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Agriculture Businesses Fund

Export Market Potential for Egyptian Food Products: Investment Rational

Analysis Methodology

Douglas Anderson, MBA
ALEB BOS MIS Director

Ali A. El-Saied, Ph.D.
ALEB MIS Co-Director

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Fresh produce

Market Research Methodology: Profitable Demand Analysis

The export market size (depth of market windows) has been measured utilizing a mathematical model consisting of the following four steps:

B_{qpi} , is the points where $CIF_{Ei} = WMP_i$
B_{Qi} = Quantity absorbed in the target export market at (B_{qpi})
$LW_i = N \quad \forall \; WMP_i > CIF_{Ei}$
$TMS_i = LW_i * (B_{qi} - SQ_i)$
Where
CIF_E = Egypt Break-even CIF delivery cost
B_{qpi} = Break-even quantity/price intercept points
B_Q = Break-even quantity
LW_i = Length of the export market window
WMP_i = Wholesale market price

The methodology to set priorities and screen export markets consists of four types of prioritizing indicators and screening criteria:

(A) Potential market size
(B) Potential profitability
(C) Competitive position
(D) Export potential.

Inside these four general types, the methodology develops quantitative indicators for ten specific prioritization and screening criteria. In developing the ten indicators the methodology also develops and utilizes the specific items as intermediate.

The overall prioritization and screening concepts, (1) product/market size, (2) profitability and (3) competitive position are quantified by the methodology as ten specific prioritization indicators as follows:

A. Potential Market Size

1. Total Market Size (total consumption as indicator of consumer eating preferences)
2. Import Market Size (seasonal imports as indicator of capacity to self-supply)
3. Profitable Demand Market Size during the Egyptian Seasonal Export Window

B. Potential Profitability and Value Added

4. Profit and Margins per Metric Ton
5. Total Profits for Profitable Demand Volumes

C. Estimated Competitive/Comparative Position

6. Seasonal Position
7. Transport Cost Position
8. Wage Rate Position
9. Landed Cost per Unit

D. Export Potential

10. Production season and geographical position (Country exports to the potential export markets and the capability of delivering high quality products)

A. Potential Market Size

The objective of the market size screening criteria and quantitative indicators is to give priority to the largest volume opportunities among the potential markets analyzed. Three separate, but related market size concepts are developed in the three component screening criteria and quantitative indicators.

Screening criteria	As an indicator of
1. Historical consumption volumes and trends	Consumer eating patterns and preferences
2. Historical import volumes and trends by season	Capability to self-supply, import dependence, and capacity to fund imports
3. Profitable Demand	Unsaturated potential import volumes during the Egyptian seasonal export window.

1. Total Market Size

Total consumption, including recent total and per capita volumes and long term trends, will be used as indicators of consumers' eating preferences and patterns. The intent of this indicator is to prioritize those markets where large consumption gives evidence of established and stable consumer product awareness and eating pattern dependence.

2. Import Market Size

Seasonal import volumes during recent years, and longer term trends, will be used as indicators of three market size concepts:

- The capability of the country to self-supply its consumption demand
- The demonstrated capability of consumers, marketers and importers and related infrastructure to handle, store, transport and pay for imports to meet local production gaps.
- The demonstrated capability of the economy to fund the foreign exchange requirements of these imports.

3. Profitable Demand Market Size

The Profitable Demand concept of market size is defined as the volume of a particular product which a specific country market has consumer demand capacity to import above recent year levels during the Egyptian seasonal export supply window at prices to Egyptian exporters above their Egyptian break-even cost level. The **Profitable Demand** concept develops a quantitative estimate of the volume of unmet consumer demand at, or above, prices which would be break-even or better for the Egyptian exporters during the seasonal window when Egypt can supply to that market.

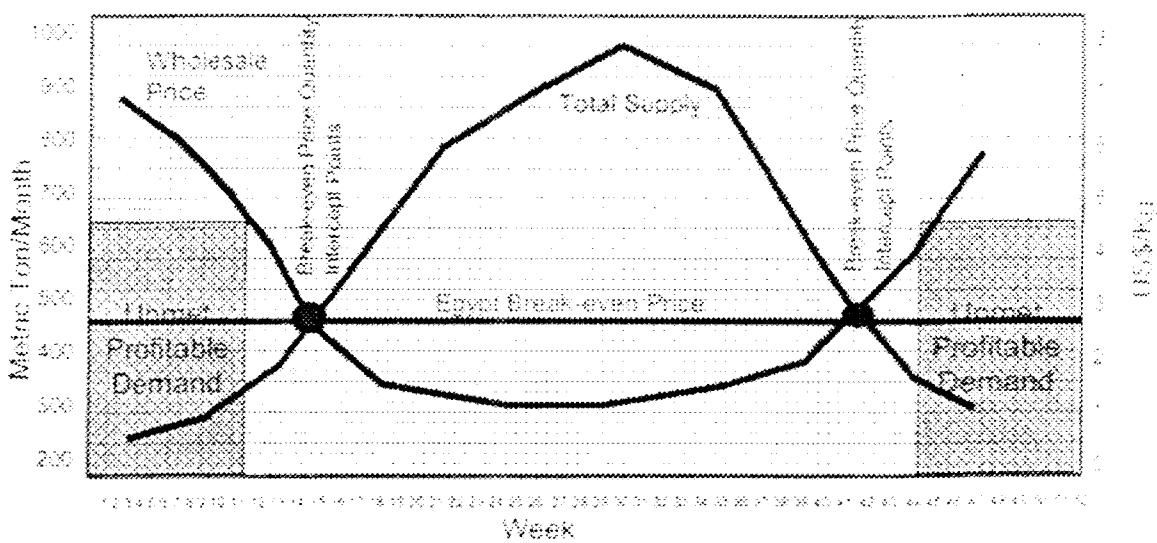
The profitable demand concept and methodology address the issues that quantity and price interact and that a single large supplier and or a number of smaller but significant suppliers can and will affect prices with the volumes they supply. This methodology provides a relatively simple method for estimating the seasonal import volume and unmet volume demand issues from the point of view of a particular supplier, such as Egypt. By estimating a sales price at which an Egyptian supplier would break-even, the methodology utilizes historical volume and price data to estimate how much additional product this market would absorb during the months Egypt could potentially supply before the price would be forced below that break-even price. The following section includes additional conceptual and methodological detail on the Profitable demand methodology is as follows.

Profitable Demand Concept and Estimation Methodology

Knowing when the market window of opportunity occurs in a given market is much simpler than knowing the depth or magnitude of the window. To estimate the depth of the market at the Egyptian break-even price requires additional logic and analytical effort. In order to understand the results of this additional analysis, it is necessary to understand some of the underlying methodology and evidence of its soundness.

Supply & Break-even Price Intercept Points: The first step in estimating *Profitable Demand*, which is to identify the points during the year when the market price is equal to the Egyptian Break-even price. The Egyptian Break-even price is the total cost of production, packaging, transport tariffs and handling to place one kilo of the product in the international market.

Unmet Profitable Demand: Concept and Estimation Methodology



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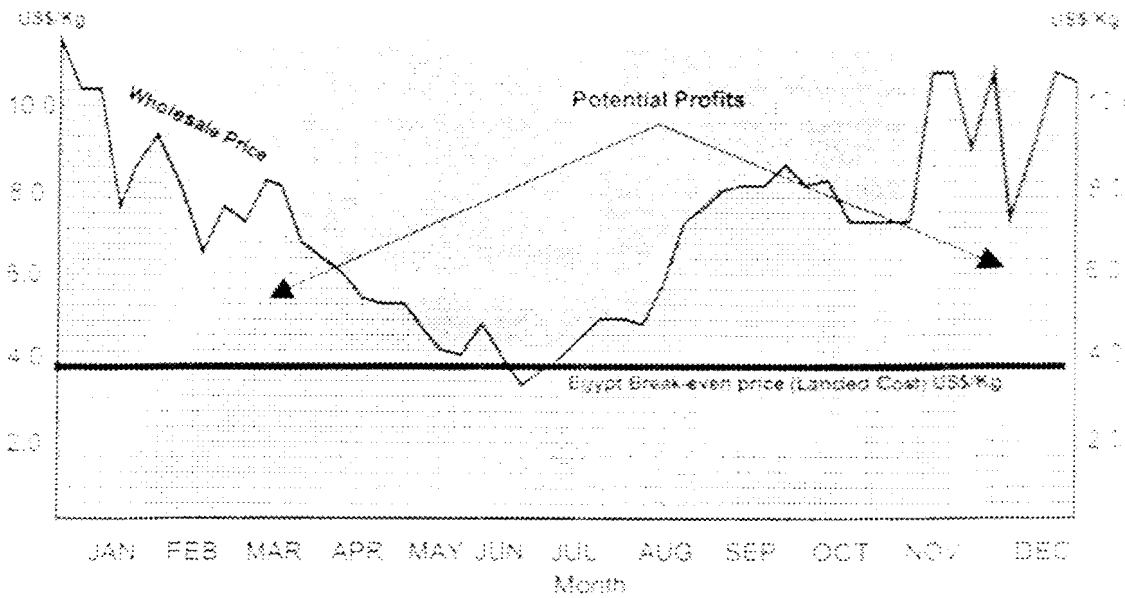
B. Potential Profitability and Value Added

4. Profit and VA Margins per Kg. or MT

The first prioritization and screening criterion for potential profitability and value added is met with an indicator which estimates profit and VA margins per Kg or MT which could be obtained in a specific product/market at historical prices paid for imported products. Although frequently used, and occasionally as the principle prioritizing indicator, profit margin estimates are of limited export strategy value, and unless balanced by volume-linked profitability concepts, can miss-prioritize products and markets by focusing on opportunities where prices may fall apart under volume supply pressure.

Strawberry Average Wholesale Market Price in Germany
and Potential Profit for Egyptian Exporters



Wholesale market prices are simple average for all varieties from different sources in a given week.
There are some slight differences between wholesale prices extracted from different sources ZMP, MNS, and ITC

5. Total Profit & VA for Profitable Demand Volumes

A safer approach to prioritizing using profitability criteria is to combine unit margin estimates with total profitability and value added estimates at a predetermined point along the price/volume continuum, which is quantified in the Profitable Demand methodology. This will shift the priority focus to product/market opportunities, which present the best AND the most robust profitability opportunities.

C. Estimated Competitive/Comparative Position

Three factors appear to be the major elements in competition between locations supplying perishable fruit and vegetables: seasonal position, transport position and wage rate position. These major factors, along with other input costs and yields, combine to contribute to landed cost

differences. While packaging costs and yield levels are both very important components of overall landed cost differences, these factors can and do change in the short run and do not usually represent longer run or underlying factors in competitive position. The methodology accounts for all of these factors as short run cost retailers in the last indicator, landed cost, but balances this estimate with separate consideration of differently measured longer run indicators for season, transport and wage rate positions.

6. Seasonal Position.

The seasonal position indicator estimates the proportion of the non-domestic supply window, which can be supplied by Egypt. Thus if a particular country can produce a specific product to supply its demand during four months of the year and the non-domestic supply window is eight months, then Egypt can supply that product to four of the gap months. The seasonal position prioritization and screening indicator is both an absolute and a comparative or competitive indicator. This indicator can be used as an absolute prioritization indicator; it can also be used as a competitive or comparative position indicator when placed alongside a similar estimate made for major competitive suppliers.

7. Transport Cost and Agility Position

Transport cost and agility indicators present a basic underlying transport position, taking into account distance and refrigerated sea traffic pattern factors. These indicators are not directly limited to average current transport pricing structures and routings, dependent as they are on volume flows, and scheduled vs. charter transport system differences. The shorter run realities of current pricing schemes is taken account of in the composite landed cost indicator 9 while this indicator 7 estimates transport costs and transit times which are expected to emerge with the volume flows implied by the Profitable Demand indicator. Thus this indicator should be a more accurate view of Egypt's underlying geographic transport position, rather than just the current low-volume transport cost which current carriers would charge to the new-market destination. Thus indicator 7 is a longer run comparative and competitive transport position indicator while indicator 9 covers the short run transport cost reality relevant to evaluating a start-up competitive position.

Of particular competitive significance from the transport perspective are product/market situations in which the perishability of the product may position Egypt to ship by sea because of its proximity to a given market where a competitor is forced to ship by air at a much higher cost. The competitive significance of these inter-modal differences will be both captured in the quantitative indicators and emphasized in the narrative analysis.

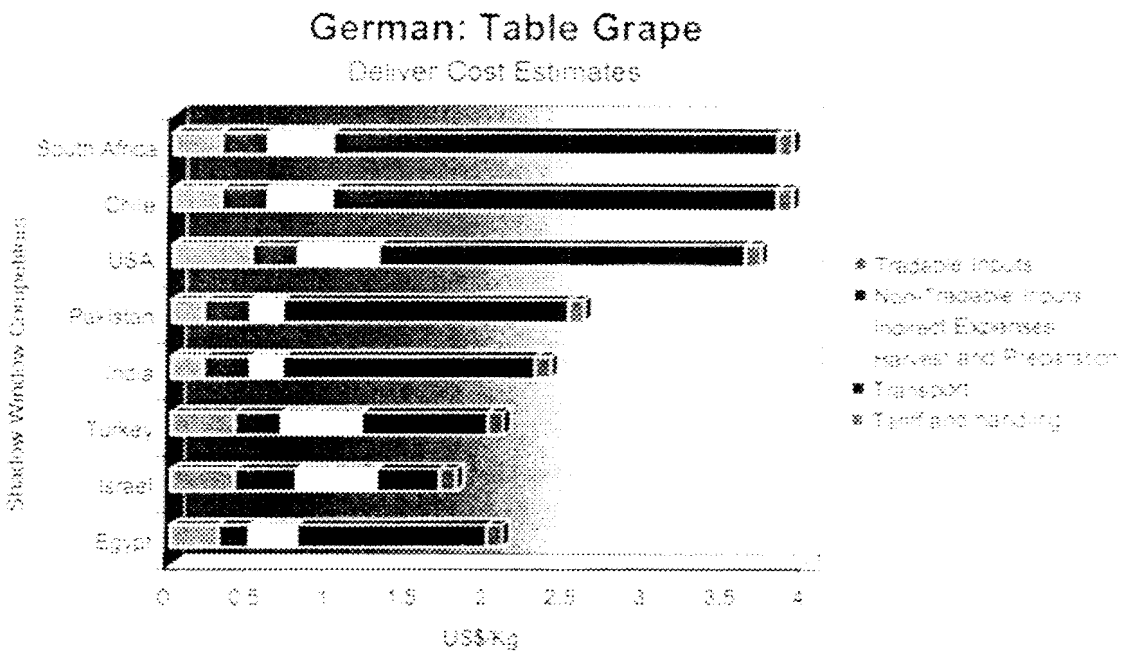
8. Wage Rate Position

For most perishable export crops, labor is the third largest cost, behind packaging and transport, which are respectively first or second depending

on whether transport is by air or sea. Thus wage rates are a major competitive and comparative advantage factor. Although rising wage rates are an obvious objective of expanded exports and wage rates are expected to change in the short run, Egypt 's comparative position vis-à-vis potential competitors is an important prioritizing and screening criteria.

9. Landed Cost per Unit

Landed cost/unit estimates are intermediate steps in arriving at profitability indicators mentioned above. They may be further used as independent estimates for competitors. The landed cost indicator concept is the same whether the estimates are based on in-depth primary statistical sources, more general secondary source estimates, or bracketed sensitivity analysis estimates across a range of different yield and cost as assumptions.



D. Export Potential

This indicator is very important at least in the short run. Production season and geographical position as well as the country exports to the potential export markets are the main quantitative indicators for this criteria.

10. Production season and geographical position

The capacity to compete in the target export markets effectively is another important indicator. The indicator could be traced by looking at the Egyptian exports to this market during the last 5 – 10 years. If the Egyptian exporters were able to hit the market even with small quantities successfully, this will give an indicator that with some modifications the Egyptian exporters could increase the Egyptian exports to this market.

Processed Food Export Market Analysis Methodology[1]

Measure A. gravity model for the calculation of trade potentials

Gravity equations are one of the most popular tools in empirical studies addressing issues in international trade. Four categories of applications can be mentioned: estimating the cost of the border, explaining trade patterns, identifying effects related to regionalism and lastly tabulating trade potentials.

The basic principles of gravity are that two opposite forces determine the volume of bilateral trade between countries – the level of their economic activity and income, and the extent of impediments to trade. The latter include in particular transportation costs, trade policies, uncertainty, cultural differences, limited overlap in consumer preference schemes, various bottlenecks etc. National borders are among these impediments, even for industrialized countries. While trade potential is the result of matched export capacities and import demands at the microeconomic level, on a more aggregated level of analysis, proximity in demand, in per capita income, in space, and in culture, are key macroeconomic determinants of export potentials. Thus various combinations of macroeconomic variables, such as gross domestic products and populations with geographic distance, are powerful predictors of trade potentials. Gravity equations share a common design that can be customized for different purposes:

- First, a gravity equation is *bilateral*. It explains a trade-related dependent variable, by the combination of macroeconomic variables (size, income, exchange rates, prices etc.) for both countries. Indicators of transportation costs between the two countries and more generally market access variables are added.

- Second, a gravity equation *may be used in order to estimate either determinants of the volume or determinants of the nature of trade flows*. In the latter case, the purpose is to use an index of intra-industry trade as a dependent variable.

- Third, *theory* definitively *provides strong* foundations *to a modelling based on rough indicators*, which is quite useful when the purpose is to integrate a large number of countries in the sample or when the statistical background for (developing) countries is limited.

- Fourth, there is inevitably a discrepancy between the theoretical model and the « ideal » equation that would fit the data well. Border

[1] This presentation is based primarily on "*TradeSim*, the ITC Simulation Model of Bilateral Trade Potentials: Background Paper. Document prepared by ITC Market Analysis Section Final Draft: Feb/2000". For more detailed information regarding gravity models and applications in trade, review the annexed list of references.

trade, seasonal trade, trade preferences or regional integration may be controlled for with specific effects by pair of country; such a solution however jeopardizes any attempt to use the model for forecasting purposes. This justifies the *introduction of cultural, historical or institutional determinants* in equations designed for an applied purpose.

- Lastly, given the type of variables under consideration, gravity-type econometric models are estimated using rather aggregated data. Numerous studies run equations on total exports.

The most common design is the following:

$$[1] \quad X_{ij} = \alpha_0 Y_i^{\alpha_1} Y_j^{\alpha_2} L_i^{\alpha_3} L_j^{\alpha_4} D_{ij}^{\alpha_5} P_{ij}^{\alpha_6} e^{u_{ij}}$$

With:

X_{ij} the total exports from *i* to *j*,

Y_i, Y_j the countries' incomes,

L_i, L_j the countries' population,

D_{ij} the geographical distance between *i* and *j*,

P_{ij} a measure of market access from *i* to *j*, and

u_{ij} the normal random error term

Such an equation can be alternatively written (Sanso et al. 1993):

$$[2] \quad \begin{aligned} & X_{ij} = \alpha_0 y_i^{\alpha_1} y_j^{\alpha_2} L_i^{\alpha_3} L_j^{\alpha_4} D_{ij}^{\alpha_5} P_{ij}^{\alpha_6} e^{u_{ij}} \\ & y = \frac{Y}{L}; \alpha_3^* = \alpha_1 + \alpha_3; \alpha_4^* = \alpha_2 + \alpha_4 \end{aligned}$$

or

$$[3] \quad \begin{aligned} & X_{ij} = \alpha_0 y_i^{\alpha_1^*} y_j^{\alpha_2^*} Y_i^{\alpha_3^*} Y_j^{\alpha_4^*} D_{ij}^{\alpha_5} P_{ij}^{\alpha_6} e^{u_{ij}} \\ & \alpha_1^* = -\alpha_3; \alpha_2^* = -\alpha_4; \alpha_3^* = \alpha_1 + \alpha_3; \alpha_4^* = \alpha_2 + \alpha_4 \end{aligned}$$

It is generally estimated in a log-linear form such as [4]. Such a specification provides elasticities of bilateral trade to income, country size and distance.

$$[4] \quad \begin{aligned} & \log X_{ij} = \alpha_0^* + \alpha_1^* \log y_i + \alpha_2^* \log y_j + \alpha_3^* \log Y_i + \alpha_4^* \log Y_j + \alpha_5 \log D_{ij} + \alpha_6 P_{ij} + u_{ij} \\ & \alpha_0^* = \log \alpha_0; P_{ij} = (1,0) \end{aligned}$$

Models generally use nominal incomes at current exchange rates. However, the associated trade-to-income elasticities may be biased when developing countries or countries in transition are integrated in the sample. Using PPPs also affect the trade-to-income elasticities. It is sometimes argued that PPPs would be much more appropriate to estimate trade potentials in the long run, an horizon in which all exchange rate adjustments towards equilibrium have taken

place. In contrast, current income would be more appropriate to analyze short-term trade potentials. However, in our model, estimating trade equations using PPPs variables leads to unreliable and highly sensitive elasticities. Hence, the alternative solution adopted here is to estimate elasticities with current exchange rates, but using a sub-sample of developing countries trading with all their partners, developing or industrialized.

Other determinants of trade

It is common to expand the basic gravity model by adding other variables. For instance, variables are added to control for common language, common border, common colonial history, common currency, land-locked characteristics and insularity. Usually these variables are introduced as dummies in the gravity equation. Shipping time is another important trade barrier, faster transport over time (some studies found that air shipping and faster ocean vessels) being equivalent to reducing tariffs from 20% to 5.5% from 1950 to 1998. Bilateral Foreign Direct Investment (FDI) is also a crucial aspect in explaining bilateral trade flows.

1) Cost of the border

If the presence of a common border facilitates bilateral trade between nations *i* and *j*, the same border is also a hindrance to trade. Hence, ceteris paribus, trade between regions of *i* should be more developed than trade between regions of *i* and regions *j*. This is the so-called "border effect".

2) Explaining trade patterns

Trade patterns have also been investigated using gravity-type equations. The trade overlap (i.e., two-way trade within industries) is examined in Bergstrand (1989) and Hummels and Levinsohn (1995); they tabulate bilateral indexes of intra-industry trade at the industry level. These indexes are then aggregated and their weighted average is explained using a gravity equation. Trade types, an alternative method used to disentangle trade in intra-industry versus inter-industry flows, are explained in Fontagné, Freudenberg and Péridy (1998). They calculate trade types at the 8-digit product level and aggregate the results at the industry level. These trade types are explained using equations integrating gravity-related variables. However, the three papers consider trade shares rather than trade volumes, which departs slightly from the bulk of work on gravity equations.

3) Regionalism effects: Trade creation versus trade diversion

Gravity models have been extensively used to address the issue of the impact of trade policies on trade flows like the impact of regional trade agreements. Consider that our two countries *i* and *j* sign a regional agreement. Introduce one dummy: 1 for «both in» (*i* and *j* in the agreement) and 0 otherwise.

If the parameter estimate is positive and significant there is trade creation due to regionalism. This exercise can be done in order to simulate trade potentials corresponding to any regional integration scheme between any groupings of countries. Cernat (2001) for example, recently analyzed South-South regional trade arrangements.

4) Calculation of trade potentials

The tabulation of trade potentials is certainly the line of related research that has been studied the most extensively by economists. This methodology has been, in particular, used extensively for Central and Eastern European Countries

Model Variables

Bilateral measure of market access

Since the model is by construction bilateral, we need to use a bilateral measure of market access that takes into account all preferential regimes.

Unlike most studies carried out capture trade agreements using dummy variables, we have used an original approach: a bilateral measure of market access. The construction and the interpretation of the bilateral database, called *MAc* is a very sophisticated measure including not only applied tariffs, but also specific duties (for example 0.2$ per kilo), tariff quotas and anti-dumping duties. All these barriers are converted into *ad valorem* equivalents and summarized in one measure. This measure is computed initially at the tariff line level. It is also possible to calculate average bilateral measures at more aggregated levels, for sectors or even for the entire economy.

In *MAc Map*, an original aggregation methodology, based on country grouping, is used in order to limit the effect of an endogenous aggregation bias.

MAc Map takes into account all preferential regimes for each importing country versus all its partner countries.

Cultural factors

A common culture variable, ranging from 0 to 1 has been created. It takes into account common national languages (official or not), as well as links established during the colonial period. The official languages were taken from *Exporters Encyclopedia 1998/99*. The following languages were considered: Arabic, Amerindian, Cantonese, Dutch, English, French, German, Irish, Greek, Hungarian, Italian, Japanese, Mandarin, Malay, Portuguese, Russian, Spanish, Swedish, Swahili and Turkish. For each country, we have distinguished primary and secondary languages. Secondary languages may not be official and include languages spoken by large communities of immigrants, such as Turkish immigrants in Germany and Latin -American immigrants in the USA. This allows us to capture influence of diasporas on trade.

Transport and transaction costs

Usually, transport and transaction costs in gravity models are captured by two variables: the physical distance between two countries and the existence of a common border. We have followed the same approach. In addition, we have considered other variables proposed recently by Loungani, Mody and Razin (2002), who have investigated alternative ways of modeling transaction and transport costs. The authors argue, "distance captures more than transport costs and that large distance may be associated with greater information and search costs". That explains why the trade-to-distance elasticity (ranging from –0.8 to –1.5 in most studies) is so high, in comparison to theory. In another study, Grossman (1998) calculated that if shipping costs are of the order of 5% of the value of traded goods, then the distance elasticity should be around -0.03. The authors suggest including variables that capture the role of informational infrastructure. They introduce two variables: bilateral telephone traffic and telephone densities (telephone lines per capita) and obtain very good results. Unfortunately, bilateral telephone traffic is only available for a limited number of countries. Consequently, we have used the bilateral telephone densities, measured as the product of telephone lines per capita in the two countries. The source for the data is the World Bank's World Development Indicators.

The distance is the great circle distance between *i's* and *j's* capital (or main) cities. Having transformed the latitude φ and the longitude λ into radians $(\times\Pi / 360)$, the formula used to calculate the distance between the pair of countries is [5].

$$[5] \quad \begin{aligned} \Delta_{ij} &= \lambda_j - \lambda_i \\ D_{ij} &= Arc\cos\left[\sin\varphi_i \sin\varphi_j + \cos\varphi_i \cos\varphi_j \cos\Delta_{ij}\right] z \end{aligned}$$

with z= 6367 for km and 3956 for miles. We used km as a unit.

The equation

The final model used for the calculations of the trade potential is the following:

$$\log X_{ij} = -9.01 + 1.54 \cdot \log Y_i + 1.04 \cdot \log Y_j + 0.39 \cdot \log Dens_i + 0.11 \cdot \log Dens_j - 0.07 \cdot \log Conflict_i$$
$$[6] \quad + 0.27 \cdot \log FDI_i + 0.85 \cdot \log Literacy_i + 0.25 \cdot \log Langdiv_i + 0.11 \cdot \log Tele_{ij} - 1.01 \cdot \log D_{ij}$$
$$+ 0.9 \cdot Border_{ij} - 0.21 \cdot Tariff_{ij} + 1.18 \cdot Culture_{ij} + u_{ij}$$

where:

i: the exporting country

j: the importing country

X_{ij}: trade from country i to country j

Y_i: GDP of country i

FDI_i: Per capita inward FDI stock in country i

$Dens_i$: population density in country i

$Literacy_i$: literacy rate in country i

$Langdiv_i$: language diversity in country i

$Tele_{ij}$: product of telephone densities in countries i and j

D_{ij}: distance between i and j

$Border_{ij}$: i and j are neighbouring countries (=1) or not (=0)

$Tariff_{ij}$: bilateral market access measure (for trade from i to j)

$Culture_{ij}$: bilateral measure of common culture

Calculation of trade potential

Trade potential is calculated on the basis of the parameter estimates shown in [6]. The formula is applied to the whole country sample. Hence for each exporting country i from the developing world, we calculate the ij X to 96 partner countries according to [6]. In order to adjust the trade potential from systematic effects, we define an "a posteriori" fixed effect Fi defined as:

$$F_i = \sum_j X_{ij} \Big/ \sum_j \hat{X}_{ij}$$

The trade potential TP_{ij} is calculated as: $TP_{ij} = F_i \cdot \hat{X}_{ij}$

This procedure calculates trade potential using so-called "fixed effects" for out-of-sample countries or, in other words, for countries not used in estimating [6].

These systematic effects capture the factors that would explain why a country would trade more (less) with the rest of the world than if it was based solely on the determinants of trade in [6]. It includes, for example, the attraction of export-oriented FDI in the manufacturing sector (Tunisia e.g.), successful export-oriented strategy (such as Mauritius), etc.

Measure B. Processed food assessing and monitoring the multi-faceted dimensions of export performance and competitiveness by sector and by county, **The Trade Performance Index (TPI)**

Content of the TPI

For each country and each sector, the TPI provides indicators on a country's general profile, on a country's position and on changes in a country's export performance. Altogether, the TPI consists of 22 quantitative indicators of trade performance. For ease of reference, these indicators are presented in absolute terms and, in addition, combined to form a ranking among the countries. Two composite rankings are calculated, one for the overall position of the country and sector under review and another one for the change in performance.

All this information is grouped under three categories referring to "general profile", "position" and "change". Firstly, descriptive indicators are provided, which will not be used in the calculation of the ranking. It is worthwhile computing their values since they provide valuable additional information for trade performance analysis. These are, for a given group of products:

G1. The value of exports (in thousand US $)
G2. The (weighted) trend of exports
G3. The share in national exports in the last year
G4. The share in national imports in the last year
G5. The average annual change in per capita exports
G6. The relative unit value in the last year
G7. The average annual change in relative unit value
G8. The revealed comparative advantage

A decreasing rank is calculated for the trend in exports and also for the change in per capita exports. However, these are indicative rankings that do not enter into the final ranking. Complementing this first set of information, the country specialization index for the group of products considered is calculated and presented separately. Such an indicator should be considered separately since competitiveness and specialization refer to two separate concepts: competitiveness refers to the advantage a country has in exporting a certain product over other countries, while specialization refers to the allocation of resources within the exporting sector, under the assumption of balanced total trade. Then, the TPI provides a second set of indicators related to *positions*:

P1. Value of net exports (in thousand US $)
P2. Per capita exports (US$/inhabitant)
P3. Share in world market (%)
P4-a. Product diversification (number)
P4-b. Product spread (ranking)
P5-a. Market diversification (number)
P5-b. Market spread (ranking)

For each of these indicators, a ranking is established, by decreasing performance, which will be used in the calculation of a composite ranking of *position*. The reasons for calculating two separate indicators of diversification for products and markets are clarified below. The composite index of *position* considers a simple average of the corresponding two ranks (average of the rankings for P4-a and P4-b for instance).

Lastly, the TPI provides a second set of indicators related to *change*:

C1. Percentage change in world market share
C2. Trend of import coverage by exports
C3. Matching with dynamics of world demand
C4-a. Change in product diversification
C4-b. Change in product spread
C5-a. Change in market diversification
C5-b. Change in market spread

The percentage change of world market share (C1) is divided into four complementary effects that are quantified separately, namely the competitiveness effect, the impact of initial geographic and product specialization and the adaptation to changes in the patterns of world demand. All these indicators enter into a composite ranking of change.

Calculation of Indicators

General profile indicators, position-related indicators and change-related indicators are surveyed respectively. All indicators are calculated for target commodities. Original data used in the computation is at the 6-digit level of the HTS nomenclature.

G1- Value of exports

Value of total country exports by sector is given in million of US$. Exports are given in FOB terms if the country is a direct reporter to the COMTRADE database or in CIF terms when using mirror statistics.

G2- Trend of exports

The weighted trend measures, for each country and each sector, the annual percentage growth of exports from 1994 to 20018. The index is calculated using the ordinary least squares method. In this index the trend is weighted against the individual weight of specific products within the sector. This technique aims to render the results more stable and minimize the effect of strong fluctuations. The ranking of the 184 countries is proportional to the average growth rate of their respective exports.

G3 (G4)- Share in national exports (imports)

This refers to the share of exports (imports) by sector in relation to total country exports (imports), for the year 1998.

G5- Change in per capita exports

The level of exports is determined by the demand for a country's products on world markets and a country's ability to satisfy that demand, which can be related to its size. Hence, the value of per capita exports shows how outward looking is a country, and the extent to which the population produces for the world market. The change in per capita exports reflects changes in a country's outward looking stance and performance for the group of products considered.

G6- Relative Unit Value

The RUV of each sector is calculated as the ratio of the average unit value of exports for a country to the world average unit value. The reference point or average relative unit value is 1 (the unit value in the targeted country equals the unit value in the world market). If the RUV is below (above) 1, then the country exports its product at a lower (higher) price than the world average unit price.

Traditionally, the comparison of unit values for homogeneous products gives an indication of exporters' relative prices. However, according to the new theories of international trade, products are differentiated by quality, which is often reflected by differences in price. Accordingly, prices are considered as an indirect indicator of the quality of differentiated products: assuming that a consumer has access to product information, two products of different quality cannot be sold at the same price.

However, since prices are not available for individual products, or even for industries, unit values (values divided by quantities) are taken as proxies for prices. Higher unit values are considered as reflecting a higher quality, other things being equal, and not as an indication of poor price competitiveness.

G7- Change in relative unit value

The change in Relative Unit Value represents the average annual evolution of the RUV index over the period (1994-2001).

G8- Comparative advantage (not displayed)

In trade flows analysis, an indicator of comparative advantage aims at measuring specialization. The specialization of a country is an indication of how a given country allocates its resources to its various industries, under the assumption of balanced total trade. The rationale underpinning this assumption is that the contribution of any product or industry to the theoretical level of specialization must be isolated from business cycle related effects, such as the impact on trade of changes in the real

exchange rate. This is the goal of the index measuring the contribution to the net trade balance developed by CEPII4 and used in the present analysis. Accordingly, the indicator has a structural character. The index, measured in thousand parts of trade, gives the contribution of each sector (and market) to the overall trade balance. It is calculated as the difference between the actual net balance and the theoretical net balance. The theoretical net balance corresponds to the net value that the sector (or market) under analysis would register when global equilibrium occurs in the country's trade. The aim of this index is to identify for each country those sectors with the highest levels of specialization, rather than to compare countries.

According to equation (8), the revealed comparative advantage is standardized by total trade for the exporting country considered.

$$RCA^{t}_{i,cl} = \frac{1000}{(X^{t}_{i,.} + M^{t}_{i,.})} * \left[(X^{t}_{i,cl} - M^{t}_{i,cl}) - (X^{t}_{i,.} - M^{t}_{i,.}) * \frac{(X^{t}_{i,cl} + M^{t}_{i,cl})}{(X^{t}_{i,.} + M^{t}_{i,.})} \right] \quad (8)$$

with:

$X^{t}_{i,.}$ and $M^{t}_{i,.}$ respectively country i total exports and imports in year t

$X^{t}_{i,cl}$ and $M^{t}_{i,cl}$ respectively country i total exports and imports of products belonging to the cluster cl in year t

$(X^{t}_{i,cl} - M^{t}_{i,cl})$ the observed trade imbalance of country i for the cluster cl in year t.

$\frac{(X^{t}_{i,cl} + M^{t}_{i,cl})}{(X^{t}_{i,.} + M^{t}_{i,.})}$ the weight of cluster cl in country i exports in year t.

$(X^{t}_{i,.} - M^{t}_{i,.}) * \frac{(X^{t}_{i,cl} + M^{t}_{i,cl})}{(X^{t}_{i,.} + M^{t}_{i,.})}$ the theoretical imbalance of country i for the cluster cl in year t.

P1- Value of net exports

Net exports are defined as exports less imports. A country's net exports are a reliable indicator of its position on the world market for two reasons. Firstly, net exports eliminate re-exports, which would otherwise introduce a bias into the raw data. Secondly, the indicator takes into account the international division of production processes, since a large part of imported intermediate products found within exports usually belong to the same sector (e.g. electronic parts and assembled computers). Hence, net exports provide a very simple but reliable correction for dealing with the globalization of production processes and the induced vertical specialization of countries at various stages of production.

P2- Per capita exports

The value of per capita exports indicates the level of outward looking of a country and the extent to which a country's population produces for the world market.

P3- Share in world market (percentage share of world exports)

The world market share for a specific country is the ratio of total country exports to total world exports. The market share can also be defined as the country's share in national markets for each partner country, and the importance of each of these partners in world trade.

Equation (1) defines the market share PM_i^t of country i at year t.

$$PM_i^t = \sum_j \sum_k X_{ijk}^t / X_{..}^t = \sum_j \sum_k \left[\frac{X_{ijk}^t}{X_{.jk}^t} \cdot \frac{X_{.jk}^t}{X_{..}^t} \right] \quad (1)$$

with

X_{ijk}^t country i exports of product k to country j at year t.

$X_{.jk}^t$ total exports of product k to country j at year t.

$X_{.j.}^t$ total exports to country j at year t.

$X_{..}^t$ world exports of all products at year t.

$X_{ijk}^t / X_{.jk}^t$ the market share of country i in country j for the product k at year t.

$X_{.j.}^t / X_{..}^t$ the weight of the importing market in world imports.

P4- Product diversification

Diversification, measured through exports, is a good indicator of production structures and industry's development level. Diversification limits the dependence on a small number of products and hence reduces a country's vulnerability to industry-specific external shocks.

In order to capture the degree of product diversification, two separate indicators are calculated: the equivalent number of products and the spread. The spread is the inverse of the corresponding concentration. The equivalent number (EN=1/Herfindal), is a theoretical value which represents the number of markets of identical size that would lead to the degree of export concentration exactly equal to the observed one. Because this indicator is not highly sensitive to activities of relatively weak importance, it is a measurement that is suited to sectoral studies. We start by presenting these indicators and then turn to an example illustrating the value added of combining the two indicators.

Calculating product differentiation by means of the equivalent number distinguishes for each country the equivalent number of exported goods of equal importance (either within each sector or in the whole national

economy) leading to the same concentration of exports. The increase in rank is a function of the increase in the level of diversification (both for products and markets). The larger the index value, the greater the diversification of exports, and consequently the better the ranking.

The *spread index* complements the equivalent number. Spread indices measure the dispersion between the highest and lowest value in a given statistical serie. They are calculated using a weighted standard error. The spread index for products calculates for each country the distribution of export products and compares it to the average export value. The greater the distribution (i.e. spread) of exports from a country as compared to the average, the higher the value of the index.

If all countries export all products, one of these indicators would be sufficient. Since this is not the case, the combination of the two indicators is useful.

In technical terms, the equivalent number (for products) is calculated as in equation (2) below:

$$NE^{t}_{i,cl} = \frac{1}{\sum_{k=1}^{n}\left(X^{t}_{i,k} / X^{t}_{i,cl}\right)^{2}} \quad (2)$$

with: $X^{t}_{i,k}$ the export of product k by country i at year t.

$X^{t}_{i,cl}$ country i exports of all products belonging to the cluster cl at year t.

$X_{i,k} / X_{i,cl}$ the share of product k in total exports of country i in cluster cl.

Turning to the index of weighted spread, equation (3) indicates that the standard deviation divided by the number of products times the average value of exports for individual products has been used.

$$S^{t}_{cl} = \left[\frac{\sqrt{\sum_{k=1}^{cl}\left(X^{t}_{i,k} - \overline{X}^{t}_{i,cl}\right)^{2}}}{N(\overline{X}^{t}_{i,cl})}\right] \quad (3)$$

with:

$X^{t}_{i,k}$ country i exports of product k to market i in year t.

$\overline{X}^{t}_{i,cl}$ the average value of country i exports in year t for the cluster cl.

$\left(X^{t}_{i,k} - \overline{X}^{t}_{i,cl}\right)$ the deviation to the average of product k in cluster cl for country i.

$\sqrt{\sum_{k=1}^{cl}\left(X^{t}_{i,k} - \overline{X}^{t}_{i,cl}\right)^{2}}$ the standard deviation.

S^{t}_{cl} the weighted spread.

P5- Diversification of markets

Diversifying partner countries reduces a country's dependence on a small number of export markets and hence the vulnerability to shocks within destination countries. In order to capture the degree of market diversification, the same two complementary indicators referred to above

are used: the equivalent number of markets and the spread. The equivalent number used for calculating market diversification (equation 4) distinguishes for each country, the number of partner countries weighed according to their importance. The increase in rank is a function of the increase in the level of diversification of markets. The bigger the index value, the greater the diversification of markets and consequently the better the ranking.

$$NE_i^t = \frac{1}{\sum_{j=1}^{p}\left(X_{ijcl}^t / X_{i,cl}^t\right)^2} \quad (4)$$

with :

X_{ijcl}^t country i exports of all products belonging to the cluster cl to country j in year t.

$X_{i,cl}^t$ country i total exports of all products belonging to the cluster cl

$X_{ijcl}/X_{i,cl}$ the share of market j in country i total exports of products belonging to the cluster cl.

Spread indices measure the existing dispersion between the highest and lowest value of a given statistical series. They are calculated using the weighted standard error (equation 5). The spread index for markets compares for each country, the share of its exports directed to different partner countries with the average export value. The greater the dispersion of exports from this country (i.e. the greater the spread) as compared to the average, the higher the value of the index. Concerning positions, the ranking of the 184 countries is a function of the degree of diffusion of exported products (of a country's exports to partner countries). The smaller the index, the more exported products are evenly distributed (amongst partner countries) and the better the ranking.

$$S_{icl}^t = \left[\frac{\sqrt{\sum_{j=1}^{p}\left(X_{ijcl}^t - \overline{X}_{icl}^t\right)^2}}{N(\overline{X}_{icl}^t)}\right] \quad (5)$$

with:

X_{ijcl}^t country i total exports to market j in cluster cl in year t.

$\overline{X}_{icl}^t$ country i average export to the p markets of products belonging to the cluster cl in year t

$\sqrt{\sum_{j=1}^{cl}\left(X_{ijcl}^t - \overline{X}_{icl}^t\right)^2}$ the standard deviation.

C1- Change in world market share

Turning to variations, the decomposition of the variation in the world market share provides information on the competitiveness of the country

considered. The market share variation can be tabulated as the simple average of the rankings according to four criteria: competitiveness, initial geographic specialization, initial product specialization and responsiveness to changes in world demand. These indicators are calculated by decomposing changes in a country's market share in elementary markets.

An elementary market is defined as the destination market "j" for a specific product "k". The market share of country "i" in the world market can be written as the sum of partner countries (markets "j") as well as products (sectors "k"), weighted by the share of these markets in world exports.

The variation in country "i"'s market share is the total derivative of this weighted average. The equation can be written as the sum of the following components:

Competitiveness effect p.a.: Gains in market shares due to increased competitiveness. It is calculated as the change in the exporting country's share in destination market imports, multiplied by the initial share of the partner countries' imports in world trade.

Initial geographic specialization p.a.: This effect captures the benefits associated with the initial specialization of domestic exports on dynamic markets. Quantitatively, it is calculated as the initial market share of the exporting country in partner countries, multiplied by the change in the share of partner countries in world trade.

Initial product specialization p.a.: This effect captures the benefits associated with the initial sector specialization of domestic supply on products facing a dynamic demand. Quantitatively, it is calculated as the change in the share of elementary markets in world trade, multiplied by the difference between the initial share of the exporting country in elementary markets and the initial market share of the exporting country in destination markets.

Adaptation p.a.: This effect captures the ability to adjust the supply of exports to changes in world demand. This is obtained by calculating the cross variation of changes in country "i"'s market share and the change in its share of elementary markets in world imports. If both changes are positive (+,+), this indicates that over the period studied, country "i" has experienced an increase in its market share on dynamic elementary markets. It follows that the outcome from the cross variation is positive. If both changes are negative (-,-), it means that over the period studied, country "i" has experienced a decrease in its market share on recessive elementary markets. Thus, the cross variation is once again positive. In contrast, increasing market shares on recessive markets (+,-) or losing market shares on dynamic markets (-,+) leads to a negative cross variation. In sum, the *ranking* for the change in market share is calculated as the simple average of the rankings for the 4 following items:

competitiveness, geographic specialization, product specialization and responsiveness to changes in world demand.

More formally, the change in world market share can be written as in (3).

$$\partial PM_{i} = \sum_{j,k} \partial\left[\frac{X_{ijk}}{X_{.jk}}\right] * \left[\frac{X^{0}_{.jk}}{X^{0}_{..}}\right] + \sum_{j,k} \left[\frac{X^{0}_{ijk}}{X^{0}_{.jk}}\right] * \partial\left[\frac{X_{.jk}}{X_{..}}\right] + \sum_{j,k} \partial\left[\frac{X_{ijk}}{X_{.jk}}\right] * \partial\left[\frac{X_{.jk}}{X_{..}}\right] \quad (3)$$

This is the sum of three terms, namely:

the gains or losses in market shares associated with changes in competitiveness:

$$\sum_{j,k} \partial\left[\frac{X_{ijk}}{X_{.jk}}\right] * \left[\frac{X^{0}_{.jk}}{X^{0}_{..}}\right]$$

the benefits of the initial specialisation on dynamic markets:

$$\sum_{j,k} \left[\frac{X^{0}_{ijk}}{X^{0}_{.jk}}\right] * \partial\left[\frac{X_{.jk}}{X_{..}}\right]$$

the adaptation to the changes in world demand:

$$\sum_{j,k} \partial\left[\frac{X_{ijk}}{X_{.jk}}\right] * \partial\left[\frac{X_{.jk}}{X_{..}}\right]$$

It is possible to split the effect of initial specialisation (the second term in equation 3) into two parts corresponding to the benefits of the initial specialisation by destination market and by product.

$$\sum_{j,k} \left[\frac{X^{0}_{ijk}}{X^{0}_{.jk}}\right] * \partial\left[\frac{X_{.jk}}{X_{..}}\right] = \sum_{j} \left[\frac{X^{0}_{ij.}}{X^{0}_{i..}}\right] * \partial\left[\frac{X_{.j.}}{X_{..}}\right] + \sum_{j,k} \left[\frac{X^{0}_{ijk}}{X^{0}_{.jk}} - \frac{X^{0}_{ij.}}{X^{0}_{i.j}}\right] * \partial\left[\frac{X_{.jk}}{X_{..}}\right] \quad (4)$$

The first term on the right side of equation (4) corresponds to the effect of the initial specialisation on destination markets. The impact is positive if the country benefits from strong initial positions on dynamic markets. The second term refers to the impact of the initial product specialisation. The two terms are not symmetric since it is impossible to fully disentangle the geographic and sectorial impacts.

C2- Trend of the coverage of imports by exports

The index is calculated as the average annual growth rate of the cover ratio from 1994 – 2001 (based on the ordinary least-squares method). It indicates the evolution of the trade balance for a group of products. A positive index will be associated with a positive trend.

C3- Adapting to world demand

This index is calculated with a view to ranking countries according to their ability to adapt to the dynamics of world demand. It is based on Spearman's rank correlation between the ranking share of the exporting countries' export products in its total exports, and the rank of growth trends in worldwide exports of those products.

Each country is given a correlation index that takes a value between 1 and –1. A value of 1 (-1) indicates that the relative importance of a country's exported goods is in full accordance (discordance) with the ranking of world export growth rates for the same goods. The country ranking is

dependent on the rank correlation index. The closer the index is to 1, the better the country ranking under analysis.

C4- Change in the diversification of products

The change in the product diversification of a given country represents the average annual variation over the period 1994 – 2001 in the number of equivalent export products. The change in the product spread of a given country represents the average annual variation over the period 1994 – 2001 in the concentration of export products.

C5- Change in market diversification

The change in the product diversification of a given country represents the average annual variation over the period 1994 – 2001 in the number of equivalent export markets. The change in the product spread of a given country represents the average annual variation over the period 1994 – 2001 in the concentration of export markets.

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