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# The effect of macroeconomic variables on the level of economic welfare In Arab Countries
# A case study of a sample of Arab countries during the period 2007-2016

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***Abstract*:**
*This study aims to examine the impact of macroeconomic variables on the level of welfare in a sample of Arab countries over the period* ***2007–2016****, using panel (longitudinal) data models.*
*The analysis employed both fixed effects and pooled regression models supported by the application of appropriate statistical tests, which indicated that the random effects model was the most suitable for the sample data.*
*The findings reveal a positive impact of trade openness and foreign exchange reserves on welfare levels in the sampled countries, while government spending and inflation exert a negative influence.*

***Key words:*** *Macroeconomics, welfare, growth economic, Panel data.*

## L'effet des variables macroéconomiques sur le niveau de bien-être économique dans les pays arabes
## Étude de cas portant sur un échantillon de pays arabes au cours de la période 2007-2016

***Résume*:**
*Cette étude vise à examiner l'impact des variables macroéconomiques sur le niveau de bien-être dans un échantillon de pays arabes au cours de la période 2007-2016, en utilisant des données de panel (longitudinales).*

*L'analyse a employé à la fois des modèles à effets fixes et à effets regroupés, soutenue par l'application de tests statistiques appropriés, lesquels ont indiqué que le modèle à effets aléatoires était le plus adapté aux données de l'échantillon. Les résultats révèlent un impact positif de l'ouverture commerciale et des réserves de change sur les niveaux de bien-être dans les pays étudiés, tandis que les dépenses publiques et l'inflation exercent une influence négative.*

***Mots clés*****:** *Macroéconomie, bien-être, croissance économique, données de panel.*

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## Introduction

The concept of welfare has deep historical roots, tracing back to the Greek philosopher Plato and his vision of the ideal city. Despite the widespread use of the term "welfare state" in both political and social discourse as well as in academic literature, its modern application reflects the idea that the state bears the primary responsibility for ensuring the welfare of its citizens. Consequently, contemporary welfare is often synonymous with the welfare state. In this context, macroeconomic policies adopted by governments play a vital role in achieving satisfactory welfare levels for their societies.

Like other nations, Arab countries strive to maximize societal welfare and improve their positions in global welfare rankings. However, they generally remain behind European and East Asian countries. Therefore, it becomes essential for these states to adapt their economic policies to attain this goal.

From the above, the following research question arises:

**To what extent do macroeconomic variables affect welfare levels in Arab countries?**

To answer this question, we start from the following hypotheses:

- The degree of trade openness is one of the determinants of welfare in some Arab countries, and therefore its impact is positive.
- Inflation rate is considered as a determinant of welfare in the sample countries.
- The exchange rate is considered as a determinant of welfare in the sample countries.

- Foreign exchange reserves have a positive impact on the economic welfare of the sample countries.

*Objectives of the study*

The following are the objectives of the study

- Assess the extent to which trade openness influences economic welfare.
- Examine the effect of inflation on welfare.
- Evaluate the role of the exchange rate in determining welfare outcomes.
- Analyze the contribution of government expenditure to the enhancement of economic welfare.
- Investigate the stabilizing role of foreign exchange reserves and their impact on welfare.

## 1. Theoretical Framework of Welfare Economics

### 1.1. Concepts of Economic Welfare

Welfare economics is concerned with objectively measurable social outcomes within the realm of economic theory. National income, defined as the flow of goods and services, is directly associated with welfare: the higher the national income and the more equitable its distribution, the greater the economic welfare of society. Welfare economics also evaluates economic efficiency and the systems related to resource allocation, aiming to maximize social utility and create conditions through which economic policies can enhance societal welfare. Such policies may involve encouraging productive enterprises and ensuring fairness in distribution through taxation, thereby boosting production and fulfilling societal needs.

**Welfare Frontier**: This concept represents the maximum level of welfare an individual in society can enjoy, given the

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welfare levels of all others. No situation within the welfare frontier reflects maximum social welfare, while no point outside it is attainable by the society.

**Welfare State**: A welfare state is one in which the government assumes clear and formal responsibility for achieving the basic welfare of its citizens by providing diverse social services to enhance both economic and social welfare. This model emerges when society or its leaders are convinced that individual welfare-alongside maintaining order and national security-is of such importance that it cannot be left to traditions, informal arrangements, or private enterprises alone. Rather, it becomes a governmental obligation, stemming from a conviction in the essential role of individual welfare in safeguarding social order and national stability **(Hussein, 1999, p18).**

### 1.2. Methods of Measuring Welfare

The level of economic welfare is determined using a combination of quantitative and qualitative variables. Quantitative measures include the level and pattern of consumer spending, whether on food or non-food items, and the level of services such as healthcare, entertainment, and education.

Qualitative measures encompass non-monetary aspects, such as the right to participate in decision-making processes that shape interpersonal relationships, the enjoyment of democracy, and the assurance of justice (**Hilal, 2006, p36).**

Measuring welfare also directly focuses on income levels, taking into account prevailing price levels (i.e., adjusting for inflation), as well as the degree of equity in income distribution across social groups. Several indices are used to

assess the extent of societal welfare or lack thereof, as outlined in the literature **(Jasim & Ahmed, 2014, p45).**

**A. Pareto Optimality Criterion**

Pareto optimality is a hypothetical state that cannot be practically applied due to the assumptions on which it is based for determining the level of welfare. These assumptions include the existence of only two individuals representing society and only two goods, as well as the economy being in a state of full employment. Pareto relied on the traditional indifference curve theory to explain optimality through the use of the Edge worth Box. The essence of this hypothesis is that the income distribution leading to welfare can only be achieved through an increase in average income; in other words, economic growth rates must exceed population growth rates.

**B. Lorenz Curve**

The Lorenz Curve is one of the most widely used indicators of economic welfare since 1905 due to its simplicity. It is an upward cumulative frequency curve that is directly related to the concept of cumulative frequency distribution. It measures the relationship between the relative accumulation of households (or individuals) and the relative accumulation of incomes (or expenditures).

**C. Theil Index**

In 1967, the English statistician Theil indicated that economic welfare could be measured using proportional statistical formulas that show the degree of fairness in income distribution. This is done by calculating the approximate value of income represented by the Theil index.

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By comparing the Theil index value to the average per capita income, the level of economic welfare can be determined: the smaller the difference, the greater the economic welfare and fairness in income distribution, and vice versa. Theil calculates the approximate value of income using the following formula:

$T=\sum qi(\log qi)\cdot(1/n)T = \sum q_i (\log q_i) \cdot (1/n)$

Where:

- **T** = Theil index for the approximate value of income
- **n** = Number of individuals, households, or total social groups
- $\mathbf{q_i}$ = Income of group *i*

## 2. Study Instrument

### 2.1. Concept of Panel Data

Different types of data in general can be used in empirical (applied) analysis, including time series, cross-sectional data, and panel data.

- A set of data that observes a phenomenon over specified time periods is called a time series, where both the value of the observation and its order are important.
- Cross-sectional data consist of a set of observations for a group of individuals during one time period or at a single point in time (e.g., crimes recorded in 50 U.S. states in a given year).
- Panel data refer to datasets that combine both time series and cross-sectional data **(Ranjit, 2007,155).**

If cross-sectional data are measured over the same time period, panel data are called **balanced panel data**. If the time period differs from one cross-sectional unit to another, they

are called **unbalanced panel data (Baltagi, Jung, & Song, p122).**

Panel data are also known as "pooled data" when they include large numbers of units, and as "longitudinal data" when they contain long time series. These terms are often used interchangeably in applied literature. In this study, we will use the term **panel data (Free & Kim, 2007, p22).**

### 2.2. Advantages of Panel Data

Panel data models are among the most modern econometric models and have several characteristics that make them among the most effective tools in economic measurement and analysis **(Gujarati, 2011,p55):**

- They account for heterogeneity between units (e.g., differences in economic characteristics between countries) and in the variables used in measurement.
- They provide richer informational content compared to time series or cross-sectional data alone, resulting in more degrees of freedom.
- They allow for detecting and measuring the effects caused by changes in study variables over time, which cannot be captured using only cross-sectional or time-series data.

### 2.3. Basic Panel Data Models

Panel data models generally consist of three main types **(Gujarati, 2011,p60):**

- **Pooled Regression Model (PRM)**:

This is the simplest panel data model, assuming that all coefficients are constant across time periods. The mathematical form is: *(formula omitted in original text)*

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- **Fixed Effects Model (FEM):**

In this model, time or cross-sectional dummies capture individual or temporal differences. The term "fixed effects" means that the intercept $\beta_0$ for each cross-sectional unit does not change over time, with variation occurring only across units.

- **Random Effects Model (REM):**

In this model, the intercept $\beta_0(i)$ is treated as a random variable with mean μ. The REM is also called the "error components model" because the error term has two components: one for cross-sectional error ($v_i$) and one for the combined error term ($\varepsilon_i$□).

**2.4. Tests for Choosing Between Panel Data Models**

- **Breusch-Pagan Lagrange Multiplier Test (1980):**

This test compares PRM and REM based on the Lagrange multiplier related to residuals from the OLS method.

- **Hausman Test (1978):**

This test determines whether FEM or REM is more appropriate by checking if the individual effects are correlated with the independent variables.

  - **$H_0$**: No correlation → Both FEM and REM are consistent, but REM is more efficient.
  - **$H_1$**: Correlation exists → FEM is consistent and preferred.
    The test statistic follows a Chi-square distribution with $k - 1$ degrees of freedom.

- **Restricted F-test (Fisher Test):**

Used to choose between PRM and FEM. If the calculated value is greater than or equal to the tabulated F-value (or p-value ≤ 0.05), FEM is preferred.

## 3. Empirical Study

### 3.1. Temporal and Spatial Framework

The study sample consists of six Arab countries: Algeria, Tunisia, Egypt, Morocco, Oman, and Jordan. These countries were primarily selected based on data availability for the study period extending from 2007 to 2016.

### 3.2. Study Variables

This applied section relies on a set of variables, represented as follows:

- **Dependent variable:** Economic welfare index
- **Independent variables:** Macroeconomic variables selected based on data availability:
    - Trade openness (OPENS)
    - Inflation rate (INF)
    - Exchange rate (RE)
    - Government expenditure (G) as a percentage of GDP
    - Foreign exchange reserves (TR)

The data used in this study were obtained from the World Bank.

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### 3.3. Descriptive Statistics

**Table 1:** Descriptive statistics for the study variables

| Variable | PROS | RE | OUV | INF | GDPP | G | TR |
|---|---|---|---|---|---|---|---|
| Mean | 56.0229 | 16.3252 | 91.3775 | 4.9204 | 1.08E+11 | 108.037 | 3.91E+10 |
| Median | 55.7806 | 3.7903 | 98.6964 | 4.1142 | 8.00E+10 | 108.175 | 1.52E+10 |
| Maximum | 60.4781 | 109.443 | 155.619 | 18.3168 | 3.18E+11 | 167.325 | 1.95E+11 |
| Minimum | 50.0482 | 0.3845 | 30.0336 | -0.8729 | 1.71E+10 | 69.3534 | 5.89E+09 |
| Std.Dev. | 2.6712 | 29.4737 | 29.6209 | 4.0385 | 7.98E+10 | 21.4048 | 5.50E+10 |
| Observations | 60 | 60 | 60 | 60 | 60 | 60 | 60 |

**Source: Outputs from EVIEWS 10**

The table above shows clear variation in mean values, primarily due to differences in units foreign exchange reserves (TR) are in USD. Most variables, including the economic welfare index, are computed indices. The lowest standard deviations were recorded for the economic welfare index and inflation rate, indicating relatively small differences in observations of these variables across the countries during the study period. Oman recorded the highest welfare index value (60.47) in 2012, indicating advanced conditions for citizen welfare, while Egypt recorded the lowest in 2014.

### 4.3. Correlation Matrix

**Figure 1:** Pearson correlation matrix among all study variables

| | PROS | RE | OUV | INF | GDPP | G | TR |
|---|---|---|---|---|---|---|---|
| PROS | 1.000000 | -0.418620 | 0.679688 | -0.465414 | -0.828440 | -0.043625 | -0.400893 |
| RE | -0.418620 | 1.000000 | -0.417227 | 0.018790 | 0.438957 | -0.211128 | 0.943291 |
| OUV | 0.679688 | -0.417227 | 1.000000 | -0.493962 | -0.832391 | 0.230806 | -0.398432 |
| INF | -0.465414 | 0.018790 | -0.493962 | 1.000000 | 0.474344 | -0.137141 | 0.018288 |
| GDPP | -0.828440 | 0.438957 | -0.832391 | 0.474344 | 1.000000 | -0.251711 | 0.443068 |
| G | -0.043625 | -0.211128 | 0.230806 | -0.137141 | -0.251711 | 1.000000 | -0.253559 |
| TR | -0.400893 | 0.943291 | -0.398432 | 0.018288 | 0.443068 | -0.253559 | 1.000000 |

**Source: Outputs from EVIEWS 10**

The table represents correlations between variables. There are correlations greater than 0.5 between some variables. However, the welfare index showed relatively weak correlation with exchange rate (TC), government expenditure (G), foreign reserves (TR), and inflation.

### 3.5.. Panel Data Model Estimation

***Pooled Regression Model (PRM)***

**Table 2:** Pooled regression model estimation

| variable | Coefficient (β) | Std. Error | t-Stat | P-Value | Significant at 10% |
|---|---|---|---|---|---|
| Constant | 65.26959 | 1.715985 | 37.6158 | 0.0000 | Yes |
| RE | -0.01420 | 0.018023 | -0.827428 | 0.4117 | NO |
| OUV | -0.01764 | 0.010957 | -0699440 | 0.4873 | NO |
| INF | -0.096138 | 0.051687 | -1.860010 | 0.0684 | **No** |
| GDPP | 2.88E-11 | 4.10E-12 | -6.86322 | 0.0000 | **YES** |
| G | -0.035 | 0.008529 | -4.158207 | 0.0001 | **YES** |
| TR | …1.135E-12 | 9.70E-12 | 0.115892 | .09082 | **No** |

***Source: Outputs from EVIEWS 10***

Observations from the pooled model:

- Parameter significance: All variables are significant at 10% except for foreign reserves and trade openness.
- Overall significance: F-test value of 30.88 is significant at 5%, indicating overall model significance.
- Goodness of fit: R-squared = 0.77, meaning the independent variables explain 77% of the variation in foreign direct investment inflows; 23% is explained by other factors not included in the model.

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### 3.6. Fixed Effects Model (FEM)

***Table 3 :*** *Fixed Effects Model (FEM)*

| Variable | Coefficient (β) | Std. Error | t-Statistic | P-Value | Significant at 10% |
|---|---|---|---|---|---|
| Constant | 56.35127 | 1.166794 | 48.2958<E"" | 0.0000 | Yes |
| RE | 0.034817 | 0.008663 | -0.8274 | 0.4117 | No |
| OUV | 0.012469 | 0.005835 | -0.6994 | 0.4873 | No |
| INF | -0.060624 | 0.035408 | -1.8600 | 0.0684 | No |
| GDPP | -3.27E-12 | 1.83E-12 | 6.8632 | 0.0000 | Yes |
| G | -0.014571 | 0.008529 | -4.1582 | 0.0001 | Yes |
| TR | 4.86E.12 | 4.50E-12 | 0.1159 | 0.9082 | No |

**Source: Outputs from EVIEWS 10**

- The intercept varies across each cross-sectional unit (country); fixed effects are shown in Appendix 1.
- Parameter significance: All variables except exchange rate are insignificant at 10%.
- Overall significance: F-test value = 82.54, significant at 5%, indicating the model is overall significant.
- Goodness of fit: R-squared = 0.94, implying 94% of variation is explained by the independent variables; 6% by others.

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**Random Effects Model (REM)**

*Source: Outputs from EVIEWS 10*

- Parameter significance: All variables significant at 5% except trade openness.
- Overall significance: F-test value = 37.14, significant at 5%, indicating overall model significance.
- Goodness of fit: R-squared = 0.94.

### 3.7. Model Selection Tests

**Breusch-Pagan Lagrange Multiplier (LM) Test**

Based on EVIEWS 10, the test compares:

- Null hypothesis: pooled regression model is appropriate
- Alternative: fixed or random effects model is appropriate

**Table 4:** Model Diagnostics

| Test | Statistic | Probability |
|---|---|---|
| Honda | 6.626324 | 0.0000 |
| Cross-section | 0.392816 | 0.3472 |
| Period | 4.963281 | 0.0000 |

**Source: Outputs from EVIEWS 10**

The test rejects the null, indicating fixed or random effects models are preferable to the pooled model.

**Hausman Test**

Hypotheses:

- Null: random effects model is appropriate
- Alternative: fixed effects model is appropriate

**Table 5:** Model Diagnostics

| Test Summary | Chi-Sq. Statistic | d.f. | Probability |
|---|---|---|---|
| Cross-section random effects | 1.665441 | 5 | 0.6552 |

***Source: Outputs from EVIEWS 10***

Since the p-value (0.6552) > 0.05, we accept the null hypothesis, indicating the random effects model is suitable.

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This implies the sample is randomly drawn from the population.

### 3.8.. Interpretation of Random Effects Model Results

**Table 6:** Fixed Effects Model (FEM)

| Variable | Coefficient (β) | Std. Error | t-Statistic | P-Value | Significant at 10% |
|---|---|---|---|---|---|
| Constant | **65.26959** | **1.715985** | **37.6158** | **0.0000** | **Yes** |
| RE | **-0.01420** | **0.018023** | **-0.8274** | **0.4117** | **No** |
| OUV | **-0.01764** | **0.010957** | **-0.6994** | **0.4873** | **No** |
| INF | **-0.09614** | **0.051687** | **-1.8600** | **0.0684** | **No** |
| GDPP | **2.88E-11** | **4.10E-12** | **6.8632** | **0.0000** | **Yes** |
| G | **-0.03500** | **0.008529** | **-4.1582** | **0.0001** | **Yes** |
| TR | **1.135E-12** | **9.70E-12** | **0.1159** | **0.9082** | **No** |

***Source: Outputs from EVIEWS 10***

**Table 7:** Model Diagnostics

| Statistic | Value |
|---|---|
| R-squared ($R^2$) | **0.94** |
| F-statistic | **82.54** |
| Prob(F-statistic) | **0.0000** |

***Source: Outputs from EVIEWS 10***

- Signs of all parameters related to macroeconomic variables were negative or positive consistent with economic theory.
- A unit increase in inflation decreases welfare index by 6%.
- A unit increase in government expenditure decreases welfare index by 1%.

- A unit increase in foreign exchange reserves increases welfare index by 3%.
- A unit increase in trade openness increases welfare index by 1%.

The results suggest that trade openness and foreign reserves directly support economic vitality and thus enhance welfare and living standards, given their link to foreign currency and import capacity, especially in resource-dependent economies. Inflation negatively impacts welfare by reducing purchasing power. The negative sign on government expenditure may reflect specific characteristics of the sample countries, possibly linked to inflationary effects.

**Additional Notes**

- GDP and exchange rate variables were statistically insignificant, possibly due to economic and political heterogeneity among the countries.
- The random effects capture country-specific unobserved factors affecting welfare, reflecting economic, political, and social differences across countries.

## Conclusion

The static panel data analysis indicates that the **Random Effects Model is the most appropriate** for the study, as the differences among Arab countries are explained by unobserved random factors. The results show that trade openness, foreign exchange reserves, inflation rate, and government expenditure all had a statistically significant

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effect on the economic welfare index, while the other variables did not show significance.

The explanatory power of the preferred model ($R^2$) reached **94%**, which is relatively high. This implies that the included factors explain most of the variations in welfare levels, while the remaining share can be attributed to other unobserved factors not incorporated in the model.

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