

# Export Diversification in a Transitioning Economy: The Case of Syria

Jamus Jerome Lim\*

February 9, 2010

## Abstract

Understanding the growth-inducing effects of trade liberalization requires a thorough understanding of the policies and processes underlying export diversification. How does government policy that explicitly engages in trade liberalization affect the process of export diversification in the economy? Furthermore, conditional on such policy, what are the directions in which exports diversify? This paper seeks to examine these questions by exploiting a directed policy effort by Syria to liberalize its trading sector beginning in 2001. The primary advantage offered by the Syrian case is that the policy in question was largely prompted by a political decision, reached independently of contemporaneous structural changes in the economy. As a consequence, Syrian trade liberalization can be analyzed under a quasi-experimental setting, which helps identify the effect of the policy on actual diversification outcomes.

KEYWORDS: Trade policy, export diversification, Syria

JEL CLASSIFICATION: F14, O24, P33

---

\*The World Bank. Email: [jlim@worldbank.org](mailto:jlim@worldbank.org). Comments by and discussions with Jorge Araujo, Fahrettin Yagci, and representatives from the Ministry of Economy and Trade—especially Samar Kusaibati and Hussam Youssef—both greatly improved this paper, as well as limited its factual inaccuracies. Naturally, they are absolved from any errors that remain. This paper was funded by MNSD WPA (BB) element EW-P113209-ESW. The findings, interpretations, and conclusions expressed in this article are entirely those of the author. They do not necessarily represent the views of the World Bank, its Executive Directors, or the countries they represent.

# 1 Introduction

The robust positive relationship between economic performance and trade openness is a result that has, literally, been demonstrated millions of times (Sala-i-Martin 1997). Countries that have more open borders are also countries that tend to grow quickly. Consistent with this result, many economies that adopted an export-oriented approach through the second half of the 20th century did in fact enjoy growth takeoffs (Jones & Olken 2008).

A pure-minded focus on export orientation, however, hides several nuances underlying such a strategy. First, the growth of export activity may well be the consequence, rather than the cause, of an investment boom and associated growth episode. This was arguably the case for Taiwan and South Korea; unlike Singapore or Hong Kong, these economies did not engage in unilateral trade liberalization until after their respective growth accelerations (Rodrik 1997). Second, export-driven growth is often accompanied by conscious industrial policy that seeks to diversify the economic base of the liberalizing economy. The Chilean export-led growth experience, for instance, involved a government-led effort to move away from mining toward manufacturing (Siliverstovs & Herzer 2007).

Third, there are reasons to believe that export orientation and export diversification are not, in fact, equivalent strategies. The content matter of exports could be just as important as, if not more important than, the actual volume of exports. For example, it is possible to attribute the rapid growth of China from the 1990s onward to the production and export of high-productivity goods more commonly produced in developed countries (Hausmann, Hwang & Rodrik 2007). Finally, export diversification itself is not a monolithic strategy. The extensive margin of export diversification can occur along several dimensions, involving expansions into new products (Hummels & Klenow 2005), new markets (Brenton & Newfarmer 2009), or up the quality ladder (Schott 2004).<sup>1</sup>

For these reasons, understanding the growth-inducing effects of trade liberalization requires a more thorough understanding of the policies and processes underlying export diversification. More specifically, how does government policy that explicitly engages in trade liberalization affect the process of export diversification in the economy? In addition, conditional on such policy, what are the directions in which exports diversify? This paper seeks to examine these questions by exploiting a directed policy effort by Syria to liberalize its trading sector beginning in 2001.

Of course, the multifaceted and complex nature of any trade liberalization regime—which typically involves simultaneous efforts at both broadening the production base as well as more direct trade-related liberalization efforts—

---

<sup>1</sup>There is evidence that the first-order driver of export growth is from the intensive rather than extensive margin (Besedeš & Prusa 2007), although this may vary according to income level, with poorer countries more likely to diversify along the extensive margin (Cadot, Carrère & Strauss-Kahn 2007). Within the extensive margin, exports of existing products into new markets generally accounts for a greater share of export growth than that of new products alone (Brenton & Newfarmer 2009).

means that it is difficult to isolate the pure effect of government policy aimed at trade liberalization. Nonetheless, the advantage offered by the Syrian case is that the policy in question was largely prompted by a political decision, reached independently of *contemporaneous* structural changes in the economy that may have induced policy action toward further diversification.<sup>2</sup> As a consequence, the possibility of reverse causality is minimized, allowing a clear lens with which to determine the effect of liberalization policy on actual diversification outcomes. Syrian trade liberalization can thus be seen as occurring under a quasi-experimental setting, which helps identify the effect of the policy on actual diversification outcomes.

There are additional reasons to believe why Syria is an ideal candidate for such an exercise. First, Syrian exports have traditionally centered on crude oil, and hence its initial position is one of extreme export concentration. Tracing the evolution of export patterns over the relatively short time span between 2001 and 2007 can provide a sense of the dynamics underlying the speed and scope of the diversification process. Second, Syria's transition since 2001 from a centrally-planned command economy to a more market-based one means that the economy was allowed to respond by engaging in the necessary factor reallocations required for export diversification. Such broader economic liberalization smooths the flow of factors into sectors where the economy possesses a comparative advantage, compared to sectors arbitrarily chosen by the state.

The theoretical literature identifies several ways by which trade can affect growth. Knowledge spillovers from the production process become amplified when countries choose to specialize and trade; alternatively, opening the economy to trade can spur investments in purposive innovation (Grossman & Helpman 1991). Both of these channels allow static gains from trade to stimulate the dynamic process of economic growth. Dynamic gains also accrue from the diversification of the production and export base, which could reduce a country's vulnerability to idiosyncratic sectoral shocks (Acemoglu & Zilibotti 1997), as well as improved industry productivity due to intra-industry (Melitz 2003) or intra-firm (Bernard, Redding & Schott 2006) reallocations of resources.

However, such a positive relationship, whether at the theoretical and empirical level, need not imply that opening an economy to trade would necessarily lead to economic growth. Economically large countries are likely to engage in greater volumes of trade, trade policy notwithstanding (Bergstrand 1985). As a result, the observed correlation between the two may be due to richer nations engaging in more trade, rather than the other way around.

Disentangling endogeneity issues has been a major thrust on the empirical research front over the past decade. While the evidence remains mixed, there is reason to believe that trade openness does in fact lead to higher per capita incomes (Feyrer 2009; Frankel & Romer 1999), and that openness is often a significant fundamental determinant of long-run economic performance as well

---

<sup>2</sup>This claim deserves further qualification. It is entirely possible—even likely—that trade liberalization policies were introduced in response to the declining net oil export position of Syria. However, changes in the pattern of *other* exports, *per se*, did not have direct influence on the adoption of this policy.

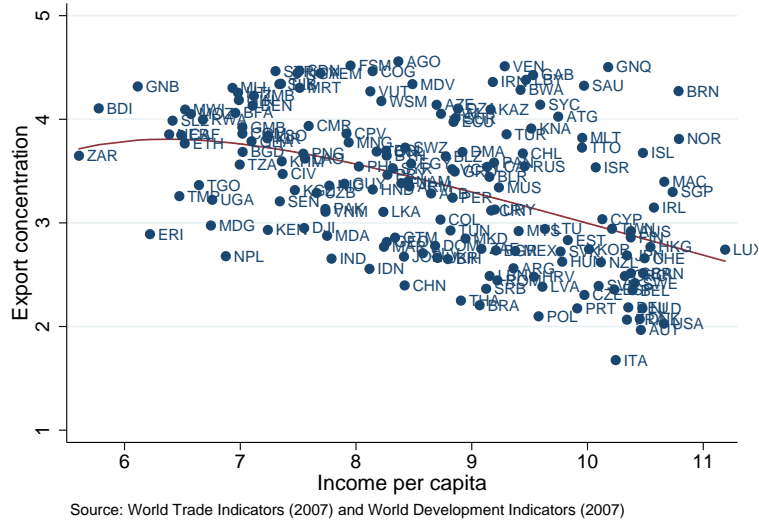


Figure 1: Inverted U-shaped relationship between per capita income and export concentration ratio, 2006, with fitted fractional polynomial line. The bivariate (linear) regression generates a negative relationship significant at conventional levels.

(Decker & Lim 2008).<sup>3</sup> The growth of real trade, therefore, is likely to drive the process of economic growth.

Along these lines, more recent work has probed the question further, along the lines of export diversification. Imbs & Wacziarg (2003) first broached the issue by establishing the stylized fact that production and employment tend to follow an inverted U-shaped relationship with regard to per capita income. This result holds similarly for export diversification as well (Carrère, Strauss-Kahn & Cadot 2007), although the relationship tends to be more L-shaped when the sample is restricted to primarily developing countries (Chandra, Boccoardo & Osorio-Rodarte 2007). Ultimately, the fit appears to be sensitive to both the measure of export concentration and the sample frame chosen, although in general the relationship is largely negative (Figure 1).

There are reasons to believe that export diversification, in and of itself, may be a driver of growth. Cross-country studies find that several measures of export diversification are positively associated with real income growth (Al-Marhubi 2000), and this result may be causal (Hesse 2009). At the country level, there

<sup>3</sup>Rodríguez & Rodrik (2000) critique this line of literature, arguing that, *inter alia*, many results based on cross-sectional studies suffer from omitted variable and endogeneity biases, and measures often do not capture trade policy variables directly. While it is important to recognize the potential limitations of the literature, the academic consensus remains favorable to a positive, causal relationship between trade and growth.

also appears to be evidence supporting the diversification-growth link (Herzer & Nowak-Lehmann 2006), perhaps through a learning-by-exporting channel.

A question that has been less frequently considered is *what* gives rise to greater degrees of export diversification. Other than the level of economic development (Carrère *et al.* 2007; De Benedictis, Gallegati & Tamberi 2009), there is reason to believe that the extent of export diversification is also influenced by trade policy (Estevadeordal & Martincus 2006), proximity to major markets for the export in question (Parteka & Tamberi 2008), and the amount of foreign direct investment (Gourdon & Nassif 2009).

Despite these recent efforts at understanding the determinants of export diversification, much of the empirical literature has concentrated on factors that apply at the cross-country level. What is far less understood are the factors that matter at the sectoral or firm level, and especially the contribution of sector-specific inputs and policies related to trade. To our knowledge, the only paper that addresses the issue of micro-level determinants of export diversification, albeit indirectly, is Goldberg, Khandelwal, Pavcnik & Topalova (2008). Using firm-level data from India, the paper finds that access to new imported inputs—as measured by declines in tariffs and the subsequent prices of intermediates—can account for an expansion of domestic firm product scope of up to 31 percent.

## 2 Syria in the Global Trading System

Although the study of transition economies has traditionally been focused on the former Soviet satellite states of central and eastern Europe, the Syrian Arab Republic offers a fascinating case study of a country that is in transition in two dimensions: From a oil-exporting centrally-planned economy, toward an economically diverse market-based system.

Beginning with the 1960s, the Syrian economy operated as a largely centralized economy with significant state intervention. This was accompanied by a relative withdrawal from the global economic system, beginning with its withdrawal from GATT in 1951. This relative isolation was sustained, in part, by a strong political regime and the discovery of oil in the late 1960s. The economy remained largely closed, with non-oil trade comprising a relatively small share of GDP for an economy the size of Syria; the share of non-oil trade in GDP amounted to about 30 percent for the period 1974–2000.<sup>4</sup>

Beginning with the turn of the 21st century, this isolationist path is now in retreat. Syria has undertaken economic reforms that are making it increasingly integrated with the world trading system. A transition program was introduced along with the 9th Five-Year Plan (FYP) in 2000, which laid out the trajectory for economic diversification and an opening to non-oil merchandise trade. Early reform objectives included the goal of diversification away from a dependence on oil, and the development of trade accompanied by entry into new markets.

---

<sup>4</sup>Data were not available for all years and hence calculations were performed with gaps in 1988, 1991, and 1993–1994.

However, many trade policies recommended and implemented in the 9th FYP remained distortionary in nature. The government maintained an export monopoly on a range of products, such as oil, wheat, barley, and lentils. While the plethora of Soviet-era state firms in charge of managing trade were merged into a single entities—exemplified by the formation General Establishment of Agricultural Products to manage agricultural commodities and the General Foreign Trade Organization to deal with imports for the public sector—trade remained hampered by a host of restrictive tariffs and nontariff barriers, and production for export suffered from a lack of quality control and a weak trade facilitation infrastructure.

In 1997 Syria became a signatory of the Arab Free Trade Area Agreement, which formed Greater Arab Free Trade Area (GAFTA).<sup>5</sup> The agreement mandated the gradual elimination of tariffs on products between signatory nations over a ten-year period, to conclude by 2008 (the agreement was ultimately brought forward and fully implemented in 2005). Participation in GAFTA committed Syria to maintaining its pace of trade liberalization, and policy moves to promote intra-regional liberalization served as a complement to broader multi-lateral efforts.

The 10th Five-Year Plan—instituted in 2006—made trade reform objectives more explicit. In addition to the primary goal of export diversification, the plan included reforms aimed at export promotion, tariff and nontariff barrier reduction, and trade facilitation through revisions in the legal framework (Table 1). Many of these reforms were centered on introducing new laws or amending old ones, such as revisions to the Trade Law or the issuance of a Competition Law. The policies were also aimed at meeting specific quantitative targets; for example, reforms objectives included reducing the balance of payments deficit to 6.6% of GDP, increasing nonoil exports by about 13% annually, and increasing private sector exports by 15% per year.

It is important to note that the policy decision to diversify the production and export base was primarily a political decision that—while influenced by historical structural features of the economy—was not directly influenced by contemporaneous economic developments. While the government explicitly acknowledged the structural imbalances across industrial sectors caused by the centralized system of the past, it is also clear that the existing changes in the structure of the economy were hitherto unremarkable and hence did not play a role in its policy choice (State Planning Commission 2005, p. 48):

[Syrian] trade has been marked for a long time by a stereotyped nature. . . predominant in most developing economies. It has specialized in exporting agricultural and raw oil materials, depriving it of benefiting [sic] from the added values which could have been achieved by industrializing these materials and exporting them as consumer products. . . economic development has not achieved, over the last 50 years, its goals of adjusting the production structure,

---

<sup>5</sup>GAFTA is also alternatively referred to as the Pan-Arab Free Trade Area, or PAFTA, especially in the non-English-language literature.

Table 1: Direct and indirect trade policy measures introduced in the 10th FYP, 2006–2010<sup>†</sup>

| Policy dimension                          | Related programs                                                                                                                                             | Timing    |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Export diversification                    | Creation of export promotion agency and quality control agencies; expand production base and improve competitiveness of firms                                | 2006–2007 |
| Enhance position as regional trade center | Improve physical and legal infrastructure; build and develop financial institutions                                                                          | 2006–2010 |
| Improve trade facilitation                | Improve transport and communications infrastructure; create export guarantee fund; simplify investment procedures and laws; simplify import/export licensing | 2006–2007 |
| Trade barriers                            | Tariff reduction and consolidation; tarrification of nontariff barriers                                                                                      | 2006–2007 |
| Macroeconomic factors affecting trade     | Unification of multiple exchange rates to fixed regime                                                                                                       | 2006–?    |

<sup>†</sup> Source: Adapted from State Planning Commission (2005).

but...increased the dependency on importing local product inputs face export challenges (weak and uncompetitive production base; inefficient infrastructure of transport and communications; and low export awareness of most exporters).

Although a systematic assessment of the 10th FYP has yet to be performed, the government’s mid-term review of progress in the area of foreign trade points to a reasonable degree of success in meeting the internal benchmarks. Many of the more straightforward legislative initiatives—such as the drafting and passing of trade-related laws—have been implemented, as have the more administrative elements (such as the formation of an export promotion agency). The record with regard to policy-related components is a little more mixed. For example, while programs designed to increase the competitiveness of the production base are underway, the import regime remains essentially unchanged, especially with regard to the tarrification and elimination of nontariff trade barriers. While some degree of tariff reduction and simplification has been achieved, the tariff schedule remains somewhat complex, with 10 nonzero tariff bands. Similarly, the introduction of the export guarantee fund is behind schedule, although other trade facilitation measures, such as customs modernization, are on track and already contributing to performance improvements, such as marked reductions in clearance times and costs at the border. The unification of the multiple exchange rate system was finally achieved in 2007, and by the end of the year Syria effectively operate under one fixed rate.

In part due to these changes, Syria has seen a surge in trade flows since 2001. Total trade has increased from 45.7 percent of GDP in 2001 to 67.0 percent in 2007; an increase of just under 47 percent in less than 7 years. Significantly, nonoil (oil) exports have risen (fallen) as a share of GDP, from 5.4 (18.5) percent

to 19.1 (11.6) percent. This has been led by the private sector, which now accounts for 92.8 percent of all nonoil exports from the country. The composition of nonoil exports has also moved from raw materials toward intermediate and consumer goods, with the latter two forms accounting for more than half of all nonoil exports in 2007.

### 3 Patterns of Syrian Exports and Export Diversification

At the most superficial level, the number of Syrian exports has grown significantly over the past decade. The number of merchandise products exported in 2006 has more than doubled from the low of 60 product lines in 1999, with these export numbers displaying a solid upward trend; in addition, this trend exceeds both the regional as well as lower-middle income country average, of which Syria is part (Figure 2).

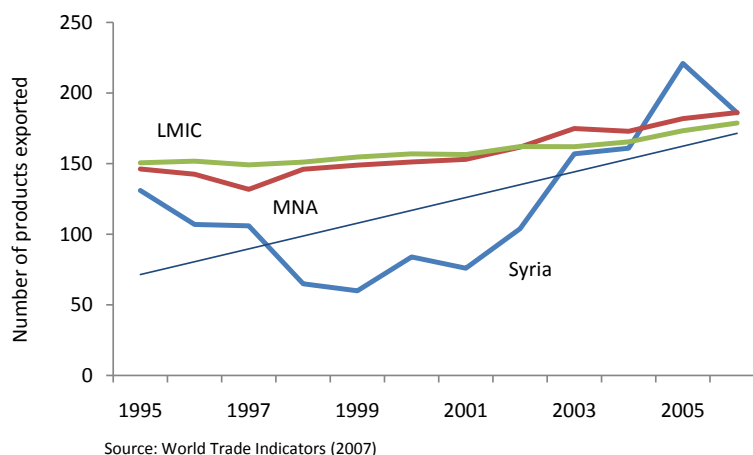


Figure 2: Number of products exported, 1995–2006, Syria, regional average, and lower-middle income country average. Number of merchandise products calculated at 3-digit SITC level, and includes only products whose value exceeds USD \$100,000 or 0.3 percent of the country’s total exports.

This trend is most pronounced in the period following the start of reform in 2001, coinciding with the launch of Syria’s 9th FYP. Over the 6-year period between 2001 and 2006, the number of products exported grew by 144.7 percent, compared to -35.9 percent in the preceding 6-year period. This corresponds to an effective (average) annual growth rate of 16.1 percent, or the addition of about a dozen new exports lines per annum. Trade flows have surged as well, with exports doubling (in absolute terms) from SYP 243.1 billion (\$5.05 billion,



or 23.9% of GDP) to SYP 505.0 billion (\$10.92 billion, or 29.6% of GDP) over the same period.

The bulk of these exports were destined for the EU—primarily Italy and France—although this has changed over time. The EU share of Syrian exports has declined from 68.3 percent to 40.2 percent between 2000 and 2006, with the MNA region taking up most of the slack (increasing over the same period from 7.8 percent to 23.1 percent) (Figure 3). Part of this can be explained by (anticipated and actual) Syrian entry into GAFTA in 2005. The EU-Syria Association Agreement (EUSAA) may once again shift export patterns between the EU and the MNA region, although this remains uncertain.<sup>6</sup>

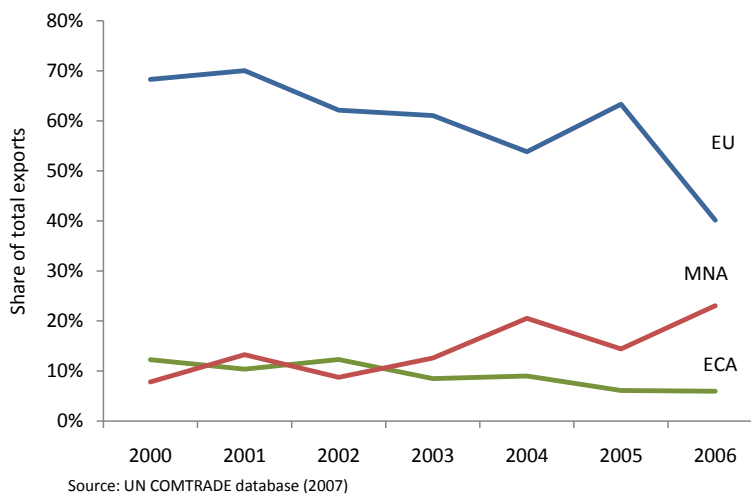


Figure 3: Changes in export destination patterns, Syria, 2000–2006. Export destination breakdown for the EU (MNA) region includes, in decreasing order of size, Italy, France, the United Kingdom, and Spain (Saudi Arabia, Jordan, Lebanon, Iraq, and Egypt). Exports to other regions are negligible.

Traditionally, Syrian exports to EU countries have been in (unprocessed) petroleum and derivative oils, and this has likewise been affected by the relative decline in the share of oil exports in total exports by Syria over time. Between 2000 and 2007, nonoil exports (as a share of GDP) grew by almost 200 percent, which accounted for a significant share of the 18 percent growth rate of total exports (as a share of GDP). In contrast, exports from Syria to the other countries of the region have mainly been in food products; the growth of such exports has in fact been the main driver of the increase in MNA-related trade in nonoil products. Table 2, which lists the key products destined for Syria’s main export partners, captures this pattern vividly.

<sup>6</sup>Negotiations on the EUSAA were completed in 2004, but political circumstances precluded its ratification by the European Parliament. Following an improvement in the political climate,

Table 2: Primary exports of Syria, 2-digit HS level, by main trading partners, 2006

| Country      | HS code     | Product                         | Value <sup>†</sup> | Share <sup>‡</sup> |
|--------------|-------------|---------------------------------|--------------------|--------------------|
| Italy        | 27          | Mineral fuels                   | 2,431,893          | 89.0               |
|              | 15          | Animal/veg fats/oils            | 116,293            | 4.3                |
|              | 52          | Cotton                          | 65,059             | 2.4                |
|              | 41          | Raw hides and skins             | 57,903             | 2.1                |
|              | <b>1-97</b> | <b>All exports</b>              | 2,731,694          | 100.0              |
| France       | 27          | Mineral fuels, oils             | 1,253,124          | 94.8               |
|              | 61          | Knitted apparel                 | 21,413             | 1.6                |
|              | 62          | Non-knitted apparel             | 17,886             | 1.4                |
|              | 39          | Plastics                        | 4,594              | 0.3                |
|              | <b>1-97</b> | <b>All exports</b>              | 1,322,439          | 100.0              |
| Saudi Arabia | 01          | Live animals                    | 215,682            | 17.7               |
|              | 07          | Edible vegetables               | 163,972            | 13.5               |
|              | 62          | Non-knitted apparel             | 123,582            | 10.2               |
|              | 20          | Prepared vegetables/fruit/nuts  | 105,087            | 8.6                |
|              | <b>1-97</b> | <b>All exports</b>              | 1,216,071          | 100.0              |
| Iraq         | 84          | Machinery/mechanical appliances | 115,998            | 18.1               |
|              | 07          | Edible vegetables               | 115,095            | 17.9               |
|              | 22          | Beverages, spirits and vinegar  | 101,566            | 15.8               |
|              | 34          | Soap                            | 57,292             | 8.9                |
|              | <b>1-97</b> | <b>All exports</b>              | 641,805            | 100.0              |

<sup>†</sup> Shown in thousands of USD.

<sup>‡</sup> Calculated as share of total exports to partner country.

We consider the extent of product and geographic diversification more formally by employing several standard (and some nonstandard) measures of export diversification. Two standard measures are the Herfindahl-Hirschman index

$$H = \sum_K \left( \frac{x_k}{\sum_K x_k} \right)^2, \quad (1)$$

which is the sum of squares of export ( $x$ ) shares for each HS line,  $k \in K$ ,<sup>7</sup> and the Theil index

$$T = \frac{1}{K} \sum_K \left( \frac{x_k}{\bar{x}} \cdot \ln \frac{x_k}{\bar{x}} \right), \quad (2)$$

which is the sum of the export shares, weighted by the share relative to the mean,  $\bar{x} \equiv \sum_K x_k / K$ . One advantage of considering these two indices in tandem is that they possess properties that render the former more sensitive to changes in large export sectors, and the latter more sensitive to changes in small sectors;<sup>8</sup> this allows us to pin down whether changes in export diversification are driven

the document was (re)initialed in Dec 2008, and is currently awaiting passage.

<sup>7</sup>To present results in an intuitive manner, we further normalize (1) by the total number of lines via  $H^* = \frac{H-1/K}{1-1/K}$ , to obtain an index with range  $[0, 1]$ .

<sup>8</sup>This results from the fact that  $H$  ( $T$ ) is convex (concave) on the shares of total export flows.

more by changes to flows from existing export champions, or from potentially emerging products.

One advantage of the Theil index is its decomposability, which breaks down the contribution of export concentration into between versus within  $i \in I$  product groups:

$$\begin{aligned} T &= T_W + T_B \\ &= \sum_I \frac{k_i}{K} \frac{\bar{x}_i}{x} \left[ \frac{1}{K_i} \sum_{k \in i} \left( \frac{x_k}{\bar{x}_i} \cdot \ln \frac{x_k}{\bar{x}_i} \right) \right] + \sum_I \frac{k_i}{K} \frac{\bar{x}_i}{x} \cdot \ln \frac{\bar{x}_i}{\bar{x}}, \end{aligned} \quad (3)$$

where  $\bar{x}_i \equiv \sum_{k \in i} x_k / K_i$  is average exports for a given group.

While it is possible to calculate Herfindahl-Hirschman indices by geographic diversification,

$$H' = \sum_L \left( \frac{x_l}{\sum_L x_l} \right)^2,$$

where export shares are now calculated for each country  $l \in L$ , we prefer the index of export market penetration introduced by Brenton & Newfarmer (2009):

$$P = \frac{\sum_K \sum_J y_{k,j}}{\sum_K \sum_J z_k}, \quad (4)$$

where  $y$  and  $z$  are indicator variables defined by

$$\begin{aligned} y_{k,j} &= \begin{cases} 1 & \text{if } x_{k,j} > 0, \\ 0 & \text{otherwise;} \end{cases} \\ z_k &= \begin{cases} 1 & \text{if } m_j > 0, \\ 0 & \text{otherwise,} \end{cases} \end{aligned}$$

where  $x_{k,j}$  are exports of a product  $k$  to importer  $j$  and  $m_j$  are imports by importer  $j$ . (4) essentially captures the aggregate market penetration of exports, where markets are defined as all countries that import a given product. The primary advantage of this measure, relative to the geographic Herfindahl, is that it not only captures the distribution of exports across markets, but importantly normalizes this distribution by the potential markets that exist for these exports.

Table 3 reports our calculations of export concentration for the period 2001–2007. We classify these measures according to three dimensions: (a) diversification between different products across all exports; (b) diversification across exports within defined product groups; (c) diversification by geographic destination. The first three columns include a count of the number of distinct products, as well as (normalized) (1) and (2) applied the all exports at the 4-digit HS level. The fourth column reports the Theil (Between) measure given by (3). The next three columns are analogous to the first three, but instead report median values across the 21 HS sections for each measure. The eighth column reports the Theil (Within) measure given by (3). The final three columns provide a count of the

Table 3: Export diversification, between and within sectors, Syria, 2001–2007<sup>†</sup>

| Year       | Between  |            |       |           | Within <sup>‡</sup> |            |       |           | Geographic |            |      |  |
|------------|----------|------------|-------|-----------|---------------------|------------|-------|-----------|------------|------------|------|--|
|            | Products | Herfindahl | Theil | Theil (B) | Products            | Herfindahl | Theil | Theil (W) | Partners   | Herfindahl | Pen  |  |
| 2001       | 142      | 0.62       | 0.45  | 0.26      | 6                   | 0.51       | 0.13  | 0.19      | 49         | 0.21       | 0.00 |  |
| 2002       | 206      | 0.46       | 0.62  | 0.33      | 9                   | 0.32       | 0.18  | 0.29      | 49         | 0.15       | 0.00 |  |
| 2003       | 881      | 0.40       | 3.45  | 1.49      | 30                  | 0.24       | 2.22  | 1.95      | 132        | 0.15       | 0.04 |  |
| 2004       | 363      | 0.33       | 1.11  | 0.65      | 12                  | 0.32       | 0.62  | 0.46      | 104        | 0.12       | 0.01 |  |
| 2005       | 651      | 0.38       | 2.27  | 0.98      | 23                  | 0.26       | 1.24  | 1.29      | 128        | 0.14       | 0.02 |  |
| 2006       | 974      | 0.15       | 2.81  | 0.80      | 34                  | 0.29       | 2.64  | 2.01      | 136        | 0.09       | 0.06 |  |
| 2007       | 509      | 0.14       | 1.18  | 0.43      | 18                  | 0.31       | 1.17  | 0.75      | 127        | 0.10       | 0.02 |  |
| Mean       | 532      | 0.35       | 1.70  | 0.71      | 19                  | 0.32       | 1.17  | 0.99      | 104        | 0.14       | 0.02 |  |
| Change (%) | 258      | -78        | 160   | 62        | 200                 | -40        | 817   | 296       | 159        | -53        | 489  |  |

<sup>†</sup> Calculations applied at the 4-digit HS level and normalized assuming full quorum of 1,213 lines. Within calculations applied at the 4-digit HS level after sorting into 21 sections, with the exception of Theil (Within). Geographic calculations applied to total exports and normalized assuming full quorum of 250 countries, with the exception of market penetration, which was applied at the 4-digit HS level.

<sup>‡</sup> Reported values are medians across sections for each year, with the exemption of Theil (Within).

number of distinct trading partners, the (normalized) Herfindahl calculated by country share of total exports, and (4).<sup>9</sup>

Across all exports, Syrian exports demonstrate a general trend toward increasing diversification (columns 1–4). The Herfindahl between all export lines has fallen significantly between 2001 and 2007, from a fairly concentrated 0.62 to 0.14, which is more consistent with moderate levels of diversification. This diversification, along the extensive margin, is also broadly supported by the decomposed Theil (Between) statistics, which demonstrate a declining trend after 2003. By way of contrast, other economies in the region possess Herfindahls that range from well-diversified (Morocco, 0.03 and Lebanon, 0.03), to moderate diversification (Egypt, 0.14), to concentrated (Iran, 0.69 and Yemen, 0.72).<sup>10</sup> Seen another way, Syria has, over a seven-year period, moved from an export diversification structure consistent with oil-exporters to one more akin to non-oil exporters. These changes in the extent of diversification is, we would argue, a function of its policy-driven transition program, and is unique in the region, insofar as rapid diversification is concerned.

Based on the Herfindahl, most of the export diversification achieved by Syria appears to be due to changes in its larger export sectors, with a decline in oil exports as the most likely driver.<sup>11</sup> As such, it is uncertain whether the moderate diversification levels achieved in 2006 and 2007 is likely to persist, especially if oil prices rise in the medium run.

The clear declining -78 percent decline in the Herfindahl-Hirschman is not, however, replicated for the (aggregated) Theil (which better tracks changes in the share of smaller export sectors); in fact, the latter increases rapidly from 2001, peaks in 2003, before declining to lower levels that are nonetheless higher than that in 2001. This suggests that, in the 2002/03 and 2004/06 periods, the rapid expansion of exports—as evidenced by the number of products—has been mostly skewed toward larger lines; equivalently, export diversification has been less pronounced along the intensive margin. While part of this result may be an artifact of the degree of disaggregation—the Theil declines more systematically over the period when measured at the 2-digit level<sup>12</sup>—the results nonetheless suggest that substantial degrees of diversification have yet to be achieved in newly emerging export lines.

This mixed result comes into sharper focus when examining concentrated indices corresponding to diversification within sections (columns 5–8). Herfind-

---

<sup>9</sup>Notably, Table 3 leaves out one other (relatively) common measure of export diversification, the Gini index. We have chosen to do so for two main reasons. First, most of the dynamics of changes in export concentration are well captured by the other reported measures. Second, the main advantage to using a Gini index—its immutability under different sample sizes—is of less consequence in our case, where we are considering only one country with very limited changes in the availability of data.

<sup>10</sup>Since Herfindahls for the other economies are more stable over the period, these values are calculated as averages for the period 2001–2007, inclusive.

<sup>11</sup>Besides the 37.3 percent decline in Syrian oil exports as a share of GDP between 2001–2007, the composition of oil in exports fell from 77.4 to 37.9 percent over the same period.

<sup>12</sup>Specifically, Theil indices calculated at the 2-digit HS level fall by 19 percent between 2001 and 2007, although the rise-and-fall pattern is replicated as well at this level of aggregation.

ahls remain fairly stable over the period, with a mean of 0.32 (and standard deviation of 0.09). Theils within sections are similar to their values between all product lines—the correlation coefficient is 0.92—which imply once again that smaller export sectors are not responsible for export diversification patterns. Taken together, the relatively stable Herfindahl and varying Theil indices are indicative of the fact that the median sector’s exports are not due to the introduction of new products, but rather due to occurring at a broader level in the economy.

Syria has also made some modest gains in terms of geographic diversification (columns 9–11). All three indicators corroborate the depiction of expanding export markets given by Figure 3, and suggest that diversification along the spatial dimension is reasonably healthy. It is useful to note, however, that export penetration remains relatively low in absolute terms; while penetration has grown almost fivefold between 2001 and 2007, it lags both regional nonoil-exporting economies (Jordan, 0.04 and Lebanon, 0.08) as well as oil exporters (Saudi Arabia, 0.07 and UAE, 0.20).<sup>13</sup>

The dynamic changes in Syria’s export structure can also be captured by indices of revealed comparative advantage (RCA) (Balassa 1965), which for a given country  $c$  in line  $k$  is

$$RCA_{c,k} = \frac{x_{c,k}/\sum_K x_{c,k}}{\sum_L x_{l,k}/\sum_L \sum_K x_{l,k}}, \quad (5)$$

where  $l \in L$  are the countries that export  $k$ . Since (5) is the export share of the country relative to the rest of the world, a value of  $RCA_{c,k} > 1$  ( $RCA_{c,k} < 1$ ) indicates a *revealed* comparative advantage (no revealed comparative advantage) in line  $k$ .

In Table 4 we report calculations of (5) for Syria at the most aggregated level (HS sections), for the period 2001–2007. Agricultural products (sections 1–4) all display rising trends, with three of the four sections switching from having no revealed comparative advantage in 2001 to demonstrating clear specialization by 2007 (the exception is vegetable products, which maintained revealed comparative advantage over the period). Textiles (section 11), another product that has traditionally featured in the Syrian export mix, also demonstrates increasing specialization (as has, more recently, footwear and headgear).

The trend in increased comparative advantage exhibited by the agricultural sector over the is especially interesting. The improvement in RCA indices in this sector has occurred alongside improvements in the amount of irrigated cultivable land—at an average annual rate of 3.11 percent (NAPC 2006)—as well as in the context of repeated water deficits, the most recent incident being a three-year drought that began in 2007. The export potential of the agricultural sector is a finding that has been corroborated by other studies (Atiya 2008; Lançon 2005) using different methodologies, although there is some concern that the long-term viability of the sector as a source of export strength may be compromised by reduced subsidy support as a result of the country’s declining oil revenues.

<sup>13</sup>As for our Herfindahl calculations, since export penetration indices are relatively stable over the period, these values are averages for the period 2001–2007, inclusive.

In contrast, mineral products—of which oil is the largest component for Syria—demonstrates a fairly rapid decline in specialization, falling to a nadir in 2006 before picking up slightly in 2007. If this trend is maintained, Syria will despecialize in mineral products by 2009<sup>14</sup>, consistent with its shift into being a net importer of oil in 2007.

Table 4: Revealed comparative advantage, aggregated categories, 2001–2007<sup>†</sup>

| Sec | Category                   | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|-----|----------------------------|------|------|------|------|------|------|------|
| 1   | Animal products            | 0.41 | 2.81 | 2.14 | 2.88 | 2.14 | 2.29 | 2.23 |
| 2   | Vegetable products         | 2.66 | 3.13 | 3.28 | 3.04 | 2.86 | 5.01 | 4.87 |
| 3   | Organic oils and fats      | 0.21 | 0.60 | 2.26 | 1.82 | 4.36 | 5.07 | 5.23 |
| 4   | Prepared foodstuff         | 0.13 | 0.27 | 0.50 | 0.89 | 0.89 | 1.28 | 1.57 |
| 5   | Mineral products           | 8.44 | 7.67 | 6.90 | 6.17 | 5.11 | 2.96 | 3.20 |
| 6   | Chemical products          | 0.01 | 0.03 | 0.08 | 0.12 | 0.27 | 0.47 | 0.44 |
| 7   | Plastics and rubber        | 0.01 | 0.04 | 0.11 | 0.15 | 0.25 | 0.50 | 0.50 |
| 8   | Hide and leather           | 0.04 | 0.48 | 0.45 | 0.50 | 0.53 | 1.28 | 1.48 |
| 9   | Wood products              | 0.00 | 0.01 | 0.06 | 0.04 | 0.08 | 0.08 | 0.09 |
| 10  | Paper products             | 0.02 | 0.05 | 0.13 | 0.13 | 0.17 | 0.44 | 0.34 |
| 11  | Textiles                   | 1.08 | 1.35 | 1.51 | 1.58 | 1.72 | 3.89 | 3.95 |
| 12  | Footwear and headgear      | 0.12 | 1.09 | 0.96 | 0.80 | 0.70 | 2.23 | 2.70 |
| 13  | Stone, ceramic, and glass  | 0.04 | 0.07 | 0.21 | 0.48 | 0.44 | 0.46 | 0.29 |
| 14  | Precious stones and metals | ‡    | ‡    | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 |
| 15  | Base metals                | 0.01 | 0.03 | 0.10 | 0.21 | 0.18 | 0.29 | 0.27 |
| 16  | Machinery and appliances   | 0.00 | 0.01 | 0.02 | 0.02 | 0.04 | 0.18 | 0.17 |
| 17  | Transportation equipment   | 0.00 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 |
| 18  | Instruments and apparatus  | ‡    | ‡    | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 |
| 19  | Arms and ammunition        | ‡    | ‡    | 0.00 | ‡    | 0.00 | 0.08 | ‡    |
| 20  | Miscellaneous manufactured | 0.00 | 0.02 | 0.11 | 0.11 | 0.12 | 0.42 | 0.41 |
| 21  | Art and antiques           | ‡    | ‡    | 0.01 | ‡    | 0.05 | 0.03 | 0.01 |

<sup>†</sup> Calculations applied to 21 HS sections, which aggregate the 97 lines at the 2-digit HS level.

<sup>‡</sup> No recorded exports of products in given year.

The broad product lines underlying these sections largely reflect the patterns at section level, although sufficient variability emerges even at this level of disaggregation that it is useful to present those lines that lie close to the bounds of calculated revealed comparative advantage, as well as those registering the greatest changes. The former are the product lines for which Syria has the strongest (and weakest) relative global presence in 2007, while the latter is suggestive of rising (and falling) stars. These 2-digit lines are listed in Tables 5 and 6, respectively, along with their key underlying 4-digit drivers.<sup>15</sup>

The calculations presented in Table 5 suggest that the strength of Syrian exports in the agricultural sector derive from live animals, especially sheep and poultry, as well as edible vegetables. Although not reported, RCA values for

<sup>14</sup>Based on a linear regression of RCA on the time trend,  $RCA_t = -0.96t + 1933.5$ , such that  $RCA_{2009} = 0.97$ .

<sup>15</sup>We identify these drivers by taking bivariate regressions of the 2-digit line on the 4-digit line, and reporting the variables that yielded the top two  $R^2$  values. Since this methodology allows for both positive and negative coefficients, it is important to keep in mind that a significant amount of the variation could be due to the negative contribution of a given 4-digit driver.

many other processed agricultural products are also high. These include products traditionally associated with Syrian agricultural exports, such as animal and vegetable oils (chapter 15), especially olive oil (heading 1509), as well as fruit and nut preparations (chapter 20), especially preserved nuts (heading 2006) such as pistachios and cashews.

Products which Syria has little (revealed) comparative advantage in include pearls and precious stones (chapter 71), seafood (chapter 3), and optical and photographic equipment (chapter 90). These are unsurprising: the former two depend largely on natural endowments, while the last is typically associated with high-skill, capital-intensive production, neither of which Syria is relatively more abundantly endowed.

Note that Table 5 also alludes to the possibility of production and export complementarity, especially with regard to downstream and upstream products. In particular, the production and export of vegetable materials is mostly due to cotton linters (subheading 140420); this is the upstream component that complements the well-diversified man-made filaments (chapter 54) sector downstream.

Table 6 highlights the most dynamic products in the export mix. As can be seen, increases in RCA (in percentage changes) outstrip decreases by several orders of magnitude. While this disparity in part due to the fact that positive changes often start from a smaller base, the more general pattern in the data nonetheless points to larger changes in RCA on the positive side. Moreover, while Syria does not specialize in many of these sectors (as seen in the upper half of the table), it has also attained specialization in many others (as seen in the lower half of the table).

Among the fastest growing goods are woven fabric (chapter 58), beverages (chapter 22), and miscellaneous manufactured articles (chapter 96). The first two have, over the 2001–2007 period, switched from nonspecialization to specialization. This is reflective of the most dynamic export sectors. Bottled waters (heading 2201), for example, did not exist as an export line in 2001; by 2007, exports of bottled waters were estimated at USD \$33,793,053, or 0.3 percent of all exports. Given the relatively low per-unit price of bottled waters, this seemingly small share is not insignificant. Other types of exports, such as brooms and brushes (heading 9603), have grown at a very rapid pace, and it is likely that some of these product lines will attain specialization in the near future.

On the negative side of the ledger, some of Syria’s more traditional exports appear to be receding in importance. Although mineral fuels (chapter 27) and edible fruit (chapter 8) have sustained comparative advantage, the declines in RCA—especially for crude petroleum (heading 2709)—suggest that these lines will diminish in importance in the Syrian export basket in the medium term, especially if the rate of decline is sustained.

While the calculations given by (5) formalizes the specific product lines for which a country has relative specialization, it does not capture important features about the nature of the goods exported. Hausmann *et al.* (2007) argue that the *type* of goods exported can be important. In particular, a given product



Table 5: Revealed comparative advantage, disaggregated categories, 2001–2007 (extreme values subsample)<sup>†</sup>

| HS code            | Product                     | RCA (2001) | RCA (2007) | Change (%) |
|--------------------|-----------------------------|------------|------------|------------|
| <b>Upper bound</b> |                             |            |            |            |
| 14                 | Vegetable materials         | 41.09      | 30.36      | -33        |
| 1404               | Other veg products          | 64.89      | 43.49      | -26        |
| 1401               | Veg plaiting materials      | ‡          | ‡          |            |
| 01                 | Live animals                | 4.53       | 18.78      | 314        |
| 0104               | Live sheep                  | 61.12      | 282.78     | 363        |
| 0105               | Live poultry                | 0.24       | 0.22       | -9         |
| 07                 | Edible vegetables and roots | 6.02       | 13.81      | 129        |
| 0707*              | Cucumbers and gherkins      | 0.59       | 3.02       | 410        |
| 0704               | Cabbages and cauliflowers   | 1.27       | 7.40       | 482        |
| 54*                | Man-made filaments          | 0.40       | 13.01      | 3,117      |
| 5407               | Woven synthetics            | 0.62       | 25.40      | 3,973      |
| 5402               | Synthetic yarn              | ‡          | 1.24       |            |
| 09                 | Coffee, tea, and spices     | 6.04       | 10.23      | 69         |
| 0909               | Seeds of anise              | 302.97     | 450.83     | 49         |
| 0901               | Coffee                      | ‡          | 0.24       |            |
| <b>Lower bound</b> |                             |            |            |            |
| 97                 | Works of art                | ‡          | 0.03       |            |
| 9701               | Handmade decorative         | ‡          | 0.01       |            |
| 9702               | Original engravings         | ‡          | ‡          |            |
| 71                 | Pearls and precious stones  | ‡          | 0.00       |            |
| 7113               | Jewels                      | ‡          | ‡          |            |
| 26                 | Ores, slag, and ash         | 41.09      | 30.36      | -33        |
| 03                 | Fish and crustaceans        | ‡          | 0.00       |            |
| 0307               | Molluscs                    | ‡          | 0.01       |            |
| 0301               | Live fish                   | ‡          | ‡          |            |
| 90                 | Optical and photo equipment | ‡          | 0.00       |            |
| 9015               | Surveying equipment         | ‡          | ‡          |            |
| 9032               | Auto reg instruments        | ‡          | ‡          |            |

<sup>†</sup> Calculations applied at the 2-digit and 4-digit HS level. At 2-digit level, lines exhibiting highest and lowest values for 2007 were reported (excluding products that did not exist in 2007). At 4-digit level, lines with highest two  $R^2$  values in bivariate regression were reported, except where the scarcity of observations made this impossible.

<sup>‡</sup> No recorded exports of product in given year.

\* Indicates (2-digit) product line for which RCA switched from  $> 1$  to  $< 1$  (if change was negative) or  $< 1$  to  $> 1$  (if change was positive).

line  $p$  can be classified by the productivity level associated with it:

$$PRODY_p = \sum_L \frac{x_{l,p} / \sum_K x_{l,k}}{\sum_L x_{l,p} / \sum_L \sum_K x_{l,k}} \cdot GDP_l = \sum_L RCA_{l,p} \cdot GDP_l, \quad (6)$$

where  $GDP_l$  is the GDP per capita of country  $l$ . The index (6) aggregates the per capita output levels across all countries exporting the product  $k$ , weighted by the revealed comparative advantage of each country in the product. Further aggregation across all exports, weighted by their respective export shares, yields the embodied productivity level associated with the export basket of country  $c$ :

$$EXPY_c = \sum_K \frac{x_{c,k}}{\sum_K x_{c,k}} \cdot PRODY_k. \quad (7)$$

In contrast to the positive trends in measures of export diversification, the

Table 6: Revealed comparative advantage, disaggregated categories, 2001–2007 (greatest changes subsample)<sup>†</sup>

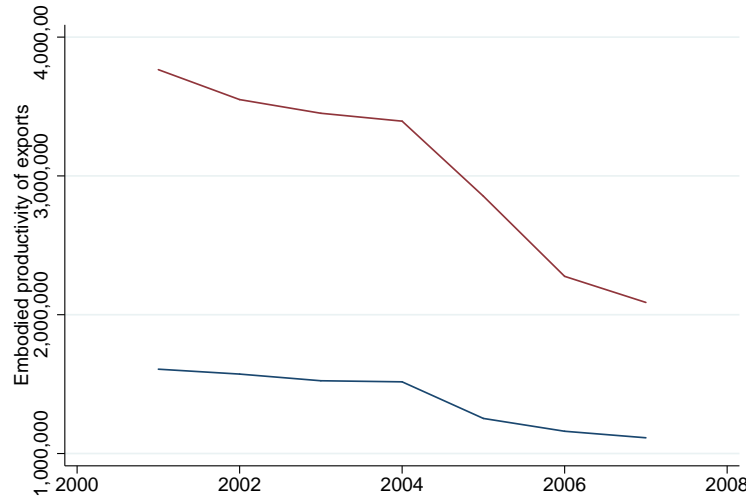
| HS code | Product                | Decrease   |            |            | Increase |                            |            |            |            |
|---------|------------------------|------------|------------|------------|----------|----------------------------|------------|------------|------------|
|         |                        | RCA (2001) | RCA (2007) | Change (%) | HS code  | Product                    | RCA (2001) | RCA (2007) | Change (%) |
| 06      | Live trees and plants  | 0.51       | 0.07       | -87        | 94       | Furniture and bedding      | 0.00       | 0.52       | 10,612     |
| 0602    | Other live plants      | 1.10       | 0.07       | -94        | 9403     | Other furniture            | 0.01       | 1.06       | 10,126     |
| 0603    | Cut flowers            | 0.01       | 0.02       | 190        | 9406     | Prefabricated buildings    | ‡          | 0.19       |            |
| 05*     | Other animal products  | 1.20       | 0.83       | -31        | 87       | Vehicles                   | 0.00       | 0.01       | 22,546     |
| 0504    | Offal                  | 2.61       | 1.59       | -39        | 8707     | Motor vehicle bodies       | ‡          | 0.12       |            |
| 0506    | Bones                  | ‡          | ‡          |            | 8708     | Motor parts                | 0.00       | 0.03       | 13,603     |
| 12      | Oil seed               | 0.41       | 0.34       | -17        | 96       | Miscellaneous manufactured | 0.00       | 0.81       | 123,780    |
| 1211    | Plants for perfumery   | 3.21       | 3.27       | 2          | 9603     | Brooms and brushes         | ‡          | 3.11       |            |
| 1205    | Rape or colza seeds    | ‡          | ‡          |            | 9609     | Pencils                    | ‡          | 0.78       |            |
| 27      | Mineral fuels and oils | 9.06       | 3.47       | -62        | 25*      | Salt, sulphur, earth       | 0.02       | 1.67       | 9,660      |
| 2709    | Crude petroleum        | 15.46      | 6.29       | -59        | 2510     | Natural calcium phosphates | ‡          | 35.74      |            |
| 2710    | Non-crude petroleum    | 2.69       | 1.63       | -40        | 2509     | Chalk                      | ‡          | ‡          |            |
| 14      | Vegetable materials    | 41.09      | 30.36      | -26        | 58*      | Special woven fabric       | 0.03       | 5.64       | 21,473     |
| 1404    | Other veg products     | 64.89      | 43.49      | -33        | 5804     | Tulles and net fabrics     | 0.19       | 18.38      | 9,566      |
| 1401    | Veg plaiting materials | ‡          | ‡          |            | 5808     | Braids in piece            | ‡          | 53.33      |            |
| 08      | Edible fruit and nuts  | 4.18       | 3.11       | -26        | 22*      | Beverages and spirits      | 0.00       | 1.49       | 89,021     |
| 0807    | Melons                 | 8.48       | 5.76       | -32        | 2202     | Sweetened waters           | 0.01       | 6.68       | 47,533     |
| 0802    | Other nuts             | 4.97       | 4.39       | -12        | 2201     | Unsweetened waters         | ‡          | 12.73      |            |

<sup>†</sup> Calculations applied at the 2-digit and 4-digit HS level. At 2-digit level, lines exhibiting greatest positive and negative changes were reported (excluding products that did not exist in either 2001 or 2007). At 4-digit level, lines with highest two  $R^2$  values in bivariate regression were reported. The upper (lower) half reports lines with  $RCA < 1$  ( $> 1$ ).

‡ No recorded exports of product in given year.

\* Indicates (2-digit) product line for which RCA switched from  $> 1$  to  $< 1$  (if change was negative) or  $< 1$  to  $> 1$  (if change was positive).

productivity level associated with Syria’s export basket has exhibited a negative trend. Figure 4 charts the evolution of (7) for Syria; for the time period 2001–2007, while the mix of the export basket became more diversified, the goods that Syria diversified into embodied lower levels of productivity. This decline is nontrivial: 31 percent (45 percent) when output per capita measured in constant U.S. dollars (PPP-adjusted international dollars).



Source: UN COMTRADE (2008), World Development Indicators (2008), and World Bank staff calculations

Figure 4: Embedded productivity of export basket, Syria, 2001–2007, calculated from 4-digit HS lines. EXPY calculated with per capita gross domestic product in constant 2000 U.S. dollars (maroon line) and constant 2005 PPP-adjusted international dollars (navy line).

It is important to keep in mind that although Syria’s policy of increased trade liberalization involved government policy explicitly aimed at opening the economy to trade, the Syrian government did not mandate specific sectors of the economy that would be targeted by the liberalization effort. Importantly, it did not adopt a strategy of “picking winners” that was common in the East Asian growth experience between the 1980s and early 1990s (World Bank 1993).<sup>16</sup>

This does not immediately suggest that directed industrial policy is therefore required to boost the calculated value of (7). Crucially, while the recognition and support for certain broad *classes* of exports—such as manufactures with high values of (6)—may lead to improved export and output performance (Hausmann *et al.* 2007), a focus on one or two narrowly-defined *products* can lead to resource

<sup>16</sup>However, it would be an exaggeration to instead argue the opposite extreme, that there was no government intervention in the economy. Certain sectors, especially the agricultural and oil sectors, enjoyed government subsidies and price guarantees for their output, and in some cases was dominated by state-owned enterprises.

misallocations and export disappointments (Easterly, Reshef & Schwenkenberg 2009). A first-best policy could instead focus on improving the business environment across all sectors, in order to raise total factor productivity—which would, in turn, raise the embedded productivity of the export basket.

How likely is Syria to break away from the relatively low levels of embedded productivity in its export basket? To better understand the potential diversification paths behind Syria’s export basket, we formalize the ease of transition to other export products. We first compute the proximity between two hypothetical goods  $p$  and  $q$ , which is an inverse measure of the distance between these goods, as (Hidalgo, Klinger, Barabási & Hausmann 2007):

$$\phi_{pq} = \min \{Pr(\rho_p = 1|\rho_q = 1), Pr(\rho_q = 1|\rho_p = 1)\}, \quad (8)$$

where  $\rho$  is an indicator variable that measures, for a given country  $c$  in product  $p$ , is given by

$$\rho_{p,c} = \begin{cases} 1 & \text{if } RCA_{p,c} > 1, \\ 0 & \text{otherwise,} \end{cases}$$

so that the conditional probability  $Pr(\rho_p|\rho_q)$  is calculated across all  $L$  countries. These are then further calculated for all  $K$  product lines, which yields a  $K \times K$  matrix of proximity values.

By aggregating proximity values for all other  $K - 1$  products around a given product line  $p$ , we obtain the paths emanating from that product:

$$paths_p = \sum_K \phi_{p,k}, \quad (9)$$

which serves as a summary measure of the *potential* export patterns of the product, as opposed to the *current* export patterns that are captured by the RCA measure (5).

The proximity measure (8) has been previously calculated by Hidalgo *et al.* (2007) at the 4-digit SITC level (totaling 775 product categories). Here, we consider the equivalent measure at the 2-digit HS level (96 product categories), but instead of taking the average values of export data for a number of years, we compute (8) on an annual basis for each year between 2001–2007. In the interests of space, we limit the results presented in Table 7 to the five product lines exhibiting the strongest RCA values, as reported in Table 5. For comparison, we also include the three lines with the largest and smallest path values in 2007.

It is evident that, for some product lines at least, there has been some evolution of the path structure over time. Man-made filaments (chapter 54), coffee, tea, and spices (chapter 9), and soap (chapter 34) show a generally rising trend, whereas clocks and watches (chapter 91) demonstrates a fairly distinct falling trend. This suggests that, at the global level at least, these lines present rising (or, respectively, falling) export opportunities over time.

For Syria, the paths corresponding to the lines consistent with its RCA are fairly broad. Three lines (chapters 1, 7, and 14) fall slightly above the median

Table 7: Selected product paths, aggregated categories, 2001–2007<sup>†</sup>

| HS code                    | Category                  | 2001  | 2002  | 2003  | 2004  | 2005  | 2006  | 2007  |
|----------------------------|---------------------------|-------|-------|-------|-------|-------|-------|-------|
| <b>Strongest RCA lines</b> |                           |       |       |       |       |       |       |       |
| 14                         | Vegetable materials       | 21.78 | 21.81 | 21.23 | 22.01 | 21.55 | 23.08 | 22.57 |
| 01                         | Live animals              | 21.17 | 21.48 | 20.61 | 21.15 | 20.58 | 22.30 | 22.56 |
| 07                         | Edible vegetables & roots | 23.87 | 24.66 | 23.86 | 23.44 | 24.46 | 24.39 | 24.97 |
| 54                         | Man-made filaments        | 17.86 | 19.16 | 18.60 | 17.43 | 19.38 | 21.64 | 20.89 |
| 09                         | Coffee, tea, and spices   | 17.07 | 17.62 | 18.47 | 18.39 | 17.63 | 18.54 | 19.47 |
| <b>Broadest paths</b>      |                           |       |       |       |       |       |       |       |
| 19                         | Prepared grains           | 26.14 | 25.99 | 26.40 | 27.31 | 27.89 | 28.76 | 29.02 |
| 68                         | Stone and plaster art     | 28.32 | 27.93 | 27.03 | 27.25 | 27.46 | 27.98 | 28.66 |
| 34                         | Soap                      | 26.02 | 24.62 | 24.91 | 25.36 | 26.90 | 28.09 | 27.92 |
| <b>Narrowest paths</b>     |                           |       |       |       |       |       |       |       |
| 75                         | Prepared grains           | 11.49 | 8.42  | 8.54  | 8.98  | 8.08  | 7.14  | 7.24  |
| 91                         | Stone and plaster art     | 10.57 | 10.70 | 10.40 | 10.21 | 9.49  | 8.42  | 7.32  |
| 45                         | Soap                      | 8.02  | 6.04  | 5.51  | 5.26  | 6.31  | 7.14  | 8.03  |

<sup>†</sup> Calculations applied at the 2-digit HS level, representing top five lines at upper bound of Table 5. Broadest (narrowest) paths represent lines with highest (lowest) path values in 2007.

path value for 2007 (of 21.48), and the other two are relatively close to the median of the distribution. This suggests that the export diversification potential of goods for which Syria has a comparative advantage is reasonably good. Notwithstanding the expansion into goods with lower embedded productivity (Figure 4), therefore, the export basket for Syria demonstrates a clear possibility of further diversification in the future.

This relationship between the proximity of new potential products to the current production structure can be represented more formally by calculating the RCA-weighted path to the total path:

$$\omega_{p,c} = \frac{\sum_K \rho_{k,c} \phi_{pk}}{\sum_K \phi_{pk}}, \quad (10)$$

where  $\rho$  is defined as before as an indicator variable that takes on unity if  $RCA_{p,c} > 1$  and zero otherwise. (Hidalgo *et al.* 2007) refer to (10) as the density of a particular product  $p$  for a given country  $c$ .  $\rho$  is bounded by  $[0, 1]$  and higher values imply that country  $c$  has relatively more export possibilities surrounding its exports of product  $p$ . We report calculations of (10) for all lines at the 2-digit level in Table 8.

These density calculations speak to the flip side of the path calculations of Table 7. The average density of all product lines is 0.324, but for goods that Syria currently does *not* export relatively intensively, the average density is 0.299.<sup>17</sup> The overall distribution of product densities, as captured in Figure 5, reflects this distinction well. In particular, the export diversification for certain

<sup>17</sup>The average density of goods for which Syria *does* possess a revealed comparative advantage in is 0.385. This number, however, is of lesser interest since it captures the potential for Syria to expand into goods for which it already has comparative advantage.

Table 8: Selected product densities, aggregated categories, 2007<sup>†</sup>

| HS code | Product                             | RCA (2007) | Change (%) | Density |
|---------|-------------------------------------|------------|------------|---------|
| 6       | Live trees                          | 0.07       | -87        | 0.429   |
| 5       | Animal products                     | 0.83       | -31        | 0.333   |
| 12      | Oil seed                            | 0.34       | -17        | 0.371   |
| 23      | Food residue & waste                | 0.15       | 29         | 0.422   |
| 24      | Tobacco                             | 0.10       | 35         | 0.344   |
| 56      | Wadding yarns, and twine            | 0.27       | 83         | 0.387   |
| 68      | Stone, plaster, and cement          | 0.51       | 241        | 0.257   |
| 46      | Straw                               | 0.56       | 304        | 0.410   |
| 18      | Cocoa                               | 0.81       | 473        | 0.369   |
| 74      | Copper                              | 0.18       | 533        | 0.193   |
| 21      | Miscellaneous edible preparations   | 0.44       | 613        | 0.392   |
| 49      | Books, newspapers, and pictures     | 0.68       | 617        | 0.197   |
| 51      | Wool and animal hair                | 0.67       | 666        | 0.254   |
| 33      | Essential oils                      | 0.48       | 848        | 0.197   |
| 83      | Miscellaneous base metals           | 0.16       | 1,283      | 0.297   |
| 42      | Leather                             | 0.42       | 1,502      | 0.312   |
| 76      | Aluminium                           | 0.51       | 1,511      | 0.322   |
| 38      | Miscellaneous chemical products     | 0.17       | 2,980      | 0.358   |
| 95      | Toys, games, and sports equipment   | 0.09       | 3,116      | 0.236   |
| 84      | Nuclear reactors                    | 0.18       | 3,582      | 0.343   |
| 48      | Paper and paperboard                | 0.32       | 3,786      | 0.193   |
| 44      | Wood                                | 0.09       | 3,811      | 0.294   |
| 39      | Plastics                            | 0.65       | 3,865      | 0.294   |
| 73      | Iron or steel articles              | 0.58       | 4,508      | 0.419   |
| 30      | Pharmaceuticals                     | 0.37       | 4,661      | 0.290   |
| 94      | Furniture                           | 0.52       | 10,612     | 0.355   |
| 87      | Vehicles                            | 0.01       | 22,546     | 0.370   |
| 96      | Miscellaneous manufactured articles | 0.81       | 123,780    | 0.320   |
| 35      | Albuminoidal substitutes            | 0.88       | ‡          | 0.322   |
| 50      | Silk                                | 0.70       | ‡          | 0.236   |
| 78      | Lead                                | 0.57       | ‡          | 0.220   |
| 43      | Furskins                            | 0.47       | ‡          | 0.322   |
| 69      | Ceramics                            | 0.44       | ‡          | 0.402   |
| 36      | Explosives                          | 0.43       | ‡          | 0.314   |
| 92      | Musical instruments                 | 0.28       | ‡          | 0.406   |
| 32      | Tanning/dyeing extract              | 0.21       | ‡          | 0.331   |
| 59      | Coated fabrics                      | 0.19       | ‡          | 0.220   |
| 85      | Electrical machinery                | 0.17       | ‡          | 0.287   |
| 72      | Iron and steel                      | 0.11       | ‡          | 0.329   |

<sup>†</sup> Calculations applied at the 2-digit level. Change in RCA calculated between 2001 and 2007. For lines with incalculable RCA changes, only those with RCA in 2007 above 0.1 were reported.

<sup>‡</sup> Indicates nonexistence of exports in 2001.

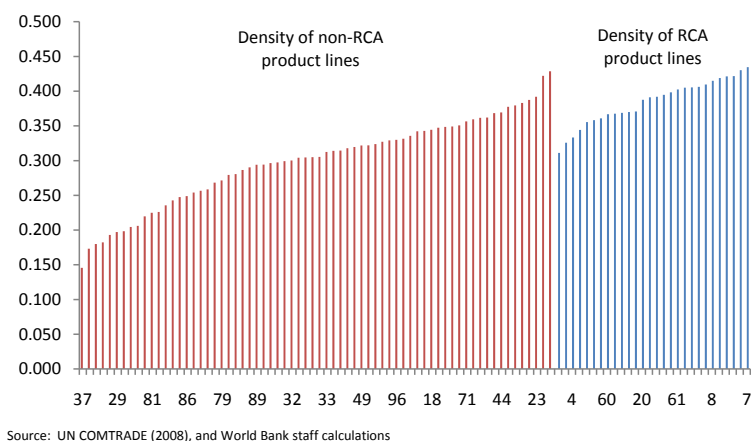


Figure 5: Density of product lines with (blue) and without (red) revealed comparative advantage for Syria, 2 digit HS level, 2007. Selected HS codes reported on the horizontal axis correspond to slightly thicker bars.

rising sectors—such as miscellaneous chemical products (chapter 38), iron or steel articles (chapter 73), furniture (chapter 94), and miscellaneous manufactures (chapter 96)—is reasonably high (averaging 0.363).

## 4 Conclusion

It is important to keep in mind that the findings presented here are focused on the diversification of goods exports. This necessarily implies that this study neither addresses the export of services, nor the economic diversification of production, more generally. Rather, we have sought to provide a sense of the qualitative direction in which Syria’s export patterns are likely to evolve into, using quantitative measures that provide an approximation of these patterns.

## References

- Acemoglu, K. Daron & Fabrizio Zilibotti (1997). “Was Prometheus Unbound by Chance? Risk, Diversification, and Growth”. *Journal of Political Economy* 105(4) (August): 709–751
- Al-Marhubi, Fahim (2000). “Export Diversification and Growth: An Empirical Investigation”. *Applied Economics Letters* 7(9) (September): 559–562
- Atiya, Basima (2008). “Comparative Advantages of Selected Commodities”. *Technical report*, Damascus, Syria: National Agricultural Policy Center
- Balassa, Bela (1965). “Trade Liberalisation and ‘Revealed’ Comparative Advantage”. *The Manchester School* 33(2) (May): 99–123

- Bergstrand, Jeffrey H. (1985). “The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence”. *The Review of Economics and Statistics* 67(3) (August): 474–481
- Bernard, Andrew B., Stephen J. Redding & Peter K. Schott (2006). “Multi-Product Firms and Trade Liberalization”. *Working Paper* 12782, Cambridge, MA: National Bureau of Economic Research
- Besedeš, Tibor & Thomas J. Prusa (2007). “The Role of Extensive and Intensive Margins and Export Growth”. *Working Paper* 13628, Cambridge, MA: National Bureau of Economic Research
- Brenton, Paul & Richard S. Newfarmer (2009). “Watching More Than the Discovery Channel to Diversify Exports”. In Richard S. Newfarmer, William Shaw & Peter Walkenhorst (editors), *Breaking into New Markets: Emerging Lessons for Export Diversification*, pp. 111–124. Washington, DC: The World Bank
- Cadot, Olivier, Céline Carrère & Vanessa Strauss-Kahn (2007). “Export Diversification: What’s Behind the Hump?” *Discussion Paper* 6590, Centre for Economic Policy Research
- Carrère, Céline, Vanessa Strauss-Kahn & Olivier Cadot (2007). “Export Diversification: What’s Behind the Hump?” *Discussion Paper* 6590, London, England: Centre for Economic Policy Research
- Chandra, Vandana, Jessica Boccardo & Israel Osorio-Rodarte (2007). “Export Diversification and Competitiveness in Developing Countries”. Mimeograph: The World Bank
- De Benedictis, Luca, Marco Gallegati & Massimo Tamberi (2009). “Overall Trade Specialization and Economic Development: Countries Diversify”. *Weltwirtschaftliches Archiv* 145(1) (April): 37–55
- Decker, Jessica Henson & Jamus Jerome Lim (2008). “What Fundamentally Drives Growth? Revisiting the Institutions and Economic Performance Debate”. *Journal of International Development* 20(5) (July): 698–725
- Easterly, William R., Ariell Reshef & Julia M. Schwenkenberg (2009). “The Power of Exports”. Mimeograph: New York University
- Estevadeordal, Antoni & Christian Volpe Martincus (2006). “Specialization and Diverging Manufacturing Structures: The Aftermath of Trade Policy Reforms in Developing Countries”. *Development Working Paper* 220, Milan, Italy: Centro Studi Luca d’Agliano
- Feyrer, James D. (2009). “Trade and Income—Exploiting Time Series in Geography”. *Working Paper* 14910, Cambridge, MA: National Bureau of Economic Research
- Frankel, Jeffrey A. & David H. Romer (1999). “Does Trade Cause Growth?” *American Economic Review* 89(3) (June): 379–399
- Goldberg, Pinelopi K., Amit Khandelwal, Nina Pavcnik & Petia Topalova (2008). “Imported Intermediate Inputs and Domestic Product Growth: Evidence from India”. *Working Paper* 14416, Cambridge, MA: National Bureau of Economic Research
- Gourdon, Julien & Claudia Nassif (2009). “Is FDI Increasing Export Diversification in MENA?” Mimeograph: The World Bank
- Grossman, Gene M. & Elhanan Helpman (1991). *Innovation and Growth in the Global Economy*. Cambridge, MA: MIT Press
- Hausmann, Ricardo, Jason Hwang & Dani Rodrik (2007). “What You Export Matters”. *Journal of Economic Growth* 12(1) (March): 1–25



- Herzer, Dierk & Felicitas Danzinger Nowak-Lehmann (2006). "What Does Export Diversification Do for Growth? An Econometric Analysis". *Applied Economics* 38(15) (August): 1825–1838
- Hesse, Heiko (2009). "Export Diversification and Economic Growth". In Richard S. Newfarmer, William Shaw & Peter Walkenhorst (editors), *Breaking into New Markets: Emerging Lessons for Export Diversification*, pp. 55–80. Washington, DC: The World Bank
- Hidalgo, César A., Bailey W. Klinger, Albert-László Barabási & Ricardo Hausmann (2007). "The Product Space Conditions the Development of Nations". *Science* 317(5837): 482–487
- Hummels, David L. & Peter J. Klenow (2005). "The Variety and Quality of a Nation's Exports". *American Economic Review* 95(3) (June): 704–723
- Imbs, Jean M. & Romain T. Wacziarg (2003). "Stages of Diversification". *American Economic Review* 93(1) (March): 63–86
- Jones, Benjamin F. & Benjamin A. Olken (2008). "The Anatomy of Start-Stop Growth". *Review of Economics and Statistics* 90(3) (August): 582–587
- Lançon, Frédéric (2005). "Comparative Advantage Study". *Technical report*, Damascus, Syria: National Agricultural Policy Center
- Melitz, Marc J. (2003). "The Impact of Trade on Intra-Industry Allocations and Aggregate Industry Productivity". *Econometrica* 71(6) (November): 1695–1725
- NAPC (2006). "Mid-Term Review of the Syrian Agricultural Strategy". *Technical report*, Damascus, Syria: National Agricultural Policy Center
- Parteka, Aleksandra & Massimo Tamberi (2008). "Determinants of Export Diversification: an Empirical Investigation". *Working Paper* 327, Ancona, Italy: Università Politecnica delle Marche
- Rodríguez, Francesco R. & Dani Rodrik (2000). "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence". In Ben S. Bernanke & Kenneth S. Rogoff (editors), *NBER Macroeconomics Annual*, volume 15, pp. 261–338. Cambridge, MA: National Bureau of Economic Research
- Rodrik, Dani (1997). "Trade Strategy, Exports, and Investment: Another Look at East Asia". *Pacific Economic Review* 2(1) (February): 1–24
- Sala-i-Martin, Xavier X. (1997). "I Just Ran Two Million Regressions". *American Economic Review* 87(2) (May): 178–183
- Schott, Peter K. (2004). "Across-Product Versus Within-Product Specialization in International Trade". *Quarterly Journal of Economics* 119(2) (May): 646–677
- Siliverstovs, Boriss & Dierk Herzer (2007). "Manufacturing Exports, Mining Exports and Growth: Cointegration and Causality analysis for Chile (1960–2001)". *Applied Economics* 39(2) (February): 153–167
- State Planning Commission (2005). "Economic Policies and Economic Reform Components". In *The Five Year Plan 2006–2010*, chapter 5, pp. 1–79. Damascus, Syria: Government of the Syrian Arab Republic
- World Bank (1993). *The East Asian Miracle: Economic Growth and Public Policy*. New York, NY: Oxford University Press