

IIb. The Energy Commodity Price Index

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in collaboration with the Energy Chamber¹*

The Energy Commodity Price Index (ECPI) is a summary measure of the price movements of Trinidad and Tobago's top ten energy-based commodity exports. Developed in a collaborative effort between the Energy Chamber and the Central Bank, the series is based on export values in 2007 and complements other available price indicators, including of individual commodities and sectoral export price indices prepared by the Central Statistical Office. The ECPI has the advantage of bringing together various, and sometimes divergent, price movements while its weighting structure is a good representation of the current importance of the commodities in Trinidad and Tobago's trade. The ECPI shows the relatively steady upward international price trend in energy-based products between 2009 and early 2008. This was followed by a dramatic plunge in the second half of 2008 and a gradual recovery thereafter. In early 2010, the relative steadiness of the ECPI reflects offsetting movements between the prices of petroleum and natural gas.

I. Introduction

Following the precipitous fall in energy commodity prices during the fourth quarter of 2008 and the extreme volatility which ensued thereafter, the Energy Chamber of Trinidad and Tobago (previously called the South Trinidad Chamber of Industry and Commerce) considered developing a summary indicator of energy prices. This indicator would provide policymakers and the general public with timely information on price trends in the energy sector and help to inform the inferences on variables such as government revenue and foreign exchange receipts.

In February 2009, the Chamber enlisted the assistance of the Central Bank of Trinidad and Tobago. The result of this collaboration, an Energy Commodity Price Index (ECPI) is presented in this note. In broad terms, the ECPI is an average of international commodity prices of key energy exports of Trinidad and Tobago weighted by each commodity's relative share of the value of energy exports. Movements in the index can provide an overall indication of how changes in the relevant international commodity prices could affect Trinidad and Tobago's export earnings or government revenue. The index will be updated monthly and published on the websites of the Energy Chamber, the Ministry of Energy and Energy Industries and the Central Bank of Trinidad and Tobago.²

II. Methodology for the Development of the ECPI

The methodology for developing the index involved the choice of an appropriate statistical method and selection of price data. Since the index would essentially convey price movements of a selected basket of energy commodities, the Laspeyres method was chosen.

A Laspeyres price index is computed by taking the ratio of the total cost of purchasing a specified group of commodities at current prices to the cost of that same group at base-period prices and

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² Details of the data are available from the Central Bank upon request.

multiplying by 100. The base-period index number is thus 100, and periods with higher (lower) price levels have index numbers greater (less) than 100. The distinctive feature of the Laspeyres index is that it uses a group of commodities purchased in the base period as the basis for comparison. In other words, a commodity's relative price (the ratio of the current price to the base-period price) is weighted by the commodity's relative importance to all purchases during the base period.

The formula is as follows:

$$P_t = \frac{\sum p_n q_0}{\sum p_0 q_0}$$

Where p_0 and q_0 are the price and quantities in the base period respectively and p_n is the price in the current period. The result, P_t , is a fraction that is normally multiplied by 100.

A Paasche index was also considered.³ This approach has the advantage that the weights would be updated to reflect how production changes over time. In other words, the latest production data are used to determine the weights. However, gathering monthly production data on a timely basis proved to be a challenge and given that the primary objective of the index is to convey information to the public expeditiously, the Paasche method was not chosen.

Data Sources

Following a review of data on export values from the Central Statistical Office (CSO) and based on the availability of appropriate benchmark prices, it was decided that the Index would comprise the top ten energy commodities in terms of value in 2007 (see Table 1).

Table 1
Top Ten Energy Commodities in Export Values *

1. Liquefied natural gas	6. Motor gasoline
2. Crude oil	7. Natural gasoline
3. Ammonia	8. Jet fuel/Kerosene
4. Methanol	9. Propane
5. Gas oil (Diesel)	10. Urea

* Based on CSO annual data for 2007.

The associated benchmark prices⁴ were obtained from a range of established sources:

- **Liquefied Natural Gas (LNG)** - LNG is benchmarked to the Henry Hub natural gas price given that more than 50 per cent of Trinidad and Tobago's natural gas exports are destined for the United States. These prices were sourced from *Bloomberg*.
- **Crude Oil** - The price for the **West Texas Intermediate (WTI)** grade of crude was used. The quality of this crude, in terms of its API gravity⁵, is fairly similar to that which is exported from Trinidad and Tobago. These prices were also sourced from *Bloomberg*.
- For **ammonia** and **urea**, the **f.o.b. Caribbean** prices were utilized. These prices were sourced from the *Fertilizer Weekly* and the *Green Markets* publications and reflect the cost of Trinidad and Tobago's products loaded at the Point Lisas Port.

³ It should be emphasized that most of the international prices utilized in this exercise are not the actual prices received, but represent the best available proxy. For example, Trinidad and Tobago's earnings from LNG are based on a net-back price and not the Henry Hub. However, the movements in the international prices selected give a very good indication of the movements in the actual prices received by Trinidad and Tobago's exporters.

⁴ Consensus standards for crude quality as developed by the American Petroleum Institute.

- The benchmark price for **methanol** is the **US Gulf Coast Spot Price** which was sourced from the *Chemical Markets Associates, Inc.* in the US
- For several commodities—**gas oil** (diesel), **motor gasoline**, **jet fuel/kerosene** and **propane**—the **US Gulf Coast Import Price**, sourced from the United States *Energy Information Administration* was utilised.
- **Natural gasoline** - The reference price is the **NYMEX Mont Belvieu** natural gasoline price sourced from *Bloomberg*.

III. Construction of the Index

Selection of Weights

Shares in energy export values in 2007 were used as weights for the Index. Since 2000, a considerable amount of capacity was added in the methanol, ammonia and liquefied natural gas industries. The wave of capacity additions came to a climax in early 2006, with the commissioning of Atlantic LNG's Train 4 facility. The introduction of Train 4—which reached optimum production levels in the subsequent year—significantly impacted the energy mix, solidifying natural gas as the main export from Trinidad and Tobago. Consequently, the year 2007 was considered a period that adequately represented the current structure of energy exports from Trinidad and Tobago.

Steps in Constructing the Index

The process of constructing the ECPI (using the Laspeyres method) was undertaken in the following steps:

1. Each commodity was weighted according to its relative contribution to the value of total energy exports of the 10 commodities in 2007. The weights (w) used in the calculation of the ECPI take the form of:

$$w_i = \frac{P_{i0}q_{i0}}{\sum_{i=1}^n P_{i0}q_{i0}}$$

Where p_{i0} q_{i0} is the export value of the i th commodity in the base period (0).

The weights of the commodities are:

Table 2
Weights of the Energy Commodities

Commodity	Percentage of Total Export Values
Liquefied natural gas	40.0 (w_1)
Crude Oil	16.6 (w_2)
Ammonia	11.8
Methanol	9.4
Gas oil/Diesel	7.0
Motor gasoline	4.3
Natural gasoline	3.5
Jet fuel/Kerosene	2.7
Propane	2.4
Urea	2.3 (w_{10})
Total	100.0

- The average (arithmetic) monthly price for each of the 10 commodities was then computed.
- A geometric average of the weighted prices was then computed using the following formula:

$$\prod_{i=1}^n (w_i p_i)^{1/n}$$

Where w_i is the weight of the i th commodity; p_i is the price of the i th commodity and n is the n th root.

Alternatively, the formula for the 10 commodities in Table 2 could be written as:

$$\sqrt[10]{w_1 \text{Liq.Nat.Gas avg} * w_2 \text{Crude Oil avg} * w_3 \text{Ammonia avg} \dots w_{10} \text{Urea avg}}$$

- The Index was computed using the formula:

$$\frac{\sum p_{ij}}{\sum p_{0j}} * 100$$

Where p_{ij} is the geometric average price of the 10 commodities in period i and p_{0j} is the geometric average price of the 10 commodities in the base period (January 2007).

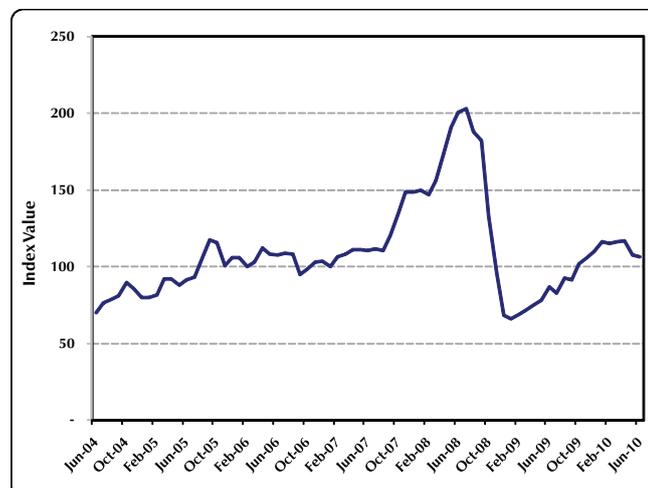
IV. Results

The Index is illustrated in Figure 1 and values are detailed in Appendix I. An increase (decrease) in the index value signifies a rise (fall) in the weighted average prices of the energy commodities exported by Trinidad and Tobago. As an example, the movement in the Index from 100 in January 2007 to 106.6 the following month reflects a 6.6 per cent rise in the average price of the top ten energy-based commodity exports.

On a year-on-year basis to June 2010, the ECPI increased by 22.6 per cent based on a recovery in the prices for all the commodities which constitute the ECPI. Optimism in the first few months of 2010 that the global economic recovery underway was sustainable and would eventually lead to an upsurge in the demand for energy, served to bolster energy prices.

It is interesting to note that, despite a relatively large increase in petroleum prices over the first three months of 2010, the ECPI was relatively unchanged during this period. Essentially, price gains in crude oil and refined petroleum products were almost totally offset by the decline in the price of natural gas. Looking at changes in the prices of crude oil or natural gas individually

Figure 1
Trinidad and Tobago Energy Commodity Price Index (Jan 2007=100)



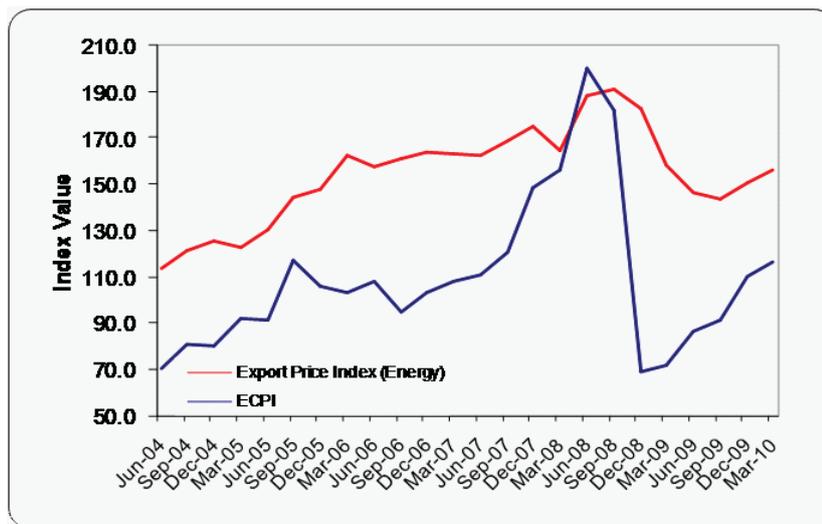
Source: Central Bank of Trinidad and Tobago.

would have generated a distorted picture of the overall impact on Trinidad and Tobago. By taking price movements of several commodities into account simultaneously however, the ECPI allows for a clearer assessment, particularly when energy prices are moving at different speeds and directions.

V. Comparison with the Index of Average Unit Value of Exports

One available index on the prices of energy exports is the Index of Average Unit Value of Exports, which is published quarterly by the Central Statistical Office (CSO) with a base year of 1996. The price of energy exports can be gleaned from Section 3 (Mineral Fuels and Lubricants) and Section 5 (Chemicals) of the index. For comparison purposes, a composite index was computed by calculating a weighted average of sections 3 and 5 according to each group's relative contribution to total energy exports (the sum of the weights for sections 3 and 5) in 1996. The results are presented in Figure II and show an important variation with the ECPI in terms of degree of fluctuation—while the direction and main turning points are similar in both indices, the movements in the ECPI are more pronounced. The main reason for this is the exclusion of LNG from the product mix in the CSO's index—Trinidad and Tobago commenced the production of LNG in 1999 and given that this index has a base year of 1996, changes in the price of LNG were not tracked by the index.

Figure 1
The ECPI and the Index of Average Unit Value of Energy Exports



Source: Central Bank of Trinidad and Tobago and Central Statistical Office

VI. Conclusion

The energy sector is central to the performance of the Trinidad and Tobago economy, accounting for almost half of the country's GDP, 55 per cent of total government revenue and approximately 90 per cent of total merchandise exports. The ECPI can give an early summary indication of developments in international prices of energy-based commodities produced by Trinidad and Tobago, signalling along with other information, the evolution of economic growth, the fiscal accounts and the balance of payments. Moreover, while the ECPI has been developed using actual data, forecasts of individual energy prices can be easily incorporated in the Index, aiding further in its relevance for policy making.

Appendix I

Table 3
Trinidad and Tobago Energy Commodity Price Index (Jan 2007=100)

Date	Index	Date	Index
May-04	69.02	Jun-07	110.67
Jun-04	70.01	Jul-07	111.30
Jul-04	76.46	Aug-07	110.68
Aug-04	78.61	Sep-07	120.37
Sep-04	81.07	Oct-07	134.74
Oct-04	89.82	Nov-07	148.54
Nov-04	85.48	Dec-07	148.59
Dec-04	79.75	Jan-08	149.74
Jan-05	80.02	Feb-08	146.73
Feb-05	81.53	Mar-08	156.22
Mar-05	91.84	Apr-08	172.50
Apr-05	91.96	May-08	190.74
May-05	87.61	Jun-08	200.24
Jun-05	91.53	Jul-08	202.83
Jul-05	93.13	Aug-08	187.70
Aug-05	104.66	Sep-08	182.11
Sep-05	117.28	Oct-08	133.17
Nov-05	115.72	Nov-08	96.15
Dec-05	100.66	Dec-08	68.52
Jan-06	105.78	Jan-09	65.94
Feb-06	105.80	Feb-09	68.74
Mar-06	100.29	Mar-09	71.59
Apr-06	103.01	Apr-09	74.94
May-06	111.92	May-09	78.11
Jun-06	108.05	Jun-09	86.67
Jul-06	107.72	Jul-09	82.88
Aug-06	108.52	Aug-09	92.41
Sep-06	107.93	Sep-09	91.12
Oct-06	94.72	Oct-09	102.03
Nov-06	98.54	Nov-09	105.96
Dec-06	102.81	Dec-09	109.95
Jan-07	100.00	Jan-10	116.05
Feb-07	106.61	Feb-10	115.27
Mar-07	107.91	Mar-10	116.23
Apr-07	111.06	Apr-10	116.50
May-07	110.94	May-10	107.63
		Jun-10	106.29 ^p

Source: Central Bank of Trinidad and Tobago.

p provisional

Appendix II

The Trinidad and Tobago Energy Commodity Price Index Using the Paasche Method of Index Calculation

I. The Paasche Statistical Method

A Paasche index compares the cost of purchasing the current basket of goods and services with the cost of purchasing the same basket in an earlier period. The prices are weighted by the quantities of the current period. This means that each time the index is calculated, the weights change. The Paasche index could be represented as follows:

$$\text{Index} = \frac{\sum (P_{it} Q_{it})}{\sum (P_{i0} Q_{it})} * 100$$

Where P_{it} = Price of commodity i ($i = 1, \dots, n$) in period t

P_{i0} = Price of commodity i ($i = 1, \dots, n$) in the base period

Q_{it} = Output of commodity i in period t

Generally, the Laspeyres and Paasche indices give similar results provided the periods being compared are not too far apart. The greater the length of time between the two periods being compared, the more opportunity there is for differential price and quantity movements and hence differences between the two indices.

II. Construction of the Paasche-ECPI

(a) Data Sources

The sources for the benchmark prices for the ten commodities used under the Laspeyres method were retained. Meanwhile, data on output of each of the commodities were sourced from the monthly bulletins produced by the Ministry of Energy and Energy Industries.

(b) Steps in Constructing the Index

The ECPI using the Paasche method was constructed as follows:

1. The average monthly price of each commodity was expressed in an index number format, with January 2007 as the base period.
2. The production data for each commodity was converted to an equivalent unit. For the purposes of this exercise, the output of each commodity was represented in tonnes.
3. Each commodity was assigned a weight according to its relative proportion of total production for the 10 commodities. The weights (w) used in the calculation of the ECPI take the form of:

$$w_i = \frac{q_{it}}{\sum_{i=1}^n q_{it}}$$

Where q_{it} is the output of the i th commodity in time period t

4. The price index for each commodity in time period t (I_{it}) was weighted according to the weight of the commodity in period t (w_t).

5. The ECPI was derived from the sum of the weighted price indices. The formula is as follows:

$$\text{ECPI} = \frac{\sum w_{it} I_{it}}{\sum w_{i,t-1} I_{i,t-1}} * 100$$

(c) Results

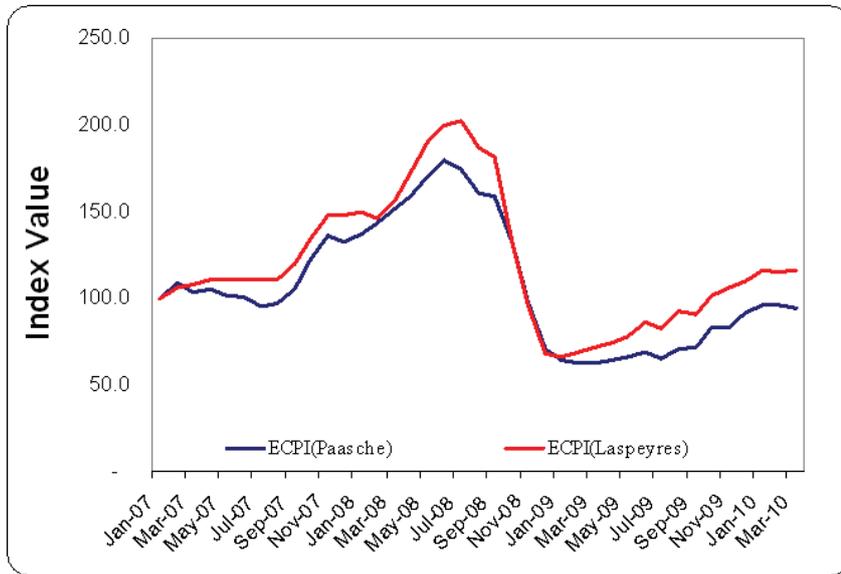
Table IV and Figure III show that while the index values computed using the Paasche method differ from those produced using the Laspeyres method, the trajectory of the indices are similar. The chart also shows one of the properties of the Paasche method, which is the fact that it typically underestimates the phenomenon it is attempting to measure. When prices increase, cheaper goods are substituted for those that become more expensive. Since the weights of the index are based on quantities in the current period, the index places greater importance (weight) on items that are relatively cheaper.

Table 4
Index Values of the Energy Commodity Price Index (Paasche Method)
(Jan 2007=100)

Date	Index	Date	Index
Jan-07	100.00	Sep-08	159.48
Feb-07	109.35	Oct-08	133.12
Mar-07	103.45	Nov-08	98.09
Apr-07	105.59	Dec-08	71.21
May-07	102.20	Jan-09	64.79
Jun-07	100.75	Feb-09	62.36
Jul-07	95.53	Mar-09	62.43
Aug-07	97.65	Apr-09	64.10
Sep-07	105.11	May-09	66.02
Oct-07	122.74	Jun-09	69.09
Nov-07	136.49	Jul-09	65.85
Dec-07	132.33	Aug-09	70.60
Jan-08	137.36	Sep-09	71.57
Feb-08	143.26	Oct-09	83.88
Mar-08	151.83	Nov-09	83.44
Apr-08	159.22	Dec-09	91.70
May-08	171.03	Jan-10	96.79
Jun-08	180.07	Feb-10	96.38
Jul-08	174.77	Mar-10	94.46
Aug-08	160.80		

Source: Central Bank of Trinidad and Tobago.

Figure 3
The Trinidad and Tobago Energy Commodity Price Index (Jan 2007=100)



Source: Central Bank of Trinidad and Tobago.

Appendix III

The Trinidad and Tobago Energy Commodity Price Index Using the Fisher Method of Index Calculation

The Fisher price index is a method used to overcome the problems of over-statement and under-statement of index values associated with using the Laspeyres and Paasche approaches to index number calculation¹. The Fisher index is a price index computed for a given period by taking the square root of the product of the Paasche index value and the Laspeyres index value. The index values using this method are illustrated in Table V. A comparison of the results using the Laspeyres, Paasche and Fisher methodologies are presented in Figure IV.

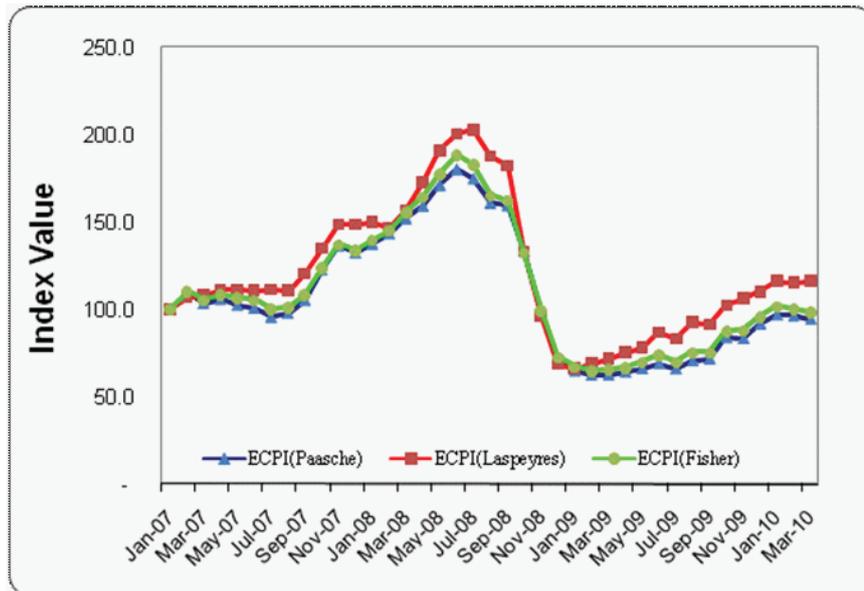
Table 5
Index Values of the Energy Commodity Price Index (Fisher Method)
(Jan 2007=100)

Date	Index	Date	Index
Jan-07	100.00	Sep-08	162.41
Feb-07	110.39	Oct-08	132.38
Mar-07	105.15	Nov-08	99.24
Apr-07	108.42	Dec-08	72.47
May-07	106.58	Jan-09	66.96
Jun-07	105.14	Feb-09	64.59
Jul-07	100.28	Mar-09	65.44
Aug-07	101.15	Apr-09	66.61
Sep-07	108.04	May-09	69.74
Oct-07	124.05	Jun-09	74.08
Nov-07	137.05	Jul-09	69.78
Dec-07	133.78	Aug-09	75.31
Jan-08	139.56	Sep-09	75.28
Feb-08	145.08	Oct-09	87.72
Mar-08	155.36	Nov-09	87.83
Apr-08	164.27	Dec-09	95.91
May-08	177.44	Jan-10	101.50
Jun-08	188.39	Feb-10	100.29
Jul-08	182.69	Mar-10	98.41
Aug-08	165.19		

Source: Central Bank of Trinidad and Tobago.

¹ The calculation of the Laspeyres index is such that it ignores the fall in quantity demanded resulting from an increase in price. In the Paasche index calculation, the substitution effect resulting from changing prices results in a greater weight being placed on items whose prices have fallen. As a result, the Laspeyres calculation systematically overstates the index while the Paasche calculation systematically understates the index.

Figure 4
Trinidad and Tobago Energy Commodity Price Index (Jan 2007=100)



Source: Central Bank of Trinidad and Tobago.

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