The Impact of Family Stability Indicators on Iran's Economy: With Emphasis on Mental Health

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Abstract: This study examines the long-run relationship between gross national income (GNI) per capita and five major demographic, social, and economic factors in Iran over the period 1990–2023. These factors include fertility, divorce, mental health burden, female labor force participation, and inflation. The analysis was conducted using the Dynamic Ordinary Least Squares (DOLS) estimator following unit root and cointegration tests to identify stable long-run relationships among the variables. The findings indicate that fertility (−0.539), divorce (−0.558), mental health burden (−0.746), and inflation (−0.140) are all negatively and significantly associated with GNI per capita, with mental health burden exhibiting the largest long-run elasticity. Female labor force participation also shows a negative association, although only marginally significant, suggesting that structural labor-market constraints may limit its contribution to economic performance. Diagnostic tests confirm the robustness and stability of the estimated model. The findings underscore the need to integrate mental health, family stability, demographic dynamics, and macroeconomic stability into long-term development strategies. Policies aimed at improving access to mental health services, strengthening family support systems, maintaining price stability, and increasing women's productive participation in the labor market may contribute to sustained improvements in per capita income. By integrating demographic, social, and macroeconomic determinants within a unified long-run framework and introducing a composite Mental Health Burden Index, this study contributes to a broader understanding of the factors associated with long-term economic performance in developing economies.

Keywords: per capita income, Mental Health Burden Index, divorce, fertility, Dynamic Ordinary Least Squares (DOLS)

1. Introduction

Economic growth is a multidimensional process shaped not only by capital accumulation, technological change, and productivity, but also by demographic structure, household stability, labor-force composition, population health, and macroeconomic conditions. In developing and emerging economies, these dimensions are particularly intertwined because demographic transitions, labor-market rigidities, social change, and macroeconomic instability often occur simultaneously. Consequently, explaining long-run changes in per capita income requires an analytical framework that extends beyond conventional production-side variables and incorporates social and demographic determinants capable of affecting both the quantity and quality of human capital. Empirical evidence increasingly indicates that fertility behavior, family structure, mental health, women's economic participation, and inflation can each influence economic performance through different but mutually

reinforcing channels. Demographic variables may alter dependency ratios, savings, human-capital investment, and labor supply, whereas social conditions such as family instability and mental ill health can affect productivity, household decision-making, and labor-market attachment. At the same time, macroeconomic instability can erode real income, weaken investment incentives, and amplify household vulnerability [1-3].

The relationship between demographic change and economic performance has long occupied a central position in development economics. Fertility affects economic growth through population age structure, household allocation of resources, female labor supply, savings behavior, and the accumulation of human capital. High fertility may expand the future labor force, but in the short and medium term it can also raise dependency burdens and reduce per-child investment in health and education. Conversely, declining fertility may produce a demographic dividend when the share of the working-age population rises relative to dependents, but extremely low fertility can eventually contribute to population aging, labor shortages, and fiscal pressures. Evidence from South Asian economies confirms that demographic variables exert significant effects on economic growth and that the consequences of population change cannot be understood independently of institutional and socioeconomic conditions [1]. More recent analyses emphasize that fertility has potentially persistent implications for long-term output by influencing the size and composition of future generations, capital deepening, and intergenerational resource allocation [4]. Evidence from Europe similarly suggests that sustained fertility decline can constrain economic growth through population aging and a shrinking working-age base, demonstrating that the growth consequences of fertility vary according to the stage of demographic transition and the surrounding economic structure [5].

These considerations are highly relevant to Iran, which has experienced one of the most pronounced fertility transitions among developing countries during recent decades. A rapid movement from relatively high fertility toward below-replacement levels changes the economic significance of fertility over time. During the earlier stages of the transition, lower fertility may reduce household dependency burdens and facilitate greater investments in education and health. Over longer horizons, however, continued fertility decline can alter labor-force growth, population aging, pension sustainability, household formation, and the demand structure of the economy. Hence, the relationship between fertility and per capita income is not necessarily linear or uniformly positive. Its sign and magnitude depend on whether demographic change improves the balance between dependents and workers, enhances human-capital investment, or instead signals deeper constraints related to economic insecurity, marriage postponement, employment uncertainty, and changing family structures. The growing literature on fertility and growth therefore supports examining fertility as an endogenous component of long-run development rather than merely as a background demographic characteristic [4, 5].

Family stability represents another potentially important but less frequently incorporated determinant of economic performance. Families perform essential economic functions, including resource pooling, consumption smoothing, childrearing, human-capital formation, intergenerational transfers, and informal insurance against economic shocks. When family structures become unstable, these functions may be weakened or redistributed in ways that affect both household welfare and aggregate economic outcomes. Divorce, in particular, can generate direct and indirect economic consequences through the division of household assets, duplication of housing and living costs, reduced economies of scale, changes in parental investments, and disruptions in labor supply. Family instability may also affect children's educational and psychological outcomes, thereby influencing future human capital and productivity. Research examining the relationship between family conditions and economic growth has

shown that changes in marriage, divorce, and household stability may have measurable macroeconomic implications and should be incorporated into broader explanations of long-term growth [2].

The interaction between family stability and labor-market dynamics is especially important when women's employment and reproductive roles are considered simultaneously. Women frequently face competing responsibilities related to paid employment, childcare, household production, and caregiving, particularly in economies where formal care infrastructure and family-friendly employment arrangements remain underdeveloped. Evidence from female-dominated informal labor markets suggests that the relationship between production and reproduction can contribute to family instability when employment conditions are insecure and work–family demands are poorly reconciled [6]. This interaction means that divorce, fertility, and female labor-force participation should not be treated as isolated variables. Instead, they form part of a broader system in which household decisions, gender roles, labor-market opportunities, and family resilience jointly shape economic behavior. From this perspective, increasing family instability may signal social changes that have consequences for household savings, labor allocation, caregiving arrangements, and ultimately aggregate productivity.

Mental health represents another fundamental component of this socioeconomic system. Mental disorders impose substantial economic costs through reduced labor-force participation, absenteeism, presenteeism, unemployment, disability, health-care expenditures, and diminished productivity. Depression and anxiety, in particular, are among the conditions most strongly associated with impaired occupational functioning and reduced quality of life. Evidence from the United States demonstrates that major depressive disorder generates a considerable and increasing economic burden, with costs extending beyond direct medical expenditure to workplace productivity losses and other indirect consequences [7]. Similar evidence from Indonesia indicates that anxiety and depression produce substantial economic costs in emerging-economy settings, highlighting that the economic consequences of mental disorders are not confined to high-income countries [8]. Broader assessments of the economic and social costs of mental ill health likewise emphasize that the aggregate burden includes health-system costs, lost earnings, reduced productivity, unemployment, welfare dependence, and consequences for families and caregivers [9].

The macroeconomic relevance of mental health becomes even clearer when its interaction with labor productivity is considered. Mental disorders can reduce workers' ability to participate consistently and effectively in productive activity and can therefore weaken the translation of labor inputs into economic output. Evidence from African countries indicates that the interaction between mental health disorders and labor productivity significantly influences economic growth, demonstrating that mental health should be viewed as an economic and human-capital variable rather than solely as a clinical or social outcome [10]. The importance of treatment and prevention further reinforces this interpretation. Mental health interventions in low- and middle-income countries can generate labor-market benefits by improving employment, earnings, work participation, and productivity, although effects differ according to intervention type and context [11]. Economic evaluations have also emphasized that preventive investment in mental health can yield substantial returns by reducing later health-care expenditures and productivity losses [12]. From the employer perspective, investment in mental health can similarly produce organizational benefits through reduced absence and improved workplace performance [13].

At the same time, the economic burden associated with mental disorders may be intensified by treatment gaps. Despite the substantial prevalence and economic consequences of depression, global treatment rates remain inadequate, especially in low-resource settings, meaning that a large share of the productivity burden remains preventable yet untreated [14]. Mental health outcomes are also sensitive to environmental, social, and economic

shocks, making them particularly important in economies exposed to recurrent crises. Methodological research on mental health has increasingly emphasized the need to investigate how large-scale contextual exposures and population-level stressors interact with psychological outcomes over time [15]. For economies experiencing inflation, social uncertainty, labor-market constraints, sanctions, public-health shocks, and changing family structures, a composite measure of mental health burden may therefore provide a more meaningful representation of population-level psychological strain than reliance on a single disorder indicator.

Female labor-force participation constitutes another major channel linking household structure, demographic transition, and economic growth. Greater participation of women in productive employment can increase the effective labor supply, expand the pool of skills and talent available to firms, increase household income, improve resource allocation, and strengthen economic resilience. Macroeconomic studies of gender gaps consistently show that excluding women from productive employment generates substantial efficiency losses. Models incorporating entrepreneurship and household production demonstrate that gender gaps in labor-market participation and occupational choice can impose sizeable macroeconomic costs [16]. Similarly, evidence on gender inclusion indicates that closing gender gaps can produce economic gains through channels extending beyond simple increases in labor quantity, including improvements in sectoral allocation, diversification, and productivity [17]. International policy analyses have therefore increasingly framed women's economic empowerment as both an equity objective and a macroeconomic strategy [18].

Nevertheless, the relationship between women's labor-force participation and economic growth is not automatically positive in every institutional context. The economic returns to female participation depend on job quality, productivity, wages, educational matching, occupational segregation, access to formal employment, childcare availability, discriminatory practices, and the extent to which women can transition from unpaid or informal work into higher-productivity activities. Research on female empowerment shows that the relationship between women's economic position and development is complex because empowerment affects household bargaining, fertility decisions, investment in children, and labor allocation through multiple channels [19]. Evidence from European Union member states suggests a close association between female economic participation and the dynamics of GDP per capita, while also demonstrating substantial heterogeneity across countries [20]. More recent evidence from Central Asia indicates that higher female labor-force participation can support economic growth, particularly when institutional conditions allow women's employment to translate into productive economic activity [21]. Policy-oriented evidence similarly stresses that increasing female labor-force participation requires coordinated measures addressing childcare, mobility, legal constraints, workplace practices, and social norms [22].

From a broader productive-capacity perspective, labor-force participation matters because economic output depends not merely on the size of the population but on the proportion of individuals effectively engaged in productive activities and the conditions under which they work. Evidence from African economies shows that labor-force participation interacts with industrialization and trade openness in shaping productive capacity [23]. Accordingly, a low or stagnant female participation rate may constrain potential output even when women possess increasing levels of education and human capital. In such settings, the expected positive relationship between female labor-force participation and per capita income can be weakened or even reversed if women are concentrated in insecure, low-productivity, or informal activities. This possibility is especially relevant when family responsibilities and insufficient institutional support affect women's labor-market continuity [6, 22].

Inflation constitutes the principal macroeconomic variable considered alongside these demographic and social determinants. Persistent inflation can adversely affect economic growth by increasing uncertainty, distorting

relative prices, discouraging long-term investment, reducing real purchasing power, and weakening the informational function of prices. It may also interact with household instability and mental health by increasing financial stress and reducing families' capacity to smooth consumption. Evidence from Central and Eastern European countries demonstrates that both inflation and inflation uncertainty can influence output growth, with the effects depending on the magnitude and persistence of price instability [24]. More recent evidence from emerging-market economies also confirms that the inflation–growth nexus remains economically significant and can be nonlinear, with higher inflation generally becoming more damaging when it exceeds levels compatible with macroeconomic stability [3]. In Iran, where inflation has remained elevated and volatile for substantial periods, examining its long-run association with per capita income is therefore essential for distinguishing macroeconomic effects from demographic and social influences.

The empirical evaluation of these relationships requires an econometric framework capable of identifying long-run equilibrium associations while addressing the statistical properties of nonstationary time-series data. When economic and social variables are integrated but cointegrated, conventional ordinary least squares estimation can produce misleading inference unless endogeneity and serial correlation are appropriately addressed. Dynamic Ordinary Least Squares offers a suitable solution because it augments the cointegrating regression with leads and lags of first-differenced regressors, producing consistent long-run estimates even in the presence of endogenous explanatory variables. Recent empirical applications have demonstrated the usefulness of DOLS for investigating relationships among growth, inflation, unemployment, migration, and human-capital variables [25, 26]. Nevertheless, because demographic and social variables may themselves respond to economic conditions, testing for endogeneity remains essential; the Durbin–Wu–Hausman framework provides an established approach for evaluating whether explanatory variables can appropriately be treated as exogenous within a given specification [27].

Despite the growing literature on individual determinants of economic performance, an important gap remains in the integrated analysis of family stability, mental health, demographic change, women's labor participation, and macroeconomic instability within a single long-run framework. Existing studies have commonly examined fertility and economic growth separately [4, 5], emphasized gender inclusion and female labor-force participation [16, 17, 21], investigated family instability [2], or estimated the economic burden of specific mental disorders [7, 8]. Yet these dimensions may be mutually reinforcing. Economic instability can affect family formation, divorce, fertility, labor participation, and psychological well-being, while changes in these social and demographic factors can in turn influence productivity and long-term income. An integrated model is therefore needed to capture these relationships while avoiding an overly narrow interpretation of economic growth as a purely macroeconomic phenomenon.

The Iranian context provides a particularly informative setting for such an analysis because the country has simultaneously experienced substantial demographic transition, changing patterns of family formation and dissolution, persistently low female labor-force participation, recurrent inflationary pressures, and significant population-level mental health challenges. These processes suggest that long-run per capita income may depend on a combination of demographic, familial, psychological, labor-market, and macroeconomic conditions rather than on any single factor. By incorporating fertility, divorce, a composite Mental Health Burden Index, female labor-force participation, and inflation into a unified cointegration framework, the present study extends prior research in several ways. It treats mental health as a measurable component of productive capacity, recognizes family stability as a potential macroeconomic determinant, links gendered labor-market participation to household and

demographic dynamics, and applies a long-run econometric methodology suitable for nonstationary annual time-series data. This integrated perspective is also consistent with the broader literature emphasizing the economic returns to stronger mental health systems, inclusive labor markets, effective human-capital utilization, and socially sustainable development [11, 12, 18].

Accordingly, the aim of this study is to examine the long-run effects of fertility, divorce, mental health burden, female labor-force participation, and inflation on GNI per capita in Iran over the period 1990–2023 using the Dynamic Ordinary Least Squares (DOLS) approach.

2. Methods and Materials

This study employs the Dynamic Ordinary Least Squares (DOLS) approach developed by Stock and Watson (1993) to estimate the long-run relationships between GNI per capita and the selected explanatory variables. DOLS is a parametric approach for estimating cointegrating regressions that accounts for the potential endogeneity of explanatory variables and serial correlation in the error terms. Unlike the conventional OLS estimator, which suffers from second-order bias in the presence of cointegration, DOLS corrects these issues by incorporating leads and lags of the first differences of the explanatory variables, thereby providing asymptotically efficient and unbiased estimates of the long-run coefficients (Kao & Chiang, 2000; Onyishi et al., 2015).

The long-run cointegrating equation for the Iranian economy is specified as follows:

$$LGNI_t = \beta_0 + \beta_1 LFER_t + \beta_2 LDIV_t + \beta_3 LHI_t + \beta_4 LLPF_t + \beta_5 LINF_t + \beta_6 t + \varepsilon_t \qquad (1)$$

where $LGNI_t$is the natural logarithm of GNI per capita at time t; $LFER_t$, $LDIV_t$, LHI_t, $LLPF_t$, and $LINF_t$are the natural logarithms of the fertility rate, divorce rate, Mental Health Burden Index, female labor force participation rate, and inflation rate, respectively; $t$denotes the time trend; $\beta_0$is the intercept; $\beta_1$through $\beta_6$are the long-run elasticities to be estimated; and $\varepsilon_t$is the error term.

The DOLS specification extends the static cointegrating regression by incorporating $p$leads and $q$lags of the first differences of the explanatory variables:

$$\begin{aligned} LGNI_t = {} & \beta_0 + \beta_1 LFER_t + \beta_2 LDIV_t + \beta_3 LHI_t + \beta_4 LLPF_t + \beta_5 LINF_t + \beta_6 t \\ & + \sum_{j=-p}^{q} \theta_{1j}\, \Delta LFER_{t-j} + \sum_{j=-p}^{q} \theta_{2j}\, \Delta LDIV_{t-j} + \sum_{j=-p}^{q} \theta_{3j}\, \Delta LHI_{t-j} \\ & + \sum_{j=-p}^{q} \theta_{4j}\, \Delta LLPF_{t-j} + \sum_{j=-p}^{q} \theta_{5j}\, \Delta LINF_{t-j} + \varepsilon_t \end{aligned} \qquad (2)$$

The inclusion of leads and lags of the differenced explanatory variables serves two purposes: (1) it corrects for potential endogeneity by orthogonalizing the error term with respect to the explanatory variables, and (2) it eliminates long-run correlation between the error term and the explanatory variables, thereby ensuring that the resulting estimates are asymptotically normally distributed and efficient (Stock & Watson, 1993).

The empirical analysis was conducted in four distinct stages, following the established literature on cointegration and long-run modeling (Engle & Granger, 1987; Johansen, 1988; Stock & Watson, 1993; Ich et al., 2025).

Stage 1: Unit Root Testing

Before estimating the cointegrating relationship, the order of integration of each variable must be determined. The Augmented Dickey–Fuller (ADF) test (Dickey & Fuller, 1979) was employed to examine the stationarity properties of the series. The ADF test equation is specified as follows:

$$\Delta y_t = \alpha + \gamma y_{t-1} + \sum_{i=1}^{k} \delta_i \Delta y_{t-i} + \varepsilon_t \qquad (3)$$

where $y_t$is the variable under investigation at time t, $\Delta$is the first-difference operator, $\alpha$is the constant term, $\gamma$is the unit-root coefficient, $k$is the optimal number of lags determined according to the Akaike or Schwarz–Bayesian information criterion, and $\varepsilon_t$is a white-noise disturbance term. The null hypothesis, $H_0: \gamma = 0$(presence of a unit root), was tested against the alternative hypothesis, $H_1: \gamma < 0$(stationarity). If the null hypothesis could not be rejected, the variable was considered nonstationary, and the test was repeated using first-differenced data.

Stage 2: Cointegration Testing

After confirming that all variables are integrated of order one, $I(1)$, the existence of long-run relationships was examined using the Johansen–Juselius cointegration test (Johansen, 1988; Johansen & Juselius, 1990). This approach is based on the maximum-likelihood estimation of a Vector Error Correction Model (VECM) and provides two test statistics: the trace statistic and the maximum eigenvalue statistic. The trace statistic tests the null hypothesis that there are at most $r$cointegrating vectors against the alternative hypothesis that there are more than $r$vectors, whereas the maximum eigenvalue statistic tests the null hypothesis of exactly $r$cointegrating vectors against the alternative of $r + 1$vectors. The optimal lag length for the underlying Vector Autoregressive (VAR) model was determined using the Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC).

Stage 3: Long-Run Estimation Using DOLS

Following confirmation of cointegration, the DOLS estimator was applied to the specified model. The selection of leads and lags was guided by the AIC, with the maximum lead/lag length restricted to two because of the relatively small sample size (Cheung & Lai, 1993). The DOLS estimator provides consistent estimates of long-run parameters that are asymptotically normally distributed and robust to the presence of endogenous explanatory variables (Stock & Watson, 1993).

Stage 4: Diagnostic Tests

To ensure the reliability and validity of the empirical findings, a series of diagnostic tests was conducted.

1. **Normality test:** The Jarque–Bera test was applied to the residuals to assess the normality of their distribution. The test statistic is specified as follows:

$$JB = \frac{n}{6}\left(S^2 + \frac{(K-3)^2}{4}\right) \qquad (4)$$

where $n$is the number of observations, Sdenotes residual skewness, and Kdenotes residual kurtosis. Under the null hypothesis of normality, the JBstatistic is asymptotically distributed as chi-square with 2 degrees of freedom.

2. **Serial correlation:** To ensure the robustness of the standard errors, heteroskedasticity- and autocorrelation-consistent (HAC) standard errors were calculated using the Newey–West (1987) procedure. This correction accounts for potential serial correlation and heteroskedasticity and thereby ensures valid statistical inference.
3. **Structural stability:** The CUSUM and CUSUMSQ tests were employed to assess the stability of the estimated coefficients. These tests examine whether the cumulative sums of recursive residuals remain

within the 5% critical bounds and thereby assess the stability of the long-run parameters over the sample period (Brown et al., 1975).

4. **Endogeneity test:** To examine the potential endogeneity of the explanatory variables, a manual Durbin–Wu–Hausman procedure was conducted in accordance with the procedure described in the literature (Patrick, 2021). The test was applied separately to each of the four potentially endogenous explanatory variables: fertility, inflation, divorce, and the Mental Health Burden Index. For each candidate variable, a reduced-form regression was estimated and its residuals were retained. These residuals were then included as an additional explanatory variable in the original DOLS equation. A Wald test was conducted to test the null hypothesis that the coefficient of the residual term was equal to zero. When the p-value exceeded .05, the null hypothesis of exogeneity was accepted.

This study uses annual time-series data covering the period 1990–2023, yielding a total of 34 observations. Table 1 summarizes the variables, their definitions, measurement units, and data sources. The data were obtained from reputable international databases: the World Bank's World Development Indicators (WDI) for GNI per capita (constant 2021 international dollars, based on purchasing power parity), fertility rate (births per woman), female labor force participation rate (percentage of the female population aged 15 years and older), and inflation rate (annual percentage change in the Consumer Price Index); the Institute for Health Metrics and Evaluation (IHME) Global Burden of Disease (GBD) database for mental health indicators, including the prevalence of depression, anxiety disorders, and suicide rates; and the Statistical Center of Iran for the divorce rate (divorces per 1,000 population). All variables were transformed into natural logarithms to facilitate interpretation of the estimated coefficients as long-run elasticities.

The Mental Health Burden Index (MHBI) was constructed using the Min–Max normalization method. First, each of the three raw indicators—suicide rate (per 100,000 population), prevalence of anxiety disorders (per 100,000 population), and prevalence of depression (per 100,000 population)—was normalized to a scale ranging from 0 to 1 using the following formula:

$$X_{\text{norm}} = \frac{X - X_{\min}}{X_{\max} - X_{\min}} \qquad (5)$$

where $X$is the raw value of each indicator, and $X_{\min}$and $X_{\max}$represent the minimum and maximum values of that indicator over the sample period, respectively. The MHBI was then calculated as the arithmetic mean of the three normalized indicators:

$$\text{MHBI} = \frac{1}{3}(\text{Suicide}_{\text{norm}} + \text{Anxiety}_{\text{norm}} + \text{Depression}_{\text{norm}}) \qquad (6)$$

Equal weights were assigned to each component, consistent with the standard approach in the literature for constructing composite mental health burden indices. Higher index values indicate a greater burden of mental disorders.

Table 1. Variable Definitions and Data Sources

Symbol	Variable	Unit	Data Source
GNI	Gross national income per capita	International dollars (PPP)	World Development Indicators (WDI), World Bank
FER	Fertility rate	Births per woman	World Development Indicators (WDI), World Bank
DIV	Divorce rate	Divorces per 1,000 population	Statistical Center of Iran

MHBI	Mental Health Burden Index	Index (0–1 scale)	Global Burden of Disease (GBD) database, Institute for Health Metrics and Evaluation (IHME)
LPF	Female labor force participation rate	Percentage of female population aged 15 years and older	World Development Indicators (WDI) / International Labour Organization (ILO)
INF	Inflation rate	Annual percentage change (Consumer Price Index)	World Development Indicators (WDI), World Bank

3. Findings and Results

This section systematically presents the empirical findings of the study. The analysis begins with descriptive statistics to provide an overview of the key characteristics of the variables under investigation. The results of the Augmented Dickey–Fuller (ADF) unit root test are then reported to examine the stationarity properties of the series, followed by the Jarque–Bera normality test to assess the distribution of the residuals. The optimal lag length for the Vector Autoregressive (VAR) model is subsequently determined, after which the Johansen–Juselius cointegration test is conducted to identify the existence and number of long-run cointegrating relationships among the variables. Finally, the Dynamic Ordinary Least Squares (DOLS) model is estimated to derive the long-run elasticities. Diagnostic tests, including structural stability tests (CUSUM and CUSUMSQ) and an endogeneity test (Hausman), are also reported to validate the robustness and reliability of the estimated model.

The descriptive statistics for the study variables over the period 1990–2023 are presented in Table 2. During this period, average GNI per capita in Iran was 14,791 international dollars, with a coefficient of variation (CV) of 20.66%, indicating relatively moderate fluctuations over the past three decades. The lowest recorded GNI per capita occurred in 1990 (9,418 international dollars), whereas the highest value was observed in 2011 (20,701 international dollars), reflecting the growth surge of the 2000s followed by a substantial decline after the intensification of international sanctions. Among the demographic variables, the fertility rate (FER) averaged 2.09 children per woman, with a coefficient of variation of 28.54%, and exhibited a clear downward trajectory, declining from 3.57 in the early part of the period to 1.45 in 2023. This trend indicates Iran's rapid demographic transition toward below-replacement fertility levels. In contrast, the divorce rate (DIV) displayed a sharply increasing trend, with an average of 12.93 divorces per 1,000 population and a high coefficient of variation of 47.68%, rising from 4.76 in 1994 to 22.78 in 2022. This high degree of variability, second only to inflation, reflects substantial institutional and cultural transformations affecting the structure of the Iranian family. The Mental Health Burden Index (MHBI), constructed using the prevalence rates of depression, anxiety disorders, and suicide from the GBD Results database, averaged 0.46, with a coefficient of variation of 25.26%, and fluctuated between 0.24 and 0.88 over the study period. The index showed particularly sharp increases in 2022 and 2023, reaching 0.73 and 0.88, respectively, potentially reflecting the psychological consequences of the COVID-19 pandemic and subsequent social unrest for the Iranian population.

Among the institutional and economic variables, inflation (INF) exhibited the highest volatility, with an average of 22.14% and a coefficient of variation of 52.52%. Inflation ranged from a minimum of 7.25% in 2016 to a maximum of 49.66% in 1995 and again exceeded 40% during the final years of the study period (2022–2023). This pattern reflects persistent instability in monetary and exchange-rate policies, together with recurrent supply-side shocks affecting the Iranian economy. The female labor force participation rate (LPF), with an average of 13.96% and the lowest coefficient of variation among all variables (18.75%), demonstrated relative stability over the study period. The rate increased from approximately 9.7% in the early 1990s to a peak of 18.7% in 2005 and subsequently declined gradually, with fluctuations, to approximately 13.6% in recent years. The considerable variation in the coefficients of variation across variables—from 18.75% for LPF to 52.52% for INF—suggests that Iran's long-run economic

dynamics have been shaped by shocks of differing magnitudes. This heterogeneity highlights the importance of employing a cointegration approach such as DOLS to uncover underlying long-run relationships among these variables.

Table 2. Descriptive Statistics of the Study Variables, Iran, 1990–2023

Variable	Mean	Maximum	Minimum	Standard Deviation	Coefficient of Variation (%)
GNI	14,791.32	20,701.09	9,418.46	3,056.41	20.66
FER	2.09	3.57	1.45	0.60	28.54
DIV	12.93	22.78	4.76	6.16	47.68
MHBI	0.46	0.88	0.24	0.12	25.26
LPF	13.96	18.68	9.67	2.62	18.75
INF	22.14	49.66	7.25	11.63	52.52

Before model estimation and cointegration analysis, the stationarity of the variables must be examined. The results of the Augmented Dickey–Fuller (ADF) unit root test for the logarithmic transformations of GNI per capita (LGNI), fertility rate (LFER), divorce rate (LDIV), Mental Health Burden Index (LMHBI), female labor force participation (LLPF), and inflation rate (LINF) are reported in Table 3. The findings indicate that, for all variables at level, the null hypothesis of a unit root (nonstationarity) cannot be rejected because the p-values associated with the ADF statistics exceed .05. For example, the ADF statistic for LGNI is −1.353 with a p-value of .855, whereas that for LDIV is −0.131 with a p-value of .963, confirming nonstationarity at level in both cases. In contrast, after first differencing, all variables become stationary at the 95% confidence level. For example, the ADF statistic for the first difference of LGNI is −5.514 with a p-value of .000, that for LFER is −3.918 with a p-value of .027, and that for LINF is −5.141 with a p-value of .001. Except for LFER, which is significant at the 5% level, the remaining variables are statistically significant at the 1% level, leading to rejection of the null hypothesis. Consequently, all six variables in the model can be concluded to be integrated of order one, or more precisely, $I(1)$. This finding satisfies a necessary condition for the existence of a cointegrating relationship among the variables and for estimating the DOLS model, because cointegration methods require variables to be nonstationary in levels but stationary in first differences.

Table 3. Results of the ADF Unit Root Test

Variable	ADF Statistic at Level	p-value	ADF Statistic at First Difference	p-value	Result
LGNI	−1.353	.855	−5.514	.000	$I(1)$
LFER	−1.887	.333	−3.918	.027	$I(1)$
LDIV	−0.131	.963	−6.295	.000	$I(1)$
LMHBI	−2.927	.167	−7.381	.000	$I(1)$
LLPF	−1.085	.916	−4.320	.008	$I(1)$
LINF	−2.986	.151	−5.141	.001	$I(1)$

Before conducting the Johansen cointegration test, the optimal lag length for the Vector Autoregressive model was determined using information criteria. According to the EViews output, the AIC, Final Prediction Error (FPE), Hannan–Quinn (HQ) criterion, and likelihood ratio (LR) test all identified lag 2 as optimal, whereas the more conservative Schwarz criterion (SC) selected lag 1. Given that the majority of criteria (four out of five) indicated lag 2, together with the widespread use of the AIC in small-sample econometric applications, a lag length of 2 was selected for estimating the cointegration system. This choice is consistent with the annual structure of the data and the sample size of 34 observations.

Following lag selection, the Johansen–Juselius cointegration test was conducted under the assumption of an intercept in the cointegrating equation and in the short-run dynamics (Case 3) for the logarithmic variables LGNI, LFER, LDIV, LHI, LLPF, and LINF over the period 1990–2023. The results are presented in Table 4.

Table 4. Results of the Johansen–Juselius Cointegration Test

Null Hypothesis (H_0)	Eigenvalue	Trace Statistic	5% Critical Value	*p*-value	Maximum Eigenvalue Statistic	5% Critical Value	*p*-value
$r = 0$*	0.943	196.09	95.75	.0000	88.81	40.08	.0000
$r \leq 1$*	0.714	107.28	69.82	.0000	38.76	33.88	.0120
$r \leq 2$*	0.667	68.51	47.86	.0002	34.10	27.58	.0063
$r \leq 3$	0.486	34.41	29.80	.0137	20.62	21.13	.0588
$r \leq 4$	0.357	13.80	15.49	.0887	13.71	14.26	.0611
$r \leq 5$	0.003	0.09	3.84	.7643	0.09	3.84	.7643

The results in Table 4 indicate that, according to the maximum eigenvalue statistic, the null hypothesis of no cointegrating vector ($r = 0$) is strongly rejected ($p = .0000$). The null hypotheses of at most one ($r \leq 1$) and at most two ($r \leq 2$) cointegrating vectors are also rejected, with p-values of .0120 and .0063, respectively. However, the null hypothesis of at most three cointegrating vectors ($r \leq 3$) cannot be rejected at the 5% level, with a p-value of .0588. Although the trace statistic indicates the presence of four cointegrating vectors, considering that the maximum eigenvalue test is regarded as more reliable in small samples and that the p-values for $r = 3$and $r = 4$are .0588 and .0611, respectively, it can be concluded that the system contains three cointegrating vectors at the 95% confidence level. This finding confirms the existence of stable long-run relationships among the model variables and provides the necessary prerequisite for estimating the long-run coefficients using the DOLS approach.

The results of the Dynamic Ordinary Least Squares (DOLS) estimation for the Iranian economy over the period 1990–2023 are reported in Table 5. To examine the long-run relationships between GNI per capita and the explanatory variables, a DOLS cointegration specification with one lead and two lags (lead = 1, lag = 2) was employed. This method was selected because of its ability to correct for serial correlation and potential endogeneity in cointegrated models, thereby substantially enhancing the reliability of the estimates. All independent variables—including the fertility rate (FER), divorce rate (DIV), Mental Health Burden Index (MHBI), female labor force participation (LPF), and inflation rate (INF)—were entered into the model in natural-logarithmic form, as was the dependent variable, GNI per capita. This log-log specification allows the estimated coefficients to be interpreted as long-run elasticities.

According to the results reported in Table 5, the elasticity of GNI per capita with respect to the fertility rate is estimated at −0.539 and is statistically significant at the 1% level. The elasticity of GNI per capita with respect to the divorce rate is estimated at −0.558 and is statistically significant at the 1% level. The elasticity of GNI per capita with respect to the Mental Health Burden Index is estimated at −0.746, representing the largest negative elasticity among all variables, and is statistically significant at the 1% level. The elasticity of GNI per capita with respect to the inflation rate is estimated at −0.140 and is statistically significant at the 1% level. The positive and statistically significant time-trend coefficient (0.037) at the 1% level indicates that, after controlling for other factors, GNI per capita exhibited an upward trend over the past three decades. In contrast, female labor force participation (LPF) has an estimated coefficient of −0.096 with a p-value of .1018, indicating significance only at the 10% level rather than at the conventional 5% level. Therefore, H4 is not supported at the conventional significance level.

Regarding the diagnostic statistics, the high adjusted coefficient of determination (Adjusted $R^2 = .922$) indicates that the model explains approximately 92.2% of the variation in GNI per capita, demonstrating substantial explanatory power. The small standard error of regression (0.052) and low residual sum of squares (0.008) further confirm the good fit of the DOLS model. In addition, the estimation specification using one lead and two lags (lead = 1, lag = 2) appears appropriate for correcting serial correlation and potential endogeneity over the 30-observation estimation period. The Johansen cointegration test confirmed the existence of stable long-run relationships among the variables and therefore provides support for H6.

Table 5. Dynamic Ordinary Least Squares (DOLS) Estimation Results for the Iranian Economy

Variable	Coefficient	Standard Error	*t* Statistic	*p*-value
LFER	−0.539***	0.111	−4.856	.0167
LDIV	−0.558***	0.097	−5.756	.0104
LMHBI	−0.746***	0.119	−6.296	.0081
LLPF	−0.096*	0.041	−2.333	.1018
LINF	−0.140***	0.024	−5.714	.0106
C	2.196***	0.238	8.890	.0030
Trend	0.037***	0.007	5.644	.0110

Diagnostic Statistics

Statistic	Value
Adjusted $\boldsymbol{R^2}$	0.922
S.E. of regression	0.052
Sum of squared residuals	0.008
Number of observations	30

Table 6. Summary of Hypothesis Testing

Hypothesis	Hypothesis Statement	Result
H1	Fertility has a significant negative relationship with per capita income.	✓ Supported
H2	Divorce has a significant negative relationship with per capita income.	✓ Supported
H3	Mental health burden has a significant negative relationship with per capita income.	✓ Supported
H4	Female labor force participation has a significant positive relationship with per capita income.	✗ Not supported
H5	Inflation has a significant negative relationship with per capita income.	✓ Supported
H6	A stable long-run cointegrating relationship exists among the variables.	✓ Supported

The Jarque–Bera test was used to examine whether the residuals were normally distributed, and the results are presented in Figure 1. The test statistic was 2.097, with a *p*-value of .350. Because the *p*-value is greater than .05, the null hypothesis that the residuals are normally distributed cannot be rejected. This indicates that the error terms follow an approximately normal distribution, thereby supporting the validity of hypothesis tests based on the normality assumption.

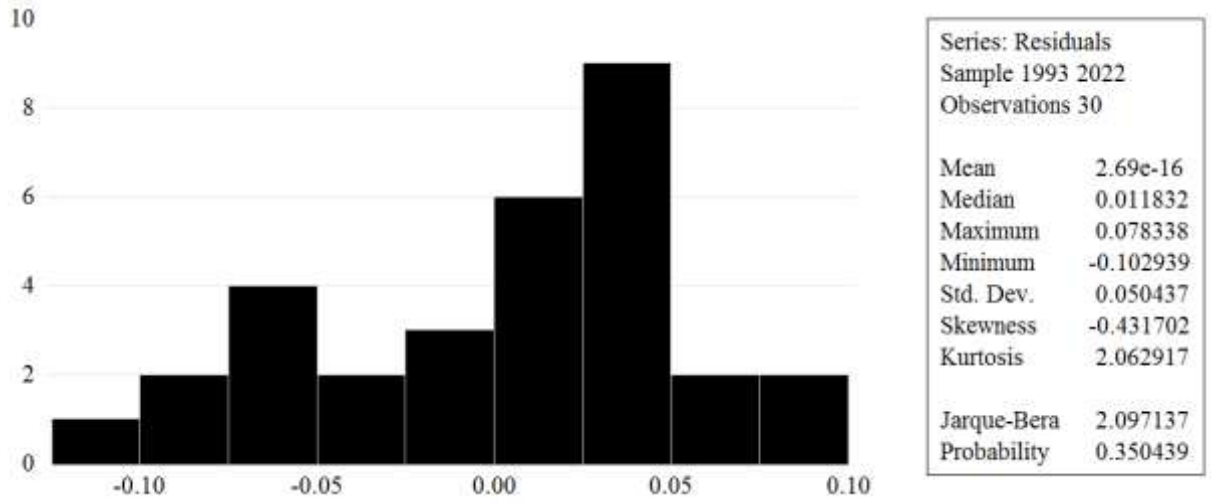


Figure 1. Jarque–Bera Normality Test for the Residuals

In addition, heteroskedasticity- and autocorrelation-consistent (HAC) standard errors based on the Newey–West procedure were applied during the estimation stage to ensure the robustness of the results. This approach, which is standard in the cointegration literature, protects statistical inference against potential serial correlation and heteroskedasticity.

The results of the structural stability tests are presented in Figure 2. The CUSUM plot indicates that the cumulative sum of recursive residuals remains within the 5% critical bounds throughout the entire sample period from 1990 to 2023. The CUSUMSQ plot also remains well within the confidence bounds after controlling for the effect of 2009 through an impulse dummy variable. Consequently, the null hypothesis of stability in the long-run coefficients cannot be rejected, confirming that the DOLS model exhibits structural stability.

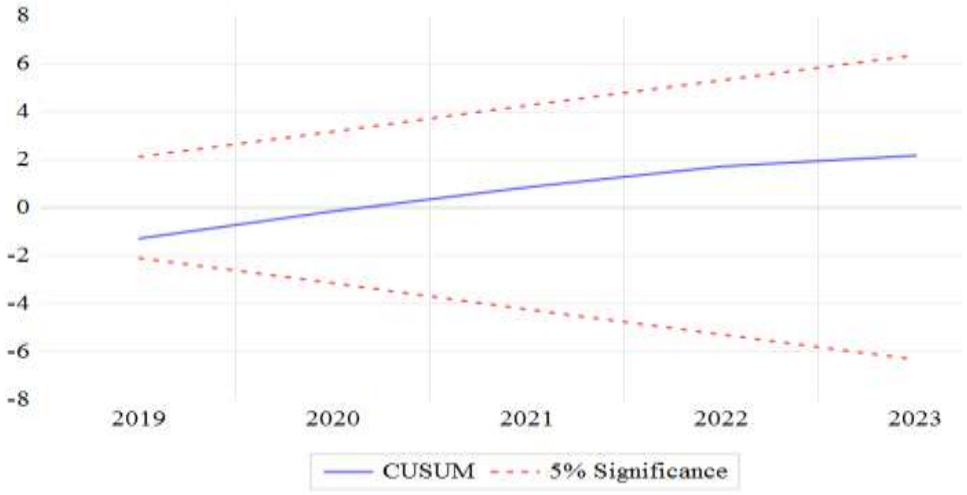




Figure 2. CUSUM and CUSUMSQ Plots

Following the manual Durbin–Wu–Hausman procedure, Wald tests conducted on the residuals for each of the four potentially endogenous explanatory variables—fertility, inflation, divorce, and the Mental Health Burden Index—produced *p*-values greater than .10, confirming that the null hypothesis of exogeneity could not be rejected for these variables.

The results of the Granger causality tests indicate that fertility, divorce, mental health burden, female labor force participation, and inflation each Granger-cause per capita income at either the 1% or 5% significance level (Figure 3). These findings indicate that past values of these variables contain useful information for predicting future movements in per capita income within the Granger-causality framework. In addition, significant causal relationships are observed among the explanatory variables themselves. Fertility emerges as a key driver, Granger-causing divorce, mental health burden, and inflation. Divorce and mental health burden exhibit bidirectional Granger causality, whereas female labor force participation Granger-causes mental health burden and inflation. Importantly, no evidence of reverse Granger causality from per capita income to the explanatory variables was found, indicating a unidirectional predictive relationship from the explanatory variables to per capita income. These findings complement the long-run cointegration estimates by providing evidence regarding the temporal direction of predictive relationships among the variables, whereas the DOLS estimates identify the magnitude and direction of the long-run associations.

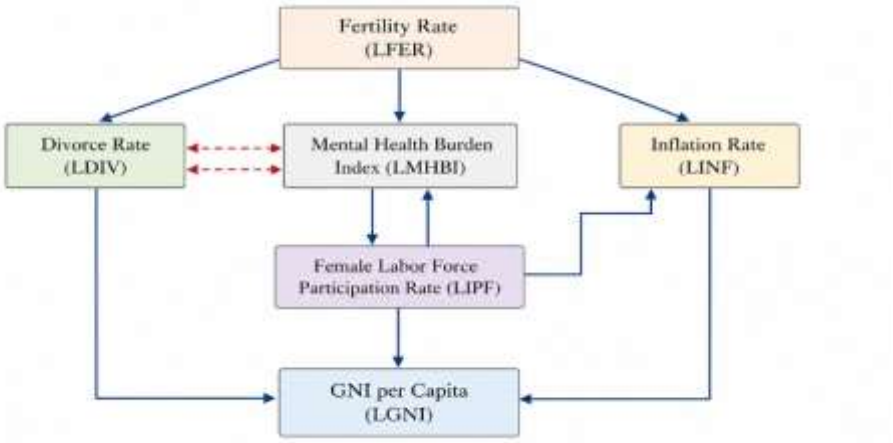


Figure 3. Significant Granger-Causal Relationships Among the Model Variables

4. Discussion and Conclusion

The present study examined the long-run relationships between per capita gross national income (GNI) and fertility, divorce, mental health burden, female labor force participation, and inflation in Iran over the period 1990–2023. The findings provided evidence of stable long-run cointegrating relationships among the variables and showed that fertility, divorce, mental health burden, and inflation were negatively and significantly associated with per capita income. Among these factors, the Mental Health Burden Index exhibited the largest negative elasticity, followed by divorce and fertility. Female labor force participation also showed a negative coefficient, although its statistical significance was limited to the 10% level and therefore did not support the hypothesized positive relationship at the conventional 5% level. In addition, the significant positive time trend suggested that, after controlling for the included demographic, social, and macroeconomic factors, per capita income retained an underlying upward trajectory across the study period. The Johansen–Juselius results confirmed the existence of multiple long-run cointegrating vectors, while the diagnostic tests supported the stability and adequacy of the DOLS specification. The Granger causality results further indicated that the explanatory variables contained predictive information for future movements in per capita income, with no evidence of reverse Granger causality from per capita income to these variables.

The negative long-run relationship between fertility and per capita income is consistent with the broader demographic-growth literature emphasizing the economic implications of fertility dynamics. In the estimated model, a 1% increase in the fertility rate was associated with an approximately 0.539% decrease in per capita GNI in the long run. One explanation is that higher fertility can increase the proportion of dependents relative to economically active household members, raise the resources required for childcare and household consumption, and reduce the amount available for savings, productive investment, and human-capital formation. At the aggregate level, these mechanisms can slow capital deepening and reduce output per person, particularly when employment creation and productivity growth do not keep pace with population growth. Evidence from South Asian economies similarly indicates that demographic variables, including fertility-related factors, are important determinants of economic growth and operate through changes in population structure, labor supply, and resource allocation [1]. The present result is also compatible with research emphasizing that fertility can have persistent long-run effects on economic growth through population dynamics, human-capital investment, and the future composition of the labor force [4].

The Iranian context may make this relationship particularly complex because the country has experienced a rapid demographic transition. A decline in fertility can initially increase per capita resources and potentially create a demographic dividend when the working-age population expands relative to dependents. However, the long-term consequences of fertility decline depend on the interaction between demographic change and employment, social protection, productivity, and aging. Evidence from European economies suggests that persistently low fertility may eventually reduce labor-force growth and weaken long-term economic expansion through population aging and a shrinking working-age base [5]. Therefore, the negative fertility coefficient identified in the present study should not be interpreted as implying that continued fertility decline will indefinitely improve economic performance. Rather, it indicates that, over the historical period analyzed, higher fertility was associated with lower per capita income after controlling for other factors. The relationship must therefore be interpreted within the particular stage of Iran's demographic transition and the institutional conditions governing employment, human-capital accumulation, and intergenerational support.

Divorce was also found to have a statistically significant negative long-run association with per capita income, with an estimated elasticity of −0.558. This result supports the proposition that family stability may have macroeconomic relevance in addition to its well-established social consequences. Family units perform important economic functions, including pooling income, sharing fixed household costs, providing informal care, allocating resources to children, accumulating assets, and managing economic risks. Divorce can disrupt these functions by creating separate households, increasing housing and living expenses, dividing accumulated assets, and altering labor-supply and caregiving arrangements. Such disruptions may reduce household savings and investment capacity and, when widespread, may become relevant for aggregate economic outcomes. The finding is consistent with evidence that family-related variables can be systematically associated with economic growth and that family stability should therefore be regarded as part of the institutional and social foundations of long-term development [2].

The negative association between divorce and per capita income may also reflect interactions between family instability, labor-market conditions, and gender roles. Family instability does not occur independently of economic pressures. Employment insecurity, inadequate work–family reconciliation mechanisms, unstable earnings, and unequal caregiving burdens can affect both household continuity and labor-market behavior. Research on female-dominated informal employment has highlighted the complex interface between reproduction, production, and family instability, demonstrating that insecure labor arrangements and competing household responsibilities can contribute to instability within families [6]. Consequently, the divorce coefficient observed in the present study may capture not only the direct economic consequences of marital dissolution but also broader structural stresses affecting households. In this sense, divorce can function as a social indicator reflecting pressures associated with employment, living costs, changing social expectations, housing conditions, and family-support institutions.

The largest estimated negative elasticity was observed for the Mental Health Burden Index. A 1% increase in mental health burden was associated with an approximately 0.746% decrease in per capita GNI in the long run. This finding is economically important because it suggests that mental health is not merely an individual health outcome but also a component of national productive capacity. Mental health disorders may reduce economic performance through several pathways, including reduced labor-force participation, absenteeism, presenteeism, unemployment, premature labor-market exit, lower occupational productivity, increased health-care expenditures, and diminished educational and human-capital outcomes. Evidence on major depressive disorder demonstrates that the economic burden of mental illness includes substantial indirect productivity losses in addition to direct medical costs [7]. Similar evidence from Indonesia shows that anxiety and depression impose meaningful economic costs in an emerging-economy context, reinforcing the relevance of mental health for productivity and economic welfare beyond high-income countries [8].

The magnitude of the mental health coefficient is also consistent with broader assessments of the social and economic costs of mental ill health. Such costs extend beyond formal health expenditure and include lost earnings, reduced employment, diminished workplace performance, informal caregiving burdens, and effects on households and communities [9]. Evidence from African economies further indicates that mental health disorders interact with labor productivity in shaping economic growth, suggesting that deterioration in population mental health can weaken the conversion of labor inputs into productive output [10]. The present findings therefore support the view that population mental health should be incorporated into long-term economic planning rather than treated solely as a health-sector concern. In a context where economic uncertainty, inflation, labor-market constraints, social

change, and family pressures can accumulate, worsening mental health may act both as a consequence of socioeconomic stress and as a mechanism through which those pressures subsequently reduce productivity.

The economic significance of mental health is further reinforced by evidence concerning treatment and prevention. Global treatment rates for depression remain inadequate, implying that a substantial proportion of individuals affected by clinically important symptoms may receive insufficient or no effective care [14]. This treatment gap has economic implications because untreated disorders can persist and impair employment and productivity over extended periods. Conversely, mental health interventions in low- and middle-income countries have shown potential to improve labor-market outcomes, including employment, work functioning, and earnings [11]. Economic analyses likewise indicate that preventive investment in mental health can generate returns by reducing downstream service utilization and productivity losses [12]. Employer-focused evidence also supports the economic rationale for workplace mental health investment, particularly through reduced absence and improved employee functioning [13]. These studies provide a coherent explanation for why mental health burden exhibited the strongest long-run negative association with per capita income in the present analysis.

The finding for female labor force participation was more complex. Contrary to the hypothesized positive relationship, the coefficient was negative (−0.096) and only marginally significant at the 10% level. This result differs from a substantial literature showing that greater female economic participation can contribute positively to output by expanding the effective labor force, improving talent allocation, increasing household income, and reducing gender-based inefficiencies. Macroeconomic models indicate that gender gaps in labor-market participation and entrepreneurship can impose sizeable output losses by preventing economies from making full use of available human capital [16]. Evidence on gender inclusion similarly demonstrates that greater participation by women can generate macroeconomic gains through improved allocation of skills and greater economic diversification [17]. International policy analyses have therefore treated women's economic empowerment as an important component of inclusive and sustainable growth [18].

However, the negative and weakly significant coefficient identified in Iran does not necessarily imply that female labor force participation itself is detrimental to economic performance. Instead, it may indicate that the structure and quality of women's employment constrain the extent to which higher participation is translated into productivity gains. Female participation can contribute substantially to growth when women have access to productive formal employment, appropriate occupational matching, entrepreneurship, childcare services, labor protections, and opportunities commensurate with their education. Evidence from Central Asia shows that female labor force participation can support economic growth, but the magnitude of this contribution depends on institutional and structural conditions [21]. Likewise, cross-country evidence from European Union member states demonstrates a relationship between female economic participation and per capita GDP dynamics while also revealing heterogeneity across national contexts [20]. Thus, the Iranian result may reflect labor-market segmentation, low overall female participation, concentration in lower-productivity activities, interruptions related to caregiving, or weak institutional support for continuous employment.

This interpretation is consistent with research emphasizing that female empowerment influences development through multiple and sometimes competing channels. Women's employment affects household bargaining, fertility decisions, childcare, household production, and investments in children, meaning that the macroeconomic consequences of greater participation depend on whether institutions facilitate an efficient reconciliation of market work and family responsibilities [19]. Policies designed to increase female labor-force participation therefore need to address practical barriers such as childcare, workplace flexibility, mobility constraints, discriminatory hiring

practices, and occupational segregation [22]. Furthermore, labor-force participation alone is not synonymous with productive employment. Research on productive capacity in developing regions has shown that labor participation interacts with industrialization, structural transformation, and trade conditions in shaping output capacity [23]. The present finding may therefore indicate that simply increasing the percentage of women counted as economically active is insufficient unless their employment is accompanied by productivity-enhancing institutional reforms.

Inflation was also negatively and significantly associated with per capita income, with an estimated long-run elasticity of −0.140. This finding is consistent with established macroeconomic mechanisms through which persistent inflation can weaken economic performance. High and volatile inflation reduces the informational value of prices, increases uncertainty, raises transaction and planning costs, erodes household purchasing power, distorts savings and investment decisions, and may reduce the horizon over which firms are willing to undertake productive investment. Evidence from Central and Eastern European countries demonstrates that both inflation and inflation uncertainty can negatively affect output growth, particularly when inflationary instability becomes persistent [24]. Recent evidence from emerging market economies likewise confirms that the growth–inflation relationship remains important and that higher inflation can become increasingly harmful to growth once macroeconomic stability deteriorates [3]. Given the recurrent episodes of high inflation observed in Iran, the negative coefficient is therefore theoretically and empirically plausible.

Inflation may also reinforce the adverse effects of the social variables considered in this study. Persistent increases in living costs can generate financial stress within households, reduce real disposable income, worsen uncertainty regarding housing and family formation, and constrain access to health care. These conditions may indirectly affect fertility decisions, marital stability, labor-market participation, and mental health. Accordingly, the effects estimated in the DOLS model should not be viewed as entirely isolated channels. The Granger causality findings provide further support for this interconnected interpretation. Fertility Granger-caused divorce, mental health burden, and inflation, while divorce and mental health burden displayed bidirectional predictive relationships and female labor force participation Granger-caused mental health burden and inflation. Although Granger causality does not establish structural causation, these results indicate substantial temporal interdependence among demographic, social, psychological, and macroeconomic variables.

The evidence of cointegration is another important finding. The Johansen–Juselius test indicated multiple stable cointegrating relationships among the variables, while the DOLS model displayed a high adjusted $R^2$and passed the reported diagnostic tests. These results suggest that the variables do not simply move together because of unrelated trends but exhibit statistically identifiable long-run equilibrium relationships. The use of DOLS is particularly appropriate in this context because it accounts for potential endogeneity and serial correlation through leads and lags of the differenced regressors. Recent applications demonstrate the usefulness of DOLS for estimating long-run relationships involving macroeconomic variables such as growth, inflation, unemployment, migration, and human-capital indicators [25, 26]. In addition, the Durbin–Wu–Hausman testing procedure provides an established means of assessing potential endogeneity and supports more defensible interpretation of long-run coefficients when explanatory variables may be jointly determined with economic outcomes [27].

Taken together, the findings support a broader conception of economic development in which household stability, psychological health, demographic structure, gendered labor participation, and macroeconomic stability are mutually connected components of productive capacity. The results are particularly notable because mental health burden and divorce displayed larger absolute long-run elasticities than inflation, suggesting that social and

health conditions may have economically meaningful associations comparable to or greater than conventionally emphasized macroeconomic variables. This interpretation is consistent with the growing recognition that sustainable economic performance depends on the ability of societies to preserve and effectively utilize human capital, maintain functional household support systems, and reduce barriers to productive participation [10, 11, 18]. At the same time, the weak relationship between female labor force participation and per capita income indicates that expanding labor supply alone may not generate growth unless employment opportunities are sufficiently productive and supported by appropriate institutional conditions. Overall, the results suggest that long-run economic policy in Iran would benefit from an integrated framework that treats family stability and mental health as economic-development concerns alongside demographic management, labor-market reform, and price stability.

Several limitations should be considered when interpreting the findings. First, the analysis is based on annual time-series data covering 1990–2023, resulting in a relatively small number of observations and limiting the complexity of the econometric specification that could be estimated without substantial loss of degrees of freedom. Second, the Mental Health Burden Index was constructed from depression, anxiety, and suicide indicators using equal weighting and Min–Max normalization; although this provides a transparent composite measure, it may not capture the full spectrum of mental disorders or differences in the socioeconomic consequences of each component. Third, national aggregate data may conceal substantial heterogeneity across provinces, income groups, age groups, urban and rural populations, and educational categories. Fourth, divorce rate and female labor force participation provide only partial representations of family stability and women's economic integration. Other dimensions such as marriage rates, household size, childcare responsibilities, employment quality, informal employment, and wage differentials were not incorporated. Fifth, although DOLS and the endogeneity diagnostics reduce several econometric concerns, the observational design does not permit definitive structural causal claims. Finally, unobserved factors such as sanctions, institutional quality, oil revenues, technological change, education, political shocks, and major policy reforms may influence both per capita income and the explanatory variables.

Future studies should extend the present framework by using longer time series, quarterly data where reliable measures are available, or provincial panel data to increase statistical power and examine regional heterogeneity. Researchers could decompose the Mental Health Burden Index into its individual components to determine whether depression, anxiety, and suicide have different long-run economic effects and could test alternative weighting methods for constructing the composite index. Future analyses should also incorporate additional indicators of family structure, including marriage formation, household size, age at marriage, single-parent households, dependency ratios, and measures of family economic insecurity. Female labor force participation could be examined alongside employment quality, wage gaps, sector of employment, informality, educational attainment, occupational segregation, and unpaid care responsibilities. Methodologically, future work could compare DOLS estimates with Fully Modified OLS, ARDL bounds testing, Vector Error Correction Models, nonlinear ARDL, threshold models, and structural-break techniques. Particular attention should also be given to possible regime changes associated with sanctions, major inflationary episodes, the COVID-19 pandemic, and demographic-policy reforms. Finally, comparative studies involving Iran and economies at similar stages of demographic transition would help determine which relationships are country-specific and which represent broader patterns in developing and emerging economies.

The findings suggest that economic-development strategies should treat family stability, mental health, women's productive employment, and price stability as interconnected policy domains rather than separate sectors.

Expanding affordable and accessible mental health services, strengthening early identification and prevention programs, and integrating psychological support into primary care, workplaces, universities, and community settings may help reduce productivity losses associated with mental health burden. Family-support policies should focus on reducing economic pressures on households through accessible counseling, childcare, housing support, and employment protections rather than attempting to address divorce only after family relationships have deteriorated. Policies aimed at increasing women's labor force participation should emphasize the quality and productivity of employment by expanding formal-sector opportunities, childcare provision, flexible but protected work arrangements, entrepreneurship support, and equal access to career advancement. Macroeconomic authorities should prioritize sustained price stability because persistent inflation not only affects investment and purchasing power but may also intensify household and psychological pressures. Demographic policy should similarly avoid focusing solely on increasing fertility rates and should instead create socioeconomic conditions in which family formation, childbearing, employment, and long-term financial security are realistically compatible.

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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