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Arab Economy-wide Trade Simulator Interface

Summary

Trade policymakers need quantitative assessments of the impact of international trade policies on their economies to formulate the right national policies and embark on the required reforms and arrangements. The United Nations Economic and Social Commission for Western Asia (ESCWA) has been supporting Arab countries' requests for such assessments; however, it has been limited by the notable increase in the number of trade arrangements in the region and the rest of the world. To facilitate these assessments, the ESCWA secretariat has developed the Arab Economy-wide Trade Simulator Interface (ATSI), an analytical tool that enables each Arab State to perform three different types of trade-related simulations: trade policy reforms in the country of interest; additional simulations related to trade policy reforms in partner countries across the world; and combined scenarios covering policy changes both in the country of interest and in selected partners.

The present document provides an overview of the main features and functionalities of ATSI. The Committee on Trade Policies in the States Members of ESCWA is invited to review its content and provide comments thereon, as well as recommendations for the development of ATSI.

Contents

Introduction

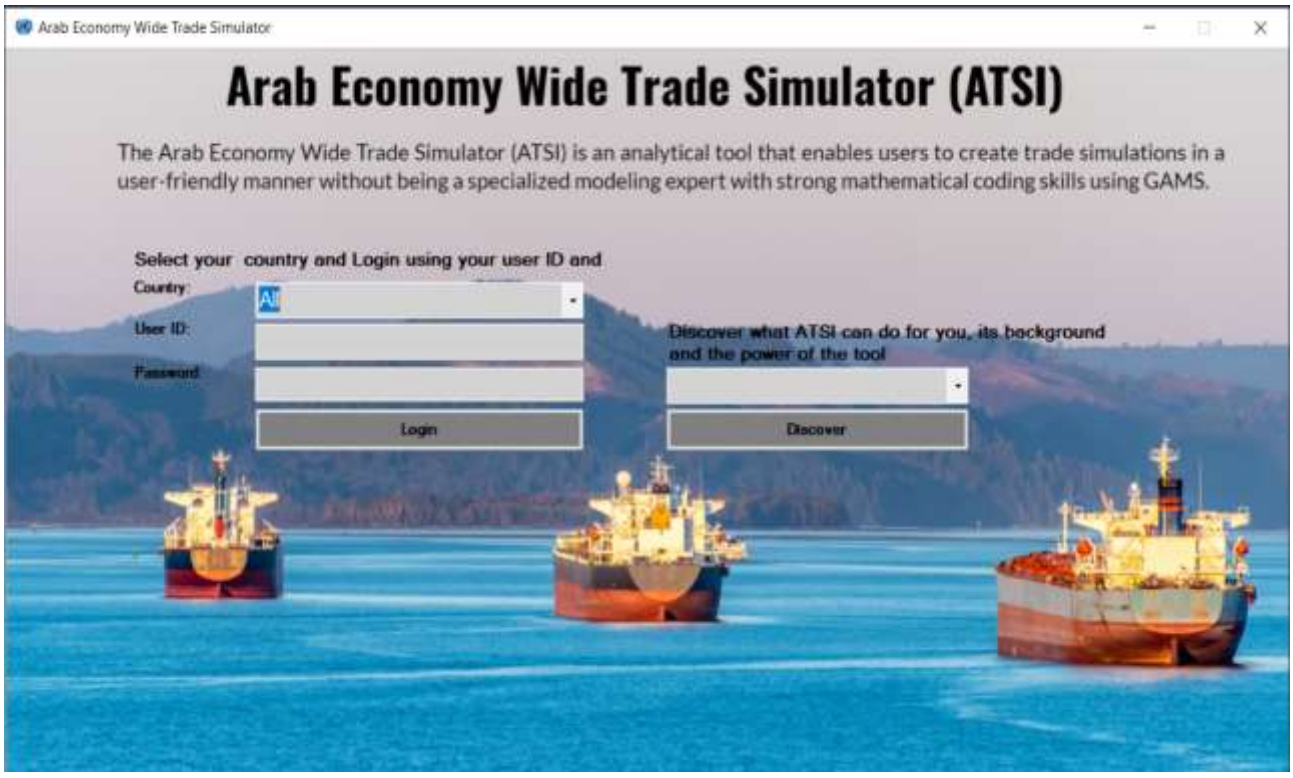
1. Policymakers in the Arab region are increasingly requesting quantitative assessments of the impact of international trade policies on their economies. The United Nations Economic and Social Commission for Western Asia (ESCWA) has been supporting these requests; however, it has been severely limited by the notable increase in the number of trade arrangements in the region and in the rest of the world.

2. The Arab Economy-wide Trade Simulator Interface (ATSI) is a user-friendly analytical tool that enables users that are not specialized modelling experts and do not have strong mathematical coding skills using GAMS (General Algebraic Modeling System) to perform trade simulations.

3. For each Arab country, the interface allows users to perform three categories of trade-related simulations. The first covers trade policy reforms in the country of interest, for example Egypt. The second allows the user to perform additional simulations related to trade policy reforms in partner countries across the world. In both cases, users will be able to perform simulations and analyse their economic impact. Finally, users can also perform combined scenarios covering policy changes both in the target country as well as in selected partners.

4. The user-friendly interface is comprised of two sections. The first, open to all users, contains the major features of the simulator. The second section, with restrictive access, provides direct access to the simulator to perform the three types of trade-related simulations. Figure 1 displays the current design of the interface home page.

Figure 1. ATSI home page design



I. Background of ATSI

5. The ATSI is an innovative and user-friendly tool that enables trade policymakers to perform trade simulations. The interface could either be installed on personal computers to allow targeted users to perform relevant trade simulations for their respective countries or securely accessed via the web application.

6. The simulator will serve as a laboratory for counterfactual trade policy analysis. The interface is based on a tailored dynamic global computable general equilibrium (CGE) model including 18 Arab countries individually. It captures interrelationships between economic sectors and institutions inside a given country and with sectors and institutions in the rest of the world.

A. The model

7. The interface is built using a MIRAGE (Modelling International Relationships in Applied General Equilibrium) model, which is a multi-region, multi-sector CGE model for trade policy analysis. It incorporates imperfect competition and product differentiation in a sequential dynamic set-up. Adjustment inertia is linked to factors stock reallocation and to market structure changes. MIRAGE draws upon a very detailed measure of trade barriers and their evolution under different hypotheses, thanks to the two global databases: the Global Trade Analysis Project (GTAP) database and the Market Access Maps Database (MAcMap).

8. The model is designed for analysis of dynamic trade scenarios. The scenarios are solved as a sequence of static equilibria, with periods linked by normally exogenous dynamic variables — population and labour growth, capital accumulation and productivity. Policy scenarios, for example the introduction of a regional free trade area, are compared to a baseline, or business-as-usual, scenario.

B. Advantages

9. It is widely acknowledged that applied general equilibrium (AGE) or CGE modelling have become the tools of choice for analysis of a wide range of policy issues in both developed and developing countries in a variety of settings. In particular, CGE modelling is useful for analysing the welfare effect of trade policy that needs to address second-best issues, where there are significant interactions between policy measures for one sector and distortions elsewhere in the economy. They represent valuable tools for putting things in an economy-wide perspective.

10. The general equilibrium framework contains all commodities and includes functioning factor markets and decisions of agents in response to price signals and the main feedback effects (or consequences of policy changes). Hence, these models are very useful for analysing changes in sectoral output, product prices, factor usage and factor prices, as well as changes in national welfare measures consequent to changes in trade regimes.

11. In addition to the common advantages of the general equilibrium framework, global CGE models are the best tools for trade policy analysis through additional advantages over other quantitative tools. These advantages lie in their capacities not only to simulate the impacts of national policy changes related to the implementation of a preferential trade arrangement on the target country but also to assess the impacts on one target country’s economy from implementing the same trade arrangements in different partner countries.

C. The database

12. The model is based on the latest (pre-)release of the GTAP dataset, version 10.0. The GTAP dataset is particularly attractive for trade analysis since it includes a fully consistent set of bilateral trade flows, bilateral trade measures (on both the export side and import side) and bilateral trade and transport margins. The GTAP database represents a unique consistent representation of the world economy for a pre-determined reference year.

13. Several data sources underlie the database, including but not limited to: national input-output (I-O) tables and trade, macroeconomic and protection data. However, the original GTAP data set, version 10.0, includes only 10 Arab countries among the 141 countries and regions individually included in the model. For many years, ESCWA actively contributed to the extension of the GTAP database to cover more countries from the Arab region, going from one country in version 5 to ten countries in the latest version 10. As a continuation

of this effort to extend the coverage of Arab countries in the database, ESCWA developed a new version of the GTAP database for the specific trade analysis in the region with an additional eight Arab countries. To do so, the original regional and sectoral composition of the original version 10 has been modified to reflect the major features of the new national SAMs developed by ESCWA in 2019. The base year of the extended and modified global database is 2011 as per the original version 10 of the GTAP database.

D. Baseline scenario

14. The baseline scenario assumes no significant structural economic policy reforms will be undertaken in all considered countries and regions over the simulation period. The current baseline scenario covers the period 2014–2030, while results will be shown only for the period 2021–2030.

15. Several assumptions have been made in order to define what seems to be the plausible developments in the world economy up to 2030, in the absence of new reforms or shocks. These assumptions define the baseline scenario, which is used as a basis for comparison of alternative policy scenarios. The sensitivity analysis carried out using the model suggests that the choice of exogenous variables within a realistic confidence interval has no major consequences. The relative variations of the different economic aggregates with respect to the baseline scenario after policy shocks seem uninfluenced by those *a priori* choices.

E. Alternative simulations

16. The users will be able to perform a large number of simulations that could reflect national reform priorities, bilateral trade agreements and global shocks. The simulations reflect potential changes in exogeneous variables and policy instruments. The current version of the model offers two policy instruments on trade of goods: import tariffs and other trade costs, mainly transport trade margins. In the future, ESCWA is planning to develop new versions to tackle further issues directly related to trade negotiations such as non-tariff measures on trade of goods and barriers to trade in services.

F. Visualization

17. By clicking on background, users will be directed to the second page where five components will be shown. By clicking on any one of the components, the interface will display a short description of it.

II. The Simulator: private section

A. The “run button”

1. *Functionality*

18. There are four essential dimensions in the model, shown in the table below.

Table 1. Model dimensions

Index	Description
i	Sectors (user determined, see Annex 1 for the model dimensions)
r	Regions and countries (user determined, see Annex 1 for the model dimensions)
t	Time (user determined, currently 2021–2030)
v	Policy instruments and external shocks (see section 1 on the list of instruments)

- *Select the target country:* users can select ONE country only. The target countries are the following: Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Mauritania, Morocco, Oman, State of Palestine, Saudi Arabia, Syrian Arab Republic and the United Arab Emirates.

- *Select the partner (country or region, single or multiple values):* In addition to Arab countries, the partner countries and regions included in release 1 of ATSI are the following: China, India, Iran, Japan, South Korea, Turkey, the United Kingdom of Great Britain and Northern Island, the United States of America, Rest of Asia, Rest of NAFTA (North American Free Trade Agreement countries, Canada and Mexico), Rest of America, European Union (EU 27), Rest of Sub-Saharan Africa and Rest of the World. Table 2 displays the mapping between the sectors considered in the model and the GTAP database release 10.

Table 2. Geographic coverage of the simulator

Description	Mapping with GTAP 10
Bahrain	98
Jordan	101
Kuwait	102
Oman	103
Qatar	104
Saudi Arabia	105
United Arab Emirates	107
Yemen	108-1
Iraq	108-2
Syrian Arab Republic	108-2
Lebanon	108-4
Palestine, State of	108-5
Egypt	109
Morocco	110
Tunisia	111
Algeria	112-1
Mauritania	112-1
Libya	112-2
China	4
Japan	6
South Korea	7
India	22
United States of America	28
United Kingdom	81
Iran	90
Turkey	106
Rest of Asia	218, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 91, 92, 93, 94, 95, 96, 97, 100
Rest of NAFTA (Canada+Mexico)	28, 29
Rest of America	30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48

Description	Mapping with GTAP 10
EU 27	54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80
Rest of Sub-Saharan Africa	113, 114, 115, 116, 117, 118, 119, 120, 121, rest 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140
Rest of the World	rest 108, 1, 2, 3, 49, 50, 51, 52, 53, 141
Rest of Europe	82, 83, 84, 85, 86, 87, 88, 89, 90

Note: A full description of the geographical details of GTAP release 10 is available at https://www.gtap.agecon.purdue.edu/databases/regions.aspx?version=10.211.

- *Select the sectors (single or multiple values):* The current version of the global model includes the following sectors: cereals, other crops, animal products, forestry and fishing, crude oil, natural gas, other extractive activities, food manufacturing, textile, chemical industries, mechanical industries, electrical and electronic industries, other manufacturing industries, transport services, tourism services, public administration, construction, health services, recreational services and other services. Table 3 displays the mapping between the sectors in the model and the GTAP database (release 10).

Table 3. Sectoral coverage of the simulator

Description	Mapping with the original GTAP version 10
Cereals	1, 2, 3
Other crops	4, 5, 6, 7, 8
Animal products	9, 10, 11, 12
Forestry and fishing	13, 14
Oil	16
Gas	17
Other extractive activities	18
Food manufacturing	19, 20, 21, 22, 23, 24, 25, 26
Textiles, apparel and leather products	27, 28, 29
Chemical industries	32, 33, 34, 35
Mechanical industries	42, 43, 44, 45
Electrical and electronic industries	40, 41
Other manufacturing industries	30, 31, 36, 37, 38, 39
Transport services	52, 53, 54
Accommodation, food and service activities	51
Public administration	62
Construction	49
Human health and social work activities	64
Recreational and related services	61
Other services	46, 47, 48, 50, 55, 56, 57, 58, 59, 60, 63, 65

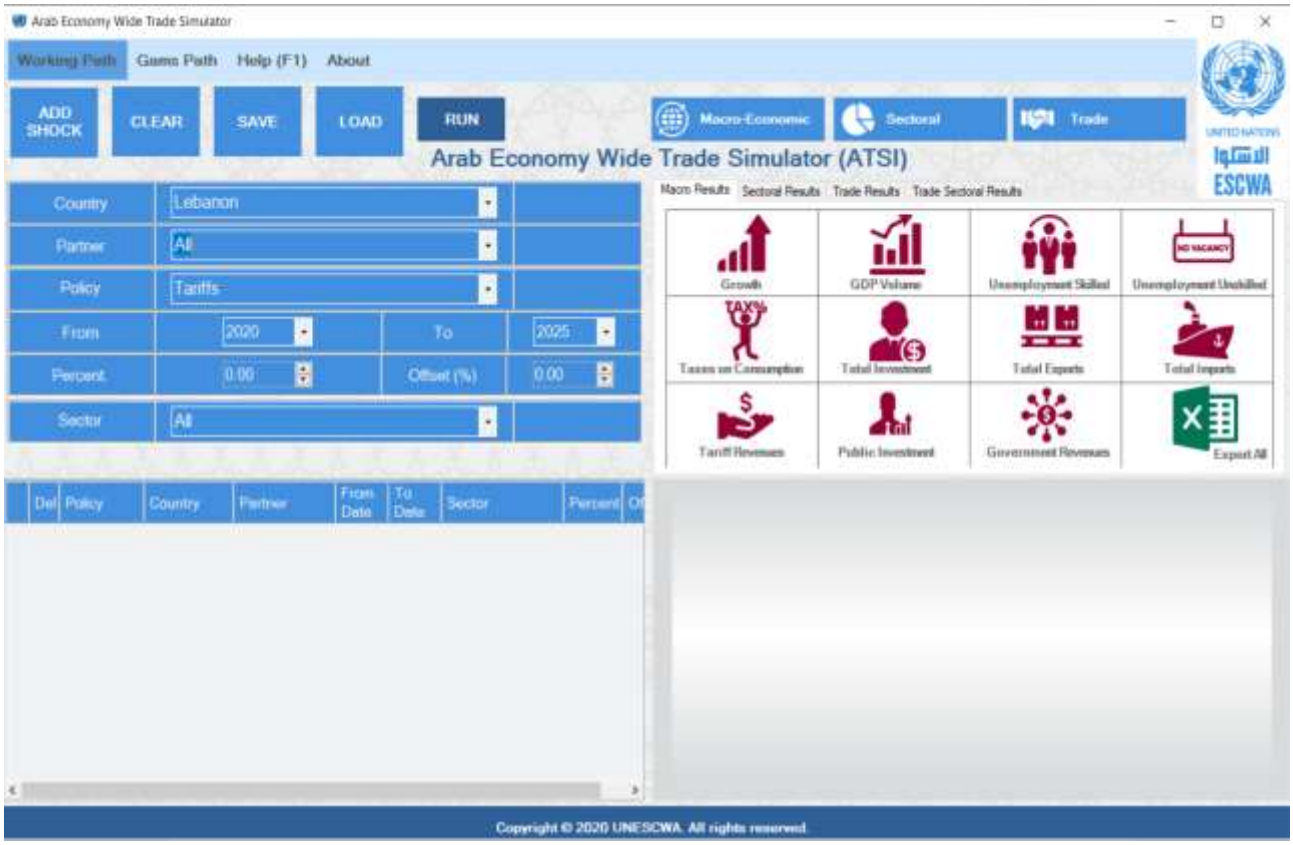
Note: A full description of the sectoral coverage of GTAP release 10 is available at https://www.gtap.agecon.purdue.edu/databases/contribute/detailedsector.asp.

- *Select the years of scenario implementation (single or multiple values):* Simulations can be implemented for 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029 and 2030.
- *Select the policy and/or external shock (single or multiple values):* There are two categories of simulations: tariff changes and reduction in other trade costs. Alternative simulations on both instruments could be imposed by products, partners and years.
- *Select the amplitude of the policy changes (single or multiple values):* After selecting the policy instrument, the user selects the percentage changes to be implemented either in a single year or progressively over a period.
- *Select the reporting years (single or multiple values):* After making all selections and before running the simulation, the user selects the years from 2021 to 2030 to show results for.
- *Simulate: After defining the simulation details, the user runs the scenario by clicking the "Run" button.*

2. *Design of the "Run" button*

19. The figure below displays a suggested mockup of the simulator.

Figure 2. ATSI Model Design



B. The "Results" button

Functionality

20. When the simulation is successfully completed, the results are shown to the user. The results are displayed in two formats: charts and spreadsheets. Users have the choice to define the results they are looking for. In fact, given the large results generated by a global model, it is always recommended that users select the variables they are looking for in their specific analysis.

21. When the user clicks “Show Results”, he/she will be redirected to another page to select the results for the variables desired. Three options will be available to display the results: macroeconomic results, sectoral results and trade results.

- Macroeconomic results (one or more values)
- Sectoral results (one or more values)
- Trade results.

22. In addition to selecting the sectoral economic variables, users can also focus on selected sectors and years. All results are expressed as a percentage change compared to the baseline value. For macroeconomic results, users select the variables and the years (one or more values). For sectoral results, users select the variables, sectors and years. For trade results, users select the variables (imports and/or exports), sectors, partners and years.

III. Using the results for policy analysis

23. The interface provides the results of the alternative simulations as changes relative to the baseline scenario. However, since the forecasts of the major macroeconomic variables underlying the baseline scenario are regularly updated by international organizations (International Monetary Fund, World Bank) and national planning institutions, it is important to calculate the values of changes using the latest estimates and not those in the baseline. For example, suppose that Egypt adopts a reduction in tariffs on imports originating from China on selected products and the impact on GDP measured by the model is a 0.1 per cent change in 2021 compared to the baseline scenario. To estimate the changes in values, users are advised to use the latest forecast of GDP and apply the percentage changes due to the policy changes.

IV. Way forward

24. The ATSI presented in this document and its related web application represents the first release of this novel toolkit. New developments will be introduced in the coming months and years to allow users to perform additional simulations related to new policy instruments such as protection on services, non-tariff measures, etc. Moreover, future releases will display new types of results such as the impact of trade reforms and external shocks on remittances inflows, foreign direct investment inflows, greenhouse gas emissions, natural resources use, employment and poverty.
