

# Purified Terephthalic Acid Margins Analysis



**Report on PTA Margin Drivers**

**April 20 2011**



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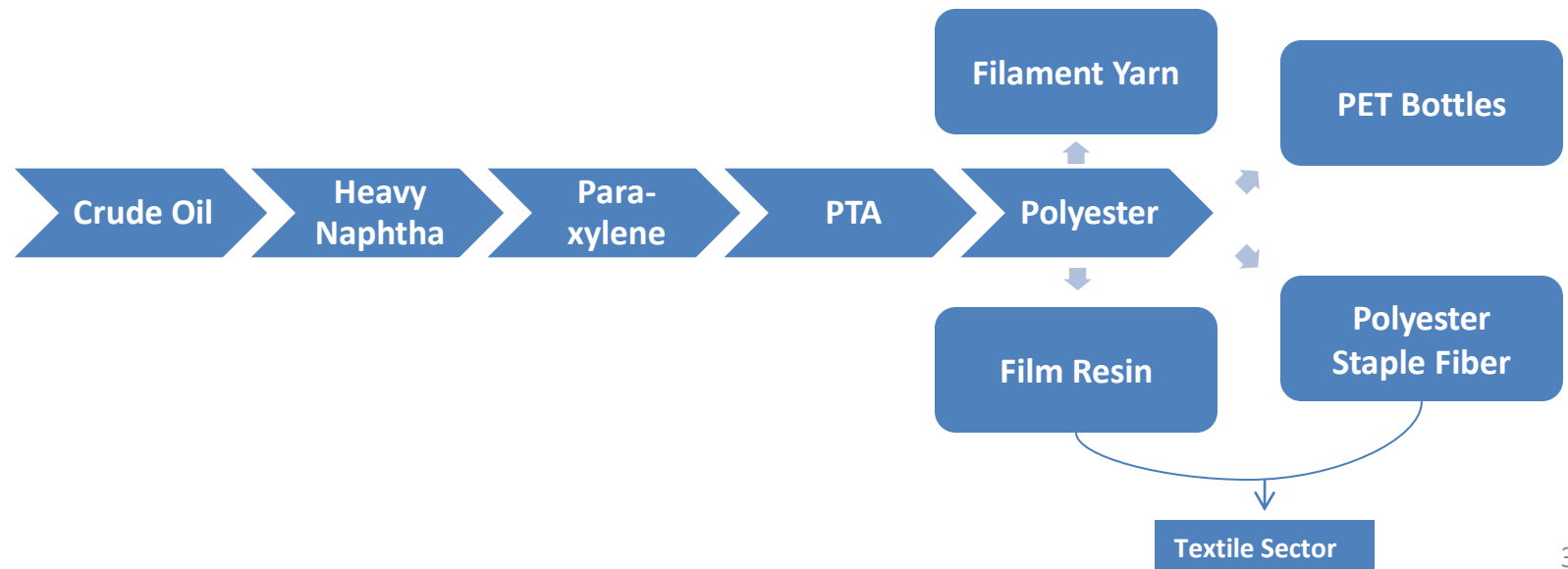
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## Introduction to PTA Value Chain

- Crude oil lies at the top of the PTA value chain , used as the main input for these petro based chemicals
- Px is used as the feed stock for PTA manufacturing which in turn is used for manufacturing of Polyester
- Polyester is used for manufacturing PSF, PET , Yarn etc
- PSF is primarily used as an input in the textile industry, typically PSF is utilized in conjunction of cotton thereby acting as a complementary product to cotton, however in extraordinary circumstances it might behave as a substitute for cotton e.g. high cotton prices



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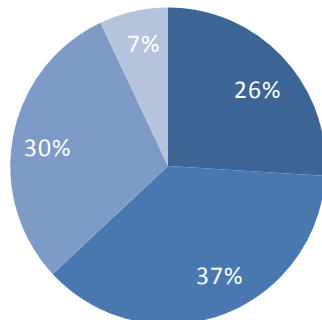
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# PTA downstream Value Chain & Consumption Pattern

## International Polyester Consumption Pattern

- Internationally polyester is primarily used for the production of filament yarn i.e. 37%
- 30% of polyester is converted into PSF
- 7% of polyester is consumed for production of Film /Resin
- Internationally 67% of polyester consumption is in textile sector

International Polyester Consumption Pattern

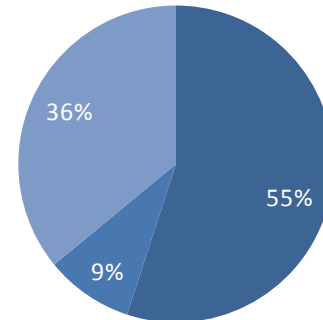


■ PSF ■ Filament Yarn ■ PET ■ Film / Resin

## Pakistan's Polyester Consumption Pattern

- Pakistan differs from international consumption pattern in the respect that 55% of polyester is used for production of PSF
- 36% of polyester is converted into PET
- Pakistan does not utilize polyester for manufacturing of Films / Resin
- 63% of polyester is consumed in textile sector

Pakistan's Polyester Consumption Pattern



■ PSF ■ Filament Yarn ■ PET ■ Film / Resin

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## PTA Margins

- PTA margin is a function of PTA cost and revenue drivers, in order to predict PTA margins we must first understand the factors affecting PTA prices and PTA manufacturing costs
- PTA prices depends on demand and supply of PTA similar to other commodities, supply is fixed however demand for PTA is positively effected by cotton prices
- PTA price is function of
  - cotton prices
  - PSF margins
  - Spinning margins
- Primary revenue driver for PTA is cotton, provided that PTA is used as the feed stock for PSF production that acts as a substitute of cotton
- In wake of rising cotton prices demand for PTA becomes relatively inelastic as clothing is a necessity therefore increasing cotton prices increases the PSF prices making cotton prices relatively more elastic
- PTA utilizes Px as the feed stock that in turn uses heavy Naphtha as the feed stock which is a derivative of crude oil, therefore major PTA cost driver is crude oil prices
- PTA cost is function of
  - crude oil price
  - Heavy Naphtha margins
  - Px margins

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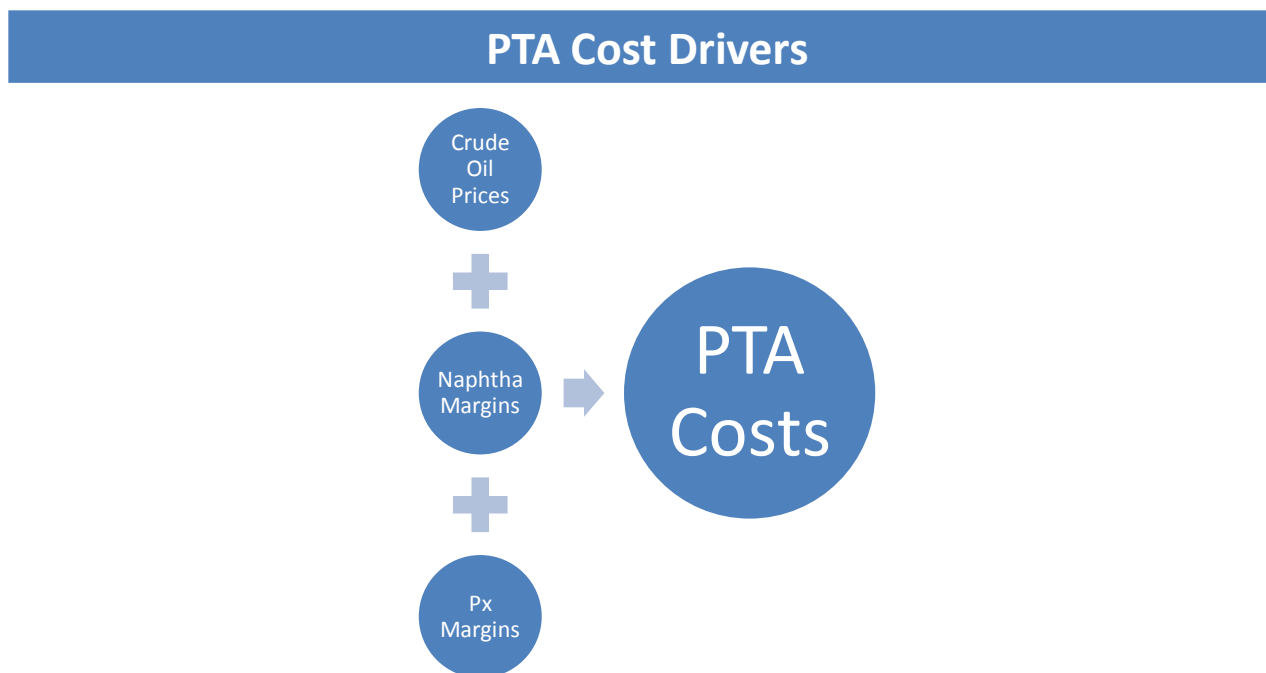
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## PTA Cost Drivers

- Crude oil is a PTA cost driver, a macroeconomic variable that can be predicted accurately to a reasonable extent
- Analysts consensus estimates are available for crude oil prices, however PTA cost is not solely dependent upon crude oil prices, it is also dependent upon Px and heavy Naphtha margins
- The most important cost driver for PTA is Px margins, that is whether Px manufacturers are able to transfer Naphtha price hikes on to PTA manufacturers or not



# PTA Cost Drivers: Naphtha Margins

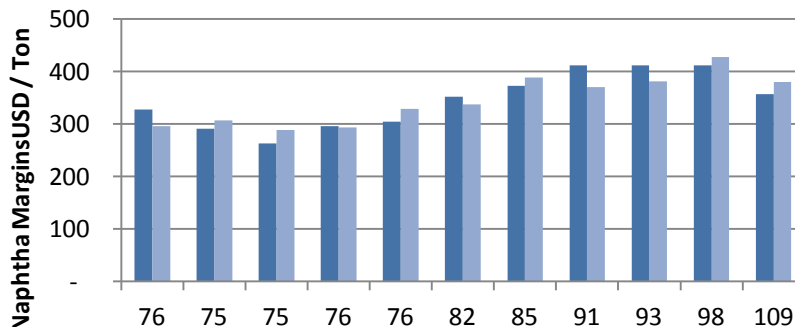
- Naphtha margin is function of crude oil prices and cotton prices
- Naphtha margins were regressed against crude oil prices and cotton prices
- To calculate Naphtha Margins it was assumed that 5 barrels of crude oil are required to produce 1 MT of Naphtha
- Regression results are shown below, according to regression results for 1 USD increase in crude oil / barrel margins decrease by 8.21 USD
- Sensitivity factor of 2.55 with cotton price indicates that for 1 US cent / Pound increase in cotton price Naphtha margins increase by 2.55 USD / Ton

$$\text{Naphtha Margin} = 685.87 - 8.21 * (\text{crude Oil Price}) + 2.55 * (\text{Cotton Price})$$

R Square = 0.77

➔ Coefficient of determination of 0.76 indicates that regression is statistically reliable

**Naphtha Margins Line Fit Plot with Crude Oil Prices as Independent Variable**

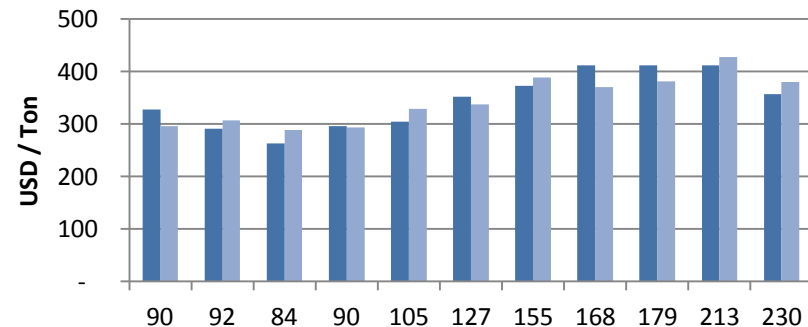


Source: fibre2fashion.com

Crude Oil Price USD / Barrel

■ Actual Naphtha Margins    ■ Predicted Naphtha Margins

**Naphtha Margins Line Fit Plot with Cotton Prices as Independent Variable**



Source: fibre2fashion.com

Cotton Price US cents / Pound

■ Actual Naphtha Margins    ■ Predicted Naphtha Margins

## PTA Cost Drivers: Px Margins

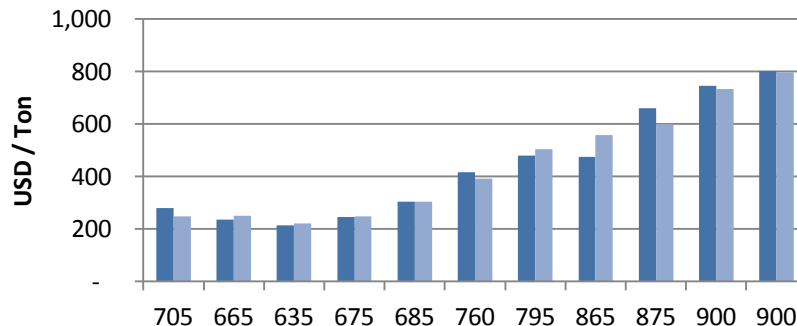
- Px margins is a function of Naphtha and Cotton Prices, therefore PX margins were regressed against Naphtha prices and cotton prices
- Px margins were regressed against Naphtha prices and PTA prices
- To calculate Px margins it was assumed 1 MT of Naphtha is utilized to manufacture 1 MT of Px
- Regression results are depicted below, according to regression results for 1 USD increase in Naphtha price Px margins increase by 0.05 USD / Ton
- Sensitivity factor of 3.85 indicates that 1 USD increase in Cotton Prices increase Px margins by USD 3.85, which means Px margins are strongly correlated with cotton Price

$$\text{Px Margin} = -139.09 + 0.05 * (\text{Naphtha Price}) + 3.85 * (\text{Cotton Price})$$

R Square = 0.97

➤ Coefficient of determination of 0.98 indicates that regression is statistically reliable

**Px Margin Line Fit Plot with Naphtha Prices as Independent Variable**

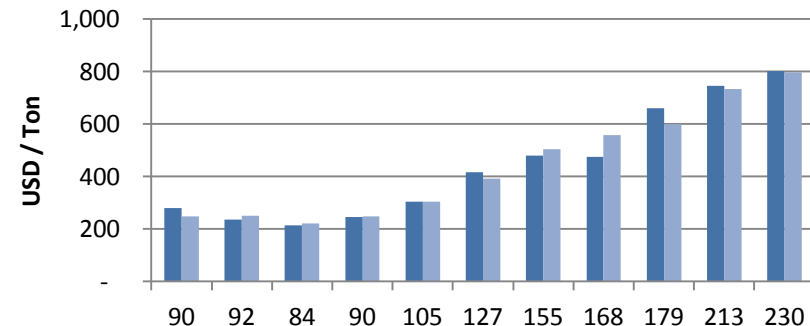


Source: fibre2fashion.com

Naphtha Price USD / Ton

■ Actual Px Margins ■ Predicted Px Margins

**Px Margin Line Fit Plot with Cotton Prices as Independent Variable**



Source: fibre2fashion.com

Cotton Price US Cent / Pound

■ Actual Px Margins ■ Predicted Px Margins

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## PTA Revenue Drivers

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- PTA revenue drivers include
  - cotton prices
  - PSF margins
  - Spinning margins
- PSF demand is directly related to cotton prices as PSF is a substitute of cotton used by the spinning industry
- Higher cotton prices results in higher PSF demand, that may result in either higher PSF margins or higher PTA prices, depending upon the bargaining power of PTA and PSF manufacturers
- Higher bargaining power is a function of demand and supply gap
- Higher demand supply gap for PSF as compared to PTA results in higher PSF margins or conversely it results into higher PTA prices

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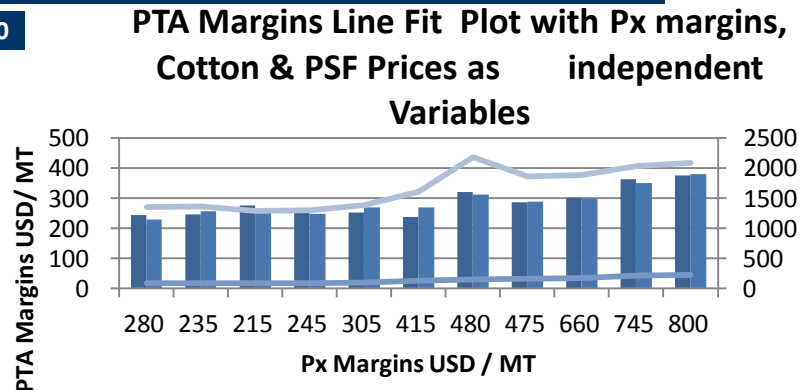
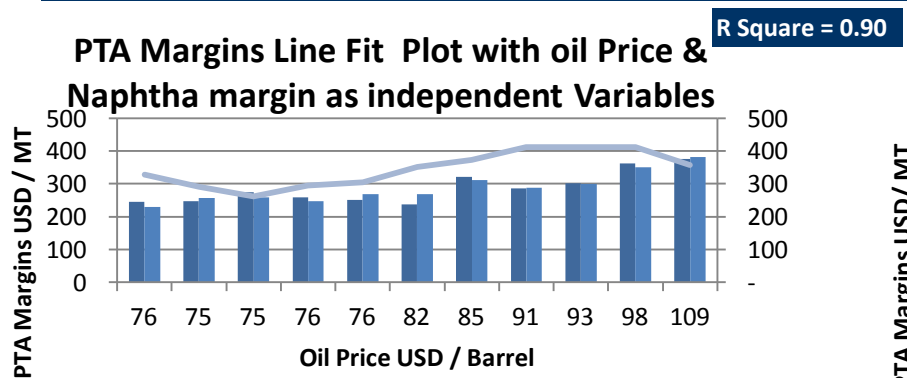
PTA Revenue Drivers

**Regression Output**

# Regression output

- PTA margin is a function of Crude oil prices, Naphtha margins, Px margin, cotton prices, spinning margins and PSF margins
- PTA margins were regressed against crude oil prices, Naphtha margins, Px margins, cotton prices and PSF prices
- The reason for taking Naphtha and Px margins is that crude oil is the primary input in the PTA value chain rest is only value addition to the primary input
- Regression results are depicted below, according to regression results for 1 USD / barrel increase in crude oil price PTA margins decline by USD 2.89
- Naphtha and Px margins also decline PTA margins, for 1 USD / MT increase in Naphtha and Px margins respectively PTA margins decline by USD 0.58 and 0.01 USD respectively
- Relationship of cotton prices with PTA is noteworthy, for 1 US cent / lb increase in cotton prices PTA margins increase by 1.57 USD / MT
- Increase in PSF prices increase PTA margins by a small amount, for 1 USD / MT increase in PSF prices PTA margins only increase by 3 US cents / MT indicating that value addition is captured mostly by PSF manufacturers in form of increased PSF margins

$$\text{PTA Margin} = 400.44 - 2.23 * (\text{crude Oil Price}) - 0.01 * (\text{Px Margin}) - 0.58 * (\text{Naphtha Margin}) + 1.57 * (\text{Cotton Price}) + 0.03 * (\text{PSF Price})$$



Source: fibre2fashion.com

■ Actual PTA margins    ■ Predicted PTA Margins  
— Naphtha Margins

Source: fibre2fashion.com

■ Actual PTA margins    ■ Predicted PTA Margins  
— Cotton Prices    — PSF Prices

# Regression output: Scenario Analysis

- The interesting thing to note is as crude oil prices increase PTA margin increases although PTA margins are negatively related to crude oil prices, the reason is as crude oil prices increase Naphtha margins decline and PTA margins are negatively related to Naphtha margins
- Naphtha margins are negatively related to crude oil prices, the reason is that Naphtha is a byproduct of crude, lower demand for POL products results in lower crude prices and lower capacity utilization of refineries that results in lower Naphtha production
- Lower Naphtha production results in higher Naphtha prices and margins, 1 USD / barrel increase results in 8.21 USD / Ton decrease in Naphtha margins and 1 USD / Ton increase in Naphtha margins decreases PTA margins by 0.58 USD / Ton, therefore 1 USD / Barrel increase in crude increase PTA margins by 4.8 USD / Ton indirectly through Naphtha margins
- Therefore the net effect of 1 USD / Barrel increase in crude is 2.5 USD / Ton increase in PTA margins

$$\text{PTA Margin} = 400.44 - 2.23 * (\text{crude Oil Price}) - 0.01 * (\text{Px Margin}) - 0.58 * (\text{Naphtha Margin}) + 1.57 * (\text{Cotton Price}) + 0.03 * (\text{PSF Price})$$

Assumptions	Calculations	Unit	
<b>Base Case Scenario</b>			
Crude Oil Price		USD / Barrel	84
PX Margin	$-139.09 + 0.05 * (\text{Naphtha Price}) + 3.85 * (\text{Cotton Price})$	USD / Ton	435
Naphtha Price	$5 * (\text{Crude Oil Price}) + \text{Naphtha Margin}$	USD / Ton	771
Naphtha Margin	$685.87 - 8.21 * (\text{crude Oil Price}) + 2.55 * (\text{Cotton Price})$	USD / Ton	351
Cotton Price		US cents / pound	139
PSF Price		USD / Ton	1,666
<b>PX Margin Calculated From Regression Equation</b>			<b>274</b>

Assumptions	Calculations	Unit	
<b>Best Case Scenario</b>			
Crude Oil Price		USD / Barrel	126
PX Margin	$-139.09 + 0.05 * (\text{Naphtha Price}) + 3.85 * (\text{Cotton Price})$	USD / Ton	889
Naphtha Price	$5 * (\text{Crude Oil Price}) + \text{Naphtha Margin}$	USD / Ton	932
Naphtha Margin	$685.87 - 8.21 * (\text{crude Oil Price}) + 2.55 * (\text{Cotton Price})$	USD / Ton	302
Cotton Price		US cents / pound	255
PSF Price		USD / Ton	2,000
<b>PX Margin Calculated From Regression Equation</b>			<b>396</b>

Assumptions	Calculations	Unit	
<b>Worse Case Scenario</b>			
Crude Oil Price		USD / Barrel	45
PX Margin	$-139.09 + 0.05 * (\text{Naphtha Price}) + 3.85 * (\text{Cotton Price})$	USD / Ton	226
Naphtha Price	$5 * (\text{Crude Oil Price}) + \text{Naphtha Margin}$	USD / Ton	758
Naphtha Margin	$685.87 - 8.21 * (\text{crude Oil Price}) + 2.55 * (\text{Cotton Price})$	USD / Ton	533
Cotton Price		US cents / pound	85
PSF Price		USD / Ton	1,000
<b>PX Margin Calculated From Regression Equation</b>			<b>152</b>