Egypt after the Multi-Fiber Arrangement: Global Apparel and Textile Supply Chains as a Route for Industrial Upgrading

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Abstract

Exporting through international supply chains was a successful way for East Asian countries to develop their textile and apparel industries in the 1970s and 1980s, but it is a less clear route for countries like Egypt trying to compete today. The challenge is particularly acute given the strength of competitors like China, and even more so in the post-MFA era. Some analysts suggest that "lean retailing" increases the importance of geography in exporting in the world of rapidly changing apparel fashion, in a way that could benefit a country like Egypt with its proximity to European end markets. Using a supply chain model, this paper suggests that shortening lead times can indeed have an impact on profits, but that the effect is not tremendous, being in the range of a 0.3 percent to 0.9 percent increase in profits for every week of improvement in lead times. The study also finds that the business environment in Egypt lags key comparator countries in several areas that help the firms compete in global apparel chains, although recent reforms by the Egyptian government are working to address several of these aspects. It concludes by exploring to what extent geography, trade preferences, and local production factors may help Egypt's textile and apparel industry carve out a role for itself in global supply chains, and provide an engine to drive industrial upgrading throughout the country.

Author's Note: I would like to thank Marcus Noland and Howard Pack for their comments and even more for their encouragement, and Gérard Cachon for his valuable insights on the model. The supply chain model uses a Monte Carlo simulation program called Crystal Ball v7.1, which is available from Decisioneering Inc.

JEL Classification: F1, O1, R3, C6, L6

Keywords: Egypt, textile/apparel, supply chain, supply chain management, geography, Multi-Fiber Arrangement

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What can a country like Egypt learn from the success of the East Asian countries in using the apparel industry to drive export-led growth? Throughout the 1970s and 1980s, in countries like Taiwan, South Korea, and Hong Kong, exporting light manufactures like apparel helped spur a process of industrial upgrading and economic development. The success of these countries has led many researchers to explore whether the process can be replicated in other developing economies.

In the classic path of upgrading, firms begin with low value-added assembly of garments for buyers in developed countries and, as their capabilities increase over time, move up the supply chain to higher value-added segments. Through a process of technology transfer, and in learning by doing in response to increasing interaction with demanding customers in developed markets, participating in global supply chains allowed and indeed required companies in East Asia to upgrade their manufacturing and managerial capabilities.¹ As these industries grew and increased their demand for locally-sourced inputs, their development had beneficial spillover effects to the local economy as a whole.

The apparel industry remains an attractive one for developing countries like Egypt—garment production is low-capital and high-labor intensive, and the local population of 66 million provides a natural market for output and a springboard for exports. The industry accounts for about 20 percent of all of Egypt's exports and employs nearly 30 percent of manufacturing employment, suggesting it has a strong foundation. Unfortunately, as more and more countries try simultaneously to use the apparel sector to replicate the success of the East Asian newly industrialized countries (NICs), competition increases, and the chances of winning decrease. Perhaps the greatest challenge is posed by China, where a combination of a large, low-wage workforce, highly automated plants, and access to lower cost inputs like fabric and trim, make the country a tremendous force with which to be reckoned. Indeed, with the accession of China to the World Trade Organization (WTO) and in preparation for the phaseout of quotas that occurred on January 1, 2005, due to the expiry of the Multi-Fiber Arrangement (MFA), for the past few years large apparel firms have been shifting production to China and reducing the number of other countries where they source garments. Already in early 2002, the CEO of OshKosh B'Gosh announced that his firm was focused on expanding its relationship with contractors in China, as were executives at Carole Hochman and The Children's Place.² So what are the prospects of a country like Egypt to drive economic growth through success in global supply chains when it must compete with the low wages and industrial strength of China?

Studies examining the role of global supply chains have looked at industries including automobiles, electronics and components, textiles and apparel, and computers (Gereffi 1999, Sturgeon and Lester 2003, and Thun 2000). However, there are at least two reasons why the apparel industry is an

¹ Gereffi has conducted several studies looking at apparel supply chains in particular (1994, 1999). Sturgeon and Lester (2003) provide an overview of many of the additional studies that have been done on industrial upgrading in apparel and other industries.

² "Sourcing in China: Firms discuss advantages, issues," January 1, 2002, *Bobbin Magazine*.

intriguing candidate for Egypt to succeed in global supply chains. First, the apparel industry is one of the strongest in the country in terms of exports, production, and employment. Second, a number of factors that are exogenous to Egypt's manufacturing capabilities may contribute to Egypt's ability to compete in the apparel industry, specifically those of geography and trade agreements. Rapidly changing fashions require quick replenishment that can reward Egypt's geographical proximity to style-conscious Europe. Moreover, with the multitude of preferential trade agreements governing global trade, even after the phaseout of the Multi-Fiber Arrangement (discussed in more detail below), Egypt has certain access advantages to key end markets for its products, although it faces challenges from countries that may have even better trade access.

This study will present an overview of the way in which global supply chains operate and how they have driven industry upgrading in developing countries. It will look at Egypt's current textile industry and examine a number of factors that help determine Egyptian companies' attractiveness as suppliers in global apparel chains, relative to a set of competitor countries, and present some empirical evidence of the industry's performance and how international investors have reacted to it. It applies a supply chain model for inventory management to quantify the potential benefits Egypt might gain from leveraging its geography to cut lead times to end markets. The study will then highlight the challenges that Egypt and similar countries face in competing against the Chinese manufacturing juggernaut, especially in the post-MFA era, along with an overview of the reforms Egypt has taken in response. Finally, it concludes by combining these elements to explore to what extent geographical, trade, and local production factors that are particular to Egypt's textile and apparel industry may help the industry carve out a role for itself in global value chains and provide an engine to drive industrial upgrading throughout the country.

AN OVERVIEW OF GLOBAL APPAREL SUPPLY CHAINS

In global supply chains, large lead firms act as general contractors to buy products from suppliers that are typically situated in lower-cost developing countries. The suppliers provide components, intermediate goods, and even final goods to the lead firms that market and sell them in developed economies. Lead firms often begin working with foreign suppliers based on the availability of low-cost labor. In the process of working with their suppliers, lead firms provide quality standards that force the suppliers to improve performance to meet the more stringent demands of consumers in developed economies.³ Lead firms may also conduct training, transfer technology, and provide foreign direct investment that helps improve the suppliers' capabilities. Development is the result as "domestic suppliers continuously upgrade their

³ Outlined in Keesing and Lall (1992) as cited in Sturgeon and Lester (2003). This is also consistent with Michael Porter's cluster theories of national competitiveness, where demand condition drive innovation—here more demanding customers in export markets substitute for less demanding local consumers.

capabilities either by serving the needs of the local affiliates of multinational firms or by supplying lead firms in advanced countries from a distance.” This process of driving local economic development through participating in global supply chains has been called “supplier-oriented industrial upgrading (Sturgeon and Lester 2003).”

In the most basic role in the global supply chain, local suppliers do labor intensive assembly on inputs that are imported, processed, and reexported, often in export zones that have special tax preferences and duty drawback provisions. The intermediate goods to be assembled, whether textiles or electronic components, are sourced from abroad when lead firms feel that local firms are incapable of producing the inputs at international standards. In this type of relationship, lead firms take advantage of low-cost labor, and local firms improve labor skills and learn about price and quality and delivery standards in international markets. Yet since the inputs are generally imported and production often takes place in geographically separate export zones, there may be few spillover effects to the broader economy.

The next step for suppliers in moving up the value chain is to play a role as original equipment manufacturers (OEMs).⁴ OEMs play a full subcontractor role to lead firms, sourcing their own inputs and supplying finished products based on design and quality specifications provided by the lead firms. These products are sold under the brand name of the buyer. After successfully acting as OEMs, some suppliers then advance to play a role in providing additional postconceptual design service.⁵ When companies have advanced to this level of production, the spillover impact they begin to have on the local economy can generally be seen in the increasing percentage of their inputs they source locally. Companies that begin to manufacture and sell finished products based on their own designs and under their own brand names enter what may be called the original brand manufacturer stage (OBMs).

At least some analysts believe that movement up the value chain tends to stimulate linkages to local suppliers, thus leading increasingly to broader industrial upgrading (Bair and Gereffi 2003). Of course, the progression up the value chain in industrial upgrading is not as smooth as the outline above might suggest. Success at one stage of the value chain does not necessarily imply that suppliers have developed the more advanced skills to succeed at later stages. One empirical study suggests that the move to the OBM stage is difficult to achieve and that even some East Asian firms pursuing their own brand approach have retreated back to the OEM phase (Sturgeon and Lester 2003). Furthermore, involvement in global supply chains may require some companies in developing economies to take a step back in the chain, from selling finished products based on their own design and under their own brand to local and foreign markets to providing inputs into a supply chain controlled by others based on more demanding specifications (Bair 2001 and 2002 and Carrillo et al. 2002, as cited in Bair and Gereffi 2003).

⁴ In the apparel industry, OEMs are generally called “full package providers.” See Gereffi and Memedovic (2003).

⁵ Some call these companies original design manufacturers or ODMs (Sturgeon and Lester 2003).

THE TEXTILES AND APPAREL INDUSTRY IN EGYPT

On the face of it, the textile and apparel industry seems like a strong candidate for Egypt to play a role in global supply chains and provide an engine of growth for the rest of the economy. In 1998 textile and apparel manufacturing accounted for nearly 30 percent of total manufacturing employment, and along with leather and footwear the industries accounted for 7.5 percent of manufacturing value added in 2002.⁶ Textiles accounted for 8 percent of total national exports in 2003 and clothing for another 11 percent, making the combined two the largest export sector in the country save for minerals. Clothing exports have increased at 5 percent annually, and textile exports increased at 8 percent from 1999 to 2003, despite slow growth in production,⁷ although other large export industries in Egypt, like chemicals and basic manufactures, experienced much stronger export growth during this time (table 1).

Another way of seeing the relative strength of the industry in Egypt's textile and apparel export capabilities is through a revealed comparative advantage analysis of its export sectors. Revealed comparative advantage measures the sector's share of exports relative to the country's share of global exports. In this analysis, both textiles and apparel are revealed to be highly competitive (table 2) relative to other export industries in the country.⁸

The Egyptian textile and apparel industry consists of 40 public-sector companies that are organized into three large holding companies, and there are an estimated total of 3,500 private and investment sector companies⁹ ranging in size from over 10,000 workers to fewer than 10. The public sector dominates the early stages of production, with a 90 percent share of spinning and 60 percent share of weaving in Egypt but only 30 percent share of the apparel production.¹⁰ The production weaknesses of Egypt's public sector are highlighted by an examination of the age of machinery used at various stages of the value chain—it shows that public companies are saddled with aging equipment, almost all of it older than 15 years. In the apparel industry, where public companies face greater competition from the private

⁶United Nations Industrial Development Organization (UNIDO) data, 2004: Egypt: Employment, Wages, and Related Indicators by Industry, at Current Prices, Selected Years.

⁷ Manufacturing value added in ISIC 32 (textiles, apparel, leather, and footwear) had an average annual growth of only 0.6 percent over 1992–2002 (www.unido.org/data/Country/Stats/StaTableC.cfm?c=EGY). At the same time, a detailed analysis of total factor productivity (TFP) growth over the period of 1988–1996 showed the textile and apparel industries to have demonstrated strong growth in cost, technical, and allocative efficiencies. See “Private Sector Contribution to Egypt's Productivity and Growth,” Development Economic Policy Reform Analysis Project (DEPRA) report, 2000.

⁸ Another reason to focus on textile and apparel industries as growth drivers for Egypt is that the country shows up as particularly uncompetitive in electronic components, another sector that has played a key role in industrial upgrading through global supply chains for East Asian countries.

⁹ Private companies are those established under Law 159 from 1981, and they report to the Central Agency for Auditing. Investment sector companies are established under Law 230 from 1989, which regulates the investment of local and foreign capital in the free zones and provides fiscal and other incentives for encouraging investment. Investment sector companies tend to be more export oriented with a more diversified export structure that favors nontraditional technology-intensive products (see DEPRA 2000).

¹⁰ Egyptian Textile Consolidation Fund data, provided by the Egyptian Embassy.

sector, the picture is somewhat better, showing a greater share of newer equipment (table 3). The findings reinforce perceptions that Egyptian firms have not mastered the ability to turn their high quality cotton into similarly high quality textiles, although their ability to manufacture ready-made garments is relatively stronger.¹¹

The picture that emerges from this analysis is that while the Egyptian textile and apparel industry have some relative advantages, Egyptian companies have not fully succeeded in leveraging the country's natural resources into building a superior manufacturing industry. Furthermore, putting its exports in a global context, while the textile and apparel industry is clearly very important to Egypt, on a global level, Egyptian textile and apparel exports each accounted for only approximately 0.3 percent of all global trade in each sector (table 1). Thus, while the textile and apparel industry in Egypt appears to be one of the strongest candidates for driving growth through global supply chains, the industry faces significant challenges in growing into international markets.

EGYPT AND ITS COMPETITORS IN GLOBAL SUPPLY CHAINS

Despite the strength of the textile and apparel industry relative to other sectors in Egypt, if its companies are to succeed in global apparel supply chains, the real question is how they measure up against regional and global competitors. The inherent strengths of the domestic industry in each of these countries is complemented or undermined by its business and investment climate, as well as the ability of companies to set up efficient and consistent supply relationships for exporting product. To explore how a lead firm in the United States or the European Union might examine Egypt against a set of competitor countries as a site for establishing a sourcing platform for apparel, we examine Egypt compared to the countries listed in table 4. The set includes China and Mexico, which together account for nearly 55 percent of global exports in textiles and apparel. Bangladesh is included to bring in a lesser-developed, low-wage Asian economy, one that is heavily focused on apparel, which accounts for over 80 percent of its exports. Morocco, Jordan, and Tunisia are regional competitors, the latter of which has over four times the amount of apparel exports as Egypt, despite having a population only about 15 percent the size. Similarly, Morocco has a workforce half the size of Egypt's but more than four times its exports. Moreover,

¹¹ Economists at the University of Cairo have shown that the revealed comparative advantage across Egypt's value chain demonstrated a bimodal distribution of strength at the early stage of manufacturing textile fibers and later in ready-made garments (Sakr and Abdel-Latif, "International Competitiveness of Egypt's Textile Industry," Cairo University, no date given). A British report on trade and investment in Egypt suggests that Egyptian companies use local textiles primarily for products targeting local markets while using imported textiles to assemble clothing destined for developed markets. UK Trade and Investment Report: "Textile, Interior Textiles, & Carpet Market in Egypt" (www.trade.uktradeinvest.gov.uk/textiles/egypt). At the same time, some observers note that Egypt's older machinery is indeed appropriate for the state of the manufacturing capabilities of its firms, particularly since Egyptian workers are generally not sufficiently skilled to utilize the latest technology, and even with the less productive older machinery, there is a high degree of idle capacity. See DEpra 2000.

Morocco signed a free trade agreement (FTA) with the United States in July of 2004 that could make it an even stronger competitor for Egypt. The advantages of an FTA with the United States are evident in the case of Jordan, which is included in the competitor set not only because it is a regional competitor but also because it signed an FTA with the United States in 2000 and subsequently saw its US-bound apparel exports increase by a factor of almost 300 over four years (see box 1). Finally, Mauritius was included because it is currently the largest exporter of textiles and apparel from among the African Growth and Opportunity Act (AGOA) countries, which all have preferential trade advantages in exporting to the United States.¹² Comparing each of the countries' exports in three major subcategories of trade over time, China clearly dominates (see figure 1a). If we remove China (figure 1b) from the data, we see that Egyptian firms seem to do well in exports of textile fibers, but they increasingly lag competitors in moving up the value chain. These data reinforce the earlier picture, which highlighted potential strengths in the foundation of the Egyptian industry. However, its firms need to develop stronger capability in higher value-added apparel production in order to participate in global supply chains and access the profits and industrial upgrading that are associated with doing so.

IMPORT TARIFFS AS A DISINCENTIVE TO EGYPTIAN EXPORTS

One of the oft-cited problems facing the Egyptian textile and apparel industry is that a combination of structural factors produce incentives whereby it is more profitable for Egyptian firms to sell goods at home than to export (DEPRA 1999a; Galal and Fawzy 2001). Primary among the complaints is that import tariffs increase prices in domestic markets, allowing local manufacturers to raise prices and capture rents. Beyond tariffs, the presence of a large local market, with consumers who are less demanding than foreign buyers, and the ability to avoid the logistical hassles involved with transporting and shipping products also encourage Egyptian companies to focus on their home markets.

The structure of high tariffs that has existed in Egypt for the last several years gives some support to these types of arguments. Indeed, in 1998, when Egypt eliminated its import ban on textiles, it immediately imposed tariffs of up to 54 percent on textiles in its place. Then in 2002, when Egypt complied with its WTO commitments and lifted the import ban on the last item on its list—apparel—it imposed tariffs that reached as high as \$300 per item on more than 1,000 categories of clothing.¹³

¹² The African Growth and Opportunity Act (AGOA) was created in 2000 and extended in 2004, giving trade preferences to countries in sub-Saharan Africa that meet the US government's political and economic guidelines. Among the trade provisions is the ability to export textiles and apparel to the United States on a duty-free basis if the products are cut and assembled from fabrics or yarns from the United States, or duty free but subject to quotas if they are from fabrics and yarns from AGOA beneficiary nations.

¹³ As reported by the Egypt Country Commercial Guide FY 2004, US Department of State.

Box 1 Jordan's apparel exports to the United States and trade diversion from Egypt

In October of 2000, the governments of the United States and Jordan signed the US-Jordan Free Trade Agreement (FTA), which came into force in December 2001. The FTA eliminated duties on bilateral trade and included provisions on the environment, trade and labor, intellectual property, and rules of origin. The impact of the FTA on Jordanian apparel exports to the United States has been dramatic, with apparel exports rising from \$2.5 million in 1999 to \$46 million in anticipation of the signing of the FTA in 2000, to \$193 million in 2001 and \$408 million in 2002, the first full year after it had been signed. By contrast, over the same period Jordanian apparel exports to the European Union actually declined from \$17 million to just over \$9.5 million. As for Egyptian exports during this time, apparel exports to the United States decreased somewhat, while exports to the European Union dipped and then recovered in 2002 (see figures 2a and 2b).

While the impact on Jordanian exports to the United States was clearly significant, and Egypt indeed saw its imports to the United States shrink slightly in the years immediately following the signing, it does not appear that the FTA played a major role in diverting apparel exports from Egypt to Jordan. To assess the impact of the US-Jordan FTA on Egyptian apparel exports to the United States, we need to look at the overall data on apparel imports to the United States during this time period, as well as the market share of both Jordanian and Egyptian companies. From 2000 to 2002, apparel imports to the United States ground virtually to a halt, hovering around \$67 billion. The only way for Egypt to increase its exports during this time and maintain the growth trend it experienced in the 1995–2000 period would therefore have been at the expense of other exporting countries. While the slight dip in Egyptian exports may be partially explained by companies diverting their supply relationships to Jordan, the magnitude of the increase in Jordanian exports shows that its boost in trade came at the expense of other countries much more than just from Egypt. Moreover, if we look at the market shares of each country during the period, Jordan managed to increase its market share of apparel exports to the United States almost 80-fold from 1999 to 2003, while it decreased its market share and absolute value of exports to the European Union during the same time, suggesting that part of the export diversion caused by the FTA came at the expense of Jordanian apparel exports to the European Union. Furthermore, over the 1998–2003 period, Egypt lost market share to the European Union as well, even in the absence of any Jordan-EU FTA, suggesting that Egypt's experience in the US marketplace is at least partly the result of its own production capabilities. Finally, in 2003, while Jordan continued its explosive growth of exports to the United States, Egypt was also able to increase both exports and market share (figures 2c and 2d). Taken together, it appears that the US-Jordan agreement had a significant impact on Jordanian exports of apparel to the United States but that it did not significantly divert trade that would have otherwise come from Egypt.

These two findings, that the US-Jordan FTA boosted Jordanian exports but did not displace Egyptian exports, are worth keeping in mind against the backdrop of recent developments in Middle East trade agreements. In mid-December 2004, the United States signed a three-way agreement with Egypt and Israel to set up a series of Qualified Industrial Zones (QIZs) that will enable Egyptian companies working in collaboration with Israel to export to the United States free of tariffs and quotas (discussed in further detail below). Within less than two weeks, Jordan and Israel announced they had signed a free trade agreement, which had been one of the European Union's preconditions to allowing the two countries duty-free access the EU market. The preceding analysis would suggest that the Egypt-Israel-US QIZ agreement will boost Egyptian exports to the United States and that, at the same time, the Jordanian-Israel-US agreement will boost Jordanian exports without greatly displacing Egyptian trade.

Moreover, a cursory look at the activity of Egyptian companies suggests that tariffs may in fact be causing companies to look inward. In a sample of nearly 2000 Egyptian textile and apparel firms compiled in 2004, only 4.5 percent export 10 to 25 percent of their production while just 8.6 percent export more than 25 percent—a seemingly small set of firms that are involved in exporting. Of course the aggregate numbers blur any deeper sense of what kind of firms are exporting. Indeed, if the tariff argument is true,

we might still expect that it would be primarily the larger firms that have the scale and skill required to navigate the marketing and logistical challenges involved in exporting and overcome the disincentives that tariffs provide. Not surprisingly, larger firms export a greater percentage of their sales—for example, among small firms with sales of 5 million to 50 million Egyptian Pounds, 19 percent export 10 to 25 percent of their production, and 31 percent export 25 percent or more; however, for companies with 50 million to 250 million Egyptian Pounds of sales, nearly 37 percent export 10 to 25 percent of their production, and over 34 percent export 25 percent or more (figure 3).¹⁴ These data seem consistent with the notion that tariffs create a relatively more profitable home market and that it requires an additional impetus for firms to see beyond the artificially attractive local markets and begin to export.

However, if we look at more detailed comparative analysis of trade-weighted tariffs, the picture is not so clear. Figure 4 shows the trade-weighted tariffs for each of the countries for three Standard International Trade Classification (SITC) categories—the final products in category 84 (apparel, clothing, and accessories), and two input categories, 65 (textile yarns and fabrics) and 26 (textile fibers). A more in-depth analysis would look at the effective rates of protection, taking into account the differences between the tariffs on inputs and finished goods and the resulting cushions that domestic producers are given to be inefficient in their manufacturing value added. However, even a simple examination of the nominal tariff rates suggests that the difference between Mauritanian tariffs on apparel (around 58 percent) and those on its textiles (approximately 2 percent) are among the highest for the group, yet the country exports more apparel than Egypt, despite the fact that its GDP is less than one-tenth that of Egypt's. Similarly, Morocco has higher tariffs than Egypt for apparel and textile yarns and still manages to export significantly more apparel, even though its economy is about half the size of Egypt's. Mexico too has substantially higher tariffs on clothing (35 percent) compared to textiles yarns (21 percent) and fibers (11 percent). In Egypt's case, both apparel and textile yarns face similar tariffs (35 percent), though the more basic textile fiber inputs are lower (11 percent).

Thus the comparative assessment does not support the argument that incentives to export from Egypt are undermined by its tariff structure, suggesting that at least some of the claims about tariffs may serve as an excuse not to focus on productivity and quality issues.¹⁵ Furthermore, recent reforms in Egypt's tariff structure (outlined below) have reduced tariffs and any disincentives going into the future.

¹⁴ Looking at the total numbers of companies that export over 25 percent of their production, there are more companies in the categories with higher numbers of employees than in the higher categories ranked by sales, showing that firms with more employees tend to export more at the same level of sales.

¹⁵ One study for managers at firms across industries in Egypt found that they had a serious lack of skill in marketing and even lacked a sense of the need for marketing. Many of these companies had a history of producing goods in an environment of Soviet-era large orders where both the quality of products and the need to find and market to customers were largely irrelevant. See DEBRA 1999a.

EGYPT'S POTENTIAL AS A MANUFACTURING PLATFORM FOR GLOBAL SUPPLY CHAINS

Looking beyond the performance of the existing domestic companies, two other ways for Egypt to strengthen its domestic textile and apparel industry would be to attract foreign companies' direct investment and to stimulate local entrepreneurship aimed at establishing manufacturing operations directed towards export markets. The next section of this paper explores how attractive Egypt might look to an international business or local entrepreneur looking to establish a manufacturing platform for exports. The analysis focuses on three steps in the sourcing decision from an investor's point of view: ease in setting up a new business, factors affecting an investor's ability to operate efficiently, and the ability to actually get product out of the country.

Setting Up a New Business

Setting up a business in Egypt is no easy task, though in the last few years, the government has made strides to improve the investment climate. The Investment Incentives and Guarantees Law 8 of 1997 allows for 100 percent foreign ownership of companies and guarantees the right to repatriate profits and capital. The Companies Law 3 of 1998 was another step towards reform—it facilitates registration of new companies through the Companies Department of the Ministry of Foreign Trade. And yet if we return to looking at our comparator set of countries, Egypt has the highest number of procedures involved in starting a new business. Furthermore, getting through these procedures requires the second longest number of days (table 5a).¹⁶ While the absolute cost involved is not crippling for the typical overseas investor, the fairly high costs that are involved relative to GNI, along with the relatively high minimum capital requirements, set a high barrier for small-scale domestic actors who might wish to initiate business operations. On almost all fronts, Tunisia and Morocco appear to be the most attractive countries of the set, with the fewest procedures, a quick turnaround time, and low costs. Turning to factors affecting the ability of foreign or local entrepreneurs to set up new businesses, such as access to capital via loans and private or public equity, Egypt seems to rate slightly above the mean for all countries surveyed (table 5b).¹⁷ Along these indicators too, Tunisia stands out, as does Mauritius. China rates poorly on several indicators, although these do not seem to deter the vast flows of foreign direct investment (FDI) into that country.¹⁸

¹⁶ As part of the recent reforms by Egyptian Prime Minister Nazif, who was appointed in July 2004, the government's investment promotion agency claims to have reduced set up times to three days. See "Remarks by Egyptian Prime Minister Ahmed Nazif to the World Economic Forum," *Federal News Service*, May 23, 2005.

¹⁷ Unfortunately, Egypt's ratings dropped across all categories except for VC availability since the survey in the previous year.

¹⁸ Interestingly, China's rating for access to local equity markets jumped 1.5 points since the previous year.

Other factors affecting a potential investor are those surrounding the ability to enforce commercial contracts and conduct business efficiently. Here Egypt looks somewhat better—it is in the middle of the pack both in terms of number of procedures and days required to enforce commercial contracts—but it still presents a daunting picture (table 5c). Once again, Morocco and Tunisia stand out near the top in terms of procedures, duration, and costs. Even China and Jordan look good compared to Egypt.

Finally, in choosing where to start a new business venture, entrepreneurs might also take into account the ability to quickly close down an insolvent business and recover some of their investment to temper the risk associated with the new venture. Higher exit costs would not only affect the decision of an international investor regarding where to invest but would also serve as a disincentive to local entrepreneurship. In this regard, Egypt stands at the tail end of our sample set, with close to the longest time and highest costs associated with closing a business and by far the lowest average recovery rate (table 5d). Investors in Jordan fare only a little better, while both Morocco and Tunisia have made the process significantly speedier and have increased recovery rates. Even Bangladesh edges Egypt in recovery rates, while China is in the middle of the pack, and Mexico is far ahead.

Operating a Business

If Egypt presents a challenging option to investors looking to start a new business, how does it measure up once companies are up and operating, i.e., how do the business environment and regulatory frameworks measure up? As stated earlier, tariffs are high, making access to imported goods more difficult. Generally speaking, companies that are conducting assembly operations must meet a minimum local content requirement of 45 percent in order to benefit from customs tariffs reductions on industrial inputs. They can also qualify for customs reductions on industrial inputs, but they must first meet a minimum local content requirement. All imports are also subject to a sales tax ranging from 5 to 25 percent, but there are no export approval requirements, and quality control is voluntary. Beyond that, Egypt has developed a system of seven public free zones,¹⁹ which provide manufacturers with a range of operating benefits. Companies operating in these zones that produce more than 80 percent of their output for export may use foreign currency and are exempt from custom duties, sales tax, and taxes and fees on capital assets and intermediate goods. A Special Economic Zones Law, passed in 2002, further increased incentives by lowering the corporate tax on companies established in these zones and by subjecting them to more flexible labor laws. More broadly, to meet with its WTO commitments, in 2002 Egypt amended

¹⁹ Nasser City (near Cairo Airport), Alexandria, Damietta, Ismailia, Sixth of October City, Suez, and Port Said. The 70 apparel and 25 textile companies that operate in these zones accounted for approximately 47 percent of apparel exports and 23 percent of textiles exports in 2003 (author's analysis, based on Egyptian Ministry of Foreign Trade data provided by the Egyptian Embassy).

Customs Law 66 to allow for temporary admission of basic materials and intermediate goods exempt from customs (Article 98). Customs Law 66 provides for refunds of customs and service fees on imported inputs that are used in manufactured goods that are exported within two years (Articles 102 and 103). At the time of the reform, the Ministry of Finance also implemented an automated system at selected ports to administer the temporary admission and drawback programs. Unfortunately, the drawback procedures are reportedly cumbersome and can take up to six months for processing.²⁰

Turning again to our set of comparator countries, we look at wages to see costs that foreign investors would face in overseeing operations. Table 6 shows comparative wages for spinning and weaving, which can be viewed as a proxy for the broader textile and apparel industry. Although labor productivity and quality are important factors in comparing costs, wages on their own help tell part of the story. Here, Egypt shows up well compared to its regional competitors, with a slight advantage over Mauritius and almost half the wage costs of Morocco. However, both China and Bangladesh offer lower wages, substantially so in the case of Bangladesh and inland China, and even in coastal China they are about 30 percent lower.

Another factor affecting the decision regarding where to send investment dollars is the level of corruption in the host country. International businesspeople do not want to be overly burdened by the inability to get product out or inputs in due to the capriciousness of local authorities. Ranked 77th out of 183 countries, Egypt is tied with Morocco and near the bottom of the comparator set. Several of the comparator countries offer a better environment, with Jordan, Tunisia, and Mauritius being noticeably higher in the rankings. Looking at additional indicators focusing on organized crime, bribes necessary to facilitate the flow of imports and exports, and the business costs of corruption, an interesting picture emerges: Organized crime does not seem to impose a significant cost on business, while Egypt scores less well on the other indicators, suggesting that Egypt's corruption problem is that of a rule-ridden economy heavily dominated by the government (tables 7a and 7b).²¹ In these respects, Egypt ekes by its competitor Morocco, but both rate relatively poorly, while Tunisia and Jordan are ranked noticeably higher.

Exporting from Egypt

Once manufacturers in Egypt have gotten past the hurdles of setting up their businesses and producing their products, another key challenge they face is in moving their product to markets.

Exporters in Egypt face a mixed story regarding transportation costs and logistics. Ports and road infrastructure are generally poor, and efficiency is low. High tariffs on trucks cause their price to be about

²⁰ Egypt Country Commercial Guide FY 2004, US & Foreign Commercial Service, Department of State.

²¹ In comparison to its ratings the previous year, Egypt has improved slightly on the measures regarding irregular payments and the costs of corruption, suggesting an improvement in the business climate, though at the same time its rating on organized crime fell considerably.

double the price in the United States, forcing companies to keep their trucks longer, leading to higher maintenance costs in addition to higher associated capital costs. Along with heavy congestion in the road system, the resulting high operating costs for trucks lead to low road transportation productivity. Strong competition in trucking and lax enforcement also leads to overloading, which causes damage to roads and further increases their maintenance costs. Poor information is another systemic logistical problem: A lack of information linking road transportation with cargo availability makes it difficult for trucks finishing deliveries to find return loads.²²

For serving apparel markets, where quick turnaround and delivery times are critical, airfreight is an important consideration. The tourist trade drives aircraft flights in and out of Egypt, since passenger traffic is more profitable than airfreight. As a result, most of Egypt's trade is delivered by sea. Cargo space is not only limited on passenger flights, but, in the event additional passenger traffic or luggage is more than expected, cargo shipments will be bumped from their scheduled flights. While textiles/apparel and food are the categories of products most likely to be air shipped in Egypt, when there is a lack of space on a given flight, the handlers prioritize perishable food over apparel. In addition, airport infrastructure is insufficient to properly handle air cargo exports, resulting in additional delays. These dynamics cause shipments for apparel exports to be unreliable—not a positive factor for companies attempting to establish themselves as suppliers to European or US retailers.

Yet in terms of flight availability, Egypt seems to be on par if not ahead of all of the countries in the comparator set, with the clear exception of China and Mexico. With approximately four times the apparel exports of Egypt, Morocco has almost the same number of flight departures, suggesting that manufacturers there face even more competition for air cargo space. At the extreme, Bangladesh has the fewest flights for relatively high apparel exports, suggesting that almost none of its exports are air freighted from the country (table 8).

As for sea shipments, the story is more reliable but slower shipments for exported products. Egypt's trade deficit results in a surplus of ocean shipping containers that arrive in Egyptian ports full and leave empty. Despite the potential availability of empty containers, the lack of consolidation facilities for outbound shipments and poor logistics information systems result in many of the containers leaving the country empty. The transportation study concluded that ocean freight costs, including handling costs, were not significantly higher for Egypt in shipping to the United States and Europe, as compared to countries like Israel, Morocco, Tunisia, Turkey, and Jordan. Similarly, airfreight costs, including landing and takeoff charges, were similar for Egypt and the same competitor group. However, increased competition from new hub ports in the Mediterranean has reduced the amount of transshipment occurring through Egypt and requires exporters to use feeder ships, increasing export costs and increasing

²² For a more in-depth analysis of Egypt's transportation costs, see DEPRA 1999b.

shipment times.²³ In an industry where margins are increasingly tight and best-in-class apparel suppliers are able to get their products to retailers within weeks or even days of an order, any increase in costs or delays in shipment times is a disadvantage to manufacturers.

Aside from costs, several logistical concerns affect the ability of exporters to move their products to market. In an industry that is increasingly trying to focus on rapid and reliable delivery times, customs clearance is an important factor to consider. The transportation study further found that customs clearance for exports in Egypt was reported to take only one to three days.²⁴ However, a survey of exporters found the mean clearance time to be 5.5 days (Clark, Dollar, and Micco 2004). Other factors affecting port efficiency and transportation costs are presented in tables 9a and 9b. While Egypt is only slightly behind China and Mexico in port efficiency, Mauritius is rated measurably higher.²⁵ Meanwhile, Egypt receives better ratings for overall infrastructure as compared to Morocco, but Tunisia and Jordan are both rated considerably higher than both, particularly in both air transport infrastructure and ports. While Egypt's ports rate slightly better than Morocco's, its air transport lags behind. Interestingly, China's infrastructure receives across the board ratings below Egypt's, but in China's case these impediments do not seem to be harming its export capability, suggesting that perhaps the people being surveyed for these ratings have higher standards and expectations of China.

Egypt also garnered a high index of mandatory services and cargo handling restrictions. These findings are consistent with other reports that critique the state-run monopolies over airport infrastructure and services. In the case of loading equipment, the Cairo Airport Authority (CAA) restricts the number of pieces of equipment that carriers are allowed to have, forcing exporters to rent equipment from Egypt Air at enormous markups—in the case of container dollies, the rental fee per hour is reportedly almost equivalent to the purchase price of a new dolly. Furthermore, due to shortages of equipment and stacking space, exporters often incur significant costs due to shipment delays, which can add up to such a degree that they exceed the revenue generated by the cargo shipment itself. Exporters have complained that these costs could be minimized if the Cairo Airport Authority acceded to the requests of exporters for additional equipment and storage space, requests that fall within existing CAA regulations (DEPRA 1999b).

²³ The DEPRA 1999b study further suggested that ocean shipping costs could be reduced through improved logistics, for example, creating a dry port in Egypt to consolidate shipments before reaching the sea ports, helping to decrease the number of empty containers leaving the country.

²⁴ The DEPRA 1999b study on Egyptian transportation costs suggests that exports clear in less than 1 day but that imports can exceed 10 days.

²⁵ In one of the more focused studies on the impact of port efficiency on trade, the authors found that a move from the 25th percentile of port efficiency to the 75th was associated with a 12 percent drop in transportation costs. See Clark, Dollar, and Micco (2004).

CONCLUSIONS ABOUT EGYPT'S RELATIVE CAPABILITIES AND BUSINESS CLIMATE ASSESSMENT

So how does the Egyptian textile and apparel industry stack up in terms of capabilities as well as the business climate? The preceding comparisons paint an impressionistic picture of an industry that has a ways to go in improving its production capabilities as well as its investment and operating environment to encourage FDI and local efforts of entrepreneurship. There are procedural complexity and costs involved in establishing businesses, although the government has taken steps to improve the investment climate. Its export zones offer a decent operating environment, though corruption remains a burden on operations. While sea shipment costs are competitive, costs have been rising, and Egypt is not yet set up for the type of rapid transportation, quick customs clearance, and additional air cargo, which are required to support the rapid-replenishment categories of the apparel industry.

Empirical evidence on the relative performance of Egypt's industry serves as a measure of how all these factors, along with many others, combine to drive the patterns of trade. An examination of the Revealed Comparative Advantage (RCA) of each country's textile fiber, textile, and apparel segments shows how each country's industry has actually performed in global markets (figure 5).²⁶ The RCA analysis shows that Egypt does in fact enjoy comparative advantages in exports of all three subcomponents of the textile and apparel industry, from textiles fibers, through yarns and fabrics, and into apparel. In fact, its RCA index is highest among the comparator countries for the two input product categories, fibers and yarns/fabrics. Unfortunately, Egypt's comparative advantage decreases as it moves up the production chain, and it falls to sixth place out of eight when it comes to apparel. Indeed, all of Egypt's regional competitors surpass it in their ability to penetrate global markets with apparel exports, and Egypt's score is higher only than that of China—which is perhaps little comfort, given China's strength across export categories and its clear strength even in textiles and apparel.

Another empirical measure looks at the actual flows of FDI as a percentage of GDP, which shows on an aggregate level how international business views the relative attractiveness of these economies (table 10a). China and Mexico clearly lead in attracting FDI, both in absolute terms as well as a percentage of GDP, although the percentage has been falling for Mexico in recent years. Morocco had a tremendous spike in 2001, following some uneven flows in previous years,²⁷ and Tunisia shows strong investment on par or just slightly behind China on a percentage of GDP basis in several years. Jordan

²⁶ RCA is calculated taking the country's share of exports in a particular sector as a percentage of global exports in that sector, over its share of total exports as a percentage of global exports—revealing in which sectors a country's exports are able to penetrate global markets relatively more strongly than the country's exports overall. Any RCA index greater than unity suggests the industry is more export oriented than others in the country. However, the index does not measure true competitive advantage, as it incorporates the distorting effects of tariffs as a given, thus comparing each industry in a country relative to others in the same country.

²⁷ Morocco's FDI has been highly dependent on its progress in executing its privatization strategy. For instance, the spike in 2001 was the result of Morocco's sale of a second GSM license to Meditel for \$1.1 billion.

seems to have benefited from the announcement of its FTA with the United States with a particularly large one-time spike in FDI to over 9 percent in 2000 and a more gradual rise since. As for Egypt, its net FDI inflows are fairly low, suggesting that so far investors have not been convinced that it offers an attractive option as a manufacturing base for export markets (or even domestic ones). The data on numbers of foreign affiliates of multinational corporations (MNCs) reinforce the picture that Egypt has been less able to attract foreign companies than its neighbors Morocco and particularly Tunisia, despite their smaller economies (table 10b).

GLOBAL SUPPLY CHAINS AND THE CHALLENGE OF CHINA

The analysis so far has presented an overview of the Egyptian textile and apparel industry and explored certain factors in its competitiveness. Despite the clear challenges involved, the success of Taiwan, South Korea, and Hong Kong makes industrial upgrading through participation in global supply chains an intriguing model for developing countries to follow. The key challenge for a country like Egypt attempting to mimic the success of the East Asian countries is how to compete when so many other countries are trying to follow the same path, particularly when one of them is China.

China is a threat not just because of its efforts to follow the same export-led growth path based on its own natural supplies of labor and capital. It has another advantage: significant FDI from neighboring countries with strong textile and apparel industries. As labor wages have risen in Japan, Taiwan, and Hong Kong, companies in those countries that had acted as apparel OEMs in earlier decades are shifting production to nearby China in an attempt to remain competitive. Thus, as a result of its own geographical advantages, China benefits from an inflow of capital and managerial skills that are helping turbocharge its inherent capabilities. The challenge posed by China, therefore, comes not only from its independent efforts to compete in global supply chains to developed countries, but also in its collaboration with the newly industrialized countries to help them maintain their own growth by partnering with Chinese firms.

Some empirical data from years prior to the end of the MFA foreshadowed how significant a threat China poses to other countries in the apparel industry. One analysis done by a textile and apparel industry association showed that the surge in China's imports after global quotas were dropped in selected apparel categories in 2002 had been devastating to other developing countries. In 29 garment categories where quotas were lifted in 2002, China increased its share of the US market from 31 to 59 percent, increasing its overall exports in these segments by 290 percent while exports from all other countries fell 14 percent. A similar outcome occurred in the EU markets: In categories where quotas were dropped in 2002, China increased its market share from 12 to 30 percent. Its dominance in certain subsectors experienced even stronger increases, for example from 14.6 to 53.2 percent in just one year for anoraks

and parkas.²⁸ More broadly, a recent WTO study has shown similar trends: During the period of 1995–2002, China’s share of global trade in apparel rose from 22.5 to 30 percent. Over the same time frame, China increased its apparel exports significantly to three quota free markets—from 54.3 to 70.4 percent in Australia, 59.1 to 77.5 percent in Japan, and 29.0 to 56.3 percent in South Africa. While in the case of the first two of these countries China enjoys geographical and time-to-market advantages, it is no closer to South Africa than many other potential global suppliers, suggesting that China’s strengths extend well beyond geographical advantages.²⁹

LEAN RETAILING AND THE POTENTIAL POWER OF GEOGRAPHY IN THE APPAREL INDUSTRY

With China coming on line in a variety of light manufacturing industries and global supply chains, Egypt’s ability to compete in textiles and apparel remains to be seen. Geographical and political factors may provide Egypt with one possible source of advantage. Egypt garners attention from developed countries as a result of a broad set of factors, including its size and proximity to Europe and its role and potential as a regional power, both in relation to the Israeli–Middle East issue and the broader efforts for the West to build ties to the Middle East. Both the United States and the European Union have self-interested reasons to foster Egypt’s economic development, including their desire to strengthen their allies in the Muslim world, as well as to improve economic conditions to help ensure political stability and, particularly in the case of Europe, to preempt migration.

Moreover, textiles and apparel may be an industry where factors other than low-cost labor can help companies gain an advantage in global supply chains. Egypt’s proximity to end markets in Europe should not only help reduce transportation costs, but may also drive shorter lead times associated with getting ever changing fashions to market. Anecdotal evidence suggests that some apparel sourcing managers believe that the advantages of geographical proximity to end markets outweigh the benefits of low-cost labor. A number of these garment buyers have stated that China will remain a source primarily for products where longer lead times are the standard and that they will need to maintain other options for products where quick turnaround times are required.³⁰ Other companies are overcoming cost disadvantages by investing in cutting edge information technology and manufacturing techniques (see box 2).

²⁸ Neil Kearney, “What Future for Textiles and Clothing Trade After 2005?” International Textile Garment & Leather Workers’ Federation, February 9, 2003, International Textile Garment & Leather Workers’ Federation Web site.

²⁹ “The Global Textile and Industry post the Agreement on Textiles and Clothing,” WTO 2004.

³⁰ For example, the vice president of Manufacturing for the Children’s Place, a US retailer, suggested that China will be appropriate for products that require a traditional 3- to 6-month lead time, but that for quicker turnaround the company will rely on production in NAFTA and CBI countries, as well as a small amount of production in the United States. J. Speer, “Sourcing in China: Firms discuss advantages, issues,” *Bobbin Magazine*, January 1, 2002.

Box 2 Competing in global supply chains: An alternate strategy

Another route for companies to compete in global apparel supply chains is at the high end of the value chain. Despite having significantly higher wages than China, some companies in East Asian countries like Taiwan have carved out important roles for themselves in the global supply chain. These firms work as middlemen in what one observer has called “triangular manufacturing” (Gereffi 1999)—taking orders from lead firms and shifting production to lower cost countries like China, Indonesia, and Guatemala. As management of the supply chain becomes increasingly important and increasingly capital and technology intensive, these companies have found themselves to be players that are difficult to cut out of the chain.¹ With tracking of every item sold at its point of sale, electronic data interchange (EDI), and nightly data dumps, buyers are increasingly relying on their suppliers to be technologically advanced enough to fill orders quickly. Another study on apparel buyers in Europe found that several factors other than cost drove the sourcing decision, among them the ability of suppliers to offer full fabric and cloth sourcing capacity, dedicated account management, lead times, and quality (Palpacuer, Gibbon, and Thomsen, undated). Even some of the companies that are surviving and competing in Mexico are those that have moved on to more complex products or have moved up the value chain from mere assembly to more capital-intensive activities such as modern laundering, textiles, and even coordinating assembly in lower-cost areas of the country (Bair and Gereffi 2003).

Studies analyzing the increasing focus on inventory management among apparel retailers support the notion that sourcing production closer to end markets can provide a significant advantage for firms. At least one study has shown that the advantage of shorter lead times, which may be affected by geography, can swamp cost savings from low wages (Abernathy, Dunlop, Hammond, and Weil 2004). Abernathy et al. argue that increased product proliferation and uneven demand in the apparel industry lead to a high variance in replenishment rates, and this variance, coupled with method and quality of transport, the carrying costs associated with inventory, and the costs of labor and other inputs, all affect lead times and the ultimate value to the buyer. Indeed, Abernathy et al. model trade-off points between local and foreign sourcing as a continuum based on all of the inputs listed above (Abernathy, Dunlop, Hammond, and Weil, 2000 and 2004). Their empirical analysis focuses on the apparel exports of Mexico and China to the United States over the course of the 1990s. Mexican apparel imports to the United States surged over the course of the decade from 2 percent of US apparel imports in 1984 to 16 percent in 2000, while those of China, Hong Kong, Taiwan, and Korea fell from 63 to 19 percent.³¹ Garment production establishments in Mexico also grew from 398 in 1994 to 1088 in 2000 (Ancelovici and McCaffrey, 2005). While observers might be tempted to explain the change as resulting from the preferential treatment Mexican exports to the United States enjoyed under NAFTA, the authors argue that over the course of this period, the effective tariff rates on Mexican and Chinese imports were essentially the same. They also

³¹ Abernathy, Dunlop, Hammond, and Weil (2004). The authors group the four countries together due to transshipment issues, which may hide some shift from these other countries to China.

cite research to show that it was not the quotas on Chinese imports that allowed Mexico to grow: If quotas were the key, Mexican imports would have grown particularly strongly in categories where China was bumping up against its quota, but this effect is not supported by an examination of the disaggregated trade data (Evans and Harrigan 2001). In another more recent study, Evans and Harrigan built a model demonstrating that firms that can produce flexibly and focus on products where the variability of demand is high locate close to end markets. The authors argue that companies farther away must have lower wages in order to compete. They then use a proprietary data obtained from a clothing retailer to determine a “replenishment” variable and regress imports to the United States by product, showing that high replenishment products from nearby countries grew significantly faster than those from more distance ones (Evans and Harrigan 2003).

More generally, traditional business strategy emphasizes the importance of geography in improving companies’ ability to compete across a range of industries. Proximity to end markets enables buyers and suppliers to build and maintain strong relationships, partially by making it easier to visit one another more frequently. Relationships are also strengthened because being closer to an end market can help a manufacturer have a better understanding of their customers’ preferences and how to meet them. And all things being equal, firms located closer to end markets can ship product more quickly and at a lower cost. While there is a case to be made that improving technology is shrinking the world’s geography, direct human interaction still remains a powerful force in facilitating communication and business relationships. These factors are important in any industry, certainly in one like apparel that places a premium on the ability to adapt to rapidly changing customer tastes.

These works provide a theoretical and empirical foundation for the argument that geography matters in global apparel markets. In short, in some instances the need for quick replenishment makes it more profitable for apparel buyers to source their products from companies in closer geographies, even if the products cost more up front.

Some more recent data suggests that the Mexican apparel may be beginning to struggle in the face of the onslaught from China. While the value of Mexican exports to the United States rapidly increased from 22 percent of China’s total in 1992 and eventually surpassed Chinese apparel exports in 1999, in the next few years Chinese exports again picked up the lead. Such end results have ripple effects up through the supply chain, as an estimated 325 of the 1,122 maquiladoras³² that make clothing closed from January 2001 to September 2003, with competition from China pointed to as the culprit.³³ More generally, one

³² Maquiladoras are Mexican companies operating under the 1989 “Decree for Development and Operation of Maquiladora Industry.” These firms are allowed to have up to 100 percent foreign ownership and management and are given special customs treatment including duty free importation of equipment. All of their output is to be exported.

³³ Juan Ferero, “Mexico manufacturers lose business to China: A new king of low-cost plants emerges,” *New York Times*, September 3, 2003.

report has suggested that of the 277 maquiladoras in Baja California that closed in the three years up to 2002, as many as 75 percent moved to China, and as many as 50,000 jobs were eliminated as a result.³⁴ And while Mexican apparel plants still enjoy an advantage in lead times at least partially due to their proximity to the United States, the best Chinese plants average shorter lead times than the worst Mexican ones—with lead times of 4 to 9 weeks for Mexican plants as compared with 7 to 16 weeks for Chinese firms.³⁵ And as noted earlier, more than one study has shown that in apparel categories where quotas were lifted in 2002, Chinese exports and global market share have surged even within a year.

And yet there may still be reasons to believe that these aggregate statistics hide some of the detail suggesting countries can compete along dimensions other than low wages to carve out a role in global supply chains. Abernathy et al.'s analysis of Mexico and China highlights another important trend, this time about the composition of trade from each country. They show that the composition of Mexican apparel exports over the 1990s was increasingly skewed towards items where high rates of replenishment are required, rising from 5 of the top 10 categories based on SITC classification in 1991 to 8 for Mexico, while the number of items with high replenishment in Chinese exports to the United States fell from 4 in 1991 to 3 in 1999. Thus even as Chinese exports surpass Mexico's, this analysis reinforces the theoretical arguments and empirical evidence that there are product types where geography plays a stronger role than for others. Their analysis can also play a role in helping companies identify product niches in which they are more likely to compete successfully.

A SUPPLY CHAIN MODEL: ANALYZING THE IMPACT ON PROFITS OF CUTTING LEAD TIMES

In order to evaluate the benefits of geography on trade in apparel, a model has been constructed to quantify the additional profits associated with shorter lead times to market. The model uses inventory management algorithms that are used in the retail industry to determine profit-maximizing inventory levels under conditions of uncertain demand. The model is based on two key points. The first is that there is a cost involved with ordering too much inventory—the costs involved in liquidating the units at the end of the season for whatever salvage value is attainable. The second is that there is a cost involved with ordering too little inventory—the cost of a missed sale. The model uses forecasts of demand to determine

³⁴ Rolando Gonzalez, president of Mexico's national maquiladora association, quoted in Dean Calbreath and Diane Linquist, "The China Challenge: Maquiladoras in Mexico are facing intense competition from Far East counterparts," *San Diego Union Tribune*, August 25, 2002.

³⁵ Abernathy et al. (2004). The authors also note that the most demanding lean retailers require replenishment orders to be filled in as little as three days. In a more extreme example, one manufacturer in Canada told how a Chinese subcontractor who had previously delivered a flawed shipment of goods was able to manufacture, airship, and deliver an entire order within two weeks to meet the required deadline. The Canadian manufacturer pointed out that she would be unable to produce the output domestically, let alone deliver it, so quickly to the buyer, even with her geographical advantage.

inventory-ordering quantities that balance these two costs and thus maximize demand. Since demand is uncertain, the results do not maximize profits in every instance, however. The next step included running a simulation with several thousand iterations demonstrating that the results, on average, do indeed maximize profits.³⁶ Appendix A contains a more detailed overview of the model.

The model confirms that shorter lead times do indeed increase profits, increasing total sales over the season (i.e., reducing missed sales) as well as decreasing liquidation costs at season's end. However, while the model shows the effect exists, the magnitude is not enormous; the ability to shorten lead times by each week has an impact on profits that is, on average, on a scale of about 0.5 percent per week. At the same time, the analysis does indicate that the results are sensitive to a range of product, demand, and selling season characteristics, which can help apparel manufacturers as well as lead firms determine in which product categories they can achieve the greatest impact in leveraging geography and shortening lead times.

The base case scenario in the model examines a product that would cost the retailer \$5, could be sold for \$10, and liquidated at the end of the season for \$4,³⁷ which is typical for a standard item of apparel such as a T-shirt. Sensitivity analysis is then conducted by relaxing the selling price and liquidation price in turn. Two selling seasons are modeled, one with 13 weeks to analyze relatively standard items in categories that change only once per season, and a 5-week selling season to reflect the impact of lead times on a more fashion-oriented product with a short selling time frame. The demand forecasts that are incorporated into the model are allowed to vary by 10 percent, 20 percent, and 40 percent, which are common ranges for staple apparel products.³⁸

The model helps quantify how various characteristics of demand, product prices, and selling season length affect returns to shorter lead times. In the first instance, as variability of demand increases, the impact of cutting lead times increases—over a 13-week selling season and with 10 percent variability of demand, cutting lead times by each week yields an increase of about 0.5 percent, so that a firm that sources from a supplier with a lead time of only 2 weeks has profits that are 4.2 percent higher than one sourcing from a firm with a lead time of 10 weeks (see figure 6a). With 20 percent variability, the benefit increases to about 0.55 percent per week or 4.5 percent for a 2-week lead time over 10 weeks, and for 40 percent, it rises to about 0.7 percent per week or 5.6 percent over the range of lead times examined. More generally, as variability of demand rises, the total profits achievable declines. The intuitive underpinning of

³⁶ Crystal Ball, a commercially available program created by Decisioneering, which runs Monte Carlo simulations, was used for estimating the outputs in this model.

³⁷ Since the model is driven by the relative costs of missing a sale as compared to liquidating costs, the model is driven by the ratio of the prices rather than the absolute values. Thus, the base case can be applied as necessary to products with higher absolute prices, using the sensitivity analysis conducted on the relative input prices to calibrate appropriately.

³⁸ Detailed output is located in the appendix.

these results is that as variability of demand rises, there is increasing value to being able to replenish inventory to respond to different levels of actual demand.

In another scenario, as the selling price increases, from \$10 to \$15, the return to shortening lead times decreases—in the case of a product with 20 percent variability, the increase to profits of about 0.55 percent per week falls to something on the order of 0.3 percent per week, or only 2.3 percent over the range of lead times analyzed (figure 6b). These results are due to the fact that as the selling margin increases, there is a greater incentive to keeping additional inventory on hand to avoid lost sales, which builds in an inventory buffer that reduces the value of frequent replenishments. Similarly, lowering the liquidation value of the item to \$2 instead of \$4 (keeping the selling price at \$10) increases the returns to cutting lead times, rising to 0.65 percent per week or 5.2 percent over the range of lead times examined. Here the opposite dynamic is at play: A lower liquidation price puts a higher premium on not ordering too much inventory and thus increases the value of frequent replenishments to fine-tune how much inventory is on hand.

Finally, as the selling season decreases, the value to cutting lead times increases. If we look at a five-week selling season, for a product with \$4-\$5-\$10 prices, and a 20 percent coefficient of variability in the demand forecast, cutting lead times by one week initially can yield an 0.86 percent increase in profits. However, as the lead times increase, the impact drops to 0.35 percent per week. The results of this scenario highlight where the greatest value in cutting lead times lies. The impact on profits is greatest if a firm has short enough lead times that it can replenish inventory at least once during a selling season (figure 6c). In this case, as soon as a firm has lead times greater than three weeks, such that it cannot replenish its inventory even once during the five-week selling season, the impact on profits plummets.³⁹ At this point, any firm with longer lead times will ship the same quantity prior to the start of the season but simply initiate its shipment earlier as appropriate.

Of course, combining several of these factors together would result in even greater returns to cutting lead times. As the model demonstrates, the impact of shorter lead times is greatest during a short selling season for a product with a high coefficient of variation in its demand forecast, where the liquidation costs are high relative to the selling margin (figure 6d). These conditions are consistent with a highly fashionable product that has a short selling window, which may or may not be a hit, and one that is not significantly marked up over its wholesale price. The model also shows that of the three inputs, demand variability and length of selling season are likely to have a greater impact than relative prices.

³⁹ The first reorder only takes place in the second week of a selling season, once demand has been realized in the first week—thus a firm with a 4-week lead time can only deliver once within a 5-week season. A firm with a 10-week lead time similarly cannot replenish inventory during the selling season; both will ship the same quantity in one upfront shipment, but the one with a 10-week lead time will have to send its shipment out several weeks earlier. The only impact on profits is the carrying costs associated with the inventory being in transit longer.

Thus, if lead times were directly dictated by geography, we would have the answer: Geography matters, and under the right conditions it can matter to a material degree. But clearly geography is only one of a host of issues driving lead times, one that is predetermined for a given country. Other factors, examined above, can be more directly influenced by firms and governments: plant efficiency and the ability to produce orders quickly; the quality, type, and reliability of transportation; the cost of capital; and the associated costs of storing inventory in order to be able to trim lead times off of a given order.

EGYPT IN THE POST-MFA WORLD OF 2005

Global trade in textiles and apparel up to 2004 was still largely governed by the MFA that was originally established in 1974 to oversee an orderly opening of markets to developing country imports. Although the agreement expired in 1994, quotas that were enacted by Canada, the European Union, the United States, and Norway under the MFA remained in force. With the establishment of the WTO in 1995 came the Agreement on Textiles and Clothing (ATC), which was created as a transition from the MFA to integrating textiles and apparel fully into the WTO framework. According to the WTO Agreement, quotas under the MFA were to be dropped according to a set schedule, culminating with the total elimination of quotas by 2005 (see table 11).

Up until January 2005, textile and apparel industries in many developed countries had been somewhat shielded from the phased removal of quotas, since their governments were able to select product categories where quotas were not binding so as to minimize dislocations.⁴⁰ However, in the run-up to the end of the MFA, several studies appeared suggesting that the elimination of quotas in 2005 would have dramatic effects on the pattern of global trade, with the greatest winners being China and India. A study by the WTO received significant attention when it suggested that soon after the expiration of the MFA quotas, China could increase its market share in the United States by up to 50 percent,⁴¹ and the empirical evidence from 2002 cited above suggests that, in categories and countries that had quotas that year, China did indeed increase its market share to such a degree. In anticipation of such changes, many developed and developing country governments began evaluating the range of possible responses. Meanwhile, as discussed above, many clothing manufacturers have spent the last few years establishing supply relationships in Asia and particularly China in anticipation of the new access to end markets that suppliers there will enjoy.

⁴⁰ A study by the WTO's Textile Monitoring Body found that the percentage of constraints carried over from the ATC that had been eliminated in the first three stages ranged from only 6 percent for the European Union, to 6.5 percent for the United States, and 7 percent for Canada (WTO 2001).

⁴¹ Nordas, (2004). Projecting gains for China of a similar magnitude, the *Wall Street Journal*, using Commerce Department statistics and a survey of industry experts, estimated that China's share of the US market for cotton pants would rise from 2.5 percent in 2003 to 45 percent in 2009 (June 16, 2004).

And yet there are those who believe that the end of the MFA might not produce as great a tidal wave of change in global textile and apparel trade patterns as the doomsayers are predicting, for the two reasons that have been discussed in this paper: geography and trade policy. While the early indications suggest the broader shifts are dramatic, the predictions that other developing country export industries will be wiped out may be somewhat overblown.

On the geography front, there is a growing set of analysis, discussed above, that suggests that geography matters, so that countries like China and India that are far away from the largest end markets in Europe and the United States will not take away all the opportunities for nimble manufacturers located in North Africa, eastern Europe, Mexico, and the Caribbean Basin. Even the WTO study suggests that its 50 percent market-share result for China that has received so much attention does not take geographical considerations into account and is likely overstated. Another finding of the same WTO study, using a gravity model to account for distance between different suppliers and end markets, suggested that having a border with the European Union could increase trade in clothing by a factor of nine. It also estimated that this effect fell off with distance at a rate of approximately 5 percent for every 10 percent increase in distance. The study further found less of a benefit to proximity in subsectors such as fibers and other inputs, reinforcing the emerging picture that geography matters and that it matters most in products that are further along the value chain and potentially more differentiated, e.g., clothing as opposed to textiles, where the opportunity to find and exploit fashion-oriented replenishment provides more advantages to location. The analysis in this paper further supports the notion that geography can make a difference and that the magnitude of its impact can be noticeable if several critical factors are in alignment. However, this analysis presupposes that companies in the geographically advantaged countries are capable of producing efficiently and cutting their lead times sufficiently to harness the benefits of being proximate to end markets.

On the trade policy front, throughout the latter half of 2004, there were efforts by governments of both developed end-market countries like the United States and the European Union, as well as those of developing countries that rely on textile and apparel exports, to work through the existing WTO mechanisms or possibly even change them to mitigate the impact of a full reduction in quotas. A newly created organization of manufacturers' associations called the Global Alliance for Fair Textile Trade drafted the Istanbul Declaration, which called for the quota eliminations of the MFA to be postponed at least until December 31, 2007. More than 90 textile and apparel lobbying associations from over 36 countries signed the declaration, including organizations in both Europe and the United States, lending powerful voices in its support.⁴²

⁴² For an overview of various challenges to China's trade and currency policies in the run-up to the end of the MFA, see Hufbauer and Wong (2004).

However, the WTO remained firm in its intention to continue on with the phaseout, with its Director of Textiles stating that the Istanbul Declaration had no place in the WTO process.⁴³ Furthermore, despite the fact that WTO Director-General Supachai Panitchpakdi agreed that an October 2004 meeting of the Council for Trade in Goods would provide an opportunity for members to raise concerns about implementation of the quota phaseout,⁴⁴ the Council subsequently reaffirmed the WTO's support for the quota reduction.⁴⁵

And yet, members countries have some methods of addressing the quota phaseout that are wholly consistent with existing WTO requirements, and recently more attention has been focused on these mechanisms. China's Accession Agreement to the WTO included a number of measures that other member countries can take to protect themselves against China's roaring economy. One is the Textile Safeguard Provision (paragraph 238 of the agreement), which allows countries to impose special quotas on China effectively until 2008 in any instance where Chinese imports create "market disruptions." Another option is the Transition Product Safeguard (paragraph 241), which requires member countries to go the additional distance of demonstrating "material injury" but then allows them to impose product-specific safeguards against any Chinese import until the end of 2013.

As a result, in the months leading up to the January 1 deadline, there was a flurry of activity on the issue that only increased in the first half of 2005, now that the quotas have indeed been lifted and as actors on different sides of the matter seek to utilize these provisions to their own advantage. Beginning in September 2004, the US government's Committee for the Implementation for Textile Agreements (CITA) announced it would be willing to review threat-based petitions. The announcement led industry groups to file 12 petitions by the end of the year, targeting \$1.9 billion in imports, although the petitions were delayed due to opposition of US retailer groups. The CITA also accepted a petition to reapply quotas from 2003 on dressing gowns and robes from China that had been slated to disappear. As a counterpoint, the US Association of Importers of Textiles and Apparel filed a suit to block the CITA's ability to review petitions and impose restrictions on imports. Meanwhile, European lobbying groups began pushing their own governments to invoke paragraph 241 against fabric and fiber imports from China. For its part, throughout 2004 the EU commission vowed to stand by the quota reduction but still set up a special monitoring system to keep an eye on imports from China and develop working guidelines for triggering import restrictions.⁴⁶

⁴³ Chiedu Osakwe in a speech at the Washington International Trade Association (WITA) event "Textiles and Clothing Quotas: The End is Near or Is It?" April 28, 2004, cited in Hufbauer and Wong (2004).

⁴⁴ WTO press release: "WTO DG consults members on possible emergency meeting to discuss textiles and clothing adjustment challenges," August 4, 2004.

⁴⁵ See Scott Malone, "The top 10 stories of 2004: Don't quota me," *Women's Wear Daily*, December 17, 2004; and John Zarocostas, "WTO Chief: End of Quotas 'On Track,'" *Women's Wear Daily*, December 10, 2004.

⁴⁶ See "The US Will Consider Maintaining Quotas on Imports from China," www.emergingtextiles.com, September 8, 2004; "European Group to Submit First China Textile Safeguard Petition," *Inside US Trade*, January 28, 2004;

Not surprisingly, China did not sit quietly while all these initiatives were under way. In early 2004 there were rumors that China had been considering a “Plan B” alternative to the Istanbul Declaration, under which it would accept maintaining quotas in textiles and apparel as long as the level of the quotas increased by 20 to 25 percent per year.⁴⁷ By later in the year, the tone of the official rhetoric from Beijing had become more aggressive, with a statement from the Chinese Ministry of Commerce arguing that any safeguard actions “sabotage the integration of textile and apparel products and . . . extend the quota system under disguise.”⁴⁸ Even more sharply, the Deputy Director of a Chinese business association charged that US companies “are more like immature babies who’ve been living on milk for 50 years, but still can’t leave their mothers’ embrace.”⁴⁹ On a more conciliatory note, in mid-December just before the expiry of the MFA, China’s Ministry of Commerce announced that China would voluntarily impose 2 to 4 percent tariffs on its own exports of certain textile products, as one of a series of measures to help ease the transition process to the quota free global trading regime.⁵⁰ Then in March 2005, the director of the China Chamber of Commerce for Import and Export of Textiles announced the trade group would self-impose price controls for its members, including published minimum prices and penalties for manufacturers who export below them.⁵¹

However, the initial trade statistics from the first quarter of 2005 have shown a dramatic increase in apparel exports from China and led to a renewed round of calls for safeguards in both the United States and Europe. Estimates of the growth of Chinese imports to the United States in January of 2005 showed a year-over-year increase of over 80 percent in exports of apparel and 43 percent in textiles, with increases to the European Union of 47 percent in apparel and 43 percent in textiles during the same timeframe.⁵² In response, in April 2005, the US Department of Commerce’s CITA initiated safeguard proceedings to determine whether the increases constitute market disruptions. Then in May, the CITA announced that it had accepted three of the threat-based petitions and would be imposing safeguards on imports of three product groups—cotton knit shirts and blouses, cotton trousers, and cotton and man-made fiber underwear—where preliminary data showed that Chinese imports had increased in the first quarter by 1,250 percent, 1,500 percent, and 300 percent respectively over the same period in 2004.⁵³ Days later, the

Kristi Ellis, “Justice Department dismisses ‘constitutional right to import,’” *Women’s Wear Daily*, December 17, 2004; and “EU trade chief vows to stand by textile liberalization,” *Reuters*, December 21, 2004.

⁴⁷ “US Silent on China Deal,” *Knitting International*, August 19, 2004.

⁴⁸ “China Warns US Over Safeguards,” *Women’s Wear Daily*, December 7, 2004.

⁴⁹ “Outlook 05: Fiber Pact’s End May Mean China-US Trade War,” *Dow Jones International*, December 3, 2004.

⁵⁰ See “Textile Duties to Ease Trade Concerns,” *Business Daily Update*, December 13, 2004; and Scott Malone and Kristi Ellis, “China to Impose Export Tariffs in Trade Reversal,” *Women’s Wear Daily*, December 14, 2004.

⁵¹ “China’s Textile Industry to Adopt Price Controls: Report,” *Agence France Press*, March 3, 2005.

⁵² “As China Exports of Textiles Grow, Limits are Sought,” *Wall Street Journal*, March 11, 2005.

⁵³ “US imposes temporary quotas on clothing imports from China,” US Department of Commerce Press Release, May 13, 2005. The China Chamber of Commerce has argued that these large increases are in some cases due to distortions in the quota system that led to unrealistic baselines in the past. For example, in the case of cotton trousers, China’s quota had previously been 5.5 million square meters, while Bangladesh had a quota of 7.8 million,

CITA expanded the list to include four additional categories of import products.⁵⁴ Not surprisingly, shortly after there were reports that several US retailers were exploring options for shifting sourcing away from China in order to avoid being entangled by the safeguard provisions.⁵⁵

Meanwhile, in Europe in April, the EU Trade Commissioner announced a new “early warning system” for Chinese textile and apparel imports—a set of guidelines specifying the percentage increase of imports above 2004 levels for each product category that would trigger an EU investigation and informal talks with China about possible protection measures.⁵⁶ A month later, the European Union requested formal talks with China, which led in June to a negotiated agreement by the two sides to limit import growth on 10 categories of goods from 8 to 12.5 percent.⁵⁷ Not surprisingly, the Chinese voiced objections to the US moves, with the Ministry of Commerce calling them a bad precedent and a departure from the spirit of free trade, though the Chinese claimed to be happier with the negotiated results with the European Union.⁵⁸

It therefore appears that while the phaseout proceeded according to schedule, a variety of other mechanisms and initiatives may somewhat mitigate the impact of the quota elimination, if only in the near term. Taken all together, the trade policy initiatives and the safeguard provisions, along with the analytical and empirical evidence in support of the power of geography in apparel trade, suggest that the most dramatic projections of China’s growth after the MFA may be exaggerated. However, there is no doubt that the changes have been dramatic and that the threat is significant, especially to a country like Egypt that relies so heavily on its textile and apparel industry. In response, the Egyptian government has created

and Vietnam’s quota was 10.2 million meters. “Possible US Textile Safeguards Draw Criticism,” *Business Daily Update*, April 7, 2005.

⁵⁴ “United States further limits clothing, textiles imports from China,” *States News Service*, May 19, 2005.

⁵⁵ See “Helping one, hurting one: importers are scrambling to cope with safeguards,” *Women’s Wear Daily*, June 1, 2005. In the meantime, US manufacturers had filed seven new safeguard petitions asking to reinstate quotas on additional categories where they claimed Chinese imports had increased anywhere from 34 to 769 percent. See Kristi Ellis, “Coalition Files Market-Disruption Petitions Against China,” *Women’s Wear Daily*, April 7, 2005.

⁵⁶ John Zarcostas, “EU Sets China Safeguard Guidelines,” *Women’s Wear Daily*, April 7, 2005. Trade data for Europe also showed dramatic increase in imports from China, including jerseys and pullovers (625 percent increase in January 2005 over January 2004), women’s shirts and blouses (244 percent increase), and bras (493 percent increase). See Peter Gumbel, “Freed from Trade Quotas, Chinese Textile Makers are Overwhelming European and African Manufacturers,” *Time Europe*, April 4, 2005.

⁵⁷ “China to limit EU textile export growth to 8.0–12.5 percent per year to defuse row,” *Xinhua Financial Network News*, June 13, 2005.

⁵⁸ The Chinese government also scrapped a plan to impose export taxes of up to 400 percent on 74 categories of textile and apparel exports, an offer it had made in hopes of tempering the United States and the European Union’s invoking the safeguard provisions. See “Tension escalates between, China, US, and EU,” *Women’s Wear Daily*, May 31, 2005; “Friendly China-EU accord contrasts with US Tack—Sides set growth limits for 10 textile categories; a jab at the American way,” *The Asian Wall Street Journal*, June 13, 2005; “CITA accepts more safeguard petitions, China calls action ‘unfair,’” *Primedia Insight*, June 2, 2005; and “EU Guide on Textiles ‘Violates WTO Rule,’” *Business Daily Update*, April 8, 2005.

several initiatives to improve productivity in its textile and apparel industry and is attempting to develop some of its own preferential trade agreements to help boost its exports.⁵⁹

RECENT DEVELOPMENTS IN EGYPTIAN APPAREL TRADE POLICY

When Egypt signed the Uruguay Round and joined the WTO in 1995, it agreed to eliminate its import ban on textiles by 2001 and implement a set schedule for lowering its tariffs. These reductions included setting the ad valorem rates on apparel to 46 percent in 2003, 43 percent in 2004, and 40 percent afterwards, while home textiles would be reduced to 41 percent in 2003, 38 percent in 2004, and 35 percent thereafter. As noted above, while Egypt eliminated its import ban in 2002, it not only imposed extremely high tariff rates, but also did so on a per piece basis, not ad valorem as had been required. After little change during the next two years, in January of 2004 the US Trade Representative (USTR) decided to take Egypt to task for breaking its commitments. USTR filed a request for consultations through the WTO,⁶⁰ which prescribed a period of 60 days during which the two sides would try to arrive at a mutually agreeable solution before moving to the more formal dispute settlement process. Later that month, Egypt announced that it would indeed live up to its commitments under the WTO and drop tariffs on apparel to ad valorem rates of 40 percent, home textiles to 35 percent, fabric tariffs to 22 percent, and yarn to 12 percent. Additional tariff exemptions were made for textile machinery and spare parts.

The next step towards reform came in July of 2004 when President Hosni Mubarak appointed Ahmed Nazif as prime minister at the head of a new cabinet. At 52, Nazif is considered a reformist-minded technocrat, and his appointment was optimistically viewed as a step toward addressing Egypt's persistent economic troubles and moving toward reform. The new cabinet was also thought to be more reformist, with the appointment of economic academics such as Youssef Boutros-Ghali and Mahmoud Mohieldin as ministers of finance and investment respectively. Of the 36 ministers in the new cabinet, 14 are new appointees, including two dynamic younger ministers with strong reputations from the private sector: Rashid Mohamed Rashid, an ex-Unilever executive as the head of the Ministry of Foreign Trade and Industry; and Ahmed El-Maghrabi at the Ministry of Tourism.

⁵⁹ Minister of Industry and Foreign Trade Rashid has discussed a plan to increase textiles exports by \$5 billion each year starting in 2010. More broadly, he announced in January that 2005 will be the year for working with a range of industrial sectors to eliminate impediments, improve quality, and increase worker productivity. See "Egypt-US Moves Closer to Free Trade Agreement," *Middle East and North Africa This Week*, February 14, 2005, and "Egyptian minister maps out industrial plan for 2005", *BBC Monitoring Middle East*, December 30, 2004. In mid-May, Egypt's Minister of Investment Mahmoud Mohieldin repeated the ambitious goal of sending \$4 billion in annual exports, from the \$530 million in 2004 ("Egypt finds a place in Post Quota World," *Women's Wear Daily*, May 17, 2005).

⁶⁰ The ad valorem effective rates of the per item tariffs were estimated to have been 100 to 150 percent, though the USTR alleged that the ad valorem equivalent of the Egyptian tariffs ranged from 141 percent to a high of 51,296 percent ("Egypt lowers import tariffs, under US pressure," www.emergingtextiles.com, January 26, 2004).

The first clear results from the new cabinet came in September 2004 when Egypt revamped its Most Favored Nation (MFN) tariff structure. The reform included reducing the number of ad valorem tariff rates from 27 categories of processing to 6⁶¹ and the elimination of service fees and import charges that range from 1 to 4 percent. Egypt also reworked its national tariff structure under the Harmonized System (HS), from 13,000 to 6,000 tariff headings at the 10-digit level.⁶² The new structure also introduced lower tariff rates, ranging from 2 percent on raw materials to 40 percent on consumer durables, bringing the estimated weighted average tariff from 14.6 to 9.1 percent. Finally, the September reforms also removed export duties on 25 products that were still subject to specific per item duties rather than ad valorem duties. These steps are all positive in loosening the restrictions on trade and bringing Egypt into closer alignment with international standards.⁶³

At a luncheon in Washington toward the end of the year, the Egyptian minister of foreign trade and industry, Rashid Mohamed Rashid, further outlined the measures the Egyptian government is taking to prepare the Egyptian industry for the end of the ATC. These steps include an industrial organization project focusing on industrial change, a European-assisted project focusing on restructuring public sector textile and apparel firms and in particular focusing on excess employment, and a project to redesign Egypt's industrial policy on textiles and apparel.⁶⁴

Another important step forward for Egyptian trade policy came on December 14, 2004, when the United States, Egypt, and Israel announced the signing of a three-way agreement to establish a series of Qualified Industrial Zones (QIZs). The QIZ relationship mirrors an existing arrangement between Jordan, Israel, and the United States, allowing products manufactured in seven designated QIZs to enter the United States quota and tariff free, as long as they contain at least 11.7 percent Israeli content. The agreement is widely seen as one that will benefit the apparel industry in particular, with higher quality inputs like buttons and patterns coming from Israel and labor supplied by Egypt. The Egyptian government is estimating that the QIZ agreement will inject \$2 billion into the Egyptian economy over

⁶¹ With the exception of duties on alcoholic beverages, tobacco and cigarettes, and passenger vehicles with cylinder capacity above 2,000. See Hany Genena, "MFN Tariff Structure Revamped," *EFG-Hermes*, September 9, 2004.

⁶² The international HS system classifies products until the 6-digit level and then allows countries to develop further subdivisions at their discretion. Egypt's new structure is more closely aligned with the international HS structure, which will improve clarity in customs and shipping transactions and may help diminish disputes.

⁶³ Other reforms the government is undertaking include a renewed focus on privatization, including the state owned banks Banque Misr, Bank of Alexandria, and Banque du Caire; at least a portion of Telecom Egypt; and one each of the main insurance and energy companies. A new income tax law signed in early June reduced the maximum corporate rate from 22 percent for industrial export firms and 40 percent for others to 20 percent. Individual tax rates were reduced as well. See "Egypt's Ambitious Liberalization Plan," *Middle East Economic Digest*, March 18, 2005; Galal and Lawrence (2005); and *Egypt Watch Bulletin*, June 15, 2005.

⁶⁴ IIE luncheon, November 15, 2004. The minister also cautioned that the reform process must be careful to balance between a market economy and a stable government, but acknowledged that the pace of reform must be faster than it has been in the past.

two years, mostly directed toward the textile and apparel industry, and create 150,000 to 250,000 new jobs.⁶⁵

Indeed, the recent QIZ arrangement with Israel and the United States appears to have been largely driven by Egyptian fears over the impending threat to its textile and apparel industry. The idea of QIZ arrangements was originally authorized by the US Congress in 1996 to promote cooperation between Israel, Jordan, and Egypt. However, little progress was made on the Egypt-Israel front until last year. The specific timing of the signing seems to have been facilitated by a recent thaw in Egyptian-Israeli diplomatic relations following the death of Palestinian leader Yasser Arafat. However, more broadly, many analysts and indeed several Egyptian businessmen have stated that the agreement was necessary to save the Egyptian textile and apparel industry from the threat of China in the post-ATC world.⁶⁶

TRADE AGREEMENTS AND EGYPTIAN TEXTILE AND APPAREL EXPORTS

Despite the range of bilateral and multilateral trade agreements that Egypt has signed with its Arab and African neighbors, the United States and the European Union remain by far the two most important export markets for Egypt (see box 3). In 1997–98 the United States surpassed the European Union as the single largest destination for aggregate Egyptian exports (figure 7). In 2003, trade to the European Union grew more quickly than that to the United States, which may in part be explained by the devaluation of the Egyptian pound, which lost 59 percent of its value against the euro over the course of the year, while falling only 33 percent against the US dollar over the same period.

⁶⁵ “Egypt expects to expand US/Israel trade deal,” *Reuters*, December 22, 2004; “Free trade deal with US causes ripples in Egyptian political circles,” *Gulf News*, December 16, 2004. Estimates from Amman suggest that over 35,000 jobs have been created in its QIZs, and that many were established through FDI from Asian companies seeking access to the US market, *Middle East Economic Digest*, “Mixed reaction to landmark trade deal with Israel,” December 17, 2004.

⁶⁶ Egypt’s efforts to improve its business environment received another boost in June when the World Bank, in recognition of the Egyptian government reforms, announced a new plan to lend the country \$2.8 billion over four years. The money is intended to support a range of initiatives, including infrastructure projects and financial sector reforms (“Egypt Economy: World Bank Lends a Hand,” *Economist Intelligence Unit*, June 17, 2005).

Box 3 Egyptian trade agreements

Bilateral Agreements

Jordan (1999), Lebanon (1999), Libya (1991), Morocco (1999), Syria (1991), Tunisia (1999), Iraq (2001).

Greater Arab FTA (GAFTA)

Covers 17 signatories across the Arab world. GAFTA included a commitment for a 10 percent reduction in duties over 10 years beginning January 1998, and starting on January 1, 2005, aims to exempt all intra-Arab trade flows from tariffs, as well as reduce nontariff barriers.

Common Market for Eastern and Southern Africa (COMESA)

Egypt signed in 1998; aims for a customs union by 2004.

FTA with the European Union

In 2001 Egypt and the European Union signed an Association Agreement that was ratified by the Egyptian parliament in 2003 and formally kicked off on January 1, 2004. The agreement is aimed at creating a process of liberalization of trade, services, and capital. The effort is part of a broader Euro-Mediterranean partnership, which aims to establish a free trade area between the European Union and 12 countries around the Mediterranean by 2010. The agreement will eliminate quotas and quantitative restrictions, including those on textiles and clothing exports from Egypt to the European Union over a period of 12 to 15 years.

FTA with the United States

There has been talk of a US-Egypt free trade agreement for several years, though progress has been slow. In 1999, Egypt signed a Trade and Investment Framework Agreement (TIFA) with the United States to help promote bilateral investment and trade.⁶⁷ In the summer of 2003, President Bush announced a goal of achieving a greater US–Middle East FTA within 10 years. In June 2003, the Senior Commercial Officer at the US Embassy in Cairo stated that FTA negotiations would take at least two years;⁶⁸ however, talks were halted in 2004, apparently when Egypt did not support the United States in a trade dispute with the European Union.⁶⁹

Egyptian officials also see the QIZ agreement with the United States and Israel as an important step in establishing a broader FTA with the United States, but it is not clear that the Egyptian government has taken enough steps towards reform to be rewarded with the potential agreement by the US administration. In February 2005, Nabil Fahmy, the Egyptian ambassador to the United States, announced that he expected negotiations to take place soon, and a few weeks earlier, Assistant US Trade Representative Cathy Novelli, who negotiated the free trade agreement with Jordan, Morocco, and Bahrain, said the sides were making strong progress on a host of issues, but stopped short of giving a time frame in which negotiations would be started.⁷⁰ Furthermore, when Deputy US Trade Representative Peter Allgeier discussed plans in February to start negotiating FTAs with the United Arab Emirates and Oman within a month, he made no mention of any

(box continues next page)

⁶⁷ This activity was followed up in 2000 when a group of 26 senators wrote to President Clinton stating their support for a FTA with Egypt, to bolster relation with countries participating in the Middle East peace process (*Reuters*, August 5, 2000).

⁶⁸ However, informal conversations with officials at both the US Treasury and USAID in June 2004 suggest that the FTA with Egypt is not likely to occur anytime soon. At the same time, Israeli papers have reported that progress in establishing Qualified Industrial Zones between Egypt, Israel, and the United States—along the lines of the current arrangement with Jordan, Israel, and the United States—was moving ahead. See “US-Egypt QIZ Talks Making Progress,” *Globes*, February 2, 2004.

⁶⁹ “Free Trade: Trading Blows,” *Middle East Economic Digest*, January 7, 2005.

⁷⁰ “Egypt-US Move Closer to Free Trade Agreement,” *Middle East and North Africa This Week*, February 14, 2005; “Egypt, US Consider Opening Free Trade Talks in 2005 – Egypt’s Envoy to US says Reforms Needed to Raise Growth,” State Department Press Releases and Documents, January 14, 2005.

Box 3 (continued)

such talks with Egypt.⁷¹ More recently, the official agenda for the Egypt visit of US Treasury Undersecretary for International Affairs John Taylor did not list the FTA as one of the issues to be discussed, as the US government continues to officially place its emphasis on Egypt achieving internal reforms.⁷² However, the USTR has also quietly sent staff for a bilateral meeting to scope out the areas to be addressed in any FTA discussions, suggesting that the process may be gaining some renewed strength.⁷³

Indeed, research on the economic impact of such an agreement is somewhat mixed though generally positive. Galal and Lawrence (2003) review two prior studies, one by Hoekman, Konan, and Maskus from 1998, and another by DeRosa from 2003. Hoekman et al., using a general equilibrium model, show only a modest impact on free trade, with Egyptian exports to the United States increasing in the range of \$342–\$450 million per year. These numbers would represent an 18 to 50 percent increase in exports to the United States, though they hide the diversion of trade that would result from an FTA and which accounts for nearly two-thirds of the gains in the conservative case and about a third in the more aggressive one. DeRosa, using a gravity model, showed growth of \$1 billion in exports to the United States, an increase of over 100 percent. However, neither of these sets of results attempts to account for the dynamic gains that would result from any trade agreement.⁷⁴ A new Galal and Lawrence study containing an updated model by Hoekman and Konan suggests that an FTA including “deep integration” (i.e., not only elimination of tariffs but also of nontariff barriers) could be significant, increasing Egypt’s real GDP by 2.8 percent, while reducing consumer prices by over 1.5 percent and increasing the returns to labor by 3 percent (Galal and Lawrence 2005).

Ultimately, the political importance of any FTA between the United States and Egypt would still outweigh the economic ones in the calculus of whether to proceed. Moreover, as the EU-Egypt agreement takes hold and leads to possible trade diversion, it will increase pressure on the United States not to be left behind in either economic or political terms.

When it comes to textiles and apparel, an even higher percentage of Egypt’s exports goes to the European Union and the United States (figure 8). In fact, in the top 10 categories of Egyptian apparel exports in 2003, European countries or the United States ranked first *and* second in all 10 categories (table 12). Of course, this pattern of trade is driven by the fact that in 2002 Europe and the United States accounted for over 70 percent of global apparel imports.

CONCLUSION

Historically, textiles and apparel have been strong starter industries for countries looking to begin a process of industrial upgrading that drives economic development throughout their economies. By

⁷¹ Press Briefing with Deputy US Trade Representative Peter F. Allgeier on Doha Development Agenda, States News Service, February 16, 2005.

⁷² “Treasury’s Taylor to Visit Egypt, Pakistan, Japan – Under Secretary to Discuss Economic Reforms, Development,” State Department Press Releases, April 1, 2005.

⁷³ Conversation with USAID official, March 2005.

⁷⁴ Galal and Lawrence suggest that DeRosa’s results are overstated since he does not account for the fact that at the time the most significant trade barriers applied to textiles and apparel, which were due to disappear with the end of the MFA. They argue that Hoekman et al.’s results are too low, since they were based on current patterns of trade that are artificially distorted by the trade and regulatory framework. “Egypt-US and Morocco-US Free Trade Agreements,” presented at the Institute for International Economics, May 7 and 8, 2003.

exporting in these low-capital, high-labor intensive industries, companies learn to operate in demanding global markets, gaining experience in focusing on product quality, delivery reliability, and marketing—skills that spill over and enable entrepreneurs to start successful businesses in other sectors.

The textile and apparel industry in Egypt has several strengths that suggest it could play this role for the country. The industry has a long tradition in Egypt and draws on the country's world-class cotton production. It is large not only in terms of number of firms but also in the portion of the Egyptian labor force and overall exports it represents, and it receives significant attention from the country's policymakers.

However, while the textiles and apparel industry is strong relative to other sectors in Egypt, viewed in comparison to textiles and apparel in other countries, it does not stand up as well. Neighboring countries like Morocco and Tunisia with much smaller economies and labor forces are exporting significantly more product than Egypt. Other countries, particularly China, are even more of a competitive threat.

With the end of the MFA, the threat from low-cost producers in countries like China will certainly increase. There are those who argue that, despite the elimination of quotas, the challenge posed by these countries will be mitigated because geography is a particularly important factor in the fashion-conscious, inventory-minimizing textile and apparel industry. The supply chain model developed in this paper suggests that shorter lead times do indeed boost profits in a manner that could help Egypt compete in supplying firms in neighboring European markets. However, the impact of this effect is on an order of magnitude of 0.5 percent per week on average, a relatively small amount. The model points out how a firm can best exploit the advantages of geographical proximity by focusing on products where shorter lead times matter more. As the analysis suggests, such product types are those with highly variable demand, where liquidation costs are high and selling margins relatively tight. More important, the model shows that shorter lead times matter most when the selling season is short, and the biggest impact comes from being able to replenish inventory at least once within these tight time frames.

Ultimately, the model concludes that the impact of cutting lead times on profits can be measurable, but it is not so great as to be able to drive sourcing decisions on its own. Moreover, the characteristics that drive increased returns to cutting lead times are generally associated with fashion items, which often require the manufacturers to produce at higher levels of quality. It is not clear that manufacturers in Egypt have the capability to produce at quality levels required by fashion oriented customers in developed country markets, the supporting infrastructure, the logistics handling abilities to deliver reliably and meet the schedules of lead firms, or the marketing skills to attract and retain customers in a way that would unlock the potential benefit of the country's proximity to Europe. And even if the Egyptian firms themselves had these capabilities, the supporting infrastructure and exporting environment in the country create challenges for manufacturers in efficiently moving their product to foreign markets.

There are other ways to help realize the potential value of geographical proximity to end markets. Firms that are interested in shortening their lead times must first look inward, towards streamlining production, improving manufacturing efficiency, and thus reducing the time it takes from receiving an order to shipping it. Suppliers in developing countries can also cut lead times by stockpiling additional inventory, either in their home countries or at warehouses in end markets. Stockpiling enables a supplier to ship product immediately following receipt of an order, rather than using the order as a starting point for the production process. However, stockpiling inventory places two new and possibly significant costs on suppliers, carrying costs associated with holding the units, and costs associated with liquidating leftover stock. Unfortunately for these suppliers, buyers are increasingly looking for partners who are willing and technologically capable of overseeing parts of the inventory management process for them. Suppliers who are unwilling to accept the lower margins that result risk being cut out of global supply chains entirely.

At the policy level, governments can take action to help improve lead times for all the firms in their home countries by improving the reliability of transportation and facilities at ports and by streamlining customs clearing processes so that shipments can move to their destinations without incurring needless delays. These are also areas where the private sector can play a role, in part through the important role of encouraging their governments to take action, particularly in areas like customs that are directly controlled by the government. Moreover, firms should take an active role in public-private partnerships, initiatives where groups of firms or industry associations work with the national authorities to tackle the infrastructure problems that delay exports and reduce the competitiveness of the country's products.

In Egypt, improving the ability of firms to get products out quickly by improving infrastructure would help companies in a wide range of export industries beyond apparel, notably fresh food and flowers. Building additional ports and better loading facilities, improving access to cold storage, creating a system of container management to increase utilization and reduce the number of containers leaving the country empty, easing Egypt Air's monopoly over loading facilities and equipment, and increasing turnaround times are all key elements of improving port efficiency in Egypt. Such improvements to the transportation infrastructure are in many ways preconditions for the apparel industry and others to take advantage of other reforms and industrial upgrading.

The comparative analysis also suggests that Egyptian firms that wish to compete should recognize that firms from neighboring countries are able to export nearly four times as much as Egyptian firms—again Morocco and Tunisia stand out. These competitors are able to export significantly more despite having smaller economies and facing similarly high tariffs on imported inputs. This analysis suggests that focusing on the tariff structure should not excuse Egyptian companies from paying attention to factors that are more under their direct control, such as improving efficiency and management capabilities. To differentiate themselves as suppliers in global apparel chains, Egyptian firms have to look at the entire set

of advantages they currently have and those they could build. Existing ones include their proximity to end markets and certain trade preferences, along with an abundant labor supply, a strong tradition of a textile and apparel industry, and the superior quality of cotton produced in Egypt. Companies can focus on improving product quality by investing in training to increase the skill level of workers, improving quality control processes, and strengthening linkages to local and foreign suppliers of high quality inputs. Right now, compared with the apparel industry, the public sector has a disproportionate influence in the production of textiles. Private firms looking for ways to improve the quality of inputs might consider integrating upstream in their own supply chain to strengthen the local capacity to turn Egyptian cotton into high quality textiles that can improve the quality of downstream goods. Beyond the production side of things, Egyptian firms should recognize the importance of professional marketing, gaining better insights into understanding the needs of customers, and then setting appropriate production goals to meet those needs. And more generally, they must invest time and energy into building and nurturing relationships with sourcing agents and other buyers.

The comparative analysis should also not allow the Egyptian government to overlook aspects of the business environment that make the economy attractive to foreign investors and local entrepreneurs. Just as China benefits from investments from companies in Japan and Taiwan looking to relocate to nearby but less expensive geographies, the North African countries offer a potential site for European companies, if governments and businesses can create an attractive investment climate.

The government of Egypt can play a role in attracting European and other foreign investment and in driving exports by improving any of the factors discussed in this study that affect the quality of the business environment. These include reducing the time and costs involved in setting up a business; and improving the court system and ability to enforce contracts, to file for bankruptcy without losing significant time, and to increase the recovery rates involved. Other dimensions include reducing official corruption, increasing port efficiency, reducing customs clearance times, and improving the quality of general infrastructure. In virtually all of these areas, Egypt lags key competitor countries like Tunisia, Morocco, and Jordan. These three countries enjoy similar geographical advantages as Egypt with respect to the European market, an advantage any of them might exploit to compete against competitors in China. Two of three of these countries, Morocco and Jordan, also have free trade agreements with the United States—which may explain why the Egyptian government has put so much emphasis on making free trade with the United States a priority.⁷⁵ As noted above, Jordan's free trade agreement has significantly improved its exports to the United States, suggesting that a similar arrangement for Egypt may indeed help level the playing field versus its closest competitors.

⁷⁵ At the event in Washington, the head of the American Chamber of Commerce in Egypt voiced his hope that the commitment to reforms being undertaken by the new Egyptian government should remove the remaining obstacles standing in the way of a US-Egypt FTA (Institute for International Economics Luncheon for the Egyptian Minister of Trade and Industry, November 15, 2004).

The recent moves by the Egyptian government to reduce import tariffs and facilitate the process of importing intermediate goods have been important steps in the direction of helping all industries, not just apparel, in accessing high-quality inputs and producing higher-quality goods. Reducing import tariffs provides firms with greater access to high-quality inputs and provides incentives to invest in intermediate goods like the modern machinery necessary to replace the aging equipment currently dominating the Egyptian textile and apparel industry. Of course, without improving the physical infrastructure in the country, the full benefits of tariff reform cannot be realized—i.e., poor roads, overloaded trucking capacity, and inadequate loading and shipping facilities all undermine the ability of companies to bring input to their factories and move finished product out, even if the inputs cost less.

It is likely that the most alarmist predictions of China's dominance in the post-MFA world are overstated, although the competitive threat is certainly significant. Moreover, Egypt should take only limited comfort from the special mechanisms that countries can employ under the WTO structure. Most of the safeguard provisions that the United States and the European Union can invoke against Chinese imports will be focused on protecting domestic industries, rather than shielding one source of foreign exports against competition from another—especially if such competition results in lower prices for domestic consumers. Political considerations may drive the United States and the European Union to some use of the safeguard mechanisms to protect industries in countries where they have other interests in fostering stability and economic growth. For the United States, these efforts are likely to focus on Mexico and the Caribbean Basin, while Europe might focus more on North Africa, eastern Europe, and Turkey. Of course, as the QIZ arrangement demonstrates, the United States also has a special interest in the Middle East region that can play to Egypt's advantage.

As discussed above, these political interests are also driven by geography, the desire of the United States and the European Union to foster stability in the Middle East and stem migration—and it is a dynamic that Egyptian policymakers could leverage in working to strengthen the export capabilities of its apparel industry. But even if the Egyptian government succeeds in negotiating significant trade preferences with the European Union and the United States, local companies still have to improve their production capabilities to fully exploit greater opportunities with lead firms. Improving the business environment and continuing the path of privatization are key steps for the Egyptian government to attract foreign investment and encourage local entrepreneurship, leverage the potential benefits of its geographical proximity to Europe, and spur growth in the apparel industry that can increase exports, drive growth, and spur the process of industrial upgrading throughout the economy as a whole.

APPENDIX A: INVENTORY MANAGEMENT MODEL

The model is constructed to maximize profits of the retailer given uncertain demand, accounting for the wholesale cost of the product, selling margins, and lead times.⁷⁶ The key to ordering inventory is to balance the expected potential loss that would result from ordering too few units and thus missing sales against the expected loss that would result from ordering too many units and being stuck with them at the end of the season, such that they must be liquidated. More specifically, the potential loss (or underage penalty, u) for ordering too few units and the penalty for ordering too many (or overage penalty, o) are given as:

$$u = r - c \quad (1)$$

and

$$o = c - v \quad (2)$$

where r is the retail price, c is the cost to the retailer, and thus u is the underage penalty or the selling margin. If v is the salvage value, then o is the overage penalty that results from having to liquidate too many items at the end of a season. If the probability we order too many units is X , then the probability we order too few must be $1-X$. Thus the basic equation would suggest that we order enough units so that we balance the expected value of ordering too many units against the expected value of ordering too few, which would be the probability of ordering too many units times the cost of ordering too many against the probability of ordering too few units against the penalty for ordering too few, or:

$$(1-X) * u = X * o. \quad (3)$$

In order to determine the probabilities associated with ordering different levels, the retailer needs a forecast of demand, which at its simplest is built on previously observed demand patterns, adjusted for seasonality, changes in fashion, style, et cetera. We assume that demand is normally distributed, with a mean of λ and a standard deviation of σ . Given a normal distribution of demand, $F(Q)$ is the probability that a particular order size Q is the actual demand. We would therefore want to choose an $F(Q)$ base that can balance the expected penalties associated with the overage and underage penalties, suggesting that equation 3 should be rewritten as:

⁷⁶ The basic model and its notation are outlined in Anand, Cachon, Netessine, and Zheng, "Operations and Information Management," 2001. I am greatly indebted to Gerard Cachon for his help in expanding the model to a multiperiod, multiple replenishment model for this paper.

$$(1 - F(Q)) * u = F(Q) * o. \quad (4)$$

From equation 4, we see that if u is very high and o is very low, we would need an $F(Q)$ that is high so that the two sides of the equation balance out. Intuitively, this represents the case where the selling margin is very high and the cost of liquidation is low—at which point the supplier would want to order a sufficient quantity to have a very high probability of meeting all the demand and would not worry too much about having a few too many units left over.⁷⁷

Rearranging the terms from equation 4, we derive that the optimal order quantity Q^* should be ordered such that:

$$F(Q^*) = \frac{u}{(o + u)}. \quad (5)$$

Then to find the order quantity, we graph the distribution of demand with a mean of λ and a standard deviation of σ and find the quantity that has a cumulative probability of occurring that is sufficient to balance the overage and underage penalties, as given in equation 5.

To make the calculation easier, we calculate the quantity that would satisfy the ratio of overage and underage penalties shown in equation 5, based on a standard normal distribution with a mean of 0 and a standard deviation of 1, and define this as z^* . Then we apply the fraction that results to the mean (λ) and standard deviation (σ) of the forecasted demand according to the form:

$$Q^* = \lambda + \sigma z^*. \quad (6)$$

⁷⁷ On a more intuitive level, assume the selling margin was large say \$1,000, while the liquidation cost was relatively small, like \$10. If we ordered enough to satisfy actual demand 90 percent of the time, then by definition in 10 percent of the cases, we would lose sales. In other words, on the margin our expected lost sales would be \$100. At the same time, we would expect to order more than demand the same 90 percent of the time, incurring marginal liquidation costs of 90 percent of \$10, or only \$9. Since the penalty for ordering too few units is so much greater than the penalty for ordering too many, we would want to order near the high end of the forecasted demand. In this case, we would want to order enough units to ensure achieving an approximately 99 percent chance of satisfying every sale. If we choose our order size correctly, we would expect to have a corresponding 1 percent chance of being wrong and losing the sale of one more unit, so that our expected marginal loss would be 1 percent of \$1,000, or \$10. At the same time, the same order size suggests that 99 percent of the time we would order one too many units, so we would have a 99 percent chance of losing the overage charge of \$10, so our expected penalty would be \$9.90. With this order, the expected two penalties are roughly even, suggesting that an order quantity that has a 99 percent probability of fulfilling demand is what would maximize profits in this example.

Thus, for any forecast with a mean of λ and a standard deviation of σ , if we know the retail price, wholesale cost, and salvage value, we can forecast an order quantity that balances the expected loss of ordering too many units against the expected loss of ordering too few.

The model described above uses the simplifying assumption that when an order is placed, it is filled immediately. The next step is to add in a time dimension, such that orders placed today arrive only sometime in the future, i.e., that there is a lead time between ordering units and receiving a replenishment. We then move to a multiperiod model (reflecting a selling season of several months) with multiple ordering opportunities and multiple replenishments.

In the multiperiod model with replenishment and lead times, the order “up to” quantity⁷⁸ for the final period is based on the simple model, although the order must be placed in advance—i.e., for a firm with a lead time of l , the final order must be placed in week_{final- l} (e.g., for a firm with a lead time of two weeks ($l=2$) in an eight-week season, the final order would be placed in week 6 so that it arrives at the beginning of week 8). Here, we are ordering enough in week 6 so that we will have enough inventory on hand in week 8 (made up of the newly replenished units as well as any inventory left over from previous weeks) so that we have exactly that quantity that balances the expected loss of having too few units (missed sales) with the expected loss of having too many (liquidation) in week 8. Then, when we go to extrapolate the order from the standard normal to the actual/predicted demand curve, we take $\lambda_l = (l + 1)\lambda$ and $\sigma_l = [(l + 1)^{0.5}]\sigma$ so that we rewrite equation 6 as

$$Q_l^* = (l + 1)\lambda + [(l + 1)^{0.5}]\sigma z^*. \quad (7)$$

The sequence of events for any given period is to place an order (O), receive a replenishment (R), open for business and experience demand (D), and then calculate the financial impact of the period (\$\$)—including sales, missed sales, carrying costs on overstock, etc. (see figure 9).

The order calculations for the earlier periods are somewhat more complex. In figure 9, the order for week 5 is such that the probability of ordering too few units, thus losing sales after they arrive in week 7, must be balanced against the probability of ordering too many units; however, in an 8-week season, units left over in inventory at the end of week 7 can still be sold during the next period. Therefore, while the probability associated with ordering too few units is the probability of ordering too few units to meet

⁷⁸ The order “up to” quantity is the quantity that balances the potential loss from ordering too many units against the potential loss of ordering too few units. The actual order in a given period is the quantity required to reach the order “up to” quantity, above and beyond any units that have already been ordered and are in transit as well as any inventory on hand at the retailer. In other words, the order “up to” quantity is the number of units up to which the retailer would order, but if there is inventory on hand (or on the way), the actual order needed is reduced accordingly.

demand during week 7, the relevant period for the probability of ordering too many units (i.e., that units on hand exceed demand) is over periods 7 and 8. Intuitively, the fact that if we overorder, we can sell off the additional inventory in the next week suggests that the order “up to” level for period 5 (arriving in period 7) will be higher than that for period 6 (arriving in period 8, when there is only the one week/period in which to sell any units, and the rest are liquidated right after).

Using our notation above, if we rewrite equation 4 to account for the time element, we would have

$$(1 - F(Q_t)) * u = F(Q_t) * o \quad (8)$$

for the final order period. For the period immediately before we have

$$(1 - F(Q_t)) * u = F(Q_{t+1}) * o, \quad (9)$$

where we balance 1—the probability that we overorder for the week $(1 - F(Q_t))$ multiplied by the cost of missing a sale (the underage penalty, u) against the probability that we overorder across the current period (t) and through the next (thus $t + 1$). Similarly, for the period prior (period 4 in figure 9) we have two weeks in which to sell any excess inventory that is ordered, such that we would want to balance the probability of ordering too few for the current week against the probability of ordering too many over $t + 2$ weeks as given by the equation

$$(1 - F(Q_t)) * u = F(Q_{t+2}) * o. \quad (10)$$

And so on for earlier periods. Assuming the first demand that we face comes in period 1, we would want to order in advance (a period 0), sufficiently early such that our period 0 order arrives just prior to the opening of the season and demand that we would face in period 1. Finally, we assume that in each period we place our order for subsequent periods before demand in that week is known, which also implies that there is no order in period 1, since the order placed in period 0 will arrive before any additional demand is presented. Thus the first new order is placed in period 2.

Following this procedure, the model used for the analysis in this paper forecasts orders and demand over a 13-period season (approximating a season’s worth of weeks for a particular fashion). Using this time frame, the analysis was conducted for sales, liquidated inventory, missed sales, profits, and working capital requirements for firms with lead times ranging from 2 to 10 weeks.

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Table 1 Egyptian export sectors, 2003

	Fresh food	Processed food	Textiles	Clothing	Chemicals	Leather products	Basic manufactures	Nonelectronic machinery	Electronic components	Miscellaneous manufacturing	Minerals
Exports (dollars, in thousands)	802,227	269,070	545,304	770,222	633,473	96,299	1,001,899	207,792	80,390	243,637	2,407,460
Trend in exports (99-03) p.a.	13%	17%	8%	5%	65%	43%	165%	14%	33%	16%	83%
Share in national export	11%	4%	8%	11%	9%	1%	14%	3%	1%	3%	33%
Share in national import	12%	9%	4%	1%	14%	0%	8%	17%	4%	6%	5%
Net exports (dollars, in thousands)	(1,090,546)	(1,111,116)	(42,854)	616,313	(1,515,797)	43,718	(230,162)	(2,403,400)	(557,540)	(731,231)	1,672,595
Per capita exports (dollars per inhabitant)	11.6	3.9	7.9	11.2	9.2	1.4	14.5	3	1.2	3.5	34.9
Share in world market	0.27%	0.09%	0.30%	0.32%	0.08%	0.11%	0.19%	0.03%	0.01%	0.04%	0.31%

Source: ITC calculations based on COMTRADE of UNSD.

Table 2 Revealed comparative advantage in Egypt

Sector	Revealed comparative advantage (Balassa index)
Clothing	3.49
Minerals	3.42
Textiles	3.21
Fresh food	2.71
Basic manufactures	1.36
Leather products	1.04
Processed food	0.85
Chemicals	0.62
Miscellaneous manufacturing	0.39
Nonelectronic machinery	0.18
Electronic components	0.11

Source: ITC (2002), based on COMTRADE data.

Table 3 Age of machinery in the public sector (percent)

Activity	Age ≤5	10 ≥ Age > 5	Age ≥ 15
Cotton yarn	5%	23%	72%
Cotton fabric	2%	6%	92%
Cotton finishing	7%	6%	87%
Wool yarn	n.a.	10%	90%
Wool fabric	n.a.	10%	90%
Wool finishing	11%	3%	86%
Apparel	20%	10%	70%
Medical cotton	1%	14%	85%

Source: Egyptian Textile Consolidation Fund, provided by the Egyptian Embassy in Washington, 2004.

Table 4 Overview of comparator countries

Countries	Population (2003, in millions)	2003 GDP (current dollars, in millions)	GDP/Capita (current dollars)	Total exports 2003 (dollars, in millions)	Textile exports, SITC 26 and 65 (dollars, in millions)	Textile exports as a percent of total	Apparel exports, SITC 84 (dollars, in millions)	Apparel exports as a percent of total
Bangladesh	138.1	51,897	376	7,232	468	6.5%	5,911	81.7%
China	1,288.4	1,409,852	1,094	443,897	14,537	3.3%	46,624	10.5%
Egypt	67.6	82,427	1,220	6,540	712	10.9%	734	11.2%
Jordan	5.3	9,860	1,858	1,489	4	0.3%	628	42.2%
Mauritius	1.2	5,225	4,265	1,957	16	0.8%	927	47.4%
Mexico	102.3	626,080	6,121	156,604	1,981	1.3%	7,572	4.8%
Morocco	30.1	44,491	1,477	9,024	141	1.6%	2,990	33.1%
Tunisia	9.9	24,282	2,454	7,706	273	3.5%	3,204	41.6%

Sources: World Bank, World Development Indicators; TRAINS Database; author calculations.

Table 5a Starting a business

Country	Number of procedures	Duration (days)	Cost (percent GNI/capita)	Cost in dollars	Minimum capital (percent GNI/capita)	Minimum capital in dollars	GNI/capital (in dollars)
Bangladesh	8	35	91%	\$364	0%	\$0	400
China	12	41	15%	\$160	1104%	\$12,146	1100
Egypt	13	43	63%	\$876	816%	\$11,337	1390
Jordan	11	36	52%	\$962	1148%	\$21,232	1850
Mauritius	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Mexico	8	58	17%	\$1,040	16%	\$966	6230
Morocco	5	11	12%	\$162	719%	\$9,486	1320
Tunisia	9	14	11%	\$242	327%	\$7,332	2240

Source: World Bank Doing Business Database, March 2005.

Table 5b Access to capital

Country	Ease of access to loans	Venture capital availability	Local equity market access	Administrative burden for start-ups
Bangladesh	2.1	2.0	5.3	3.3
China	2.5	3.0	5.0	4.2
Egypt	3.3	3.3	4.4	3.7
Jordan	3.1	2.9	5.3	5.3
Mauritius	3.9	3.6	5.2	4.5
Mexico	2.3	2.4	4.5	3.1
Morocco	2.8	3.1	5.1	3.7
Tunisia	3.8	3.9	5.4	5.4
Mean (102 countries)	3.2	3.2	4.6	4.1

Source: Global Competitiveness Report 2003-2004.

Table 5c Enforcing commercial contracts

Country	Number of procedures	Duration (days)	Cost (percent GNI/capita)	Cost in dollars	Procedural complexity index ¹	GNI/capital (in dollars)
Bangladesh	29	365	270%	\$1,027	51	380
China	25	241	32%	\$307	52	960
Egypt	55	410	31%	\$451	50	1470
Jordan	43	342	30%	\$528	49	1760
Mauritius	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Mexico	37	421	10%	\$592	62	5920
Morocco	17	240	9%	\$106	69	1170
Tunisia	14	27	12%	\$239	48	1990

¹ Higher values indicate more complexity in enforcing a contract. The OECD average is 49.

Number of procedures and duration are from March 2005, all other entries from Djankov et al.

Sources: World Bank Doing Business Database, March 2005; *Snapshots of Business Environment*, from Djankov, La Porta, Lopez-de-Silanes, and Shleifer; and Courts, *Quarterly Journal of Economics*, May 2003.

Table 5d Exiting a business due to insolvency

Country	Time (years)	Cost (percent of estate value)	Recovery rate (cents on the dollar)
Bangladesh	4.0	8	23.2
China	2.4	18	35.2
Egypt	4.2	18	18.4
Jordan	4.3	8	26.7
Mauritius	n.a.	n.a.	n.a.
Mexico	1.8	18	64.5
Morocco	1.8	18	34.8
Tunisia	1.3	8	50.1

Source: World Bank Doing Business Database, March 2005.

Table 6 Spinning and weaving labor cost comparisons, 2004

Average cost per operator hour	USA	Bangladesh	China, coastal	China, mainland	Jordan	Egypt	Mauritius	Mexico	Morocco	Tunisia
Direct wages (local currency)	12.21	15.47	3.72	2.55	n.a.	3.30	31.10	17.61	15.83	1.99
Other costs paid to operator (local currency)	1.09	0.76	0.99	0.64	n.a.	0.71	1.90	2.11	1.85	0.16
Other costs paid by company (local currency)	2.48	0.81	1.59	0.76	n.a.	1.14	10.59	5.32	4.24	0.40
Total cost per hour (local currency)	15.78	17.05	6.31	3.96	n.a.	5.14	44.59	25.04	21.93	2.54
Rate of exchange as of June 17, 2002 US-\$ 1 =	1.00	61.0	8.29	8.29	n.a.	6.27	28.49	11.41	8.58	1.24
Total cost in dollars	15.78	0.28	0.76	0.48	n.a.	0.82	1.57	2.19	2.56	2.05
Ratio to US cost (percent)	100%	2%	5%	3%	n.a.	5%	10%	14%	16%	13%

Source: Werner International, *Primary Textiles Labor Cost Comparisons*, Winter 2004–2005.

Table 7a Corruption perceptions index, 2004

Country rank 2004	Country	CPI 2003 score	CPI 2004 score	Surveys used	High-low range
37	Jordan	4.6	5.3	9	4.6–5.9
39	Tunisia	4.9	5.0	7	4.5–5.6
54	Mauritius	4.4	4.1	5	3.2–4.8
64	Mexico	3.6	3.6	11	3.3–3.8
71	China	3.4	3.4	16	3.0–3.8
77	Egypt	3.3	3.2	8	2.7–3.8
77	Morocco	3.3	3.2	7	2.9–3.5
145	Bangladesh	1.3	1.5	8	1.1–1.9

Note: CPI Score relates to perceptions of the degree of corruption as seen by business people, academics, and risk analysts, and ranges between 10 (highly clean) and 0 (highly corrupt).

Source: Transparency International Corruption Perceptions Index 2004.

Table 7b Impact of crime and corruption on business

Country	Crime Index (1-7) (1)	Organized crime	Irregular payments in exports and imports	Business costs of corruption
Bangladesh	n/a	2.9	2.3	2.7
China	4.44	4.3	5.0	3.9
Egypt	6.37	5.1	4.4	4.0
Jordan	n/a	6.6	5.7	4.8
Mauritius	5.53	5.7	3.7	3.2
Mexico	2.61	3.3	4.6	3.8
Morocco	n/a	5.1	3.6	3.2
Tunisia	n/a	5.8	5.3	4.5
Mean (102 countries)		4.7	4.7	3.9

Source: Global Competitiveness Report, 2003-2004.

Table 8 Annual aircraft departures, 1999–2002

Country	1999	2000	2001	2002	2003
Bangladesh	5,900	6,300	6,500	6,500	7,200
China	547,800	572,900	840,900	932,100	946,400
Egypt	44,300	47,400	41,400	41,800	42,100
Jordan	15,900	16,400	15,900	16,400	15,400
Mauritius	10,700	12,200	12,300	13,800	14,500
Mexico	328,300	290,400	292,200	271,000	287,100
Morocco	43,900	44,500	44,300	37,600	34,800
Tunisia	20,100	19,900	19,400	18,500	18,700

Source: World Bank, *World Development Indicators*.

Table 9a Port efficiency measures

Country	Port infrastructure quality	Port efficiency index	Median clearance time (days)	Mandatory services index (0-1)	Cargo handling restriction index (0-1)
Bangladesh	2.1	n.a.	n.a.	n.a.	n.a.
China	3.7	3.49	7.00	0.50	0.00
Egypt	3.9	3.72	5.50	0.75	0.75
Jordan	4.7	n.a.	n.a.	n.a.	n.a.
Mauritius	5.2	5.35	n.a.	1.00	0.38
Mexico	3.3	3.34	4.00	0.50	0.38
Morocco	3.7	n.a.	n.a.	0.50	0.13
Tunisia	4.5	n.a.	5.50	0.13	0.50
Mean (102 countries)	3.9				

Sources: Fink, Matoo and Neagu (2000), cited in Clark, Dollar, Micco, *Port Efficiency, Maritime Transport Costs, and Bilateral Trade*, February 2004.

Table 9b General infrastructure quality

Country	Overall infrastructure quality ^a	Road infrastructure quality ^b	Air transport infrastructure quality ^a	Electricity prices ^b
Bangladesh	2.1	3.7	2.7	3.7
China	3.5	4.4	3.9	3.9
Egypt	3.9	4.9	4.0	4.6
Jordan	5.2	4.9	5.6	4.1
Mauritius	4.6	4.0	5.4	3.3
Mexico	3.6	5.0	4.6	3.9
Morocco	3.1	n.a.	4.3	n.a.
Tunisia	4.7	n.a.	4.9	n.a.
Mean (102 countries)	3.9		4.5	

Sources: a. *Global Competitiveness Report 2003-2004*.

b. *Global Competitiveness Report 2001-2002*.

Table 10a Net FDI as a percent of GDP

Country	1999	2000	2001	2002	2003
Bangladesh	0.4%	0.6%	0.2%	0.1%	0.2%
China	3.9%	3.6%	3.8%	3.9%	3.8%
Egypt	1.2%	1.2%	0.5%	0.7%	0.3%
Jordan	1.9%	9.3%	1.1%	0.6%	3.8%
Mauritius	1.2%	6.0%	-0.6%	0.6%	1.2%
Mexico	2.7%	2.8%	4.2%	2.3%	1.7%
Morocco	3.9%	1.3%	8.3%	1.2%	5.2%
Tunisia	1.7%	3.9%	2.3%	3.8%	2.2%

Sources: World Bank, *World Development Indicators*, author's calculations.

Table 10b Foreign affiliates located in the economy

Country	Year	Number of affiliates
Bangladesh	2002	13
China	2002	363,885
Egypt	1999	99
Jordan	2002	13
Mauritius	2002	35
Mexico	2002	25,708
Morocco	2002	194
Tunisia	2002	2,503

Source: UNCTAD, *World Investment Report* 2003.

Table 11 Quota relaxation commitment under the WTO

Year	Quota relaxation	Cumulative quota relaxation
1995	On 16 percent of imports by volume	16%
1998	An additional 17 percent of imports by volume	33%
2002	An additional 18 percent of imports by volume	51%
2005	The remaining 49 percent of imports by volume	100%

Table 12 Export destinations for top 10 Egyptian apparel categories (SITC 84XX)

SITC	Product category	2003 Exports (dollars, in thousands)	Top export destination	Second export destination
8414	Men's and boys' trousers, etc., woven	144,795	US	EU
8426	Women's and girls' trousers, woven	115,472	US	EU
8454	T-shirts/singlets, knit/crochet	99,761	EU	US
8453	Jerseys, pullovers, etc.	76,172	US	EU
84371	Men's and boys' trousers, cotton, knit/crochet	30,505	US	EU
84151	Men's and boys' trousers, cotton, woven	25,303	US	EU
84381	Men's and boys' underwear, knit/crochet	25,247	EU	US
84324	Men's and boys' trousers, etc., knit/crochet	22,609	US	EU
84512	Baby clothes, knit/crochet	18,086	EU	US
84426	Women's and girls' trousers, knit/crochet	16,505	US	EU

Sources: WITS, author's calculations.

Figure 1a Exports of comparator countries by major category

Figure 1b Exports of competitors, excluding China, by major category

Source: TRAINS Database.

Figure 2a Exports of SITC 84XX to the United States
(dollars in thousands)

Figure 2c Egypt and Jordan's Share of SITC 84XX Exports to the United States

Figure 2b Exports of SITC 84XX to the European Union
(dollars in thousands)

Figure 2d Egypt and Jordan's Share of SITC 84XX Exports to the EU

Figure 3 Exports by company size, employees, and issued capital

*10 firms did not report any data.

*18 firms did not report any data.

Source: Amirah El-Haddad (2005). Vertical Integration and Institutional Constraints on Firm Behavior: The Case of the Garment Industry in Egypt. PhD Dissertation, Economics Department, University of Maryland.

Figure 4 Trade weighted tariffs for all importers by product category, 1995–2003

Note: Bangladesh data is for 1999 and 2003; China for 1996, 1998, and 2003; Egypt for 1995, 1998, 2002; Jordan for 2000 and 2003; Mauritius for 1995, 1998, 2002; Mexico for 1995, 1999, and 2003; Morocco for 2000 and 2003; and Tunisia for 1995, 1998, and 2003.

Source: TRAINS Database, author calculations.

Figure 5 Revealed comparative advantage, 2003

Source: TRAINS Database; author's calculations.

Figure 6a Impact of variability of demand

(13-week selling season, liquidation value \$4,
wholesale price \$5, retail selling price \$10)

Figure 6b Impact of relative input prices

(13-week selling season, variability of demand of 20 percent)

Figure 6c Impact of length of selling season

(Liquidation value \$4, wholesale price \$5, retail selling price \$10,
variability of demand of 20 percent)

Figure 6d Confluence of factors

(Liquidation value \$2, wholesale price \$5, retail selling price \$10,
variability of demand of 40 percent)

Figure 7 Aggregate Egyptian exports by geography

Source: Egyptian Central Bank.

Sources: TRAINS Database, author's calculations.

Figure 9 Graphical illustration of order up-to level, company with 2-week lead time, 8-week selling season

Company 1 , L = 2

Note: Adapted from Anand et al. 2001.

Appendix Table 1. Summary of Results: Liquidation, Wholesale, Retail Prices \$4-\$5-\$10

Selling Season of 13 weeks									
Product Demand = average of 5000/week, standard deviation of 500									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/ week	cumulative % increase	Profit Incl. Inventory	% increase profit/ week	cumulative % increase
Lead Time 2 weeks	\$324,727	\$901	\$405	\$323,826			\$319,356	0.50%	0.50%
Lead Time 3 weeks	\$324,682	\$1,040	\$451	\$323,641	0.06%	0.06%	\$317,758	0.53%	1.03%
Lead Time 4 weeks	\$324,607	\$1,169	\$525	\$323,438	0.06%	0.12%	\$316,090	0.53%	1.57%
Lead Time 5 weeks	\$324,561	\$1,277	\$571	\$323,284	0.05%	0.17%	\$314,409	0.56%	2.12%
Lead Time 6 weeks	\$324,509	\$1,378	\$623	\$323,131	0.05%	0.21%	\$312,659	0.56%	2.69%
Lead Time 7 weeks	\$324,462	\$1,483	\$670	\$322,980	0.05%	0.26%	\$310,911	0.50%	3.19%
Lead Time 8 weeks	\$324,431	\$1,570	\$701	\$322,861	0.04%	0.30%	\$309,368	0.51%	3.70%
Lead Time 9 weeks	\$324,393	\$1,654	\$740	\$322,739	0.04%	0.34%	\$307,792	0.52%	4.22%
Lead Time 10 weeks	\$324,370	\$1,734	\$762	\$322,637	0.03%	0.37%	\$306,202		

Selling Season of 5 weeks									
Product Demand = average of 5000/week, standard deviation of 500									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/ week	cumulative % increase	Profit Incl. Inventory	% increase profit/ week	cumulative % increase
Lead Time 2 weeks	\$124,662	\$912	\$396	\$123,750			\$122,079	0.62%	0.62%
Lead Time 3 weeks	\$124,594	\$1,049	\$464	\$123,546	0.17%	0.17%	\$121,322	0.66%	1.29%
Lead Time 4 weeks	\$124,537	\$1,174	\$521	\$123,363	0.15%	0.31%	\$120,522	0.33%	1.62%
Lead Time 5 weeks	\$124,537	\$1,174	\$521	\$123,363	0.00%	0.31%	\$120,121	0.34%	1.96%
Lead Time 6 weeks	\$124,537	\$1,174	\$521	\$123,363	0.00%	0.31%	\$119,719	0.34%	2.29%
Lead Time 7 weeks	\$124,537	\$1,174	\$521	\$123,363	0.00%	0.31%	\$119,318	0.34%	2.63%
Lead Time 8 weeks	\$124,537	\$1,174	\$521	\$123,363	0.00%	0.31%	\$118,917	0.34%	2.97%
Lead Time 9 weeks	\$124,537	\$1,174	\$521	\$123,363	0.00%	0.31%	\$118,516	0.34%	3.31%
Lead Time 10 weeks	\$124,537	\$1,174	\$521	\$123,363	0.00%	0.31%	\$118,114		

Selling Season of 13 weeks									
Product Demand = average of 5000/week, standard deviation of 1000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/ week	cumulative % increase	Profit Incl. Inventory	% increase profit/ week	cumulative % increase
Lead Time 2 weeks	\$324,309	\$1,862	\$837	\$322,446			\$317,167	0.58%	0.58%
Lead Time 3 weeks	\$324,208	\$2,134	\$938	\$322,074	0.12%	0.12%	\$315,335	0.55%	1.14%
Lead Time 4 weeks	\$324,051	\$2,356	\$1,094	\$321,695	0.12%	0.23%	\$313,596	0.54%	1.68%
Lead Time 5 weeks	\$323,968	\$2,580	\$1,178	\$321,388	0.10%	0.33%	\$311,904	0.56%	2.24%
Lead Time 6 weeks	\$323,875	\$2,805	\$1,271	\$321,069	0.10%	0.43%	\$310,170	0.56%	2.80%
Lead Time 7 weeks	\$323,768	\$2,981	\$1,378	\$320,786	0.09%	0.52%	\$308,447	0.55%	3.35%
Lead Time 8 weeks	\$323,742	\$3,176	\$1,404	\$320,566	0.07%	0.59%	\$306,746	0.58%	3.93%
Lead Time 9 weeks	\$323,659	\$3,347	\$1,487	\$320,312	0.08%	0.66%	\$304,977	0.61%	4.54%
Lead Time 10 weeks	\$323,537	\$3,505	\$1,609	\$320,032	0.09%	0.75%	\$303,132		

Selling Season of 5 weeks									
Product Demand = average of 5000/week, standard deviation of 1000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/ week	cumulative % increase	Profit Incl. Inventory	% increase profit/ week	cumulative % increase
Lead Time 2 weeks	\$124,171	\$1,854	\$789	\$122,317			\$120,580	0.86%	0.86%
Lead Time 3 weeks	\$124,012	\$2,132	\$949	\$121,880	0.36%	0.36%	\$119,553	0.83%	1.69%
Lead Time 4 weeks	\$123,937	\$2,376	\$1,023	\$121,562	0.26%	0.62%	\$118,570	0.35%	2.04%
Lead Time 5 weeks	\$123,937	\$2,376	\$1,023	\$121,562	0.00%	0.62%	\$118,152	0.35%	2.40%
Lead Time 6 weeks	\$123,937	\$2,376	\$1,023	\$121,562	0.00%	0.62%	\$117,734	0.36%	2.75%
Lead Time 7 weeks	\$123,937	\$2,376	\$1,023	\$121,562	0.00%	0.62%	\$117,316	0.36%	3.11%
Lead Time 8 weeks	\$123,937	\$2,376	\$1,023	\$121,562	0.00%	0.62%	\$116,898	0.36%	3.47%
Lead Time 9 weeks	\$123,937	\$2,376	\$1,023	\$121,562	0.00%	0.62%	\$116,480	0.36%	3.83%
Lead Time 10 weeks	\$123,937	\$2,376	\$1,023	\$121,562	0.00%	0.62%	\$116,063		

Selling Season of 13 weeks									
Product Demand = average of 5000/week, standard deviation of 2000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/ week	cumulative % increase	Profit Incl. Inventory	% increase profit/ week	cumulative % increase
Lead Time 2 weeks	\$323,085	\$3,727	\$2,225	\$319,358			\$313,740	0.71%	0.71%
Lead Time 3 weeks	\$322,839	\$4,258	\$2,471	\$318,582	0.24%	0.24%	\$311,541	0.74%	1.44%
Lead Time 4 weeks	\$322,505	\$4,765	\$2,805	\$317,740	0.26%	0.51%	\$309,257	0.70%	2.14%
Lead Time 5 weeks	\$322,284	\$5,211	\$3,026	\$317,074	0.21%	0.72%	\$307,119	0.68%	2.82%
Lead Time 6 weeks	\$322,124	\$5,621	\$3,186	\$316,504	0.18%	0.90%	\$305,043	0.68%	3.51%
Lead Time 7 weeks	\$321,979	\$6,003	\$3,331	\$315,976	0.17%	1.07%	\$302,970	0.69%	4.20%
Lead Time 8 weeks	\$321,882	\$6,389	\$3,428	\$315,493	0.15%	1.22%	\$300,891	0.74%	4.93%
Lead Time 9 weeks	\$321,678	\$6,738	\$3,632	\$314,939	0.18%	1.39%	\$298,692	0.73%	5.66%
Lead Time 10 weeks	\$321,585	\$7,096	\$3,724	\$314,490	0.14%	1.54%	\$296,524		

Selling Season of 5 weeks									
Product Demand = average of 5000/week, standard deviation of 2000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/ week	cumulative % increase	Profit Incl. Inventory	% increase profit/ week	cumulative % increase
Lead Time 2 weeks	\$123,009	\$3,744	\$2,020	\$119,265			\$117,369	1.14%	1.14%
Lead Time 3 weeks	\$122,899	\$4,295	\$2,130	\$118,604	0.56%	0.56%	\$116,049	0.89%	2.03%
Lead Time 4 weeks	\$123,015	\$4,697	\$2,014	\$118,318	0.24%	0.80%	\$115,028	0.39%	2.42%
Lead Time 5 weeks	\$123,015	\$4,697	\$2,014	\$118,318	0.00%	0.80%	\$114,577	0.40%	2.81%
Lead Time 6 weeks	\$123,015	\$4,697	\$2,014	\$118,318	0.00%	0.80%	\$114,125	0.40%	3.21%
Lead Time 7 weeks	\$123,015	\$4,697	\$2,014	\$118,318	0.00%	0.80%	\$113,674	0.40%	3.61%
Lead Time 8 weeks	\$123,015	\$4,697	\$2,014	\$118,318	0.00%	0.80%	\$113,223	0.40%	4.01%
Lead Time 9 weeks	\$123,015	\$4,697	\$2,014	\$118,318	0.00%	0.80%	\$112,772	0.40%	4.41%
Lead Time 10 weeks	\$123,015	\$4,697	\$2,014	\$118,318	0.00%	0.80%	\$112,321		

Appendix Table 2. Summary of Results: Liquidation, Wholesale, Retail Prices \$4-\$5-\$1f

Selling Season of 13 weeks									
Product Demand = average of 5000/week, standard deviation of 500									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$649,838	\$1,178	\$377	\$648,660	0.04%	0.04%	\$644,172	0.27%	0.27%
Lead Time 3 weeks	\$649,745	\$1,373	\$470	\$648,372	0.03%	0.07%	\$642,461	0.26%	0.53%
Lead Time 4 weeks	\$649,719	\$1,533	\$496	\$648,186	0.03%	0.10%	\$640,801	0.27%	0.79%
Lead Time 5 weeks	\$649,690	\$1,681	\$525	\$648,009	0.03%	0.13%	\$639,084	0.28%	1.07%
Lead Time 6 weeks	\$649,645	\$1,811	\$570	\$647,833	0.02%	0.15%	\$637,301	0.28%	1.35%
Lead Time 7 weeks	\$649,610	\$1,938	\$605	\$647,672	0.02%	0.17%	\$635,522	0.25%	1.60%
Lead Time 8 weeks	\$649,597	\$2,056	\$618	\$647,541	0.02%	0.20%	\$633,949	0.26%	1.86%
Lead Time 9 weeks	\$649,552	\$2,164	\$663	\$647,389	0.03%	0.22%	\$632,326	0.27%	2.12%
Lead Time 10 weeks	\$649,487	\$2,264	\$728	\$647,222			\$630,649		

Selling Season of 5 weeks									
Product Demand = average of 5000/week, standard deviation of 500									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$249,479	\$1,201	\$339	\$248,278	0.10%	0.10%	\$246,587	0.33%	0.33%
Lead Time 3 weeks	\$249,405	\$1,384	\$413	\$248,021	0.08%	0.18%	\$245,766	0.34%	0.68%
Lead Time 4 weeks	\$249,381	\$1,555	\$437	\$247,826	0.00%	0.18%	\$244,927	0.17%	0.84%
Lead Time 5 weeks	\$249,381	\$1,555	\$437	\$247,826	0.00%	0.18%	\$244,519	0.17%	1.01%
Lead Time 6 weeks	\$249,381	\$1,555	\$437	\$247,826	0.00%	0.18%	\$244,112	0.17%	1.18%
Lead Time 7 weeks	\$249,381	\$1,555	\$437	\$247,826	0.00%	0.18%	\$243,704	0.17%	1.35%
Lead Time 8 weeks	\$249,381	\$1,555	\$437	\$247,826	0.00%	0.18%	\$243,297	0.17%	1.51%
Lead Time 9 weeks	\$249,381	\$1,555	\$437	\$247,826	0.00%	0.18%	\$242,889	0.17%	1.68%
Lead Time 10 weeks	\$249,381	\$1,555	\$437	\$247,826			\$242,481		

Selling Season of 13 weeks									
Product Demand = average of 5000/week, standard deviation of 1000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$649,502	\$2,369	\$790	\$647,134	0.08%	0.08%	\$641,806	0.31%	0.31%
Lead Time 3 weeks	\$649,375	\$2,737	\$918	\$646,638	0.07%	0.15%	\$639,826	0.29%	0.60%
Lead Time 4 weeks	\$649,229	\$3,069	\$1,064	\$646,159	0.06%	0.21%	\$637,957	0.28%	0.89%
Lead Time 5 weeks	\$649,106	\$3,349	\$1,187	\$645,757	0.06%	0.27%	\$636,145	0.29%	1.18%
Lead Time 6 weeks	\$648,976	\$3,613	\$1,316	\$645,363	0.05%	0.32%	\$634,310	0.28%	1.46%
Lead Time 7 weeks	\$648,912	\$3,853	\$1,381	\$645,059	0.05%	0.37%	\$632,531	0.29%	1.75%
Lead Time 8 weeks	\$648,846	\$4,093	\$1,446	\$644,753	0.05%	0.42%	\$630,713	0.30%	2.05%
Lead Time 9 weeks	\$648,758	\$4,327	\$1,534	\$644,432	0.05%	0.47%	\$628,830	0.31%	2.36%
Lead Time 10 weeks	\$648,665	\$4,551	\$1,627	\$644,114			\$626,889		

Selling Season of 5 weeks									
Product Demand = average of 5000/week, standard deviation of 1000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$248,886	\$2,395	\$808	\$246,491	0.22%	0.22%	\$244,709	0.47%	0.47%
Lead Time 3 weeks	\$248,744	\$2,784	\$949	\$245,960	0.14%	0.36%	\$243,562	0.44%	0.91%
Lead Time 4 weeks	\$248,718	\$3,114	\$975	\$245,604	0.00%	0.36%	\$242,497	0.18%	1.09%
Lead Time 5 weeks	\$248,718	\$3,114	\$975	\$245,604	0.00%	0.36%	\$242,067	0.18%	1.27%
Lead Time 6 weeks	\$248,718	\$3,114	\$975	\$245,604	0.00%	0.36%	\$241,636	0.18%	1.44%
Lead Time 7 weeks	\$248,718	\$3,114	\$975	\$245,604	0.00%	0.36%	\$241,205	0.18%	1.62%
Lead Time 8 weeks	\$248,718	\$3,114	\$975	\$245,604	0.00%	0.36%	\$240,775	0.18%	1.80%
Lead Time 9 weeks	\$248,718	\$3,114	\$975	\$245,604	0.00%	0.36%	\$240,344	0.18%	1.98%
Lead Time 10 weeks	\$248,718	\$3,114	\$975	\$245,604			\$239,914		

Selling Season of 13 weeks									
Product Demand = average of 5000/week, standard deviation of 2000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$648,810	\$4,912	\$2,120	\$643,898	0.17%	0.17%	\$638,134	0.40%	0.40%
Lead Time 3 weeks	\$648,426	\$5,608	\$2,504	\$642,818	0.15%	0.31%	\$635,582	0.39%	0.79%
Lead Time 4 weeks	\$648,208	\$6,330	\$2,723	\$641,878	0.15%	0.47%	\$633,140	0.40%	1.19%
Lead Time 5 weeks	\$647,823	\$6,938	\$3,107	\$640,885	0.11%	0.58%	\$630,617	0.36%	1.55%
Lead Time 6 weeks	\$647,615	\$7,432	\$3,315	\$640,183	0.10%	0.68%	\$628,348	0.36%	1.91%
Lead Time 7 weeks	\$647,431	\$7,911	\$3,499	\$639,521	0.11%	0.79%	\$626,072	0.38%	2.29%
Lead Time 8 weeks	\$647,187	\$8,344	\$3,744	\$638,842	0.08%	0.87%	\$623,727	0.36%	2.65%
Lead Time 9 weeks	\$647,115	\$8,775	\$3,815	\$638,340	0.05%	0.92%	\$621,487	0.34%	2.99%
Lead Time 10 weeks	\$647,193	\$9,163	\$3,737	\$638,030			\$619,355		

Selling Season of 5 weeks									
Product Demand = average of 5000/week, standard deviation of 2000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$247,879	\$4,790	\$2,011	\$243,089	0.36%	0.36%	\$241,089	0.66%	0.66%
Lead Time 3 weeks	\$247,728	\$5,512	\$2,162	\$242,216	0.16%	0.52%	\$239,506	0.50%	1.16%
Lead Time 4 weeks	\$247,978	\$6,138	\$1,912	\$241,840	0.00%	0.52%	\$238,321	0.20%	1.36%
Lead Time 5 weeks	\$247,978	\$6,138	\$1,912	\$241,840	0.00%	0.52%	\$237,845	0.20%	1.56%
Lead Time 6 weeks	\$247,978	\$6,138	\$1,912	\$241,840	0.00%	0.52%	\$237,368	0.20%	1.76%
Lead Time 7 weeks	\$247,978	\$6,138	\$1,912	\$241,840	0.00%	0.52%	\$236,892	0.20%	1.96%
Lead Time 8 weeks	\$247,978	\$6,138	\$1,912	\$241,840	0.00%	0.52%	\$236,415	0.20%	2.16%
Lead Time 9 weeks	\$247,978	\$6,138	\$1,912	\$241,840	0.00%	0.52%	\$235,939	0.20%	2.37%
Lead Time 10 weeks	\$247,978	\$6,138	\$1,912	\$241,840			\$235,462		

Appendix Table 3. Summary of Results: Liquidation, Wholesale, Retail Prices \$2-\$5-\$10

Selling Season of 13 weeks									
Product Demand = average of 5000/week, standard deviation of 500									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$323,753	\$1,556	\$1,113	\$322,197	0.11%	0.11%	\$317,757	0.56%	0.56%
Lead Time 3 weeks	\$323,580	\$1,745	\$1,286	\$321,836	0.11%	0.22%	\$315,998	0.57%	1.13%
Lead Time 4 weeks	\$323,425	\$1,945	\$1,441	\$321,480	0.11%	0.33%	\$314,197	0.59%	1.72%
Lead Time 5 weeks	\$323,276	\$2,141	\$1,590	\$321,135	0.08%	0.41%	\$312,344	0.59%	2.32%
Lead Time 6 weeks	\$323,181	\$2,312	\$1,685	\$320,870	0.09%	0.51%	\$310,503	0.60%	2.92%
Lead Time 7 weeks	\$323,057	\$2,485	\$1,809	\$320,572	0.07%	0.58%	\$308,641	0.53%	3.45%
Lead Time 8 weeks	\$322,980	\$2,644	\$1,886	\$320,336	0.07%	0.65%	\$307,007	0.54%	3.99%
Lead Time 9 weeks	\$322,893	\$2,780	\$1,973	\$320,113	0.08%	0.73%	\$305,363	0.56%	4.55%
Lead Time 10 weeks	\$322,767	\$2,910	\$2,099	\$319,857			\$303,659		

Selling Season of 5 weeks									
Product Demand = average of 5000/week, standard deviation of 500									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$123,859	\$1,523	\$1,109	\$122,336	0.31%	0.31%	\$120,698	0.76%	0.76%
Lead Time 3 weeks	\$123,709	\$1,747	\$1,259	\$121,962	0.29%	0.60%	\$119,791	0.78%	1.53%
Lead Time 4 weeks	\$123,549	\$1,939	\$1,419	\$121,610	0.00%	0.60%	\$118,868	0.33%	1.86%
Lead Time 5 weeks	\$123,549	\$1,939	\$1,419	\$121,610	0.00%	0.60%	\$118,478	0.33%	2.19%
Lead Time 6 weeks	\$123,549	\$1,939	\$1,419	\$121,610	0.00%	0.60%	\$118,088	0.33%	2.52%
Lead Time 7 weeks	\$123,549	\$1,939	\$1,419	\$121,610	0.00%	0.60%	\$117,698	0.33%	2.86%
Lead Time 8 weeks	\$123,549	\$1,939	\$1,419	\$121,610	0.00%	0.60%	\$117,308	0.33%	3.19%
Lead Time 9 weeks	\$123,549	\$1,939	\$1,419	\$121,610	0.00%	0.60%	\$116,918	0.33%	3.53%
Lead Time 10 weeks	\$123,549	\$1,939	\$1,419	\$121,610			\$116,528		

Selling Season of 13 weeks									
Product Demand = average of 5000/week, standard deviation of 1000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$322,346	\$3,079	\$2,192	\$319,268	0.25%	0.25%	\$314,073	0.71%	0.71%
Lead Time 3 weeks	\$322,039	\$3,575	\$2,500	\$318,464	0.23%	0.48%	\$311,857	0.66%	1.37%
Lead Time 4 weeks	\$321,737	\$4,003	\$2,802	\$317,734	0.20%	0.68%	\$309,803	0.64%	2.02%
Lead Time 5 weeks	\$321,523	\$4,423	\$3,016	\$317,100	0.16%	0.84%	\$307,826	0.61%	2.63%
Lead Time 6 weeks	\$321,324	\$4,739	\$3,214	\$316,585	0.19%	1.03%	\$305,947	0.65%	3.28%
Lead Time 7 weeks	\$321,071	\$5,081	\$3,467	\$315,991	0.16%	1.20%	\$303,964	0.64%	3.92%
Lead Time 8 weeks	\$320,852	\$5,378	\$3,686	\$315,474	0.15%	1.35%	\$302,033	0.64%	4.56%
Lead Time 9 weeks	\$320,639	\$5,634	\$3,899	\$315,004	0.16%	1.50%	\$300,122	0.66%	5.22%
Lead Time 10 weeks	\$320,484	\$5,979	\$4,054	\$314,505			\$298,143		

Selling Season of 5 weeks									
Product Demand = average of 5000/week, standard deviation of 1000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$122,667	\$3,014	\$2,294	\$119,653	0.72%	0.72%	\$117,993	1.20%	1.20%
Lead Time 3 weeks	\$122,305	\$3,503	\$2,656	\$118,802	0.49%	1.20%	\$116,597	1.01%	2.20%
Lead Time 4 weeks	\$122,103	\$3,876	\$2,858	\$118,227	0.00%	1.20%	\$115,435	0.34%	2.55%
Lead Time 5 weeks	\$122,103	\$3,876	\$2,858	\$118,227	0.00%	1.20%	\$115,040	0.35%	2.89%
Lead Time 6 weeks	\$122,103	\$3,876	\$2,858	\$118,227	0.00%	1.20%	\$114,644	0.35%	3.24%
Lead Time 7 weeks	\$122,103	\$3,876	\$2,858	\$118,227	0.00%	1.20%	\$114,249	0.35%	3.59%
Lead Time 8 weeks	\$122,103	\$3,876	\$2,858	\$118,227	0.00%	1.20%	\$113,853	0.35%	3.93%
Lead Time 9 weeks	\$122,103	\$3,876	\$2,858	\$118,227	0.00%	1.20%	\$113,458	0.35%	4.28%
Lead Time 10 weeks	\$122,103	\$3,876	\$2,858	\$118,227			\$113,062		

Selling Season of 13 weeks									
Product Demand = average of 5000/week, standard deviation of 2000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$320,517	\$6,187	\$5,482	\$314,329	0.58%	0.58%	\$308,957	1.03%	1.03%
Lead Time 3 weeks	\$319,738	\$7,228	\$6,260	\$312,511	0.49%	1.07%	\$305,796	0.95%	1.98%
Lead Time 4 weeks	\$319,129	\$8,134	\$6,870	\$310,995	0.48%	1.55%	\$302,927	0.95%	2.93%
Lead Time 5 weeks	\$318,362	\$8,847	\$7,636	\$309,515	0.34%	1.88%	\$300,080	0.82%	3.75%
Lead Time 6 weeks	\$317,913	\$9,438	\$8,085	\$308,475	0.40%	2.29%	\$297,645	0.90%	4.65%
Lead Time 7 weeks	\$317,279	\$10,035	\$8,720	\$307,243	0.35%	2.63%	\$294,993	0.86%	5.51%
Lead Time 8 weeks	\$316,792	\$10,618	\$9,206	\$306,174	0.33%	2.96%	\$292,471	0.86%	6.37%
Lead Time 9 weeks	\$316,376	\$11,205	\$9,622	\$305,171	0.24%	3.20%	\$289,982	0.78%	7.15%
Lead Time 10 weeks	\$316,049	\$11,611	\$9,949	\$304,438			\$287,734		

Selling Season of 5 weeks									
Product Demand = average of 5000/week, standard deviation of 2000									
	Total Sales	Liquidated Inventory	Missed Sales	Profit from Sales	% increase profit/week	cumulative % increase	Profit Incl. Inventory	% increase profit/week	cumulative % increase
Lead Time 2 weeks	\$119,502	\$6,534	\$5,094	\$112,967	1.24%	1.24%	\$111,248	1.78%	1.78%
Lead Time 3 weeks	\$118,911	\$7,324	\$5,685	\$111,587	0.55%	1.79%	\$109,302	1.13%	2.91%
Lead Time 4 weeks	\$118,847	\$7,872	\$5,749	\$110,974	0.00%	1.79%	\$108,082	0.38%	3.29%
Lead Time 5 weeks	\$118,847	\$7,872	\$5,749	\$110,974	0.00%	1.79%	\$107,676	0.38%	3.67%
Lead Time 6 weeks	\$118,847	\$7,872	\$5,749	\$110,974	0.00%	1.79%	\$107,269	0.38%	4.05%
Lead Time 7 weeks	\$118,847	\$7,872	\$5,749	\$110,974	0.00%	1.79%	\$106,863	0.38%	4.43%
Lead Time 8 weeks	\$118,847	\$7,872	\$5,749	\$110,974	0.00%	1.79%	\$106,456	0.38%	4.81%
Lead Time 9 weeks	\$118,847	\$7,872	\$5,749	\$110,974	0.00%	1.79%	\$106,050	0.38%	5.20%
Lead Time 10 weeks	\$118,847	\$7,872	\$5,749	\$110,974			\$105,643		