

Arab Early Warning Index

Food and Water Security, Core Inflation, and External Trade

Pressure Risks

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Preface

Recent global and regional developments have shown that food and water security risks in Arab countries are no longer isolated or region-specific. Instead, they are the result of complex and interconnected shocks. Factors such as global food price volatility, climate change, disruptions in international trade and tight economic conditions have collectively put upward pressure on domestic prices, external balances and living standards. This pressure can quickly spread across sectors, turning external disturbances into sustained inflation and social pressures. However, the absence of an integrated early warning framework hinders the ability of decision makers to anticipate and proactively respond to risks. The proposed Arab Early Warning Index aims to address this gap by providing a comprehensive and forward-looking tool that assesses exposures, transmission channels and response capacity. By including food and water security, core inflation, foreign trade risks and policy buffers, the index facilitates preventive policymaking and improves regional preparedness for future shocks.

1. Conceptual Framework of the Index

The proposed Early Warning Index is structured around five interrelated pillars, which together provide a comprehensive assessment of countries' vulnerability to food, water, inflationary, and external pressure.

Pillar (1): Food Security and Access to Food

This pillar captures pressures on food availability, affordability, and households' access to food, reflecting the sensitivity of domestic food systems to external price shocks and supply disruptions. It includes the following core indicators:

- Monthly food price inflation rate
- Share of food in the Consumer Price Index (CPI) basket
- Dependence on imports of staple cereals as a share of consumption or supply
- Indicators of malnutrition and food insecurity (annual)
- Cost of a basic food basket

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Table (1) : Pillar 1

Indicator	Risk Direction
Change in domestic food prices	↑
Share of food in the CPI basket	↑
Dependence on imports of staple cereals % of consumption or supply	↑
Cost of a basic food basket	↑
Prevalence of malnutrition and food insecurity	↑

Pillar (2): Water Security and Climate-Related Water Stress

This pillar assesses the degree of water scarcity, variability, and climate stress, and the ability of water systems to meet growing demand under changing environmental conditions. The pillar includes:

- Water stress index, which is related to water withdrawals relative to renewable resources.
- Renewable water resources per capita
- Reliance on desalination and groundwater resources
- Frequency of droughts and soil moisture indicators
- Efficiency of agricultural water use

Table (2) : Pillar 2

Indicator	Risk Direction
Water stress index	↑
Renewable water resources per capita	↓
Reliance on desalination and groundwater	↑
Frequency of droughts and soil moisture indicators	↑
Efficiency of agricultural water use	↓

Pillar (3): Core Inflation and Price Stability Sustainability

This pillar reflects the extent to which external shocks translate into generalised and persistent inflationary pressures across the economy, beyond food and energy prices. It includes:

- Core inflation (Core CPI)

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- Inflation diffusion index: share of CPI items increasing above a 5% annual threshold
- Nominal and/or effective exchange rate movements and volatility as a price pass-through channel
- Growth in credit and domestic liquidity as an indicator of demand pressures

Table (3) : Pillar 3

Indicator	Risk Direction
Core inflation (Core CPI)	↑
Inflation diffusion (share of CPI items above threshold)	↑
Exchange rate volatility	↑
Real credit growth	↑

Pillar (4): External Trade Exposure and Vulnerability to External Shocks

This pillar focuses on how external shocks related to prices, logistics, and trade restrictions are transmitted through international trade channels. It includes:

- Import concentration index (Herfindahl–Hirschman Index, HHI)
- Share of essential commodities in total imports, including food, fuel, and fertilisers
- Degree of trade openness
- Shipping and logistics costs, proxied by clearance time, Logistics Performance Index (LPI), or transport costs
- Import bill as a share of GDP or international reserves

Table (4) : Pillar 4

Indicator	Risk Direction
Import concentration (HHI)	↑
Share of food and energy in total imports	↑
Trade openness (Trade/GDP)	↑
Import bill relative to GDP or reserves	↑
Shipping and logistics cost indicators	↑

Pillar (5): Buffers and Policy Response Capacity

This pillar assesses whether countries possess sufficient fiscal, monetary, and institutional space to absorb shocks and implement timely policy responses. It includes:

- International reserves and months of import coverage
- Current account balance
- Fiscal space indicators, including fiscal balance, public debt, and debt service
- Size and targeting capacity of social safety nets (structural indicator)
- Exchange rate flexibility and effectiveness of monetary policy

Table (5) : Pillar 5

Indicator	Risk Direction
International reserves (months of imports)	↓
Current account balance	↑
Debt service to revenue ratio	↑
Size and effectiveness of social safety nets	↓
Exchange rate flexibility	↓

2. Structure of the Early Warning Index (Pillars)

In order to ensure a thorough assessment of early warning risks, the proposed index is organised into five interconnected pillars. Each pillar represents a different aspect of vulnerability, including food and water security, inflation dynamics, foreign trade risks and political response capacity. These columns are calculated separately and combined into a composite index. This approach allows detailed analysis of specific risk factors and an overall assessment of sensitivity to external shocks. Using this framework, we can identify the main ways in which global and regional shocks affect economic stability and living standards in Arab countries.

2.1 Systemic food and water security risks in the Arab region

Food and water security challenges in the Arab region have increasingly evolved into systemic and interconnected risks, driven by interactions between external shocks and internal structural vulnerabilities. Contrary to traditional region-specific constraints, recent crises have shown that food insecurity in Arab countries is rarely the result of domestic production failure alone, but rather complex pressures arising from global price volatility, climate stress, trade dependence and macroeconomic transmission mechanisms.

Most Arab economies show a high degree of dependence on imported staple foods, especially grains and vegetable oils, which makes them directly exposed to fluctuations in international markets. In addition, the region faces chronic water shortages, making it one of the most water-stressed regions globally. Climate change has further exacerbated these pressures through rising temperatures, increased evapotranspiration, irregular rainfall patterns and more frequent drought events, all of which limit agricultural productivity and limit the possibility of import substitution through domestic production.

The interaction between water scarcity and food import dependence creates a structural mechanism. When food prices globally rise or supply chains are disrupted, countries with limited water availability and low agricultural flexibility are unable to respond through domestic supply adjustments. As a result, external shocks spread rapidly through domestic food markets, leading to sharp increases in consumer prices and increasing vulnerability among low-income households, where food expenditure constitutes a large share of total consumption.

These dynamics underscore the inadequacy of isolated food security indicators that focus only on availability or production levels. Instead, a more comprehensive analytical framework is needed that can capture the connections between food, water, climate and external risks. The proposed index addresses this gap by integrating these dimensions into a unified early warning framework, enabling policymakers to identify emerging risks before they escalate into full-scale food or social crises.

2.2 Core inflation as a transmission channel for external shocks

While food and energy prices often represent the starting point for the impact of exogenous shocks, their macroeconomic and social consequences depend critically on the extent to which these shocks propagate to core inflation. Core inflation acts as a leading indicator of generalised and sustained price pressures, reflecting the spread of initial shocks in goods and services beyond the volatile components.

Empirical evidence from several Arab countries indicates that food price shocks often translate into higher transport, storage and distribution costs, which then increase non-food prices. In economies with exchange rate volatility, shallow domestic markets or limited monetary policy credibility, this pass-through effect is faster and more pronounced. As a result, what initially looks like a relative price adjustment can develop into increasing inflationary pressure.

The relevance of core inflation in the context of food security lies in its direct connection to real income erosion and living standards. Unlike headline inflation driven by temporary supply disruptions, persistent increases in core inflation

undermine purchasing power, weaken consumption, and complicate policy responses. In such contexts, traditional mitigation measures such as temporary price controls or selective subsidies become less effective and may even exacerbate fiscal pressures.

Incorporating core inflation into the proposed early warning index allows for a more nuanced assessment of risk dynamics. It enables the distinction between countries experiencing transitory shocks and those facing broader inflationary regimes that are likely to require coordinated monetary, fiscal, and social policy interventions. This distinction is critical for anticipating the depth and duration of food-related crises and for designing timely preventive measures.

2.3 External Trade Dependence and Shock Amplification

External trade constitutes one of the primary channels through which global shocks are transmitted to domestic economies in the Arab region. High levels of import dependence for food, energy, and intermediate goods, combined with concentrated trade relationships, significantly increase exposure to disruptions in global markets.

In many Arab countries, a limited number of commodities and trading partners account for a substantial share of total imports. Such concentration magnifies vulnerability to geopolitical tensions, export restrictions, logistical bottlenecks, and sudden increases in freight and insurance costs. Recent global disruptions have demonstrated that even in the absence of sharp price increases, supply chain frictions alone can substantially raise the domestic cost of essential goods.

Furthermore, rising import bills are putting pressure on foreign exchange reserves and the balance of payments, particularly in countries with limited export diversification. This, in turn, could lead to a decrease in the value of the currency, increasing inflationary pressures and raising the cost of food imports in the local currency. The cumulative effect is a self-reinforcing feedback loop between trade exposure, macroeconomic instability, and food price inflation.

By explicitly integrating trade-related indicators into the early warning index, the proposed framework moves beyond outcome-based metrics and focuses on transmission mechanisms. This approach enables policymakers to identify whether rising food insecurity risks stem primarily from price shocks, supply disruptions, financial constraints, or structural trade dependencies, thereby informing more targeted and effective policy responses.

2.4 Fiscal space and social protection as shock absorbers

The final economic and social consequences of food and price shocks are determined not only by the extent of the shock, but also by the authorities' ability to

react. Fiscal policy spaces and social protection systems represent the last line of defence against the transformation of economic shocks into wider social crises.

The fiscal position determines the government's ability to implement countercyclical measures, such as expanding food subsidies, increasing cash transfers or absorbing higher import costs without compromising debt sustainability. However, rising public debt levels, increasing debt service burdens, and limited revenue bases have significantly reduced fiscal policy in many Arab economies, limiting the room for manoeuvre during the crisis.

Social protection systems play a complementary role by protecting vulnerable populations directly from income and consumption shocks. While coverage levels vary widely across the region, evidence suggests that countries with broader and more institutionalised social protection frameworks are better positioned to mitigate the distributional effects of food price increases. Importantly, the effectiveness of these systems depends not only on coverage but also on their scalability and responsiveness during periods of stress.

The inclusion of both fiscal room and social protection indicators in the proposed index provides a balanced assessment of shock absorption capacity. This allows differentiation between countries that face similar external shocks but have markedly different policy buffers, thus increasing the relevance of the index for preventive policy-making and regional risk monitoring.

2.5 Buffers and Policy Response Capacity

Arab countries have the financial, monetary and institutional capacity to absorb and respond to external shocks related to food, water, inflation and trade. This includes the ability of governments to implement timely and effective policy interventions to mitigate the impact of shocks on the economy and society. The strength of macroeconomic buffers, fiscal and monetary policy space and institutional preparedness play important roles in determining countries' ability to respond to crises. Countries with stronger buffers and political flexibility are better equipped to stabilise prices, protect vulnerable populations and prevent temporary shocks from turning into long-term crises. Conversely, limited response capacity increases sensitivity to external pressure and can have more serious consequences for the economy and society.

3. Computational Methodology

A. Normalization

To ensure comparability across indicators with different units and scales, all indicators are normalized using a min–max transformation as follows:

$$\text{Normalized Score} = (\text{Value} - \text{Min}) / (\text{Max} - \text{Min}) \times 100$$

All indicators are rescaled to a 0–100 range, where higher values indicate higher risk exposure.

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B. Pillar Scoring

Each pillar score is calculated as a weighted average of its normalized indicators:

$$\text{Pillar Score} = \sum (\text{Normalized Indicator} \times \text{Indicator Weight})$$

This approach allows flexibility in assigning relative importance to indicators within each pillar, while preserving internal consistency.

C. Composite Index Construction

The overall Early Warning Index is computed as a weighted aggregation of the five pillar scores:

$$\text{AEWI} = \sum (\text{Pillar Score} \times \text{Pillar Weight})$$

Proposed Pillar Weights (Adjustable):

1. Food Security: 25%
2. Water Security: 20%
3. Core Inflation: 20%
4. External Trade Exposure: 20%
5. Buffers and Response Capacity: 15%

These weights reflect the relative importance of each dimension in shaping vulnerability to food, water, and external shocks, and can be adjusted based on country-specific contexts or policy priorities.

D. Thresholds and Early Warning Levels

To improve interpretability and policy relevance, the overall AEWI score is translated into four early warning levels using a transparent threshold system. Thresholds divide the 0-100 scale into intervals of equal width, so that numerical results can be converted into intuitive and easily communicated warning signals. Early warning levels are defined as:

Table (6) : Threshold Level

Level	Score Range	Color	Interpretation
Level 1 – Low Pressure	0–25	Green (■)	indicates largely stable conditions with limited exposure to food, energy, inflation or external stressors
Level 2 – Moderate Pressure	25–50	Yellow (■)	Reflects emerging stress signals that require increased monitoring and precautionary political attention.
Level 3 – High Pressure	50–75	Orange (■)	Indications of increased vulnerability and increasing risk, which require timely preventive measures and targeted political interventions.
Level 4 – Critical Pressure	75–100	Red (■)	Represents severe and widespread pressure that requires immediate and coordinated policy responses at both national and regional levels.

Note: The levels reflect the degree of exposure to external pressures rather than probabilistic risk.

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This threshold-based classification employs a traffic-light signalling approach, enabling policymakers to rapidly identify countries under increasing stress, monitor transitions across risk levels over time, and prioritise policy responses accordingly. Importantly, these thresholds capture the intensity of exposure and pressure, rather than serving as probabilistic forecasts of crisis occurrence.

3. Policy Response Matrix

The Policy Response Matrix links the early warning risk levels to pre-defined policy actions across key sectors. Its purpose is to translate early warning signals into practical and timely policy responses, ensuring that rising risks are met with proportionate and coordinated interventions.

Table (7) Policy Response

Risk Level	Food	Water	Inflation	Trade
Yellow: Monitoring	Price monitoring and market surveillance	Demand management and conservation measures	Targeted monetary guidance	Supplier diversification
Orange: Preventive Action	Targeted food support measures	Active demand management	Monetary policy intervention	Strategic stockpiling
Red: Critical Pressure	Emergency social protection measures	Water emergency response	Exchange rate stabilization	Import financing arrangements