue that neglecting the interrelationships between pension reform and the imperfect labor market leads to under forecasting the effects of such reform. The positive point of this research is entering the field of imperfect competition market and combining it with the life cycle model and applying reforms such as reducing the replacement rate in the pension system.

The New Keynesian model with generational overlap to address pension reforms to combat the aging population had been calibrated in southern Europe. The main finding is that raising the retirement age is the least harmful policy in terms of long-term consequences. However, there is talk about the feasibility of implementing this policy. The main and important feature of this research is that it compares different pension reforms and suggests the best way to reform.

He, Ning and Zhu [7] examined the effects of rapid ageing and pension reform on savings and labor supply in a Chinese case study. The results show that rapid ageing and pension reform have both increased household savings rates by 15 percent between 1995 and 2009 and that both factors, together, have increased labor supply by 14 percent.

Given that in previous studies, the issue addressed by this paper has not been directly studied, the current paper examines the effect of fluctuations in macroeconomic variables on the resilience of pension funds in Iran in line with these studies and in a complementary way, using the method of a combined data model with different Midas frequency. The results of the current paper can help us to clarify whether its results are consistent with previous domestic and foreign studies, given the dependence of the Iranian economy on oil revenues and vulnerability to the shocks of macroeconomic variables. Oil fluctuations, inflation, unemployment, government debt affect the resilience of pension funds, which we will analyze the results by designing a hybrid data model with different Midas frequencies for the Iranian economy and the period 1991-2018.

5 Research methodology

The current paper investigates the fluctuations of macroeconomic variables on the resilience of pension funds in Iran using the combined data model method with different Midas frequency and examines that how much influence has the government had on the financing of pension funds in Iran despite oil fluctuations, currency jumps, inflation, money supply, unemployment and non-monetary variables such as debt? Thus, in the first stage, the effect of oil fluctuations and currency jumps using the Arch and Garch model and Hodrick-Prescott filter on our country's economy is calculated to be used in forecasting the Combined Data Pattern Method with Different Frequency (MIDAS).

The forecasted model is as follows:

$$TSE_{it} = c(s_t) + \gamma_1 GD_t + \delta_1 UN_t + \chi_1 INF_t + \rho_1 M_t + \varpi_1 OIL_t + \varsigma_1 EX_t + \varepsilon$$

In the above equation, financial markets

TSE: Total Social Security Expenditure.

GD: Government debt

UN: Unemployment

INF: Inflation rate

M: Money volume

OIL: Indicates fluctuations in the price of heavy Iranian crude oil,

EX: exchange rate jump,

It can be explained that Total Social Security expenditures, government debt and unemployment variables data are obtained from annual data (1991-2018) and oil price fluctuations, exchange rate jumps, money supply and inflation rates variables data are obtained from seasonal data (1991Q₁-2018Q₄).

6 Combined Data Pattern Method with Different Frequency (MIDAS)

In the traditional method of modelling time series to predict economic variables, all the variables involved in the pattern necessarily have the same frequency, for example, if the dependent variable is seasonal, the explanatory variables must also be seasonal. Now, if there are variables in a regression relationship, some of which are annual and some of which are seasonal or monthly, it is not possible to estimate the coefficients of this regression unless we convert the seasonal or monthly data into annual data and then estimate the regression coefficients. However, recently a technique has been developed that can contract variables with different frequencies in regression and estimate their coefficients. Building a model based on this has two main advantages. First, the inclusion of more frequent variables alongside the less frequent variables in a regression makes it possible to predict the dependent variable more accurately for the near future. Second, when new information about radiative variables is obtained, the previous prediction for the low-frequency dependent variable of the model can be revised [12]. The basic idea of modelling based on high-frequency variables was proposed by Klein and Sojo [10] and was recently developed by Ghysels, Santa-Clara, and Valkanov [4] and then developed by Ghysels, Sinko, and Valkano [5], known as the Combined Data Pattern Method with Different Frequency (MIDAS). To introduce this pattern, first, we will discuss how to symbolize the variables that vary in the frequency pattern. Suppose that two time series $(y_t)_t$ and $(x_\tau)_\tau$ are constant with different frequencies, so that the variable $(y_t)_t$ is dependent and the variable $(x_\tau)_\tau$ is explanatory. t is the unit of time used for low-frequency variables. We use coefficients s to create a relationship between two variables with t and τ frequencies. The coefficient s is a fraction of the time interval between t and $t - 1$ such that $m = \frac{1}{s}$ indicates how many times the variables of the brighter time series $(x_\tau)_\tau$ have been observed in this time interval.

Therefore, $t = \tau \cdot m$ and x_τ appears m times more than the time series y_t . The symbol $x_\tau^{(m)}$ means $x_\tau = x_\tau^{(m)}$. For example, for quarterly and monthly data, this means $m = 3$ that in each chapter we will have one view of the quarterly data and three views of the monthly data. A variable containing seasonal data is a less frequent variable and a variable containing monthly data is a more frequent variable. Ghysels, Sinko, and Valkano [5] introduced the simple Midas regression to the world of science. A simple Midas regression is explicitly stated with respect to the variable x_τ explanatory variables and their intervals as follows:

$$y_t = c_0 + \beta \sum_{j=0}^{j \max} W(j; \theta) \cdot L^{\frac{j}{m}} x_t^{(m)} + u_t.$$

The weighting function $W(j; \theta)$ represents a polynomial for applying specific weights to wide intervals x_τ . Ghysels [3] introduced Midas weighting functions as functions such as Lamon weighting function, exponential Lamon weighting function and beta weighting function, respectively. After applying the Midas approach to evaluate the effect of fluctuations in macroeconomic variables on the resilience of pension funds in Iran, we will estimate the model using the VAR time series.

When considering the behavior of one or more time series variables, it is necessary to consider the relationship between these variables in the form of a model of a system of simultaneous equations. In such a model, some variables are endogenous and some are exogenous. Before forecasting such a pattern, it is necessary to ensure that the system equations are identifiable. It is common practice to assume that a number of exogenous variables are entered into only some of the model equations. Therefore, before forecasting the pattern of the system of simultaneous equations, the pattern variables should be classified into two categories of exogenous and endogenous, then apply constraints to the coefficients of the pattern variables to achieve pattern recognition [6]. This was strongly criticized by Sims [13]. According to him, if there really is synchronicity between a set of pattern variables, all variables should be viewed the

same and the previous judgment about whether the variables are endogenous or exogenous is not correct; thus, he presented the VAR model [1]. This model is in fact a kind of linear relationship between the dependent variable and intervals of all variables present in the system of simultaneous equations that the number of intervals is determined by the researcher [12].

A self-explanatory pattern (VAR) that has a K endogenous variable and a P time lag for each variable is shown in the matrix form as follows [12]:

$$y_t = \Phi_1 y_{t-1} + \dots + \Phi_p y_{t-p} + u_t \quad u_t \sim IN(0, \Sigma).$$

In this relation, Y_t and its intervals are $K \times 1$ vectors related to pattern variables. Φ_i are $K \times K$ matrices for $i = 1, \dots, P$ pattern coefficients and the U_t is $K \times 1$ vector corresponds to pattern perturbation sentences. Now to link the short-term Y_t behavior to its long-run equilibrium values, the above relation can be expressed in the form of a vector error correction (VECM) pattern as follows:

$$\begin{aligned} \Delta Y_t &= \delta_1 \Delta Y_{t-1} + \delta_2 \Delta Y_{t-2} + \dots + \delta_{P-1} \Delta Y_{t-P-1} + \Pi Y_{t-p} + U_t \\ \delta_i &= -(I - \Phi_1 - \Phi_2 - \dots - \Phi_i), \quad i = 1, 2, \dots, P-1, \end{aligned}$$

where the Π matrix contains information about long-run equilibrium relationships. In fact, $\Pi = \alpha\beta'$ is in which α is the adjustment coefficient of imbalance and indicates the speed of adjustment towards long-term equilibrium and the matrix of coefficients of long-run equilibrium relations. Note that if the number of interrupts of model one is considered, on the right side of the system equations can only exist as part of the error correction sentences and the first-order difference interrupts of the variables will not appear [12]. There are several methods to investigate the co-integration relationship of time series variables. Engle-Granger method is basically a bivariate method that studies only the relationships between two sets of variables. Therefore, multivariate models cannot be analyzed [15]. Johansen's method has been introduced to cover the shortcomings of the Engle-Granger method. In Johansen's method, the determination and estimation of cointegration vectors (coefficients related to long-run equilibrium relationships) between variables are performed using the self-explanatory model coefficients (VAR) between those variables. The relationship between the pattern (VAR) and the co-integration makes it possible to easily explain the co-integration vectors from the coefficients of the pattern itself [14]. In three cases, there will be no contradiction in the reliability of the relationship Y_t disorder sentences (17) [12].

When all the Y_t vector variables are really $I(0)$. Of course, if this is the case, there will be no more fear of obtaining false regression, and the appropriate method is to estimate the VAR pattern based on the level of variables. When $\Pi = 0$, this is when, in fact, there is no auto-correlation vector. That is, no linear combination between Y_t variables cannot be found to be $I(0)$. In such a case as $U \sim I(0)$, Π must necessarily be a $K \times K$ matrix of zero so that the unstable relations cannot enter the model equations through ΠY_{t-p} . A suitable VAR pattern in this case is a pattern that is adjusted based on the first-order difference of the variables and does not include long-run relationships. When there is a $K - 1$ auto-correlation between the K vector variables Y_t .

7 Results and discussions

7.1 Results of ARCH and GARCH model estimation

In the first stage, the autocorrelation test is checked by the LM test (Breusch–Godfrey test) in which the null hypothesis is the absence of serial autocorrelation between the survivors and the opposite hypothesis shows the existence of serial autocorrelation between the survivors. The test results for the exchange rate variable are presented in Table 1:

Table 1: Results of serial autocorrelation test

	Statistics	Value	Confidence level
Oil price	F-statistic	1.047636	0.3651
	Obs×R-squared	0.967257	0.6165

According to Table 1, the null hypothesis that there is no serial autocorrelation between the residuals can not be rejected. Therefore, there is no problem of autocorrelation between data. Now, by performing the heterogeneity test of variance, according to Engle [2], we determine the appropriate rank of ARCH and GARCH models for the oil price variable. Table 2 presents the results of this test for the variable:

Table 2: Results of serial autocorrelation test

	Statistics	Value	Confidence level
Oil price	F-statistic	4.646403	0.0399
	Obs×R-squared	4.269754	0.0388

The results of Table 2 show that the null hypothesis of this test based on the ineffectiveness of ARCH is rejected with a 90% confidence level and the opposite hypothesis, ie the existence of the ARCH effect, is accepted. As a result, using the conditional heterogeneity variance models, the model for the oil price variable is forecasted.

Table 3: GARCH and ARCH models for two variables

	Model	P	q
Oil price	GARCH	1	1

After reviewing the GARCH and ARCH models and selecting the best model and answer, using the Make GARCH Variance Series option, oil price fluctuation data are obtained on a seasonal basis, to be used in forecasting the final model.

7.2 Calculation of exchange rate jumps

The exchange rate jump variable is created based on the separation of the real exchange rate using the Hodrick-Prescott filter and positive fluctuations in the exchange rate. The chart below 5 shows the trend of real exchange rate cycles.

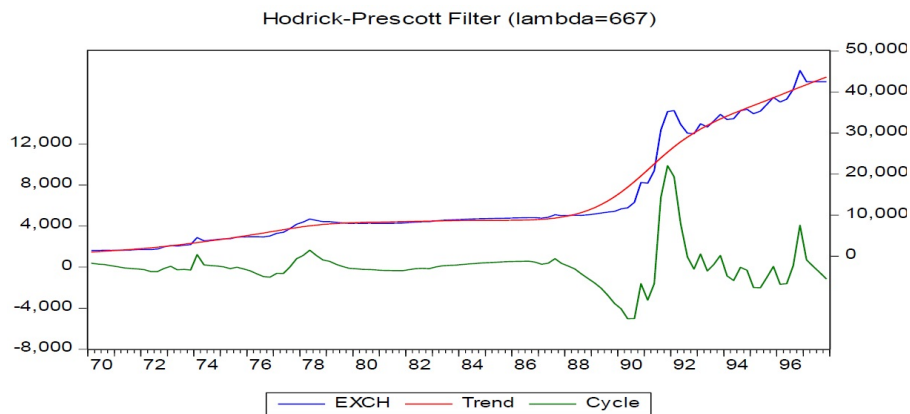


Figure 5: Currency exchange rate breakdown based on trend section

To calculate the exchange rate monetary momentum, the free market exchange rate was used instead of the official exchange rate, and to calculate the exchange rate jump, only positive exchange rate shocks were considered and zero was replaced instead of negative shocks because it can be the result of all changes in monetary, financial, commercial and non-economic developments and can be an important variable in economic decisions.

7.3 Results of unit root tests

In most time-series studies, the presence of a unit root in time series variables may lead to false regression estimation and therefore the obtained results are not reliable. In addition, the precondition for using the co-integration test to examine the presence of a long-run relationship is that the variables are not a sum of two degrees, so it is necessary to accurately determine the static and collective degrees of variables before performing the co-integration test and forecasting long-term coefficients. The augmented Dickey-Fuller Unit Root Test (ADF) test was used for this purpose. The test results show that the research variables remained at the level of stability and are a sum of zero degrees. A summary of the results of these tests is presented in Table 4.

Table 4: The augmented Dickey – Fuller Unit Root Test

Test statistics ADF			Variables	
Collective degree	First order difference	Level		
I(0)	0.0256	-3.5626	TSE	Total Social Security Expenses
I(0)	0.0125	-3.5462	GD	Government debt
I(0)	0.0005	-3.3267	UN	Unemployment
I(0)	0.0325	-3.1452	INF	Inflation
I(0)	0.0000	-5.9865	OIL	Fluctuations in the price of heavy Iranian crude oil
I(0)	0.0135	-3.1478	EX	Exchange rate jumps
I(0)	0.0001	-4.2653	M	Money volume

Table 5: Results of model coefficients with Combined Data Pattern Method with Different Frequency (MIDAS)

Method: MIDAS					
Sample (adjusted): 1370 1397-1370Q1-1397Q4					
		Coefficient	SD	t	Probability level
Width of origin	C	0.237455	0.018496	12.83819	0.0000
Interruption of the total Social Security expenses	FM(1)	-0.075534	0.028238	-2.674897	0.0092
Government debt	GD	0.526566	0.238343	2.209281	0.0295
Inflation	INF	0.022316	0.002596	8.596242	0.0000
Unemployment	UN	0.020468	0.013110	1.561267	0.1190
Money volume	M	0.119064	0.007606	15.65365	0.0000
Exchange rate jumps	EX	0.006095	0.003061	1.991131	0.0470
Fluctuations in crude oil prices	OIL	0.279373	0.113819	2.454542	0.0145
R-squared= 0.9236 Adjusted R-squared= 0.9124 Durbin-Watson stat= 1.6325 hAh.test=0.7841 jarque.bera.normality.test =2.9362 (p=0.1758)					

7.4 Estimation of Combined Data Pattern Method with Different Frequency (MIDAS)

The results of forecasting the model coefficients with Combined Data Pattern Method with Different Frequency (MIDAS) are reported in Table 5.

The pattern determination coefficient is forecasted to be $R^2 = 0.9992$, which indicates the very high explanatory power of the pattern. The statistical quantity of hAh. the test is 0.78, which shows that the constraints imposed on the specified Midas model coefficients are statistically significant and have the necessary adequacy. According to the quantities of the Durbin-Watson test and the normality test, the pattern distortion sentences do not have a continuous correlation and have a normal distribution. The interval of the dependent variable is statistically significant. Inflation rate, money supply, exchange rate fluctuations and crude oil price fluctuations have a statistically significant effect on the total Social Security expenditures. In other words, in terms of economic structure and according to the principles of economics, a steady increase in the exchange rate leads to economic prosperity in society, but if this increase is cross-

sectional, economic prosperity can not be observed. A floating and managed increase in the exchange rate will cause relative stability in the foreign exchange market, which in turn will increase the total Social Security expenditures in the long run. Exchange rate fluctuations lead to an increase in debt by companies and the government, and an increase in debt will lead to a general lack of liquidity, which in general, the lack of liquidity of enterprises has a negative effect on the situation of the Social Security and increase the total costs. Oil fluctuations, currency jumps, and political conditions factors of the country have a positive effect on the total Social Security expenditures. In general, it can be concluded that with the increase of some factors such as; political conditions and factors of the country, the economic situation of the world and Iran, the annual budget of the country, macro-monetary, fiscal and exchange rate policies, inflation rate, stock and currency price fluctuations, transparency of financial information and many other factors have led to fluctuations in this market. This factor is a reason to reduce the efficiency and increase the total Social Security expenditures.

7.5 Forecast

Figure 6 shows the amounts realized and simulated by the total Social Security expenditure relationship. The red lines represent the simulation values and the black lines represent the actual values and can be a confirmation of R^2 above the expected level in the specified and forecasted relation. The specified relationships of the total Social Security expenditures have been forecasted using the annual data of 1991 to 2018. Based on the forecasted relationships, the first out-of-sample forecast for 2019, based on the seasonal data of fluctuations up to the end of the last quarter of 2018, has been made as follows.

Table 6: Forecasted and realized results of total Social Security expenditures

Forecasted amount of the total Social Security expenditure index: 523632.36
Realized amount of total Social Security expenditure index in 2019: 536236.85

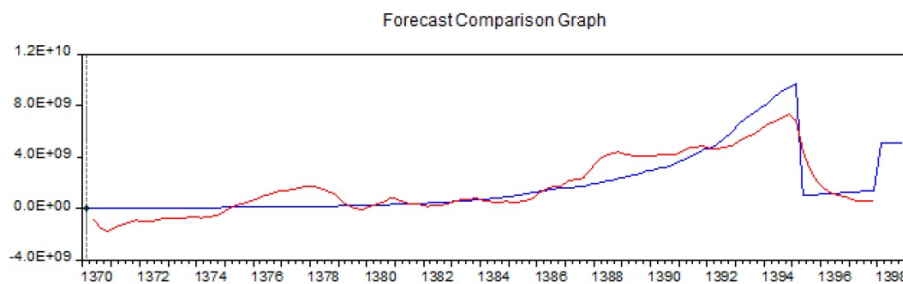


Figure 6: Realized and simulated values by the ratio of total Social Security expenditures for 2019

In the following, the annual data from 1991 to 2017 are used in the forecast. The results of forecasting the total Social Security expenditures are shown in Table 7.

Table 7: Results of the step-wise forecast of the total Social Security expenditure index using Combined Data Pattern Method with Different Frequency (MIDAS)

Realized value	Forecast value	Forecast of the total Social Security expenditure index in 2019
536236.85	512363.12	using the statistics of 2019

Accordingly, comparing the amount of the total Social Security expenditure forecast of with the realized value indicates an accurate forecast of the patterns.

8 Summary and Conclusion

The current paper aimed at investigating the fluctuations of macroeconomic variables on the resilience of pension funds in Iran Combined Data Pattern Method with Different Frequency (MIDAS) in the period of annual and quarterly data from 2012 to 2018 and expenditure forecast in 2019. The effects of sanctions, financial crises, oil and monetary fluctuations, and currency fluctuations lead to increased fluctuations in the total Social Security expenditures, and as a result, the efficiency of the organization decreases with price increased index fluctuations. According to the findings

of the research and problem solving of the pension fund, given that our economy is a government-based economy, the government should choose between promoting pension funds or bankruptcy of the pension funds, each of which has positive and negative consequences for all classes of society. Experience has shown that in many macro-policies, the government makes decisions almost independently and without the consent of the social partners, and implements its decision. Society has never been a serious obstacle to the implementation of policies in the absence of strong civic institutions and social formations. Assuming that the government chooses the bankruptcy of the funds and these funds reach the crisis stage, this crisis will reach the government apparatus and the government apparatus will be in crisis and will have two-sided effects. Based on these issues and the results obtained in the fourth section, some suggestions are provided as:

1. When the economy's dependence on oil and sanctions and the structure of government are among the main problems of the Iranian economy, fluctuations in oil revenues, large volumes of economic decisions and sanctions force the government to adopt expedient monetary policies, so the Iranian economy needs reforms in government policy structures in macroeconomics, especially monetary structures and policies (such as giving positive anti-inflation messages with practical measures to reduce inflation expectations).
2. In policy-making, it is suggested that macroeconomic policies, especially on the demand side of the economy, be such as address the important issue of inflation, the causes and roots of its occurrence and ways to reduce it (such as empowering the government to regulate legislation, government non-involvement in unnecessary economic activities).
3. Given the relatively large challenges and crises that the country is facing, as well as the capacities and opportunities that remain for the government and the pension funds, "Transparency" and mutual trust between the government and pension funds, should increase, and in the absence of transparency in terms of funding in the not-too-distant future, pension funds will become dependent on government resources.
4. Inflation is one of the most important and influential macroeconomic variables, that it is suggested that pension fund managers always monitor its situation and consider its impact on the fund budget. Redistribution of income to the benefit of asset owners and to the detriment of wage earners is the destructive effects of inflation, increasing uncertainty and thus shortening the decision-making time horizon and reducing long-term investment and resource allocation.
5. In the case of unemployment, it is suggested that political influence be avoided for economic purposes and that the creation of industries and investments should be accompanied by the active participation of the private sector and the establishment and guidance of the government, without the direct intervention of the government. The government should eliminate the problems and obstacles to the growth and development of small and medium enterprises and turn them into large and competitive enterprises by creating links and strengthening them between small, medium and large enterprises.

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