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Looking at the effects of financial cycles on the real sector of economy: An examination on the affectability of the unemployment and income inequality in Iran's economy

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Abstract

The present study analyzes the effects of financial cycles and their components on the real sector of Iran's economy and more precisely on the unemployment rate and income distribution inequality. The theoretical reason behind juxtaposing unemployment and income distribution, is the positive correlation between the two variables under the job-search models, along with their challenging and problematic natures. Employing a multiple-stage methodology, over the 1985-2020 period, this study commences with creating a time-varying index based on the "power cohesion" of dependent and independent variables and then continues by determining their joint-distribution by the Kalman-filter approach. At the second stage, it tries to find the degree of coincidence (or asynchrony) between real sector and financial-credit indices by generating a composite index consisting of cohesive joint-distributed components, yielded in the last phase. In the final phase, it benefits from non-linear models for robustness and validity checking. The results emerging from the second stage illustrate that the values indicating counter-cyclical movement (or improving) among financial cycles, on the one hand, and real sector cycles, unemployment, and Gini-Coefficient, on the other hand, are 0.61, 0.71, and 0.64, respectively. Also, there is an improvement and significant movement between credit cycles and the real sector variables. However, the significance is weak for credit cycles generated from so-called "Directed credits." The validity of the second stage results is verified by the outcomes of the third phase using some standard and more detailed models which are estimated by non-linear methods. The third stage has considerable policy implications for decision-makers.

Keywords: financial cycles, credit cycles, income inequality, unemployment, Kalman-filter, power cohesion
2020 MSC: 91G15, 91G80

1 Introduction

A significant emphasis of studies has changed from a limited relationship between credit and the real economy sector to the broader relationship between "financial cycles" and the real economy sector in recent years. Financial cycles are often defined by economists based on their features as they use financial cycles as a general term to describe price cycles of real properties (housing), stock price index cycles, and credit cycles.

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Property value cycles will not pose a serious risk to the economy as long as they do not become "bubbles" but a sharp rise in property prices sometimes turns into bubbles that burst after a while for a long period. In the bubble situation, property prices deviate from what the models and fundamentals suggest and deviate from their normal range in fully competitive financial markets. The bubble is thus "a part of the upward movement of the gross property price that deviates significantly from its base price".

Stock market price index cycles can also be out of their ordinary states. Stock market crises occur after the creation of stock price bubbles due to overpricing some (or all) of them. A price bubble is created when the price of a financial property substantially exceeds the present value of its future net income. The investors' positive expectations that it is possible to sell those properties at a higher price is the main reason for the excessive increase in the price of such properties. In such a situation, the sharp sale of properties suddenly causes a sharp fall in their prices as soon as the expectations are reversely regulated .

Furthermore, "credit cycles" are defined as a stage in the behavior of financial institutions based on which applicants for funds access to financial resources easier than other periods. In these periods, the amount of resources available for lending increases significantly, the conditions required by borrowers to qualify are reduced, and borrowing costs do not increase based on the regulatory frameworks of institutions in lending. In defining credit cycles, Vincenzo and Iasio (2020) state that lenders will be able to increase their debt by borrowing more than previous or new lenders, or both. These increases will eventually complete a cycle with a gradual or sudden reduction in lending.
After the definition of financial cycles and their components, the main question is whether they lead to sensitivity in the real economy sector? More precisely, the creation of influence in this sector means the degree of stimulation of variables in the real economy sector. Two variables, namely the unemployment rate and the Gini coefficient, are considered for the Iranian economy in this study.

This study is important in at least two aspects: first, policy-making in financial cycles and relying on financial resources for the real economy sectors are the main priorities of monetary and financial authorities, and second, determining the limits of financial and credit cycles for "financial crises" and "credit booms" is important in economy because experience indicates that "credit booms" is "dangerous" at best for the economy and "catastrophic" at worst. In a study by Nili and Mahmoudzadeh [31], the credit "expansion" and "contraction" cycles are considered to be more than average and less than the average normal growth of credits respectively, while the bubble of property prices and credit growth are recorded two to three times more than other variables on average the expansion situation during the credit booms and financial crises according to empirical studies . In the case of collapse, the bubble depletion and credit decline occur 10 to 15 times higher than other indices. Numerous factors can play roles in the sharp increase in credit, including shocks and severe structural changes in markets. Shocks from positive changes in productivity, economic policies (especially expansionary monetary policies), and inward capital flows can all contribute to the rapid growth of credits. However, this study investigates the impact of "financial and credit cycles" rather than their affectability or the concept of "credit booms".

To answer the main question of the research, the second section of the manuscript discusses theoretical bases and the difference between studies with the present study from the perspective of covering dimensions of the problem. The third section highlights differences between this research and different approaches in the methodology, including the data used and the types of research methods, and discusses the main issue and interprets the results while indexing the time-varying parameters and estimating the models. The final section of the study also presents the conclusion and policy recommendations.

2 Theoretical bases and research background

In an article titled "On the Positive Correlation between Income Inequality and Unemployment", Penha [33] states that there is a general consensus that "income inequality is a counter-cyclical variable in terms of behavior"; in other words, an increase in unemployment worsens "the situation of low-income groups". This point has also been confirmed in other studies, including Penha and Turchick [32], and Carvalho and Guilmi [10] as the latter included access to credit in the model while studying the effect of unemployment on income inequality. In the framework of a general theoretical equilibrium model, Bandyopadhyay et al. [5] prove that credit contraction cycles can be distinguished from two main indices, "high share of credit fund cost" or "high probability of bankruptcy of the enterprise". Using the theoretical and empirical examination of effects of financial-credit cycles on unemployment and welfare, Herkenhoff [21] states that if access to credit is extended to individuals in the short term, this expansion of access will act as a safety net for households, and they will search for less available but high-paying jobs, and if this search fails, they will use these loans to streamline their consumption. If this credit growth occurs in a recession, then its short-term effect will increase unemployment, and its long-term effect will be a slight improvement and decrease in unemployment. He

calls this effect the "expansion effect". Bartoletto et al. [6] found that a sharp decline in the rate of credit is associated with the creation of recession and unemployment, while there is not necessarily a strong co-movement in economic prosperity and credit expansion. More precisely, lending has an asymmetric effect on real variables of the economy. Brei et al. [9] state that there is a nonlinear relationship between financial structures and income inequality. The researchers believe that increasing access to credit to a certain point can reduce income inequality, but as soon as it goes beyond that point, it can increase income inequality. Dabla-Norris et al. [12] enumerate the most important factors influencing the reduction (or increase) of income inequality in economies such as technological changes, economic openness, globalization, changes in labor market institutions, education, income redistribution policies, the roles of financial market variables, and in general, the "deepening of financial markets".

Soleimani et al. [36] conducted a study titled "The effects of financial cycles on business cycles in Iran based on the Bayesian averaging approach" and found that cycles related to the stock market index, the cost of building one meter of infrastructure, government, and non-government loans, oil revenues, and current government payments had significant effects on business cycles. Seifi Kashki et al. [35] conducted a study titled "The relationship between business and credit cycles in the Iranian economy" and concluded that there was a co-movement between business and credit cycles in most research periods. Eynian et al. [15] conducted a study titled "Credit cycles of the Iranian economy" and concluded that the correlation between credit and business cycles in the Iranian economy was more than 70%. the study also did not reject a two-way relationship between the two variables. Nili and Mahmoudzadeh [31] examined the microdata of companies listed on the stock exchange and concluded that not only there was a synchronicity between credit and business cycles at the macro data level, but also the synchronicity could not be rejected in firms.

3 Methodology

Financial cycles, in general, and credit cycles, in particular, can be detected through the joint movements of components and indices based on time series related to the financial sector. The methodology of the present study is based on the following steps:

A- Necessary transformations in data related to the financial and real sectors of the economy;
B- Calculating the "power cohesion" index for two variables based on the common probability distribution between them proposed by Schuler et al. [34];
C- Creating a composite index of time-varying parameters between the financial and real sectors of the economy;
D- Finding the degree of coincidence (asynchrony) of the composite indices created between the financial and real sectors of the economy;
E- Investigating the rates of robustness and accuracy of the results obtained in the previous section using a nonlinear econometric model

Each of the above stages is explained in detail as follows.

3.1 Necessary data and transformations

Data of this study cover both financial and real sectors of the economy. In the financial sector of the economy, monetary and financial variables which are obtained from the Central Bank system, Statistical Center of Iran, and statistics of the Ministry of Roads and Urban Development for 1984 to 2019 (due to better access to the majority of data in this period) are as follows: Total loans given to different economic sectors (private sector), total loans given from the directed notes of the annual budgets by the banking system to the economic sectors, the housing sales price index in the whole country, and the total stock market price index. Real sector variables also include unemployment rate, economic growth rate, and Gini coefficient. The annual inflation rate of the whole country is also used among the price indices.
It should be noted that the dummy variable of war is used for 1984-1988, and the dummy variable of sanctions for 2011, 2012, 2013, 2018, and 2019.
Given the data transformation, data not present in the figures of rates were first included in the model at real prices, and secondly, their growth rate was used instead of the data level. Given the de-trending of the variables using time-varying parameters, the unit root tests on all de-trended series indicated the stationarity of cyclic components. To avoid prolonging the discussion, the table is not reported in the research text.

3.2 Power cohesion: gaining the frequency and synergy of financial cycles between related indices

A multivariate spectral scale, called power cohesion, that is used by Schuler et al. [34], is utilized to obtain the common frequency between the variables as follows.

$$\mathrm{PCoh}_X(\omega)\frac{1}{(M-1)M}=\sum_{i\neq j}\left|f_{x_ix_j}(\omega)\right|, \tag{3.1}$$

Where, M is the number of variables greater than or equal to 2, $t=1$ is the time dimension, ω is the frequency of cycles, and x is static random processes in a way that that $f_{x_ix_j}(\omega)$ is defined as follows:

$$f_{x_ix_j}(\omega)=\frac{s_{x_ix_j}(\omega)}{\sigma_{x_i}\sigma_{x_j}}=\frac{1}{2\pi}\sum_{k=-\infty}^{\infty}\frac{\mathrm{Cov}\left[x_{i,t},x_{j,t+\mathrm{k}}\right]}{\sigma_{x_i}\sigma_{x_j}}e^{-1k\omega}, \tag{3.2}$$

Where σx_i and σx_j are the standard deviations and $(\omega)s_{x_ix_j}$ is the broad intersection of x_is and x_js. To standardize the above equation, an integral is obtained in the range of $-\pi$ to π according to Hamilton [19].

$$\int_{-\pi}^{\pi}s_{x_ix_j}(\omega)\,d\omega=\mathrm{Cov}\left[x_{i,t},x_{j,t}\right] \tag{3.3}$$

In this regard, the following relation is obtained.

$$-1\leq\int_{-\pi}^{\pi}f_{x_ix_j}(\omega)\,d\omega\leq 1 \tag{3.4}$$

The index will be in the following range by obtaining the absolute value of the figures.

$$0\leq\int_{-\pi}^{\pi}\left|f_{x_ix_j}(\omega)\,d\omega\right|f_{x_ix_j}\leq 1 \tag{3.5}$$

Unobserved components time series models, which are modeled by Harvey and Trimbur [20], are used to obtain Xs.

$$y_{it}=\mu_{it}+_{it}+\varepsilon_{it}$$

$$\mu_{it+1}=\mu_{it}+\varepsilon_{it} \tag{3.6}$$

$$\begin{bmatrix}\Psi_{it+1}\\ \Psi^*_{it+1}\end{bmatrix}=\Phi_i\begin{bmatrix}cos\lambda_i & sin\lambda_i\\ -sin\lambda_i & cos\lambda_i\end{bmatrix}\begin{bmatrix}\Psi_{it}\\ \Psi^*_{it}\end{bmatrix}+\begin{bmatrix}\omega_{it}\\ \omega^*_{it}\end{bmatrix} \tag{3.7}$$

$$\varepsilon_{it}\sim N(0,\sigma^2_{\varepsilon i})$$

$$\varepsilon_{it}\sim N(0,\sigma^2_{\varepsilon i})$$

$$\begin{bmatrix}\omega_{it}\\ \omega^*_{it}\end{bmatrix}\sim N(0,\sigma^2_{\omega i}) \tag{3.8}$$

In the above model, y_{it} refers to the value of the element i of y_t at time t. μ_{it} refers to the long-term trend, $_{it}$ represents the short-term, medium-term, and long-term cyclic dynamics, or x_i and x_j , and ε_{it}, ε_{it}, and ω_{it} are error terms of each equation and are normally and independently distributed for $i\neq j$ and $t\neq s$. λ_i refers to the cyclic frequency in the range of $0\leq\lambda\leq\pi$. The state-space model is used as follows to estimate the above equations.

$$y_t=Z_t\alpha_t+\varepsilon_t$$

$$\alpha_{t+1}=T_t\alpha_t+\eta_t \tag{3.9}$$

The equation y_t is the observation equation and the equation α_{t+1} is called the state equation. The state vector of α_t contains hidden process and cycle components. The matrices Z_t and T_t contain parameters related to the equations y_{it}, μ_{it+1}, and $_{it+1}$ which will be estimated.

The Kalman-filter is used to obtain the filtered and streamlined part of the unobserved components of α_t. The maximum likelihood method is also used to estimate the variance of the error term of different unobserved components, as well as $\emptyset_i$ and λ_i parameters .

Diagrams (3.1) to (3.4) show the results of estimating the above equations and separating the non-obvious terms for the sample in terms of the unemployment rate, Gini coefficient, growth of total credit to GDP ratio, and growth of total stock index respectively. The values of unemployment rate time series and Gini coefficient will be used as indices of the real economy sector, and values of growth of total credit to GDP ratio, and stock market index growth along with housing price index, and directed credit variables will be used as financial indices. To eliminate the very short-term or long-term effects of business cycles, the Kalman-filter method has the advantage that it makes it possible to extract expansion and contraction cycles with less errors by assuming cycles in the medium- term. This study uses such an assumption.

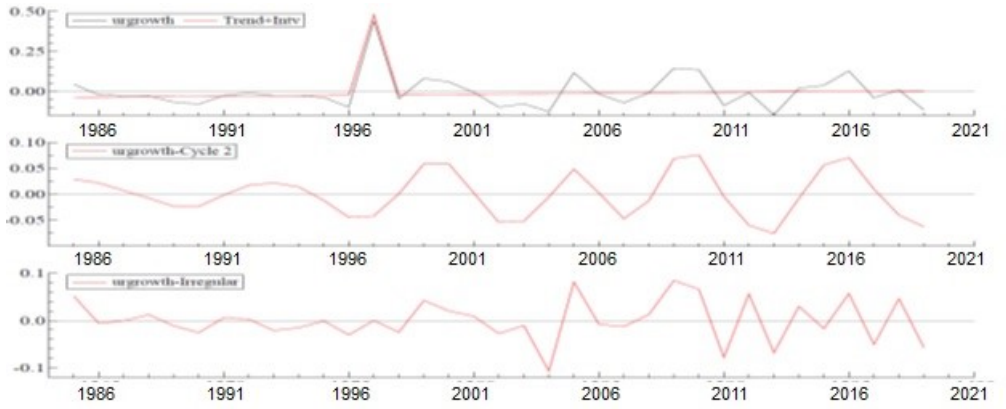

Figure 1: Estimation of the α_t vector for the unemployment rate growth (urgrowth): Assumption of cycles: Medium-term

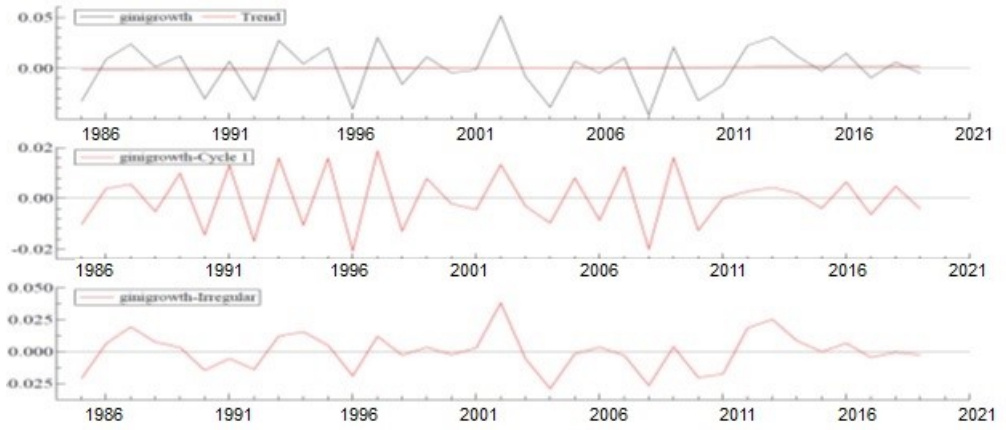

Figure 2: Estimation of the α_t vector for ginigrowth growth: Assumption of cycles: Medium-term

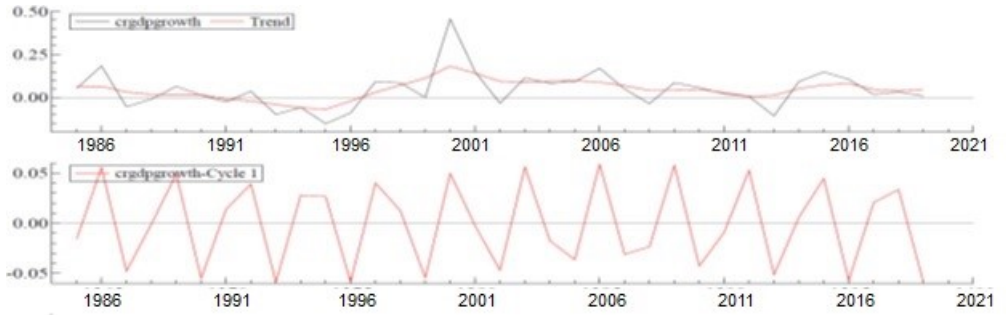

Figure 3: Estimation of the α_t vector for growth of total credit to GDP ratio (crgdpgrowth): Assumption of cycles: Medium-term

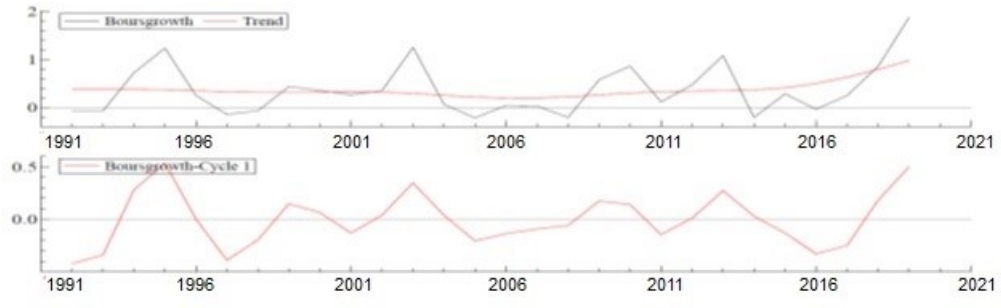

Figure 4: Estimation of the α_t vector for the growth of the total stock index (Boursgrowth): Assumption of cycles: Medium-term

3.3 Power cohesion and synergy: pairwise multiplicative distributions

After estimating x_i and x_j discussed in equations (3.6) and (3.7) of the state-space model (3.9), we can now obtain the integral of the standardization distribution of the equations (3.3) to (3.5) proposed by Hamilton [19] at a range of 0 to π and drew the series. For example, the main research distributions, which are related to credit cycles, unemployment rate, and Gini coefficient, are shown in Diagrams (3.5) and (3.6). Based on the trend obtained for pairwise distributions of credit cycles and variables of the real economy sector (unemployment rate, and Gini coefficient), these pairwise indices show a power synergy. These cohesion and synergy are significantly different for unemployment rates and credit cycles in a distance of $\pi/25$ to $\pi/18$ to zero. This synergy is significantly different for the Gini coefficient and credit cycles at a distance of approximately π to $\pi/19$ from zero. However, the results indicate a significant relationship between the variables.

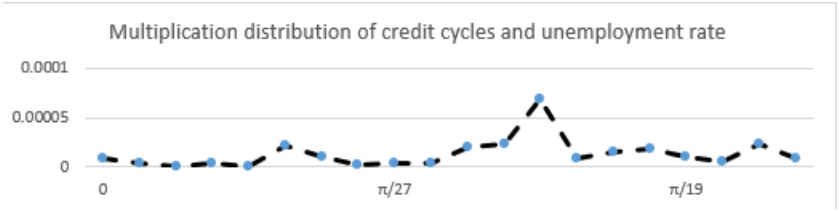

Figure 5: Multiplication distribution of credit cycles and unemployment rate based on equation (3.2)

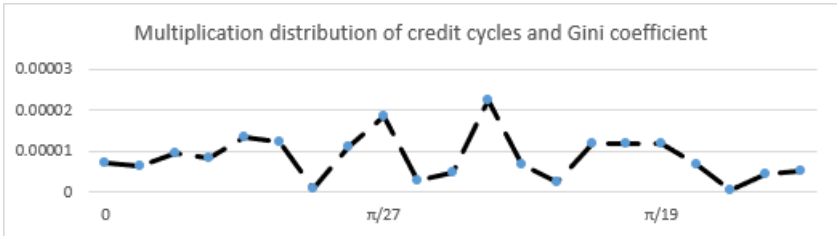

Figure 6: Multiplication distribution of credit cycles and Gini coefficient based on equation (3.2)

3.4 Creation of a hybrid index with time-varying parameters to obtain financial and real economy indices

Integrating single and pairwise indices of cycles to create combined financial and real economy indices is the next stage of empirical study. According to Holló et al. [22], the correlations of the variables (cycles obtained according to Equations (3.7) and (3.9), or Ψ_{it+1}) based on the Exponentially Weighted Moving Average (EWMA) is obtained according to the following equation:

$$\sigma_{ij,t} = \gamma\sigma_{ij,t-1} + (1-\gamma)(\Psi_{it} - 0.5)(_{jt}-0.5) \tag{3.10}$$

Based on the above calculation, the composite index is equal to

$$PC_t = \frac{1}{\acute{I}\sigma_t I} I\acute{\sigma}_t\psi \tag{3.11}$$

Where, the parameter γ is considered from 0.8 to 0.9 for annual to seasonal data depending on the frequency of data and according to the researcher's recommendation. Due to the annual data in this study, this parameter is considered to be 0.82. $\Psi = (\psi_{i,t}\ , \ldots, \psi_{M,t}$ is the unit vector for the number of variables or the same M.
Diagram (7) shows the composite indices obtained for financial cycles and cycles of the real economy sector. Financial cycles are obtained by combining the growth rate of total credit given to the private sector to GDP, the growth rate of directed credit to GDP, the growth rate of the stock market index, and the housing price index. The index of the real economy sector is also obtained from the components of the unemployment rate and the Gini coefficient.
Based on the two indices, the composite financial index of the 1991s is mainly ended with a halt in the declining and depressing phase. Even though there are fluctuations and efforts for improvement at this stage, it has normal fluctuations for the next 15 years. Furthermore, the index for 2011-2013 and the second half of 2011, especially after 2017, indicates a sharp decline in the financial cycle of the economy.
The composite index for the real sector of the economy has counter-cyclical movement with the financial index for many years. This movement has a more significant lack of co-movement from the second half of 2017 onwards, the indirect meaning of which is the significant impact of financial sector movements on the real sector of the economy if finally confirmed with the quantitative quantities of section 3.5.

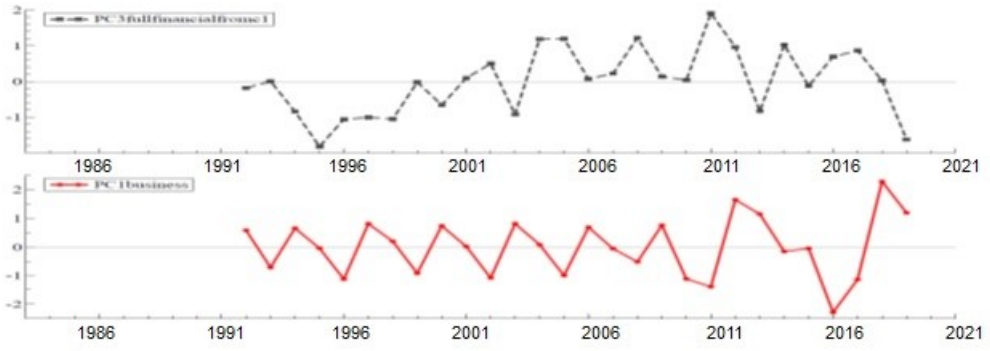

Figure 7: Composite indices of financial cycles (PC Financial) and real sector of the economy (PC Business)

3.5 Finding the rate of asynchrony of composite indices created between the financial and real sectors of the economy

The following index, proposed by Claessens et al. [11] is used to find the rate of asynchrony of peak and low points as well as non-common ascending and descending ranges between financial and real economy indices.

$$CI_{ij} = 1 - \frac{1}{T}\sum_{1}^{T} PC_{it} \times PC_{jt} + (1 - PC_{it})(1 - PC_{it}) \tag{3.12}$$

Where, PC_i is the composite financial index of the economy and PC_j is the real composite index (unemployment, and Gini coefficient). CI_{ij} indicates the degree of asynchrony between the two composite indices. The higher the index is above 50%, especially higher than 58%, the higher the degree of asynchrony, and the counter-cyclical movement, and the higher the statistical significance with greater confidence level between time series. Values less than 50% are not statistically significant. The rate of asynchrony means that the variables financial sector of the economy such as granting credit were in a state of contraction and at a minimum in periods when unemployment rates and the Gini coefficient were on the rise, and vice versa. It indicates the significant role of credits in stimulating the real sector of the economy and requires a statistical modeling test. As shown in Diagram 8, the degree of coincidence of the two composite indices indicates a counter-cyclical movement except in 1998 and 2008 as the value of CI index is more than 0.61 which is a very significant value for the relationship between financial and real economy indices. In periods such as the 2011s, the more the financial index cycles were negative, the worse the composite index of the real sector of the economy (unemployment and income distribution). co-Co-movement and positive cyclical movements are reported in the 1981s and some years of the 1991s, indicating the lack of significant impact of the financial sector on the real sector of the economy.

The effects of components of financial variables on real sector variables, as well as the composite effects of financial variables are discussed under the name of the financial index and affectability of combined real variables as the real sector index. As shown in Table 1, the rate of lack of co-movement (rate of reverse motion) of the variables related to

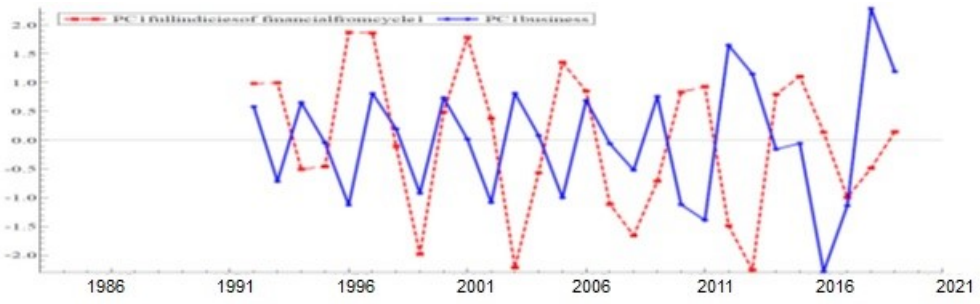

Figure 8: The behavior of indices relating to financial cycles and the real sector of the economy

Table 1: Numerical value of CI_{ij} index

	Real variables cycle	UR	Gini
Financial cycle	0.61	0.71	0.64
Total Credit cycle	0.60	0.55	0.60
Directed Credit (Taklifi) cycle	0.75	0.58	0.5

Source: Software output

the financial cycle, and real variables cycle is equal to 0.61. In other words, in 61% of the periods, these two variables have opposite movements. This value is statistically significant and shows that the real sector of the economy has been often affected by the stimuli of the financial sector of the economy. This value is equal to 0.71 between the financial sector and the unemployment rate (Ur), indicating that the financial index seems as a significant supporter of reducing the unemployment rate in the economy. The values of this table indicate that there is a significant relationship between the total credit and the real variables cycles of the economy, i.e. the composite real sector index, unemployment rate, and Gini coefficient have significant relationships. Furthermore, directed credit has a significant but low relationship with the composite index of the real sector and the unemployment rate, but its value is not only low and only 50% for the Gini coefficient, but also shows that it does not affect the Gini coefficient.

3.6 Validity and robustness check: Markov switching models

Markov switching models (MS-VAR) are used to analyze nonlinear relationships of time series due to their dynamic structures. The dynamics of these models depend on the state (or unobserved) variable of s_t. From a theoretical point of view, it is assumed that the unobserved variable $s_t$in these models, follows the first-order Markov chain process and is defined according to the transition probability between N states as follows

$$P\{s_t = i \,|s_{t-1} = j,\ s_{t-2} = k, \cdots\} = P\{s_t = i \,|s_{t-1} = j\} = p_{ij} \tag{3.13}$$

Therefore, the above-mentioned implication indicates that the probability of moving from state j in a period to state i in the next period depends only on the previous period. The functional form of the Markov switching process can be discussed after determining the statistical bases of the unobserved variable s_t, The functional form of the MS-VAR process is often defined as follows:

$$y_t = \nu(s_t) + A_1(s_t)y_{t-1} + \cdots + A_p(s_t)y_{t-p} + \varepsilon_t \tag{3.14}$$

Where, y_t is the time series vector of the next n. v refers to intercept terms, A_1 to $A_p$are matrices that contain the self-explanatory parameters, and ε_t is the error term vector in a way that $\varepsilon_t \,|s_t \sim NID(0, \Sigma(s_t))$. In the above equation, the intercept term changes along with other parameters as the regime changes. Krolzig [28] introduced several types of switching patterns (including Markov-Switching Mean Model, Markov-Switching intercept term, Markov-Switching Autoregressive Parameters, and Markov-Switching hetroskedasticity). These models use the symbol I to indicate the switching intercept (or dynamic regression), M for the switching mean, A for autoregressive parameters, and H after the two letters of MS for the hetroskedasticity. The more general form of specifying MS-VAR models, in which all model parameters are conditionally changed by regime change, is shown below:

$$y_t = \left\{ \begin{array}{ll} v_1 + A_{11}y_{t-1} + \cdots + A_{p1}y_{t-p} + \sum_1^{1/2} u_t & \text{if} \quad s_t = 1 \\ : & \\ v_M + A_{1M}y_{t-1} + \cdots + A_{pM}y_{t-p} + \sum_M^{1/2} u_t & \text{if} \quad s_t = M \end{array} \right\} \tag{3.15}$$

Depending on whether the intercept term, mean, and hetroskedasticity in the above models are regime-dependent or independent, the MS-VAR models are converted to the above four states or a linear VAR model, as summarized by Krolzig in Table 2.

Table 2: Different states of Markov switching models

		MSM	MSI Specification		
		μ(variable mean)	μ (constant mean)	ν (variable intercept)	ν (constant intercept)
ConstantA_j	Σ (Constant heteroskedasticity)	MSM–VAR	*linear* MVAR	MSI–VAR	*linear* VAR
	Σ (Variable heteroskedasticity)	MSMH–VAR	MSH–MVAR	MSIH–VAR	MSH–VAR
Variable A_j	Σ (Constant heteroskedasticity)	MSMA–VAR	MSA–MVAR	MSIA–VAR	MSA–VAR
	Σ (Variable heteroskedasticity)	MSMAH–VAR	MSAH–MVAR	MSIAH–VAR	MSAH–VAR

Source: Krolzig [29]

3.6.1 Empirical model

We present a model for the unemployment rate, the most important advantage of which is to implicitly test valid theories such as the "Okun's law differential model (a model based on economic growth rather than production gap)" and the "Phillips curve" in a general econometric specification in addition to examining the effects of financial-monetary market indices on the unemployment rate as the relationship between economic growth and the unemployment rate can be explained within the framework of Okun's law, the relationship between the unemployment rate and inflation within the framework of Phillips curve, and the relationship between policy variables and the unemployment rate within the framework of Abrams theory. Accordingly, the specified model for the unemployment rate with the presence of financial and credit variables and other conventional determinants, such as the model of a study by Dromel et al. [14] is as follows:

$$\begin{aligned}\text{unemployment rate} = {} & \beta_0 + \beta_1 \text{umemployment rate}_{t-1} + \beta_2 \text{financial cycle index}_t \\ & + \beta_3 \text{credit cycle}_t + \beta_4 \text{inflation}_t + \beta_5 \text{economic growth}_t + \beta_6 \text{sanctions}_t + \varepsilon_t \end{aligned} \tag{3.16}$$

where,

umemployment rate$_{t-1}$: Unemployment sustainability index

financial cycle index: Financial cycle index except for credit cycles

credit cycles: Cycles of credit

inflation: Inflation rate based on the Phillips curve theory

economic growth: Average economic performance (economic growth based on Okun's law differential model)

sanctions: Dummy variable of sanctions

A more general econometric specification used in works such as Jaumotte et al. (2103) and Dablanoris et al. [12] is presented for the Gini coefficient model.

$$\begin{aligned}\text{Inequality} = {} & \beta_0 + \beta_1 \text{inequality}_{t-1} + \beta_2 \text{financial cycle index}_t + \beta_3 \text{credit cycle}_t \\ & + \beta_4 \text{Macroeconomic instability}_t + \beta_5 \text{economic growth}_t + \beta_6 \text{sanctions}_t + \varepsilon_t \end{aligned} \tag{3.17}$$

In the above model, the variables are defined as follows:

Inequality: Income Inequality Index (Gini coefficient)

Macroeconomic instability: Macroeconomic instability index (Inflation rate)

In addition to the above general model, Carvalho and Guilmi's model (2020), in which the effect of the unemployment rate on the Gini coefficient is also tested, will be also estimated.

All variables of the model are in the forms of growth rates and ratios; hence, their logarithms are not used.

3.6.2 Results of model estimation for unemployment rate and its determinants

Table 3 presents the results of the composite financial index and credit cycles along with other variables on the unemployment rate without switching the explanatory variables in different regimes. These results are consistent with the theoretical bases presented by Bandyopadhyay et al. [5] and Herkenhoff [21].

Based on the model by Dromel et al. [14], a positive and significant coefficient of lagged unemployment rate shows the unemployment stability in the Iranian economy. The significant value of this coefficient indicates structural challenges that create unemployment in the economy. It should be noted that even with the improving effects of employment in terms of financial variables, its size and unemployment endurance are still high.

Table 3: Estimation of Markov Switching Model for the unemployment rate (model: MSH-VAR: constant intercept and switching heteroskedasticity)

Variable and regime	Coefficient	Standard deviation	t-statistic
Intercept term	7.60***	0.35	21.9
Lagged unemployment rate	0.51***	0.032	16.1
Economic growth	-0.028***	0.0023	-12.2
Inflation rate	-0.06***	0.0017	-37.7
Composite index of financial cycles	-0.03***	0.015	-2
Credit cycle index	-0.023***	0.0001	-19.4
Dummy sanctions variable	0.85***	0.053	16
P_{00}	0.88	0.08	
P_{11}	0.78	0.14	
P_{22}	0.57	0.21	
LR test	28.325		

Source: Research calculations and estimates

The association of the unemployment rate with inflation is also consistent with the forecast of the Phillips curve in the short term. As inflation increases in the economy, the unemployment rate decreases. This result is consistent with other studies on the Iranian economy that examined the relationship between unemployment and inflation in a nonlinear model. The nonlinearity of the model makes it possible not to consider a fixed slope for the Phillips curve, and the interaction between the unemployment rate and inflation at any point is affected by changes in other variables such as economic growth. For example, Amiri and Gorji [4] concluded that the relationship between inflation rate and unemployment in the short term was non-linear and inverse. Furthermore, Bastanifar [7] examined the temporal incompatibility of economic policies in Iran within the Phillips curve and indicated that increasing the unemployment rate at certain intervals decreased the inflation rate in the Iranian economy. Abbasinejad and Kazemizadeh [1] obtained an opposite result between the two variables in the short term and rejected their long-term relationship.

Economic growth also has a theoretical effect on the unemployment rate. According to the estimation results, a one unit increase in economic growth significantly decreased the unemployment rate by 0.028 units. The value obtained is similar to the values obtained in other studies. Studies, which merely tested Okun's law in the Iranian economy, have concluded that the economic growth rate must grow by 2% to 5% to reduce the unemployment rate by 1%. Khiabani (2001) obtained a negative and significant coefficient equal to 3%, Akhbari and Amadeh [3] reported 4.81%, and Hosseinzadeh et al. [23] reported 0.032 (3.2%). In addition to theory-based variables, the present manuscript did not overlook the effect of the most important challenge of Iran's economy, that is, the effect of severe economic sanctions on the real sector of the economy, especially in the recent decade. As expected, the dummy variable (sanctions) is quite effective in increasing the unemployment rate in the Iranian economy, and the effect of sanctions on increasing the unemployment rate cannot be ignored. This result is consistent with the results obtained in studies by researchers such as Garshasbi and Yousefi [18], and Nademi and Sedaghat Kalmarzi [30].

The variables' switching in three regimes (based on modeling criteria) and in MSIH-VAR state became possible to study the model in other states of the Markov switching model, examine the effect of explanatory variables at different intervals, and investigate the temporal compatibility of effects. According to Table 4, almost all regimes yielded the same results as Table 3. Variables such as inflation rate, financial index, credit to GDP ratio, dummy

variable of sanctions in different regimes are not changed. However, the lagged unemployment rate and economic growth in regime 2 change sign and inconsistency. Given the same results obtained in two of the three regimes, the results obtained for the whole model can be considered almost unchanged from the previous state.

Table 4: Estimation of the Markov switching model for the unemployment rate (model: MSIH-VAR: switching intercept term and heteroskedasticity)

Variable and regime	Coefficient	Standard deviation	t-statistic
Intercept term (regime 0)	7.88***	0.06	142
Intercept term (regime 1)	15.34***	2.60	5.90
Intercept term (regime 2)	11.64***	1.21	9.58
Lagged unemployment rate (regime 0)	0.49***	0.004	122
Lagged unemployment rate (regime 1)	-0.08	0.22	-0.36
Lagged unemployment rate (regime 2)	0.35***	0.09	3.81
Economic growth (regime 0)	-0.03***	0.0006	-47.1
Economic growth (regime 1)	-0.09***	0.04	-2.10
Economic growth (regime 2)	0.06	0.016	3.90
Inflation (regime 0)	-0.06***	0.0005	-125
Inflation (regime 1)	-0.10***	0.21	-4.87
Inflation (regime 2)	-0.15***	0.03	-4.91
financial cycles (Composite index)	-0.02***	0.004	-4.54
Credit cycles index	-0.025***	0.0004	-63.3
Sanction (Dummy variable)	0.91***	0.01	77.1
P_{00}	0.68	0.15	
P_{11}	0.76	0.12	
P_{22}	0.59	0.22	
LR test	67.614		

Source: Research calculations and estimates

3.6.3 Gini coefficient model

Table 5 presents a similar estimate for the Gini coefficient. Based on the theoretical bases of the determinants of income distribution and inequality, discussed in the second section of the manuscript, factors such as financial globalization, financial deepening, economic openness, economic policies, and economic growth are among the most effective determinants of the income distribution.

According to the estimated results, credit and financial cycles, despite their small coefficients, have been effective in reducing income inequality in the Iranian economy. This result is consistent with studies such as a study by Dabla-Norris et al. [12] on advanced and developing economies.

The results also show that economic growth, as an average of long-term economic performance, is effective and significant in improving the Gini coefficient. Even though the value of the coefficient is estimated to be very small, its sign is theoretical and significant. Consistent with these results, Khalesi and Piraei [25] and Dehghani et al. [13] reported the direct and optimal effect of economic growth on income distribution.

Macroeconomic instability, which is reflected in variables such as inflation, government budget deficit, sharp exchange rate fluctuations, and high government debt, has a negative and significant effect on the behavior of variables in the real sector of the economy. As Stanly Fischer [16] and Bleaney [8] state, “The macroeconomic framework will be stable when 1”. Inflation is low and predictable; 2. Interest rates are real, equilibrium, and reasonable; 3 Financial policy is stable; 4. The exchange rate is real, competitive, and predictable; 5. “The balance of payments is appropriate”.

Another important point in the last column of Table 5 is the inclusion of the unemployment rate coefficient in the model, which is modeled based on existing theoretical bases such as those stated by Penha [33], and Carvalho and Guilmi [10]. According to the research results, the unemployment rate has worsened income inequality in the Iranian economy.

Due to the switching nature of explanatory variables in Table 6, no significant change occurred in the results of Table 6 and no significant regime incompatibility occurred.

Table 5: Estimation of Markov switching model for Gini coefficient (model: MSH-VAR)

Variable and regime	Coefficient	Standard deviation (t-statistic)	The model with the existent of unemployment rate (t-statistic)
Intercept term	0.43***	(122.8)0.0035	(43.6)0.12***
Lagged Gini coefficient	0.078***	(24.1)0.0032	(95)0.072***
Unemployment coefficient	–	–	(6.37)0.01***
Economic growth	-0.000126***	(-5.75) 2.186e-05	(-38.7)-0.0073***
Inflation rate	0.000246***	(8.02)3.065e-05	(-11.8)0.000286***
Composite index of financial cycles	-0.0009***	(-34.8) 2.597e-05	(-9.04)-0.00091***
Credit cycles	-0.00121***	(-28.6) 4.247e-05	(03.85)-0.00103***
Sanctions (Dummy variable)	0.65***	(11.4)0.057	(12.4)0.75***
P_{00}	0.67	0.040	0.61
P_{11}	0.51	0.054	0.63
P_{22}	0.50	0.041	0.55
LR test	39.82		24.43

Source: Research calculations and estimates

Table 6: Estimation of Markov switching model for Gini coefficient (model: MSIH-VAR)

Variable and regime	Coefficient	Standard deviation	t-statistic
Intercept term (regime 0)	0.31***	0.003	103
Intercept term (regime 1)	0.28***	0.0026	107.7
Intercept term (regime 2)	0.31***	0.004	77.5
Lagged Gini coefficient	0.23	0.00193	119.1
Credit cycle (regime 0)	-0.005***	0.004	-104
Credit cycle (regime 1)	-0.34	0.039	-8.54
Credit cycle (regime 2)	-0.04***	0.0007	-57.2
Economic growth (regime 0)	-0.0079***	0.0000197	-405.1
Inflation (regime 0)	0.0028***	0.00002	137
Financial cycles (composite index) (regime 0)	-0.00015***	0.000035	-4.23
Financial cycles (composite index) (regime 1)	-0.011***	0.000027	-407
Financial cycles (composite index) (regime 2)	-0.0025***	0.000042	-59.52
Sanctions (dummy variable)	0.74***	0.01	74
P_{00}	0.77	0.18	
P_{11}	0.67	0.31	
P_{22}	0.58	0.32	
LR test	134.7		

Source: Research calculations and estimates

4 Conclusions and policy recommendations

Based on what was examined in different sections of the study, the most important findings and key points are as follows:

1- In terms of the real sector of Iran's economy, two of the most complex economic issues, namely "unemployment rate" and "income distribution" were used as variables to construct a composite index of the real sector of the economy based on their positive correlation.

2- In terms of theory, the two paths, namely "high share of credit costs" or "high probability of bankruptcy of firms" were the main passage of the effects of decreasing financial and credit cycles on variables such as increasing the cost of capital in total production costs, increasing the interest rate paid to banks through firms, biased income distribution towards capital owners by increasing the cost of capital rent, reducing the output of each firm, and then reducing the total production of the economy, increasing unemployment rate, and finally decreasing income equality, and total welfare in the economy.

3- Another channel of financial and credit impact in the two contexts of the current status in the economy in terms of "stagnation or inflation" and also "permanent or temporary access to financial resources" is created from the

net outcome of the "expansion" and "quantitative" effects of credits. Unemployment and income inequality will decrease if the expansion effect is stronger than the quantitative effect.

4- The "asymmetric effect" of credit cycles on the business cycle of the economy is another important point that is highlighted in theoretical bases and empirical studies as the destructive effect of reducing credits in the recession is more than the effect of its improvement at other stages of the cycle. This implies that policymakers in recessions need to move more than ever to create and inject sufficient credit into economies.

5- Another important point about the extent of credit and its non-linear impact on theoretical bases indicates that most developing countries are in the range of the desired impact of credit on income distribution, and policymakers in these countries can expect the improvement of income distribution by granting loans, but this is not necessarily the same as developed countries.

6- Based on the research findings at the first and second stages of the methodology and according to the trend obtained for pairwise distributions for credit cycles and variables of the real sector of the economy (unemployment rate, and Gini coefficient), it can be concluded that these pairwise indices show a kind of power synergy. In other words, the results indicate a significant relationship between the variables.

7- Based on the time-varying index and composite index, the composite financial index has ended the 1991s by stopping at the declining stage. The index for 2011-2013, and the second half of 2011s, especially after 2017, indicated a sharp decline in the financial cycle of the economy. The composite index for the real sector of the economy has counter-cyclical movement with the financial index for many years which means that the movements of the financial sector have a significant effect on the real sector of the economy.

8- The obtained values in the lack of co-movement of the composite indices and their components indicate that the total composite financial index has a significant effect on the real index of the economy and its components, i.e. unemployment rate and Gini coefficient. This is also true for credit cycles and the real sector of the economy, along with its components. However, directed credits cannot have a strong movement compatible with the variables, especially the Gini coefficient. The political implication of this point is that the approaches of financial and monetary authorities are less likely to be achieved with this tool if aimed at a better distribution of income.

9- In the nonlinear specified model for the unemployment rate, it is found that the whole credit cycles and the financial sector index of the economy have a significant and positive effect and the economic policymaker should make the credits available for enterprises and households in monetary and credit policies.

10- The unemployment-related model indicates that unemployment has structural stability in Iran, and the sufficient credit expansion policies are not enough to eliminate it; hence, they are considered as a necessary condition because the coefficient obtained for the stability of unemployment is very high.

11- The interaction between inflation and unemployment for the Iranian economy is based on what the Phillips short-term curve predicts, and accepting inflation (but with a small coefficient) is inevitable to reduce the unemployment rate. Furthermore, no time incompatibility was observed in the switching of the coefficients in different regimes between the two variables, and the previous interpretation was valid for all times.

12- The coefficient obtained from the economic growth was within the framework of Okun's differential model and similar to the findings of other studies. This finding implies that economic policymakers cannot simply focus on short-term determinants (e.g. credit) and ignore long-term determinants such as economic growth.

13- The role of economic sanctions on the unemployment rate and the Gini coefficient is negligible even in the presence of all the basic determinants, and failure to resolve them will create serious problems for these two variables on income groups.

14- Based on the results estimated for the Gini coefficient model, credit and financial cycles, despite their small coefficients, are effective in reducing income inequality in the Iranian economy.

15- Macroeconomic instability, even with moderating variables such as credit and economic growth, has had an adverse effect on income distribution in the Iranian economy. In other words, the economic policymaker cannot expect the improvement of the Gini coefficient simply by granting credit in an unstable macroeconomic environment.

16- The effect of the unemployment rate on the Gini coefficient in the Iranian economy in the research period was positive and significant and worsened income distribution. More precisely, the political implication is that a structural solution to improve the distribution of income goes through the labor market.

References

[1] H. Abbasinejad and Gh. Kazemizadeh, *Study and determination of Phillips curve, and determination of unemployment rate in the Iranian economy*, Journal of Economic Research **35** (2000), no. 2, 133–160.

[2] B.A. Abrams, *The effect of government size on the unemployment rate*, Public Choice **99** (1999), no. 3-4, 395–401.

[3] R. Akhbari and H. Amadeh, *Analysis of the correlation between the unemployment rate and economic growth with the bounds test approach: Evidence from Iran's economy*, **15** (2015), no. 59, 125–160.

[4] H. Amiri and E. Gorji, *Estimation of Phillips curve using smooth transition regression models*, Quart. Econ. Model. Res. (2011), no. 3, 169–190.

[5] S. Bandyopadhyay, D. Elias and U. Bulent, *Effects of credit supply on unemployment and income inequality*, Federal Reserve Bank of St. Louis Rev. **100** (2018), no. 4, 345–62.

[6] S. Bartoletto, Ch. Bruno, M. Elisabetta and P. Paolo, *Business cycles, credit cycles, and asymmetric effects of credit fluctuations: Evidence from Italy for the period of 1861–2013*, J. Macroecon. **61** (2019), no. 585, 103–130.

[7] I. Bastanifar, *Time incompatibility test in Iranian economy*, J. Econ. Res. **49** (2014), no. 4, 699–727.

[8] M.F. Bleaney, *Macroeconomic stability, investment, and growth in developing countries*, J. Dev. Econ. **48** (1996), no. 2, 461–477.

[9] M. Brei, F. Giovanni and G. Leonardo, *Financial structure and income inequality*, BIS WP/No 756, 2018.

[10] L. Carvalho and C.D. Guilmi, *Technological unemployment and income inequality: A stock-flow consistent agent-based approach*, J. Ev. Econ. **30** (2020), no. 1, 39–73.

[11] S. Claessens, M.A. Kose and M. Terrones, *Financial cycles: What? How? When?*, NBER Int. Seminar Macroecon. Chicago, IL: University of Chicago Press **7** (2011), no. 1, 303–344.

[12] E. Dabla-Norris, K. Kalpana, R. Frantisek, S. Nujin and T. Evridiki, *Causes and consequences of income inequality: A global perspective*, International Monetary Fund, 2015.

[13] A. Dehghani, S.M.H. Hosseini, M. Fattahi and S. Hekmati Farid, *A study on the relationship between economic growth and income distribution in Iran during 1971-2014, An approach to nonlinear smooth transition regression*, Appl. Econ. Stud. Iran **6** (2017), no. 21, 213–236.

[14] N. Dromel, E. Kolakez and E. Lehmann, *Credit constraints and the persistence of unemployment*, Discussion paper series, IZA DP no. 4501, 2009.

[15] M. Einian, F. Najafi Ziarani and A. Mahmoudzadeh, *Credit cycles of Iranian economy*, Monetary Bank. Res. **11** (2018), no. 38, 565–598.

[16] S. Fischer, *The role of macroeconomic factors in growth*, Working Paper no. 4565, NBER, December, 1993.

[17] P.M. Garber, *Famous first bubbles: The fundamentals of early manias*, Cambridge, MA: MIT Press, 2000.

[18] A. Garshasbi and M. Yousefi Dindarlou, *A study on the effects of international sanctions on Iran's macroeconomic variables*, Quarterly of Economic Modeling Research (2016), no. 25, Fall 2016, 130-182.

[19] J. Hamilton, *Time series analysis*, Princeton University Press, Princeton, 1994.

[20] A.C. Harvey and T.M. Trimbur, *General model-based filters for extracting cycles and trends in economic time series*, Rev. Econ. Statist. **85** (2003), no. 2, 244–255.

[21] K. Herkenhoff, *The impact of consumer credit access on unemployment*, NBER Working Paper no. 25187, 2018.

[22] D. Holló, M. Kremer and M. Lo Duca, *CISS- A composite indicator of systemic stress in the financial system*, ECB Working Paper Series 1426, 2012.

[23] J. Hosseinzadeh-Neyestani, K. Hojabr-Kiani, T. Rahmani and M. Mehrara, *Investigating the impact of the economic growth rate on the actual and NAIRU unemployment in Iran's provinces*, Macroecon. Res. Lett. **14** (2020), no. 28, 61–84.

[24] K. Hubrich, A. D'Agostino, M. Cervena, M. Ciccarelli, P. Guarda, M. Haavio, P. Jeanfils, C. Mendicino, E. Ortega, M. T. Valderrama and M. Valentinyin´e Endr´esz, *Financial shocks and the macroeconomy*, ECB Occasional Paper, no. 143, 2013.

[25] G. Khalesi and Kh. Piraei, *The relationship between economic growth and income inequality among provinces of Iran*, Quart. Econ. Res. **16** (2016), no. 2, 155–171.

[26] N. Khiabani, *Policies for reducing labor market non-equilibrium and increasing economic growth in Iran*, Sci. J. Strategy 20 (2001), 78–96.

[27] S.J. Koopman, N. Shephard and J.A. Doornik, *Statistical algorithms for models in state space form: Ssfpack 3.0.*, Timberlake Consultants Ltd, 2008.

[28] H.M. Krolzig, *Markov-switching vector autoregressions: Modelling, statistical inference, and application to business cycle analysis*, 454, Springer-Verlag, Berlin, 2013.

[29] H.M. Krolzig, *Econometric modelling of Markov-switching vector autoregressions using MSVAR for Ox*, Discussion Paper, University of Oxford, 1998.

[30] Y. Nademi and H. Sedaghat-Kalmarzi, *Investigating the effect of oil shocks and economic sanctions on unemployment regimes in Iran using the Markov switching approach*, **7** (2018), no. 26, 131–156.

[31] F. Nili and A. Mahmoudzadeh, *Business and credit cycles*, Monetary and Banking Research Institute, Policy Paper, 93015, 2014.

[32] R.P. Cysne and D. Turchick, *Equilibrium unemployment-inequality correlation*, J. Macroecon. **34** (2012), no. 2, 454–469.

[33] R.P. Cysne, *On the positive correlation between income inequality and unemployment*, Rev. Econ. Statist. **91** (2009), no. 1, 218–226.

[34] Y. Schüler, P. Hiebert and T. Peltonen, *Characterising the financial cycle: A multivariate and time-varying approach*, ECB Working Paper, 2015

[35] A. Seifi-Kashki, S.J. Mohseni-Zanouzi and A. Rezazadeh, *A study on the relationship between credit cycles and business cycles in Iranian economy*, Econ. Growth Dev. Res. **20** (2020), no. 3, 1–32.

[36] F. Soleimani, M. Shahiki Tash, G. Zamaniyan and R. Zamani, *The effect of the financial cycles on the business cycles in Iran based on Bayesian averaging approach*, J. Econ. Stud. Polic. **7** (2020), no. 2, 215–238.

[37] V. Cuciniello and N. di Iasio, *Determinants of the credit cycle: Flow analysis of the extensive margin*, ESRB: Working Paper Series 2021/125, Available at https://dx.doi.org/10.2139/ssrn.3924740.

[38] M. Waez Barzani and B. Ebrahimi, *Theoretical analysis of the impact of unrealistic values on the global financial crisis of 2007-2009*, Research Institute of Hawzah and University, First Edition, Qom, 2015.