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The Cotton Cost

Victor Olsson

What is it, Why is it and what Could it be

Abstract

This paper studies the current cotton market situation. The situation is a recent vast increase in cotton fibre price, mainly due to tight supply and demand circumstances. Focus is on two issues; how the fibre price affect companies cost wise and the likely future development of the cotton market. The cotton market has been studied by hard facts and contemporary views from industry people and companies. Factors influencing the cotton market such as economical growth, population and substitute textile fibres are taken into consideration. Besides how companies themselves claim to respond to the cotton price increase cost calculations approximated by thumb rules of the industry are performed. The result is a higher cost, derived from higher cotton price, at the finish garment stage. The magnitude depend on if one sees it relative to retail price or manufacturing cost along with how the participant in the value chain react. The future cotton market is evaluated by what might effect cotton supply and cotton demand and how the market mechanism is likely to answer. Short term the high prices seem to lower the demand and along with a larger harvest next season prices should be lowered. Long term the price is suggested to remain high because of a larger grow in demand then supply.

Keywords: Cotton market, retail manufacturing cost, textile fibres, cotton future, cotton substitute

Preface

I would like to address a great thanks to all people who has contributed in the process of this paper. Especially I would like to thank my supervisor Jan Carlsson who has been supportive throughout the working process.

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1. Introduction

1.1 Choice of subject

This paper will coherently focus on cotton, how it affects textile companies and what is affecting the cotton market. The choice of subject came from the currently emerging cotton situation. To gain knowledge about this complex subject is relevant in textile business now and probably also in the future.

1.2 Background

The global demand of textile fibres has been growing rapidly during the last century in which cotton and polyester have been the most important fibres. Today the world consumes over 70 million tones of textile fibre every year (Oerlikon, 2010). Two main reasons for the growth is the large increase in population and the growing wealth due to the industrialisation (Eberle et al., 2003, p.9). The main part of the textile fibre growth has come from man-made fibre, especially polyester. The textile fibre market is looking to continue its growth with approximated 3,5 % per year the coming decades (Oerlikon, 2010). Some expect a 300% rise in demand for textile fibres to occur 2050 as a result of population and GDP growth (Habit Sko&Mode, 2011a). According to Messure, senior vice president at Cotton Incorporated, the demand of basic cotton clothing will grow as a consequence of population growth and a higher income in developing countries (Cotton Inc., 2011a). Even though the cotton production has increased in actual numbers, cottons share of the world market has decreased from 68 % in 1960 to 34,4 % in 2010 (Plastina, 2009; Cotton Inc., 2010).

The average normal price for cotton is around 60 cents/lbs. However, the current price is around 2 \$ /lbs which represents a runup well over 200% from march 2010 until march 2011 (Trading Economics, 2011). This has put the textile industry under extra pressure. The reason for the price increase is said to be a tight supply and demand situation along with flooding and bad weather in Pakistan, China and the southern hemisphere which have resulted in a lower harvest (Beggs, 2011). The main opinion (Cotton Inc. 2011b; Habit Sko&Mode, 2011a; Ellis, 2011; Beggs, 2011) for next season is that the harvest will be big which should stabilize and lower the prices, although still on historic high levels. How the increased price will have effect on companies and customers are not yet clear. Underwear company Topeco claims that their production cost has increased 60 % only because of the cotton price. As a reaction they have raised their prices with 20 % (Habit Sko&Mode, 2011b). Other companies have been forced to blend cotton with synthetics to meet the higher cotton price. The search for alternative fibre sources has also resulted in higher demand and price for man-made fibres (Ellis, 2011). As the full effect of recent price increases takes time for the retail market to absorb, some (Frederick, 2011) are expecting up to 25-35 % higher prices this fall, other not more than 15 % (Barrie, 2011).

There is also a growing concern about margins, which might have to take a hit as a result from the cotton price (Ellis, 2011; Habit Sko&Mode, 2011b). VF Corporation says that a 7 % product cost increase brings roughly 1 % lower gross margins (Barrie, 2011). Swedish fashion company H&M saw their gross margin went from 61,9 % first quarter of 2010 to 57,8 % for the first quarter of 2011 as a result of higher buying costs, partially driven by more expensive cotton (H&M, 2011).

1.3 Research question

The situation described in the background motivates further research on the subject. The fundamentals behind higher cotton prices and the economic cost effect of higher cotton prices will be the focal point. Different participants in the textile value chain will be considered. However the main perspective will be from the company purchasing from the end of the manufacturing chain. It is also the kind of company the formulation below refers to. The research question of the study is:

What cost effect comes with a higher cotton price for textile companies – and how might the cotton market develop in the future?

1.4 Problem discussion

As the textile demand in the world keeps on growing along with population and economy, there is a question mark whether cotton can keep up that pace. Even though the textile fibre growth is estimated to be mainly contributed by man-made fibres, cotton is still projected to grow to 24 % until 2029 (PCI Fibres, 2004). That prognosis counts on a further higher cotton yield. To increase the world's cotton harvest with the same farm land as dramatic as would be needed, vast improvements by genetic manipulated crops are required. There is also a doubt if cotton can keep the same land area as of today. A growing population does not only need cotton but food and water. So if cotton could be replaced with some other textile fibre and leave more land to food, it might would. However, even with the same land area and considerable yield increases, the future supply and demand situation could be tight for cotton.

On a long-term perspective textile companies might have to find ways to deal with a somewhat cotton scarcity. It could lead to a need to adjust business models so there is still possible to make good profit alongside a higher cotton price. It could also mean that the allocation of power in the value chain switches. Moreover it could mean a shift in some extend to alternative fibres. Bresky¹ believes cellulosic fibres as viscose and lyocell along with other fibres who posses similar properties as cotton will benefit. In the future also an expansion of flax and bamboo fibres could be a result of higher cotton prices, Toftegaard² states. A long-term perspective might also suggest different preferences and consumption behaviour from the consumers.

¹ Interview, Bresky, 2011-05-10

² Interview, Toftegaard, 2011-05-10

In a shorter term, there seems to be some confusing in the industry on how to adjust to the record high cotton prices. Although prices always have fluctuated, a price situation extreme as this has never occurred in modern time. The reactions from companies vary. Some companies, e.g Topeco, answers with a higher retail price to compensate the cost increase. VF Corporation states that the cotton price has most impact for their jeans segment were cost increases could bring a 15 % higher price during the year (Barrie, 2011). H&M on the other hand made it clear in their interim report of the first quarter (2011) that they will not transfer a higher acquisition cost to the retail price. That would mean a lower gross margin, probably along with trying to make the manufacturer upstream the value chain also to take some of the margin hit. Other companies consider changing fabric blends to use less cotton fibre (Beggs, 2011; Ellis, 2011). The Chinese market is more acceptable to polyester and the switch to cotton/polyester blends is supposed more natural there (Driscoll, 2011). Altogether it appears as the industry does not know how the higher price will be spread among the actors of the textile value chain. To better understand the situational this paper will study how fibre prices theoretically effects the costs.

1.5 Aim of study

This study will bring a background in the world textile fibre market with focus on cotton. It will support the understanding of current market situation and how it affects textile companies. By considering consumption, wealth, population growth and the cost effect cotton bring the future of cotton will be more conceivable to anticipate. Moreover the appetite for a cotton substitute will be examined from an economical perspective by calculating different scenarios. The scenarios will demonstrate how various garment costs are affected by different textile fibre costs at the beginning of the supply chain. Hopefully this will answer to how different fibre cost actually effects textile companies and what a switch to cotton substitutes would implicate. By understanding this, the goal is to better perceive the future cotton market.

1.6 Delimitations

The study will concentrate on the clothing side of the textile industry, focus on the economical costs of cotton and other fibres. It will not include environmental costs although it could include agriculture issues. Present fibre prices will be fixed at the level of march 2011 and not change during the work process of this paper even though the market change every day. The study will not go deep into material properties or possible intangible values associated with some fibres. As the textile industry is much diversified, yet using the same fibres, calculations based on thumb rules will always differ from a more complex reality and should therefore be seen as rough estimations.

2. Methodology

2.1 Design of research

The study will use a qualitative research method. Qualitative method and data has the strength in its ability to reveal the whole picture of a problem. This is done by digging deep into the situation. It is also flexible and corrections regarding for example the research question formulation can be done during the work process. This makes it easier to discover unexpected correlations (Holme & Solvang, 1997, p. 79-80, 88). The qualitative profile has been used because its ability to expose a wide situation, which the cotton market and the effect of it represents. Also the flexibility during the work process which allows unexpected findings will match this work. However elements from the quantitative approach such as narrowed data will also be used as a complement to the qualitative data.

This study will practice some of the main feature from both an explorative and a descriptive research design. The descriptive research aims to gain knowledge about the surrounding conditions in a certain situation (Sekaran, 2003, p.121). This study has used the descriptive design to understand the circumstances of the cotton market, before forming the definite research question. One characteristic of the explorative design is to gather a great deal of information material from various sources and put it together to better understand a problem (Sekaran, 2003, p.119) which this paper has the ambition to do. The study uses existing theory to better understand and explain the research problem.

2.2 Information collection

This study use primary and secondary data. Examples of secondary data used are information from scientific articles, books, magazines and company. Scientific articles have in most cases been found through the database Business Source Premier and World Textiles. Primary data has come from interview based on a question inquiry distributed by e-mail (see appendix). New data which could be considered as primary data has come from the cost scenario calculation performed, based on information from secondary data.

2.2.1 Reliability of data

The reliability of data considers whether the data is trustworthy and credible. High reliability applies to the data when different independent research finds the same or almost the same result. Therefore comparing different studies of the same content is one way to assure the data reliability (Holme & Solvang, 1997, p.163-165). Qualitative data can suffer problem with reliability because it might come into existence under special circumstances, why this will be considered when using the data (Johannesen & Tufte, 2002, p.28). This paper will use multiple sources when possible to make sure different studies have similar results, to assure the information to be reliable. It will be practice

for information regarding economical growth, population and fibre consumption among other subjects.

2.2.2 Validity of data

No matter how reliable the information might be, it may be useless for the aim of the research unless it measures what is intended. The information must be valid and relevant to its purposes to achieve high validity (Holme & Solvang, 1997, p.167-169; Jacobsen, 2002, p.21). This paper strives to attain good information validity by considering what the author of the information has aimed to measure. Likewise the paper will not use information bound to a certain context in another one. Also the publishing date, not least regarding statistics, is considered assuring the containing information to be valid.

2.3 Scientific approach

There are mainly two scientific approaches, a positivistic and a hermeneutic. This study relies on both approaches to some extent, which is not unusual (Boolsen, 2007, p.33). The positivistic approach relies on knowledge based on empirics. Positivism does not regard facts which cannot be measured as valuable, why it concentrate on hard facts. The positivistic approach can describe a part of an actual situation, but it does often not cover the total picture (Boolsen, 2007, p.36-39). Typical positivistic hard data is used in some cases to understand a specific matter such as GDP or population numbers. The hermeneutic approach emphasizes interpretation of text or information as the technique to understandings. Hence the researcher has to respect and considerate in what context a text has been produced, which this study strives to do. The hermeneutic circle is the process when a researcher goes from the understanding of an individual section to understanding of the entire and back, again and again (Boolsen, 2007, p.31-34). This study will be conducted in the manner of the hermeneutic circle because it is a good way of getting a more holistic knowledge. Understanding how cotton prices effects companies cost wise benefits the understanding of the cotton market as a whole and vice versa.

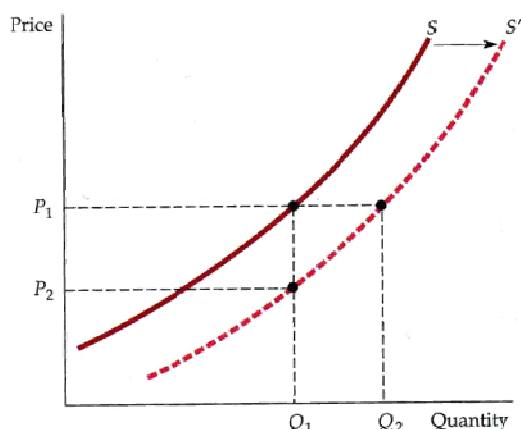
3. Theoretical framework

3.1 The supply and demand market mechanism

3.1.1 Supply curve

The supply curve shows the relation between the quantity of goods producers sells, Q , and the price, P . As the figure below expose, a higher price motivates a greater quantity of goods to be sold. Hence this example is only stressing the price and quantity and do not consider other factors that could affect the supply. Such factors are for example wages, interest charges and the cost of raw material. If the cost of raw material declines, which lowers the production cost, the supply will increase regardless of the current market price. Price changes due to supplied quantity change along the same supply curve. Price movements because of other supply variables results in a shift of the whole supply curve. These are differentiated as *change in the quantity supplied* respectively *change in supply* (Pindyck & Rubinfeld, 2005, p.22-23).

Figure 1: The Supply Curve

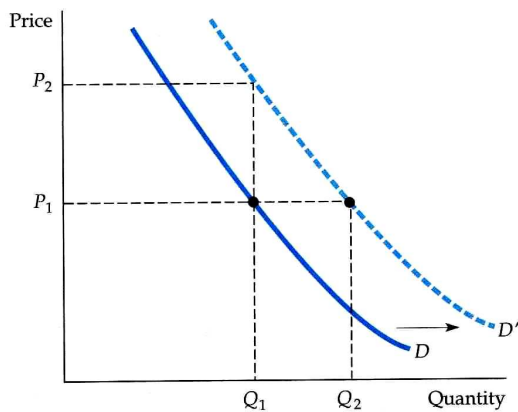


Pindyck & Rubinfeld, 2005, p.22

3.1.2 Demand curve

The demand curve shows what quantity customers are willing to buy, depending on the price. As shown in the figure, a lower price results in a larger amount of sold goods. This model does not consider other variables than price and quantity such as purchase power and substitutes. Changes in demand can be distinguished as movements along the same curve, *change in the quantity demanded*. It can also be a shift of the whole curve, called *change in demand*. Substitute goods are goods which can be used industrial for the same purpose as the original one. The substitute goods and the original will follow each other pricewise. If for example the demand for copper rise, and therefore also the price, the price of the substitute goods aluminum will also increases. The same mechanism applies to complementary goods, which is goods that are used together. If the gasoline price decreases, the demand for cars will increase (Pindyck & Rubinfeld, 2005, p.23-25).

Figure 2: The Demand Curve

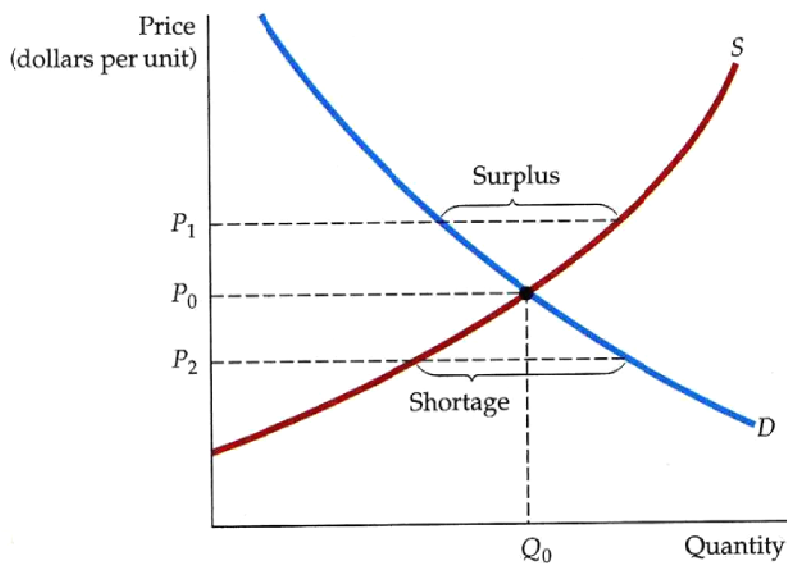


Pindyck & Rubinfeld, 2005, p.23

3.1.3 The market mechanism

The market mechanism controls what sellers receive for a specific quantity and what the buyers will pay for a specific quantity. It consists of the supply and demand curves put together and where they cross, the equilibrium point occurs. This point is called the market clearing price. At this position the demand and supply in a market are in balance and there is no need for the price to change. The market mechanism tendency in free markets is to adjust the price until the market clears. However, the market might not reach the equilibrium immediately when the conditions are rapidly changing. For the market mechanism to work it is obligated that the market has competition. In a competitive market both sellers and buyers have the ability to affect its price. If the price increases for a finite resource, consumption will probably transfer to substitute resources (Pindyck & Rubinfeld, 2005, p.25-26, 31).

Figure 3: The Market Mechanism



Pindyck & Rubinfeld, 2005, p.25

3.2 Elasticity of supply and demand

Elasticity measures how much the supply or demand will change depending on the price. The elasticity is specified by how much change in one variable is required for the other to change 1 percent. There are mainly two types, *price elasticity of demand* and *price elasticity of supply*. Price elasticity of demand tells how the demand responds to change in price. If the percentage of decline in quantity demanded is more than the percentage of price increase, the commodity is price elastic of demand. Price inelastic of demand applies to goods which demand quantity declines less in percentage than the price rise. Price elasticity of supply reveals how much the supply changes in relation to change in price (Pindyck & Rubinfeld, 2005, p.34-36). The price elasticity of supply is calculated by dividing change in quantity supplied with change in price. If the price rises with 10% and the quantity supplied increases 20% as a reaction, the price elasticity of supply would be calculated 2 because $20\% / 10\% = 2$. Price elasticity of demand is calculated with the same method, change in quantity demanded divided with price change (Fair, 1999, p.119).

Usually the price elasticity depends on the availability of substitute goods. In case there are close substitutes available on item x a price increase will likely result in a greater decrease in demand along with greater purchases of the substitute goods. This will make the item x highly price elastic of demand. However if the item x has no adequate substitute the demand will probably be price inelastic, demand will not change relatively as much as the price. The perfectly inelastic demand is when the price has no effect on the demanded quantity. Perfectly elastic demand is in case the customers will buy as much as possible at a certain price, and with unlimited increase in demand for a lower price, while every higher price will kill all the demand. This is shown as below. (Pindyck & Rubinfeld, 2005, p.34-36)

Figure 4: Perfectly Inelastic Demand and Perfectly Elastic Demand



courses.cit.cornell.edu/econ101-dl/lecture-elasticity-uses.html

As the demand of one good is often affected by the price of other goods, there is also the term cross-price elasticity of demand. It refers to the link of demand between two substitutes. It reveals how much percent of change in quantity is required for a 1-percent

price increase of the substitute goods. This goes for substitutes who can compete on the same market (Pindyck & Rubinfeld, 2005, p.36).

For manufactured goods the elasticity of supply concerning raw material are negative. With other conditions being equal this means higher raw material costs would result in less supplied quantity. Often the demand is more price elastic long term compared to shorter periods. Short term is up to a year while long term is longer or enough time for producers or consumers to adjust fully to the price change. To fully adjust to a different price level often means to gradually change which is why the price elasticities are much greater on long term when the adjustment is completed (Pindyck & Rubinfeld, 2005, p.37, p.40). For goods that can be supplied by secondary sources, as recycling of scrap metal to produce metal, the supply could be more elastic in the short run. The secondary supply is more costly and therefore higher prices must motivate this supply (Pindyck & Rubinfeld, 2005, p.45).

3.3 Kraljic's supply matrix

Peter Kraljic's supply matrix is a tool used to design the purchasing function of a company. The basic idea is that different supply markets need differentiated strategies (van Weele, 2010, p194). One of the main issues the model tries to answer is how a company can ensure continuous supply of material without increasing its risks (Kaminsky et al., 2008, p.286). The matrix is dependent on two variables; the purchasing's impact on the company's profit and the supply risk. By evaluating the company's situation from these two variables the management are able to decide what supply they should use their purchasing power on and which to reduce its risks against. The matrix is used to avoid bottlenecks and interruption along with how much risk the company can accept (Kraljic, 1983, p.110).

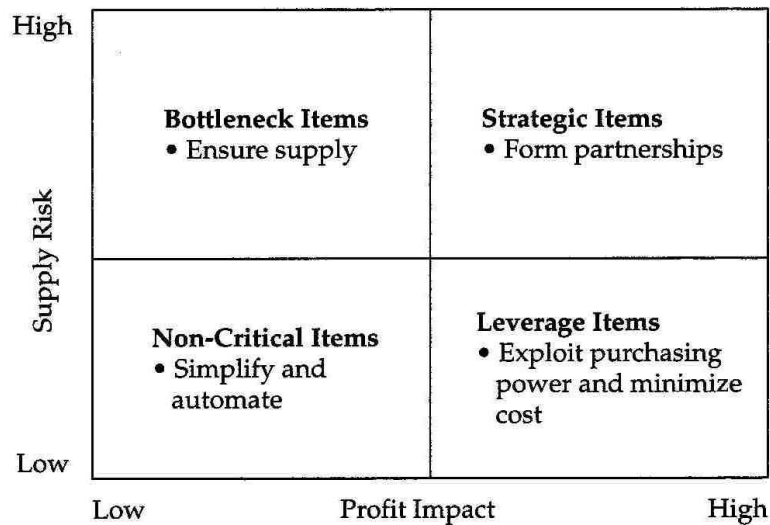
- **Profit impact**

The variable purchasing's impact on the company is determined by how the supply item affects the company cost wise. Perspective that should be considered is the percentage of the total cost the item constitutes, impact on product quality or business growth and the volume purchased. The item's price elasticity and how the product affects company margins should also be considered. The higher sum of money involved the higher profit impact on the company. (van Weele, 2010, p195-196).

- **Supply Risk**

The supply risk is measured in both short term and long term product availability as well in possible available substitutes. The supply risk also involves geographic distance, number of suppliers, cost of changing supplier and the structure of the market (van Weele, 2010, p195).

Figure 5: Kraljic's Supply Matrix



Kaminsky et al., 2008, p.287

3.3.1 The four purchasing approaches

After valuing the supply item by supply risk and profit impact, four different groups are revealed; bottleneck items, strategic items, non-critical items and leverage items.

- **Bottleneck items**

The items in this category do not constitute much to a products cost or the company profit but they possess a high supply risk (Kaminsky et al., 2008, p.287). In this market supplier often has the power position as a result of few suppliers. This might consequence in high prices, long delivery time and bad service (van Weele, 2010, p198). However the recommended strategy for this group is to ensure supply, even at a premium cost. This can be done by carrying stock of the bottleneck items along with long term supplier contracts (Kaminsky et al., 2008, p.287).

- **Strategic items**

Strategic items both have high impact on profit and a high supply risk. Often only one supply source is available and changing source would be costly. A common example of a strategic item is engines for automobiles (van Weele, 2010, p196). The appropriate strategy for this group is to form long term partnerships with suppliers to assure the supply (Kaminsky et al., 2008, p.286).

- **Non-critical items**

The non-critical items have a low supply risk along with a low financial impact. There are often many suppliers and switching to another is not a great cost factor. As the items only have a small value each, the cost comes to a great part from the administrative

handling of the goods (van Weele, 2010, p198). These items should be purchased decentralized with focus on reducing time and energy (Kaminsky et al., 2008, p.287).

- **Leverage items**

This item has a low supply risk due to many available suppliers while they have a high impact on profit. The items of this group typically come in standard quality grades. A small price change results in a relatively strong effect on the cost of the end product. The buyer has the power of the market due to low switching costs and suppliers often compete on pricing (van Weele, 2010, p198). The buyer strategy should be to reduce their cost by forcing the suppliers to compete (Kaminsky et al., 2008, p.287).

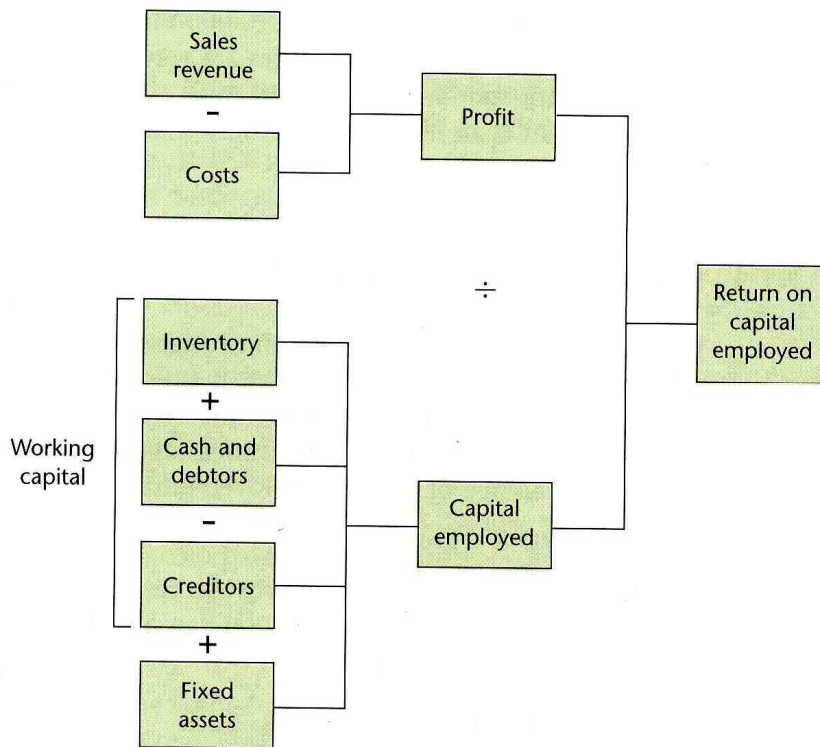
3.4 Scarcity in economics

The definition of scarce goods is when the demand of a free resource or goods exceeds the free supply. Then scarcity occurs and the goods become economic goods. Other goods are called free goods, such as air and seawater. In other words, scarcity is the force that creates a demand. How scarce the resource is decides what product are produced from it and how many and for whom. The choice of how to use the scarce resource is made by considering alternative production and deciding what process is worth more (Bronfenbrenner, 1962). The scarcity level of a resource, along with the availability of substitutes, will determine the price of the resource. Increased scarcity will drive the production and innovation of substitutes. Sometimes scarcity leads to allocation of resources in form of resource recycling, a substitute as a secondary market (Hackett, 2001, p76, 86).

3.5 Return on investment

The return on investment analysis reveals at what interest an investment in the particular business brings. The result is a measurement along with business risk on how attractive it is to invest money in the company. It is usually calculated by dividing profit before interest and tax with capital employed. Capital employed is the amount of money that is invested in the business, for example inventories and fixed assets. Profit is sales minus costs (Harrison & van Hoek, 2008, p.66-69). The cost includes raw material cost, personnel and depreciations. By lowering the costs, the profit will increase and so will also the return on investment. One way of lowering the cost is to reduce the direct material costs. If the cost increases, the return on investment will decrease (van Weele, 2010, p.12-14).

Figure 6: Return On Investment



Harrison & van Hoek, 2008, p.68

4. The cotton and textile fibre market

4.1 Textile fibers

There are different ways to organize fibres. The first distinction is made between natural fibres and man-made fibres. Then the group of man-made fibres is divided into synthetic and cellulosic fibres. Examples of natural fibres are cotton, flax, wool and silk. Man-made synthetic fibres are derived from petroleum e.g. polyester, nylon, acrylic and elastane. Cellulosic man-made fibres are created of dissolved cellulose from wood. Viscose, Modal and Acetate are common cellulosic man-made fibres (Eberle et al, 2003, p.8-9).

The usage of textile fibres could be divided in three groups. First group is apparel usage, which satisfies the need for clothing among the population. Secondly are household textiles such as bed and table linen, furnishing and floor covering among other appliance. Third group is technical or so called industrial textiles which range from protective clothing and medicine to packaging and house or road building (Eberle et. al, 2003, p.9). Apparel and household textiles amasses 95% of the cotton production (Cotton Inc., 2011a).

4.1.1 Fibre blending

Main reasons for fibre blending are quality improvement such as easy-care or to avoid shrinkage. Other reasons are to get lustre or structure effects and cost efficiency. It is often advantageous to mix natural fibres with man-made fibres to achieve many of the aims with blending. Cotton fibre is often blended with other fibres to achieve better properties. It is frequently blended with polyester, nylon, viscose or modal. Cotton is also often blended with other qualities of cotton fibres. The fibre blending takes place in the yarn production process or during fabric production (Eberle et al., 2003, p.13, 43).

4.2 The cotton fibre

Cotton is a 100% cellulose staple fibre which has a great length variation ranging from 0,32cm to 6,35cm. The length depends on what type of cotton plant it comes from. There are many types of cotton but the American Upland is the most common, constituting 50% of the world's crop. Cotton fibres used in garment manufacturing are mainly around 2,2-3,2cm. Longer fibres are more narrow and of higher quality (Hatch, 1993, p.163, 169). Cotton is used in many different applications for apparel, home textiles and technical textiles. Some main usage in apparel is shirts, blouses, underwear, jeans, workwear and outerwear. In households bed clothes, towels and kitchen cloths are often made from cotton (Eberle et al., 2003, p12-13).

Because of the comfort cotton is frequently used for apparel. Cotton can absorb up to 20% of vapor, yet not feeling wet. It can also contain 65% of its own weight as liquid without dripping. Because of the fibre softness and finesse, cotton feels comfortable against the skin. The fibre also possesses a high tenacity and it gets stronger in wet condition (Eberle et al., 2003, p.12-13, 47). Cottons dyeing and laundering abilities are also important factors for its wide use in apparel (Bide, Collier & Tortora, 2009, p.71). Cotton does also possess some weak properties such as poor resilience, why it wrinkles easy, and has a rather low extensibility (Hatch, 1993. p.167).

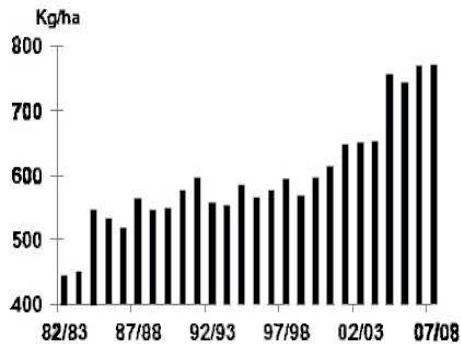
4.2.1 Cotton production

The cotton plant is usually grown as a shrub measuring a height between 25cm and 2 meters. It takes around 175-225 days for the plant to mature. When matured the boll of seed hair is harvested either by hand or picking machines (Eberle et al., 2003, p.10-11). Cotton is sensible to insects and pests which is a significant problem for farmers. It is cultivated in warm areas with adequate water supply in form of favorable rain or irrigation (Bide, Collier & Tortora 2009, p.64). To harvest 1 kilo cotton 10,000-17,000 liter of water is required and to attain 1 kilo cotton textile, over 1 kilo of chemicals is on average used (Habit Sko&Mode, 2011b).

Most of the world's raw cotton is produced in just a few countries. About half of the world's cotton is harvested in China and US. If adding India and Pakistan the sum is 75% (Anderson et al., 2005). 2,5 % of the world's farming land area is used for cotton

farming (Habit Sko&Mode, 2011b). This area has been stable around 32 million hectares for many decades. The yield of cotton is measured in kilo/hectares. While the farm land area has been stable the harvests has tripled since 1960 because of better technology which has increased the yields. The cotton yield varies a lot between regions and in a few locations two harvests a year is possible. In 2009 the world average cotton yield was 734 kilo per hectare. China had a yield of 1358, US 868, India 499 and Pakistan 711 (Oerlikon, 2010).

Figure 7: World Cotton Yield



International Cotton Advisory Committee. 2009

The production of natural fibres as cotton differs essentially from the production of man-made fibres in some aspects. If the demand of cotton increases during the season, the cotton farmer can not increase its supply instantly to meet the demand. A producer of a man-made fibre like polyester gets the raw material from oil instead of a seasonally oriented supply as cotton. This makes it easier for a polyester manufacturer to answer to increased demand more rapidly (Bide, Collier & Tortora, 2009 p.9). It is confirmed by the numbers Suits (1995) apply to cotton, a short term price elasticity of supply at 0,3 and a long term value at 1.0.

4.3 Substitute fibres

Cotton has some substitute which more or less can achieve the properties of cotton. Consider a shirt, generally is it made from cotton but it could also be made of polyester, viscose, flax or a combination. For example the viscose fibre is sometime referred to as man-made cotton because it can achieve some similar properties such as handle. Viscose is made of dissolved cellulose derived from wood (Eberle et al., 2003, p.30-33). Flax fibres are sometimes cottonized which refers to a mechanical or chemical process that breaks down the fibre bundles to individual fibrils. After the cottonizing process the fibre sometimes becomes weaker but it has a condition closer to cotton (Hatch, 1993, p.175). This makes it possible to blend with cotton and being processed in the same machinery (Flax Council of Canada, 2002). Cellulosic based fibres often have the advantage of better absorbency and worse resilience performance compared to synthetics (Bide, Collier & Tortora, 2009, p.22). Diagram below shows fibres who in different application substitutes for cotton, their current production volume and the potential to grow.

Figure 8: Cotton Substitutes

Fibre Type	Resilience	Moisture regain	World production 2009	Growth potential
Cotton	Low	High	22,3 million tonnes	Moderate, limited by land area
Viscose	Low	High	2,7 million tones	Very good
Polyester	Very high	Low	31,9 million tonnes	Good, depending on oil price
Flax	Very low	High	0,78 million tonnes (2007)	Very good, area could be increased

Hatch (1993) pp. 114, 167, 173- 176, 184 & 212; Oerlion (2010); Barriga-Bedoya et al (2008)

4.3.1 The unknown future

While viscose, polyester and sometimes flax along with other fibres act as cotton substitutes in different applications today, the development of new fibres and methods for manufacturing and processing fibres are breeding. One driver for the improvements is the urge for biodegradable and sustainable fibres, which might could be developed by mimicking natural fibre production (Bide, Collier & Tortora, 2009, p.219-220). Besides producing new fibres is a lot of research done on how to take advantage of other natural fibres than those we generally use today. Some new raw materials in the maturing process of being more widely used for textiles are soya bean, mice, coconut, bamboo and nettle. Rami is one nettle plant with some similarities to flax which also could be blended with other natural fibres, e.g. cotton. Another source of future raw material could be recycling, for example recycling polyester (Habit Sko&Mode, 2011c; Fletcher, 2008, p.16).

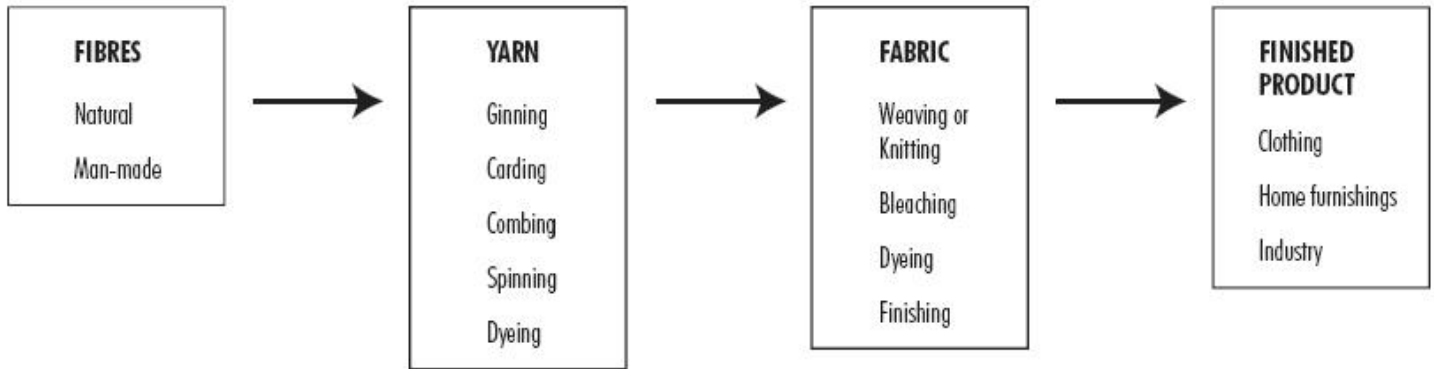
4.4 Textile production

4.4.1 The manufacturing chain

The supply chain for clothing is usually long and with multiple partners ranging from cotton seed to the retailer. The manufacturing of a textile product starts with the production of raw material such as cotton or polyester fibres. After that the fibre is spun to yarn where it also might be dyed or processed in other ways. The yarn is used to make a fabric, which often is processed to get certain properties. There are three types of fabric constructions; knitted, weaved and non-woven's. The last manufacturing stage

of the supply chain is to cut, sew and trim the fabric to a finished garment. This stage is the most labour intensive in the manufacturing process. Yarn and fabric production are more capital intensive and dependent on technology (McNamara, 2008).

Figure 9: The Textile Manufacturing Chain



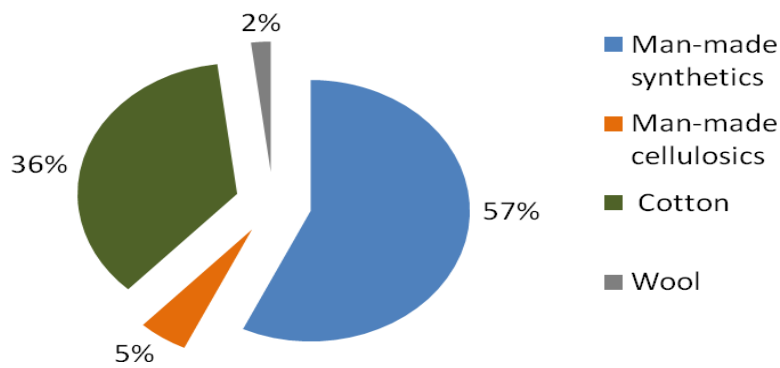
McNamara (2008)

Fashion companies usually do not own the whole supply chain themselves, which is why they have to outsource some parts. The two main models that fashion companies use to purchase clothing production are CMT and Full Price. CMT refers to cut, make and trim which are the services the buying company receives while they purchase the required fabric for the order themselves. In the Full Price model the buying company leaves the fabric acquisition along with cutting, making and trimming to the producer (Hedén & McAndrew, 2005, p.110-112). In 2005 the quotas were taken away from the global garment industry. This created a buyers market where a much greater capacity than demand made the producers battle with prices (Birnbaum, 2005b).

4.4.2 Fibre spread in production

Of the global textile fibre production of 70,5 million tonnes in 2009, man-made fibres constituted 44,1 million tonnes; 62,6%. Of these 57% were synthetics and 5% cellulosic. Cotton represented 22,3 million tonnes or 36%. Wool make up for 2%. Altogether the market grew with 4% from previously year. The cellulosic man-made fibre segment increased by 7,7% with the viscose fibre growing 11% (Oerlikon, 2010). The market share of cotton decreased from the 36% in 2009 to 34,4% in 2010 (Cotton Inc. 2010).

Figure 10: Textile Fibre Market Share 2009

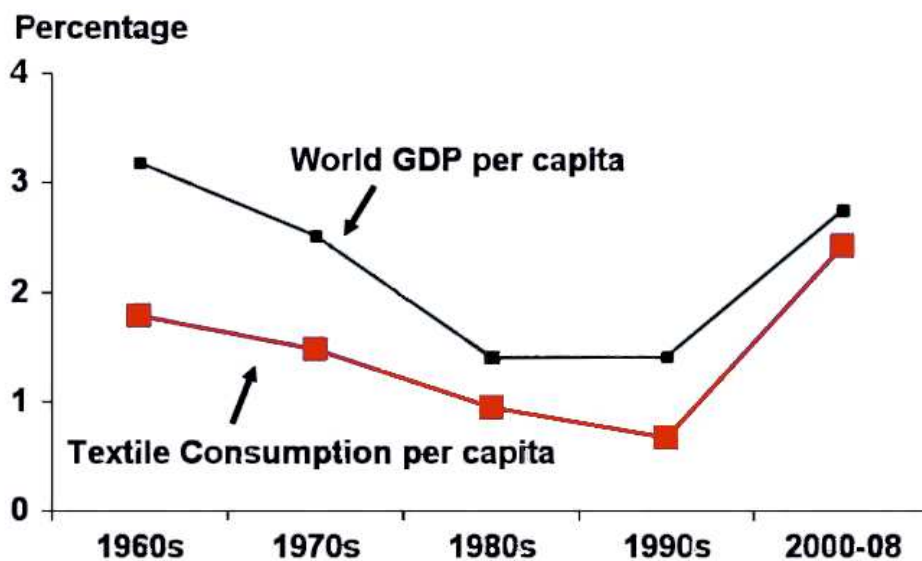


Own graphic based on data from Oerlikon (2010)

4.5 Textile fibre consumption

In 1950 the worlds total fibre usage measured 9,4 million tonnes with a 3,7 kg textile fibre consumption per capita. In 2009 the numbers had gone up to a global usage of 70,5 million tonnes textile fibres and an average of 10,4 kg consumption per capita. The textile fibre consumption per capita has grown every decade since start of the measuring 1950 (Oerlikon, 2010, p.88). The annual textile fibre growth has averaged at 3,8% during 1970-2007. The demand for textile fibres has been driven by population increase and a larger consumption per person as a result of higher income per capita. The consumption of textile fibres is more related to changes in GDP than in relative textile prices (Plastina, 2009). The textile consumption growth history has a close correlation to the growth of GDP per capita. Almost on an one-to-one ratio (Reichard, 2011).

Figure 11: GDP and Textile Consumption Yearly Growth



International Cotton Advisory Committee (2009)

Forecast predicting a world consumption of 107 million tonnes year 2029. It would represent a doubling since 2003 or a 53% increase from 2009. The yearly growth rate is projected to be around 3,5% (Oerlikon, 2010). The growth will be powered mainly from man-made fibres. Although a 24% cotton growth to 27 million tonnes is proposed (PCI Fibres, 2004).

Figure 12: Textile Fibre Consumption, Population and Consumption per capita

Year	TOTAL	Population billion	Consumption kg / capita
2009	70,526	6.76	10.4
2000	52,643	6.08	8.7
1990	40,840	5.28	7.7
1980	29,528	4.46	6.6
1970	21,878	3.71	5.9
1960	14,974	3.04	4.9
1950	9,404	2.56	3.7

Oerlikon (2010)

4.6 Consumption of cotton

The forecasted production increase in cotton by 2029 to 27 million tonnes from today's 22,3 million tonnes could be hard to reach due to land constraints and water availability. The forecasts rely heavily on the usage and development of genetic modified cotton (PCI Fibres, 2004). Some believe the peak cotton, were the world has reached the limit of cotton output, is nearby³. Maybe even within five years time⁴.

The world average consumption of cotton fibre per capita measured to 3,4 kg in 2009 while the total production reached 22,3 million tonnes (PCI Fibres, 2010b). PCI Fibre estimate the per capita consumption of cotton fibre to rise to 3,8 kg until 2020 (PCI Fibre, 2010a). The cotton consumption varies much between different countries. In the industrialised countries an yearly average of 14,1 kg cotton per person was measured in 2007. Even though cotton consumption has grown both measured in total consumption and per capita, cottons relative share of the textile fibre market has been declining for quite some time. 1960 cottons share of the textile fibre market accounted for 68%, double compared to today (Plastina, 2009).

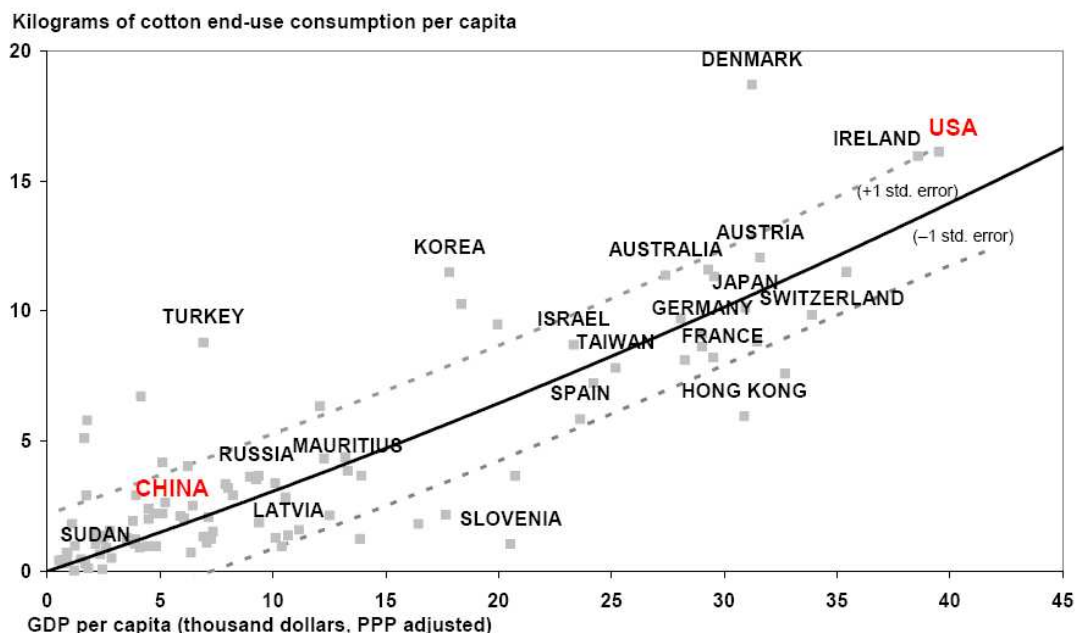
In general the trend of cotton consumption is that it trails the GDP per capita. Note however that even when GDP income is taken into account, consumption differs in some cases. An example of this is Denmark who consumes about the double France despite comparable GDP per capita levels (MacDonald, 2007). Drivers behind increased

³ Interview, Toftegaard, 2011-05-10

⁴ Interview, Bresky, 2011-05-10

cotton consumption have historically been GDP growth and population escalation (Plastina, 2009).

Figure 13: Cotton consumption per capita correlated with GDP per capita



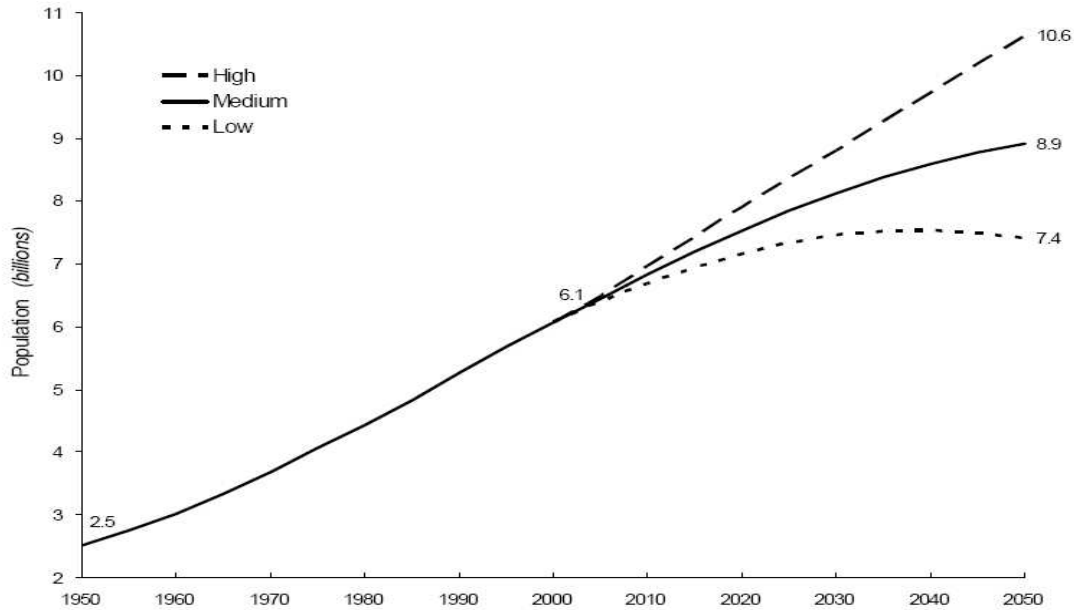
MacDonald (2007)

As stated the textile consumption grows along with the GDP and so does the cotton. However, depending on the existing income level in the country, the textile consumption grows in different ways. When the GDP per capita income is below \$13,000-16,000/year but raise, the increase of textile consumption comes mainly from synthetic fibres. When the GDP growth starts at levels at or over the \$13,000-16,000/year, customers begin to relatively switch from synthetics to cotton consumption. Why lower income consumers choose synthetics could partly be because of the durability properties. The higher income consumers could afford to prefer the comfort of cotton (Meyer, MacDonald & Skinner, 2006).

4.7 Population

To anticipate the future consumption and demand of textile fibres, the population growth must be taken into consideration. The United Nations presented their estimations on the world population in 2004 (U.N., 2004). By 2050 the global population is estimated to reach 8,9 billions. The study claims major part of growth in population will come from developing countries. Other research has equal estimations. The National Geographic predicts the world population to reach 9 billion plateau already 2045 and 8 billion 2024. Supposedly the population will increase with over 2 billions or 30% within the next 40 years. Already 2030 1 billion people of the developing countries will belong to the global middleclass, compared to 400 million 2005 (National Geographic, 2011).

Figure 14: Projected World Population until 2050



U.N. (2004)

4.8 Economical growth

The world averaged a GDP growth of 3,74% during 2010 (World Bank, 2010). The lion's share of the growth is carried by China and India along with other emerging countries. China grew 10 % and India 8,4% while Asia, Japan excluded, averaged 7,8% (BMI, 2010). The emerging markets⁵ of the world grew 7,67%. US and Europe grew respectively 2,4% and 1,8%. Historically the world GDP has growth around 3 % every year. 1970-2003 the average growth was 3,1% (World Bank, 2010).

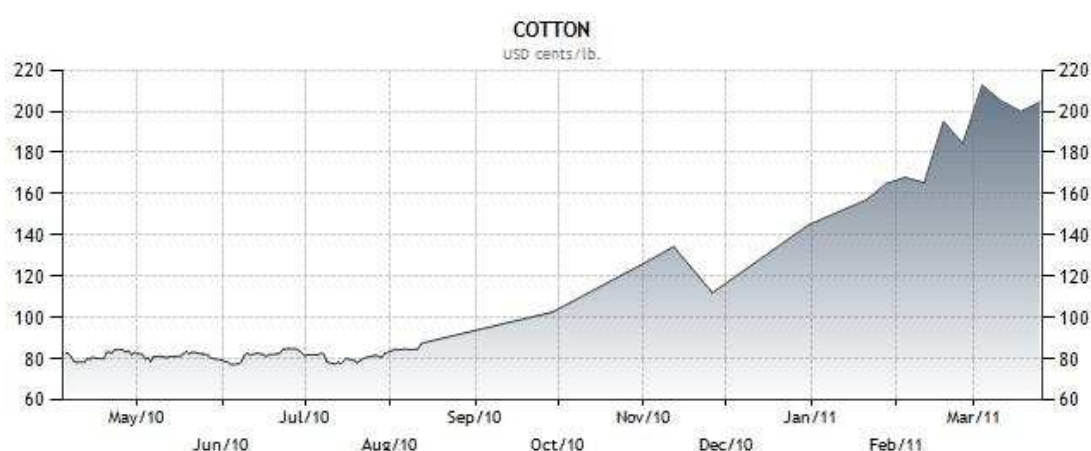
The global GDP is estimated to grow 3,3% during 2011 and at a 3,7% rate throughout 2012-2015. Also during this span Asia and especially China is the motor of growth. China is expected to have an average GDP growth of 7,6% 2012-2015. Comparable numbers for US is 2,35% and for Europe only 1,9% (BMI, 2010). Long-term GDP forecasts estimates a global yearly average growth in GDP by 3,2% from 2006 until 2050 (Hawksworth, 2006) or 3,4% during 2011-2020 and 3,1% 2005-2030 (World Bank, 2010).

⁵ Mexico, Brazil, Chile, Czech Republic, Hungary, Poland, Slovakia, Russia, China, India, South Korea, Taiwan, Indonesia, Malaysia, Philippines, Thailand, Vietnam, and Singapore

4.9 Cotton prices

Cotton is priced as cents per pound in the standard quality A Index. The average cotton price between 1970 and 2011 was 62 cents/lb (Trading Economics, 2011). In one year, march 2010 to march 2011, the price has rushed from 85 cents/lb to historical record levels up to 229 cents/lb. The reason behinds this 269% run is said to be a strong global cotton demand along with limited supply and low world stocks of cotton. The limited supply is partly to blame on flooding in Pakistan and heavy rain in China which harmed the crops (Beggs, 2011). On top of that India has instated restrictions on their cotton export (Habit Sko&Mode, 2011a). The strong cotton demand has been driven up by regions outside U.S and Europe, especially China and India (Ellis, 2011).

Figure 15: Cotton Price Graph April 2010 – April 2011



www.tradingeconomics.com/commodity/cotton

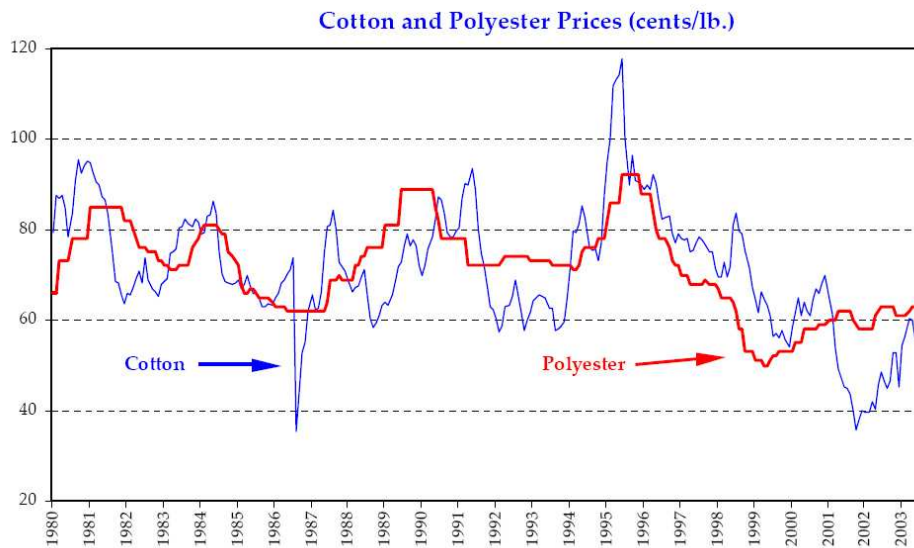
The forecast of next year's cotton crop is that it might be the largest ever harvested (Cotton Inc. 2011b). It would by common supply and demand sense lower the price levels. However, the common view is not to expect historical normal price levels although it should be lower than recent records. Burke, ceo of American Apparel and Footwear Association, do not believe we will see cotton prices at where they were one year ago (Ellis, 2011). Frankel of Standard Textiles concurs and sees this as a long-term issue with a new higher normal price which the industry has to adjust to (Beggs, 2011). Toftegaard⁶ and Bresky⁷ do not think the historical normal price around 0,6 \$/lbs will be normal in the future. The Secretariat of International Cotton Advisory Committee approximates the A Index prices to average at 153 cents/lb (Plastina, 2011). Cotton Inc. (2011b) makes similar estimations while emphasis that any weather event that harms the production should create price affects. The farm land with cotton is not likely to expand significant even though the price race. This is because it competes for land with other profitable crops as wheat, corn and soya bean which also has gone up in price (Cotton Media Group, 2011).

⁶ Interview, Toftegaard, 2011-05-10

⁷ Interview, Bresky, 2011-05-10

The high price levels of cotton could make textile companies seek alternative fibre sources. Some companies are looking at alternatives such as changing fabric blends with more polyester while decreasing cotton (Beggs, 2011). One issue is that other fibres such as polyester also have gotten more expensive (Alison, 2011). One reason for the one year price increase by about 50% for synthetic fabrics is due to the risen demand of alternative blends (Ellis, 2011). There exist a short-term relationship between cotton prices and polyester prices. The price signals are transmitted faster from polyester to cotton and the price effect is greater than the other way around. However, the long-term price correlation is normally strong between the fibres and the price ratio has been around 1:1 (Baffs & Gohou, 2005).

Figure 16: Cotton and Polyester Price Correlations



Baffs & Gohou (2005)

Weber, ceo of LVMH, views the alternative as changing blends and adjusting products or increase prices (Ellis, 2011). There are concerns in the industry that consumers would not absorb higher prices which the higher fibre prices could lead to (Cotton Inc., 2011b). Beside the possible lower consumer demand due to higher prices stands the concern about lower margins for the companies. The industries overall margin could be decreased with 1% as a direct effect of the higher cotton prices (Ellis, 2011). However because of lead-times up to 12 month the full impact of the recent cotton price increase has not hit the market yet but should be at full effect this fall (Alison, 2011).

5. Raw material cost effect of cotton and substitutes

Because of the volatility in fibre prices and the steep rise of cotton price recently this study will conduct and observe the cost effect in the supply chain created by fibre prices. The comparison will focus on how cotton at different price tags theoretical implicates through the manufacturing stages. It will also notice how substitutes compare to cotton.

5.1 The mark-up pricing used in the textile supply chain

As described in previous chapters the manufacturing chain in textiles has many stages, often with different companies involved in the special processes. How much profit each company make in their stage varies a lot from companies, country and the specific product. It exists mainly to markup methods; first one is standard markup which multiplies the actual cost with a fixed number. The other one is the market markup where the seller markup the product to the price the buyer is willing to pay. At the retail stage market price is generally used (Hedén & McAndrew, 2005, p.203-204).

Looking at Birnbaums (2005a) cost breakdown of a standard cotton shirt sold in U.S reveals some numbers. If the price of the complete garment FOB (Free on Board), quotas excluded, is 5 \$, then the fabric cost constitutes 3 \$ and 2 \$ makes up of cut, make and trim processes. The retail price for this item will eventually be over 4 times higher than the finished garment FOB cost. To understand how the raw material price effect cost wise we have move upstream beyond the fabric cost. If 1 kg cotton cost 1,2 \$, 1 kg cotton yarn of the same quality will be 2,75 \$ and 1 kg fabric would end up at 3,75 \$ (McNamara, 2008). The percent of yarn cost in cotton fabric is confirmed to be around 70 % by Colourage (2010). Converted to markup numbers this gives:

- Fibre to yarn 2,29 markup
- Yarn to fabric 1,36 markup

How the cost of a complete garment at the FOB stage split between fabric cost and manufacturing cost depends. Some garments use up more labor time with more complicated tasks. Lighter weight garment use less raw material while might still need the same manufacturing cost (Devine & Plastina, 2011). However one heuristic rule seem to be the breakdown with 60 % fabric cost and 40 % represented by cut, make and trim costs (Birnbaum, 2005; Hedén & McAndrew, 2005 p.214; Vigneswaran, 2009). Notice that the cut, make and trim costs are not only the salary of the labor. It includes fixed costs such as machinery, management cost and profit. How the finished garment FOB cost transfers to retail price range a lot wider, consider a shirt from a luxury brand or at discount shop. For typical priced ready-to-wear garments the markup from finished garment to retail is around 4-4,5 (Hedén & McAndrew, 2005, p.215; Landon). However this comparison will focus on the stages from fibre to finished garment FOB using mentioned markup numbers.

The comparison will be made on 3 typical cotton garments; t-shirt, woven shirt and a pair of jeans. Because there is a waste factor all along the manufacturing stages these garment can not just be weighted as finished goods. It has to be converted to how much raw material necessary at the start. The U.S Cotton Inc. has collected data from retail and converted it to estimated cotton needed for the garment (Devine & Plastina, 2011) and those numbers are used in this study. The estimated fibre consumption required for the garments are as shown below.

T-shirt	0,41 lbs
Woven Shirt	0,5 lbs
Jeans	1,92 lbs

5.2 Cotton fibre cost effect, scenario 1-3

Cottons raw fibre prices are used as following:

- Scenario 1. Historical average 0,62 \$/lbs (www.tradingeconomics.com, 2011)
- Scenario 2. Current price 1,97 \$ /lbs (The Fibre Price Sheet, WWD, March 2011)
- Scenario 3. Predicted price for next season 1,53 \$ /lbs (Plastina, 2011)

The examples will use a fixed cut, make and trim cost because it should not be 100% correlated to the fibre and fabric cost fluctuations. Therefore the thumb rule of 60 % fabric cost and 40 % cut, make and trim cost will be used calculated from the cotton price average of 0,62 \$ /lbs. Otherwise a doubled cotton price would bring a doubled cut, make and trim price per se.

Fixed cut, make and trim prices used are:

- T-shirt cut – 0,53 \$
- Woven shirt – 0,64 \$
- Jeans – 2,47 \$

Scenario 1 – 0,62 \$ /lbs cotton

T-shirt 100 % cotton

Fabric cost $0,62 \$ * 0,41 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} = 0,79 \$$

Cut, make, and trim cost $0,79 / 0,6 * 0,4 = 0,53 \$$

Finished garment cost $0,79 / 0,6 = 1,32 \$$

Woven shirt 100 % cotton

Fabric cost $0,62 \$ * 0,5 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} = 0,97 \$$

Cut, make, and trim cost $0,97 / 0,6 * 0,4 = 0,64$ \$
Finished garment cost $0,97 / 0,6 = 1,61$ \$

Jeans 100 % cotton

Fabric cost $0,62$ \$ * $1,92$ lbs * $2,29$ markup * $1,36$ markup = **3,71** \$

Cut, make, and trim cost $3,71 / 0,6 * 0,4 = 2,47$ \$

Finished garment cost $3,71 / 0,6 = 6,18$ \$

Scenario 2 - 1,97 \$ /lbs cotton

T-shirt 100 % cotton

Fabric cost $1,97$ \$ * $0,41$ lbs * $2,29$ markup * $1,36$ markup = **2,51** \$

Cut, make, and trim cost $0,53$ \$

Finished garment cost $2,51 + 0,53 = 3,04$ \$

Woven shirt 100 % cotton

Fabric cost $1,97$ \$ * $0,5$ lbs * $2,29$ markup * $1,36$ markup = **3,07** \$

Cut, make, and trim cost $0,64$ \$

Finished garment cost $3,07 + 0,64 = 3,71$ \$

Jeans 100 % cotton

Fabric cost $1,97$ \$ * $1,92$ lbs * $2,29$ markup * $1,36$ markup = **11,77** \$

Cut, make, trim cost \$ $2,47$

Finished garment cost $11,77 + 2,47 = 14,24$ \$

Scenario 3 – 1,53 \$ /lbs cotton

T-shirt 100 % cotton

Fabric cost $1,53$ \$ * $0,41$ lbs * $2,29$ markup * $1,36$ markup = **1,95** \$

Cut, make, and trim cost $0,53$ \$

Finished garment cost $1,95 + 0,53 = 2,48$ \$

Woven shirt 100 % cotton

Fabric cost $1,53$ \$ * $0,5$ lbs * $2,29$ markup * $1,36$ markup = **2,38** \$

Cut, make, and trim cost $0,64$ \$

Finished garment cost $2,38 + 0,64 = 3,02$ \$

Jeans 100 % cotton

Fabric cost $1,53$ \$ * $1,92$ lbs * $2,29$ markup * $1,36$ markup = **9,15** \$

Cut, make, trim cost $2,47$ \$

Finished garment cost $9,15 + 2,47 = 11,62$ \$

5.3 Polyester, Viscose and Cotton mix cost effect, scenario 4-8

To study the cost of alternative fibre sources these scenarios will look at 100 % polyester and 100 % viscose fibres and blending with cotton. The fibre prices used are:

- Current polyester staple fibre price 0,99 \$ /lbs (The Fibre Price Sheet, WWD, March 2011)
- Current viscose staple fibre price, 1,95 \$ /lbs (Price Watch Report, YNFX, March 2011)

Scenario 4 - Polyester 0,99 \$ /lbs

T-shirt 100 % polyester

Fabric cost 0,99 \$ * 0,41 lbs * 2,29 markup * 1,36 markup = **1,26 \$**

Cut, make, trim cost 0,53 \$

Finished garment cost 1,26 + 0,53 = **1,79 \$**

Woven shirt 100 % polyester

Fabric cost 0,99 \$ * 0,5 lbs * 2,29 markup * 1,36 markup = **1,54 \$**

Cut, make, trim cost 0,64 \$

Finished garment cost 1,54 + 0,64 = **2,18 \$**

Jeans 100 % polyester

Fabric cost 0,99 \$ * 1,92 lbs * 2,29 markup * 1,36 markup = **5,92 \$**

Cut, make, trim cost 2,47 \$

Finished garment cost 5,92 + 2,47 = **8,39 \$**

Scenario 5 - Viscose 1,95 \$ /lbs

T-shirt 100 % viscose

Fabric cost 1,95 \$ * 0,41 lbs * 2,29 markup * 1,36 markup = **2,49 \$**

Cut, make, trim cost 0,53 \$

Finished garment cost 2,49 + 0,53 = **3,2 \$**

Woven shirt 100 % viscose

Fabric cost 1,95 \$ * 0,5 lbs * 2,29 markup * 1,36 markup = **3,04 \$**

Cut, make, trim cost 0,64 \$

Finished garment cost 3,04 + 0,64 = **3,68 \$**

Jeans 100 % viscose

Fabric cost 1,95 \$ * 1,92 lbs * 2,29 markup * 1,36 markup = **11,66 \$**

Cut, make, trim cost 2,47 \$

Finished garment cost 11,66 + 2,47 = **14,13 \$**

Scenario 6 – Polyester 50% Cotton 50%

T-shirt 50 % polyester 50% cotton

Polyester fabric cost 0,99 \$ * 0,41 lbs * 2,29 markup * 1,36 markup * 0,5 = 0,63 \$

Cotton fabric cost 1,53 \$ * 0,41 lbs * 2,29 markup * 1,36 markup * 0,5 = 0,98 \$

Fabric cost 0,63 + 0,98 = **1,61 \$**

Cut, make, trim cost 0,53 \$

Finished garment cost 1,61 + 0,53 = **2,14 \$**

Woven shirt 50 % polyester 50% cotton

Polyester fabric cost $0,99 \$ * 0,5 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 0,77 \$$

Cotton fabric cost $1,53 \$ * 0,5 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 1,19 \$$

Fabric cost $0,77 + 1,19 = \mathbf{1,96 \$}$

Cut, make, trim cost $0,64 \$$

Finished garment cost $1,96 + 0,64 = \mathbf{2,6 \$}$

Jeans 50 % polyester 50% cotton

Polyester fabric cost $0,99 \$ * 1,92 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 2,96 \$$

Cotton fabric cost $1,53 \$ * 1,92 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 4,57$

Fabric cost $\mathbf{7,53 \$}$

Cut, make, trim cost $2,47 \$$

Finished garment cost $7,53 + 2,47 = \mathbf{10 \$}$

Scenario 7 – Viscose 50 %, Cotton 50 %

T-shirt 50 % viscose 50% cotton

Viscose fabric cost $1,95 \$ * 0,41 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 1,24 \$$

Cotton fabric cost $1,53 \$ * 0,41 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 0,98 \$$

Fabric cost $1,24 + 0,98 = \mathbf{2,22 \$}$

Cut, make, trim cost $0,53 \$$

Finished garment cost $2,22 + 0,53 = \mathbf{2,75 \$}$

Woven shirt 50 % viscose 50% cotton

Viscose fabric cost $1,95 \$ * 0,5 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 1,52 \$$

Cotton fabric cost $1,53 \$ * 0,5 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 1,19 \$$

Fabric cost $1,52 + 1,19 = \mathbf{2,71 \$}$

Cut, make, trim cost $0,64 \$$

Finished garment cost $2,71 + 0,64 = \mathbf{3,35 \$}$

Jeans 50 % viscose 50% cotton

Viscose fabric cost $1,95 \$ * 1,92 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 5,8 \$$

Cotton fabric cost $1,53 \$ * 1,92 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 4,57$

Fabric cost $5,8 + 4,57 = \mathbf{10,4 \$}$

Cut, make, trim cost $2,47 \$$

Finished garment cost $10,4 + 2,47 = \mathbf{12,87 \$}$

Scenario 8 – Viscose 50 %, Polyester 50 %

T-shirt 50 % viscose 50% polyester

Viscose fabric cost $1,95 \$ * 0,41 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 1,24 \$$

Polyester fabric cost $0,99 \$ * 0,41 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 0,63 \$$

Fabric cost $1,24 + 0,63 = \mathbf{1,87 \$}$

Cut, make, trim cost $0,53 \$$

Finished garment cost $1,87 + 0,53 = \mathbf{2,4 \$}$

Woven shirt 50 % viscose 50% polyester

Viscose fabric cost $1,95 \$ * 0,5 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 1,52 \$$
 Polyester fabric cost $0,99 \$ * 0,5 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 0,77 \$$
 Fabric cost $1,52 + 0,77 = \mathbf{2,29 \$}$
 Cut, make, trim cost $0,64 \$$
 Finished garment cost $2,29 + 0,64 = \mathbf{2,93 \$}$

Jeans 50 % viscose 50% polyester

Viscose fabric cost $1,95 \$ * 1,92 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 5,8 \$$
 Polyester fabric cost $0,99 \$ * 1,92 \text{ lbs} * 2,29 \text{ markup} * 1,36 \text{ markup} * 0,5 = 2,96 \$$
 Fabric cost $5,8 + 2,96 = \mathbf{8,76 \$}$
 Cut, make, trim cost $2,47 \$$
 Finished garment cost $8,76 + 2,47 = \mathbf{11,23 \$}$

5.4 Result and compared costs

These cost simulations reveal a cost effect derived from the fibre price. The 100 % cotton t-shirt has a finished cost at 1,32 \$, using the average cotton price of 0,62 \$ /lbs. By changing cotton cost to current record levels of 1,97 \$ /lbs the cost increases to 3,04 \$ for a t-shirt. A 1,72 \$ cost or 230 % increase. Using the forecasted next season cotton price of 1,53 \$ /lbs gives a t-shirt cost of 2,48 \$. The woven shirt summon equal numbers, with a minimum cost at 1,61 \$, current price 3,71 \$ and a projected next season cost at 3,02 \$. The jeans use a lot more fabric than t-shirt or a shirt which makes the cost effect greater. The jeans cost under normal conditions would be 6,18 \$ while the 2011 march cost rush to 14,24 \$. The upcoming season estimates a jeans cost of 11,62 \$.

At current fibre price levels, using viscose instead of cotton would give a minor cost advantage, while next season cotton again should be the cheaper one. In terms of cost polyester offers a great advantage against cotton both today and next season. For example the 100 % polyester shirt costs 2,18 \$ compared to the cotton shirt at 3,71 \$, or a approximated 3,02 \$ next season. A blend of 50 % cotton, at next years predicted price, and 50 % polyester would land a shirt cost at 2,6 \$. The 50/50 viscose/polyester mix t-shirt at 2,4 \$ gives under current cost circumstances an advantage against a cotton t-shirt at 3,04 \$. Next season the suggested cost improvement would be less. The cotton/polyester 50/50 blend in jeans would still offer a cost improvement next season with a price tag at 10 \$, comparable to 11,62 \$ for a 100 % cotton fabric.

6. Analysis

6.1 Cost effect analysis

All calculations indicate a cost effect on the finished garment derived from a more expensive fabric in the manufacturing as a consequent of a higher raw material price. The outcome is dependent on how much raw fibre that is required for the garment. A heavier garment is more affected than a lighter one. The cost effect is great in proportional numbers when the fibre price difference is even greater. Seen in actual money the effect looks a little more modest. Besides this papers approximations several companies such as VF Corporation, H&M and Topeco has acknowledge cost increases spring from higher cotton price. It supports the view of a cost effect.

The cost calculations performed are estimated until the point of a finished garment at the distribution gate. As mentioned previously, how much the garment will cost the end consumer in shop depend greatly. If we assume the garments are typical ready-to-wear bought in by a wholesaler who distributes it to retail shops we could get an idea of a reasonable retail price. From the state of a finished garment FOB to the retailer the aggregated mark up number are commonly 4,5 or 4 (Hedén & McAndrew, 2005, p.215; Landon). How the cost increases are transmitted here can be viewed from different perspectives. Either you could multiply the cost changes and get unrealistic price changes at the retail stage. More realistic is to see the actual cost increase in money at the manufacturing stage and see how it could be compensated. It would mean lower mark-ups and consequently lower gross margins; a higher product cost with the same retail price. Another possibility is to add the isolated cost increase from the manufacturing to the retail price. Hence this could mean the same actual profit of a garment in terms of cash, but lower mark-ups and margins. Consider this simplified example without freights, VAT and other possible taxes.

With the performed cost estimations a typical pair of jeans of the normal 0,62 \$/lbs cotton price will cost the buying company 6,18 \$. With the forecasted price of 1,53 \$/lbs next season they will cost 11,62 \$. Assuming the buying company uses a mark-up factor of 4 from the finished garment stage then the first jeans will end up in store at 24,7 \$, with a contribution profit of 18,54 \$ (24,7 \$ price - 6,18 \$ direct cost). The same mark-up for the second pair would result in a retail price of 46,48 \$ with a contribution profit of 35,23 \$. It is doubtful customers will accept this vast price increase for the same product. If the buying company instead would accept the contribution profit of 18,54 \$ per jeans, the price effect would not react exponential. The second pair would end up at 30 \$ (11,62 \$ direct cost + 18,54 \$ contribution profit). It would mean a 22 % retail price increase instead of 88 %. The same principal might be applied in the fibre to fabric process instead of a fixed mark-up percent which results in exponential increases when the starting cost is higher. Although the mark-up numbers in the manufacturing stages is not as high as in retail and the value lower, therefore it would not have the same major effect while still contributing. If applied, the retail price increase would not be as high as 22 %, more likely in around the mid-teens. Such price increase is in line

with the confirmed 20 % of Topeco, and not far from the rough approximations from Toftegaard and Bresky at 5-20 %. It is also very similar to VF Corporations estimation of a 15% raise for their jeans. The resemblances make it reasonable to believe this is how the cost effect of cotton is converted through the value chain, at least in some segments.

6.1.1 Implications for return on investment

Assuming the cost transfers as described in chapter 6.1 and that customer would accept that 15% somewhat price increase. It would give the companies equal contribution profits during a higher cotton cost, but it would have negative implications by a lower return on investment. It would take more money, because of higher costs, to make the same profit which lowers the return on investment interest. While a lower return on investment might tick some speculators off, the company should be ok in a short-term when making the same money. Although if the situation remains, basically if the higher cotton prices linger, the lowered return on investment would make the business less attractive to invest in. Such an effect could be harmful to the textile industry. That is one reason why it is important to consider if the price levels are temporary high or closer to a new normal. If all companies in the textile value chain uses their normal mark-up numbers regardless of the cotton fibre price, the return on investment would not be affected. That is because a higher cost then transfers into a higher profit in the same proportion.

6.2 Cotton market analysis

6.2.1 Cotton market demand

All calculation performed strongly signals a substantial cost effect at the finished garment stage coming from the fibre price. It is also evident that the polyester fibre at the moment holds a huge economical advantage. With a price half of the cotton it does bring considerable cost incitements to its benefit. The viscose fibre, usually more expensive than cotton, is at an equal cost. With the forecasted slightly lower cotton prices this fall it might still compete fairly good cost wise. Even a mix of viscose and polyester would by next season not cost more than a 100% cotton garment. These numbers suggests some reaction from the principles of price elastics of demand. The natural reaction would be a reduced cotton demand because of substitutes available at lower prices. Such an effect is very likely to occur. Isolated it would bring the price of cotton down as the tendency of the market mechanism. In the more complex reality it will only have a relative effect on the demand as well as the price. That is because other factors also have to be regarded. Growing population would automatic feed the demand. Economic growth would probably cause higher textile fibre consumption.

According to the U.N. research the population is expected to grow at a level around 50-70 million people a year the coming decades. It equals the same number of brand new cotton and textile fibre consumers each year. These groups will push the demand for

cotton mostly by basic needs as the majority of population growth will take place in developing countries. Along with the actual increase in humans with basic needs is the size of the global middle class. In rapidly growing countries such as India and China the development is projected to result in a higher GDP per capita and a larger middle class. As revealed in previous chapters cotton consumption is much correlated to the income. This should result in a higher demand of cotton as well. Although the positive GDP development to a large extent is driven by China and India, the global economy is expected to grow over 3,5% yearly the following 5 years and thereafter around 3,2%. Thus the demand of cotton will be fed from all over the world. A lot of countries are underway to entering the GDP per capita level around 15 000 \$ where they tend to switch to preferring cotton. So the actual demand situation in the cotton market seems to be a lowered cotton demand because of the price elasticity of demand but concurrently a cotton demand boosted by population and GDP growth.

6.2.2 Cotton market supply

As for the supply part of cotton the risen price should make the supply quantity larger according to supply curve theory. This may match reality as a higher cotton price gives farmers incentives to expand their farm land. Most of world's cotton fields only give one harvest a year and that is why the effect of such an adjustment is not instant. It should also be the reason for cottons low short-term (less than a year) supply elasticity at approximately 0,3 while the long-term (more than a year) is at 1.0. This explains why the supply of cotton has not yet reacted to the prices, and therefore let the price run more free short-term. The long-term elasticity of supply at 1.0 suggest farmers because of the price would increase their farm land of which supply effect we could see already this fall, over a year since the price increase started. Such supply effect is backed up by the estimations of a record harvest the coming season done by Cotton Inc. The market mechanism would expect a lower price by then. However the price lowering might not be that large since other competing crops also have become more expensive and by that more attractive to grow.

The market situation of cotton supply beyond this fall and the next several years could be more intriguing. There is a limited land area suited for cotton farming. These areas are competing with especially food crops. The food crops might be more needed because a larger population to feed. Although according to the scarcity theory, the resource which is scarce, in this case farm land, will be used to the most valuable task. If growing cotton gives farm land owners profit advantages against other usage, it should mean cotton is what they will grow. Besides competing to keep the same acres, it looks pessimistic to hope for a significant increase in cotton acres to expand the supply. It would be first time in many decades. A larger supply relies therefore on higher yields. While it is hard to predict the progress in farm technology genetic modified cotton seems to be what could make a difference. A possible change in the cotton market to a situation where cotton substitutes have better competitiveness of some reason would have consequences for the farm land. Cotton farm lands relative scarcity would decrease because of the alternatives and more valuable crops would be grown. Furthermore the

projected limited cotton supply would imply the growth of textile consumption to rely on other fibres.

6.3 Implication on purchasing

As presented cotton have a various range of uses. Some products will be easier to find appropriate substitutes for while others will have more trouble. While cotton for most time been steady in its supply and prices, companies have had a low supply risk and the opportunity to treat cotton as a leverage item. Companies who sell products for which there are no good fibre substitute might reevaluate their purchasing strategy if the relative cotton scarcity continues. It would increase the supply risk for cotton and possible move it on Kraljic's purchase matrix from a leverage item towards a more strategic one. Such an outcome would imply more bargaining power to the supplier. Although it could not be fully adapted as a strategic item because it will be multiple sources available.

7. Discussion

To understand how the cotton market may develop under the market mechanism the supply and demand forces must be balanced against each other. The demand should be a little diminished by the elasticity of demand and as seen in this paper companies do look for and use alternative fibre sources. How strong this effect is depends on the cotton price and the adequacy of the alternatives. The empowering forces of cotton demand consisted of economic and population growth. These forces looks superior as cotton still is the main selection in general despite great cost disadvantage. The cotton supply will probably grow, but due to land constraints and competition from other crops, not in pace to match the demand. This demand and supply situation hints that the equilibrium point could move to a higher normal market clearing price. A higher normal price has also been supported by the opinions of persons in the industry throughout this paper.

A significant higher cotton price will have several implications within the industry short and long term. Short term this will affect the costs of textile companies. Companies buying finished garments will probably try to pressure yarn and fabrics manufacturers to not use standard mark-ups resulting in exponential price increases. In other words, they suggest margins to be lowered upstream in the value chain. The pressure would likely be delivered from the garment manufacturer with which the buying companies should have hard price negotiations. Especially large companies would be prone to try to leverage their bargaining power. The outcome of this will effect how much customer prices have to be raised. To what extend companies can find less expensive fibre blending accepted by customers will also be a factor. The x-factor might be how customers react to price increases. If they do not accept raises then the short term adjustment of the industry will be more severe.

On a longer perspective the higher standard price would benefit cotton substitutes and the development of new fibres. Regarding the substitutes viscose, polyester and cottonized flax all possess a better growth potential than cotton. Cotton has traditionally had around a 1:1 price ratio with polyester. Now when the price ratio is rather 1:2 cottons competitiveness against polyester will be put to the test. Polyester can increase supply quickly as long as it can compete pricewise for oil. A higher cotton price makes polyester more tolerant to higher oil prices. Flax has the upside that it can be cultivated in areas with less competition than cotton farm land suffers. This makes it possible to increase the acres and with a development in the cottonization process it could gain market shares from costly cotton. Viscose is already in an ascending trend, growing 11% only during 09/10. The raw material comes from wood, which in contrast to cotton could be grown all around the planet. It presents a good opportunity for continued growth. Altogether this points toward a movement where these fibres take advantage of the tight demand and supply situation for cotton. Besides existing fibre substitutes the cotton market offers great incentives to the research of new fibres with properties resembling cottons. A potential new fibre similar to cotton with a comparable or lower cost would have good chances to success in the current market situation.

8. Conclusion

- The cotton fibre price has effect on the costs for companies in the textile value chain.

How great its effects depends on the perspective used and how the value chain transmits the increase from the starting point. In terms of cash relative to retail price the effect is not overwhelming. Seen as the proportional increase of fabric cost, the price effect is significant.

- To maintain gross margins retail prices will in some cases have to be raised

The increased cost is likely to be beard partly by higher retail prices. Otherwise companies gross margin will take all the hit. Just how much prices need to be raised depends on the type of garment and the company strategy. Garments where a larger share of the total production cost is made up by cotton fabric cost are more affected. It will also depend on the customer reaction.

- Lower return on investment is supposable

The lower return on investment is caused by higher costs and lower margins which are suggested to happen as a reaction to higher cotton prices. To what extent the return on investment is affected depends on the degree of possible higher retail prices. It is also ruled by how the cotton cost increases transmits through the value chain.

- A higher normal cotton price is likely

The future is expected to hold a higher normal cotton price compared to the normal price of 0,62 \$. This is because the reasonable projected cotton supply would not be able to answer to the proposed higher demand. The market clearing price would therefore be higher.

- A tight cotton market might affect the power balance of purchasing

As the supply risk of cotton seems to be higher due to relative shortage the buyers bargaining power might decrease.

- Substitute fibres will benefit along with new fibres

All substitute fibres to cotton will benefit from the high prices. Especially substitute fibres with the potential to grow in production could take shares from the cotton market. New fibre development will get incitements from the cotton market situation. Possible new fibres could easier be successful under these circumstances.

- Future enlargement of the textile consumption can not be carried by cotton

As the cotton supply is limited by farm land a larger production would come from higher yields. If and how much higher the yields can get is unknown but it certainly has a limit. Consequently the textile market growth will mainly be carried out by other textile fibres.

8.1 Further research

Textile business nature of long lead times makes retail price changes lag up to over a year after fibre prices change. Therefore a follow up study from a retail perspective would be suitable sometime fall/winter 2011. It might have the opportunity to observe how possible retail price increases affect customers. Such a study may come to conclusions about what kind of strategy buying textile companies and retailers should use to adjust to a higher cotton price.

The opportunity of a greater cotton production seems to be determined by potential yield increases. A study about the possibilities of a higher cotton yield should be very interesting and useful. There is also plenty gap of knowledge about cotton substitutes. Further research could be conducted both from a customer preference perspective as well as an economic. It could also focus on the development of new cotton substitutes.

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Appendix 1. interviews

Questions for e-mail inquiry

- 1. Approximately, how much of the cotton cost increase will transfer to higher prices in retail and/or lower margins?**
- 2. Can historical normal cotton prices around 0,6 \$/lbs also be normal prices in the future?**
- 3. What other fibres or material could benefit from the higher cotton price?**
- 4. Is the so called “peak cotton” when world has reached it production limits nearly?**

Answer sheet 1.

Ola Toftegaard, CEO at TEKÖ, Swedish trade organisation for textile and fashion companies. [2011-05-10]

1. Short-term 5-10 % price increases, similar effect for margins.
2. No, not with the increase in population we see now.
3. Hard to predict but probably an increase of cellulosic based fibres, and in the future an expansion of flax and bamboo.
4. Absolutely

Answer sheet 2.

Erik Bresky, Head of the Swedish Textile School and project manager for research project Smart Textiles. [2011-05-10]

1. You can presume that the share of fabric and manufacturing cost usually never is more than 20 % of the retail price. It is really hard to estimate, but depending on product group maybe 10-20 % price increase.
2. I do not think so. The cotton price will of course continue to fluctuate but I believe the normal price will be higher than previously. One problem last 30 years is the U.S subsidies for raw cotton.
3. In a short-term all the textile fibres gains from a higher price of cotton because it creates higher margins by higher prices on textile fibres. Then fibres with properties similar to cotton will benefit more than others. For example has the price of cellulose derivative, which is used as raw material for viscose and lyocell, four doubled in price.

4. Yes, now or in 5 years time. Considering a larger population, problems with water supply and competition over farm land makes it hard to produce more cotton.



THE SWEDISH SCHOOL
OF TEXTILES
UNIVERSITY OF BORÅS

Visiting adress: Bryggaregatan 17 • Postal adress: 501 90 Borås • Website: www.textilhogskolan