How GDT Price Indices are calculated

Summary

This note summarises why price indices are needed and how the GDT Price Indices are calculated. It explains how price indices help to avoid the bias introduced by simple weighted-average winning prices, how GDT provides a range of individual and aggregated product indices, and the international best practice that underpins GDT's calculation methods.

Why are price indices needed?

Market commentators and analysts need a single number for easy reference to describe the overall movement of prices for all products between trading events. The benefit of using an index over a simple weighted-average price is that the index avoids biases that can arise due to changes in quantities.

To see how a simple quantity-weighted average price can be misleading, consider the following example as shown in Table 1. In this example, the prices of the two products both increase by 1% between the two trading events but the proportion of product sold has shifted in favour of the more expensive product, i.e. more of the expensive product has been sold, and less of the cheaper product has been sold. This has resulted in the average price increasing by 5% despite the fact that both products experienced a 1% price increase.

To avoid this bias and to give a more accurate reflection of the price movements between trading events, the GDT Price Index is used. The GDT Price Index essentially uses a weighted-average of the percentage changes in prices. In the example below, the individual products had a 1% change, so the weighted-average price change is also 1% - this is the number reported by the GDT Price Index.

Table 1: Illustration of bias when using average prices

	Trading Event 1		Trading Event 2		
	Quantity Sold	**Price**	**Quantity Sold**	**Price**	**Price Changes**
Product 1	1000	$3,000	725	$3,030	1%
Product 2	1000	$4,000	1275	$4,040	1%
Average price		$3,500		$3,674	5%
GDT Price Index					1%

GDT Price Indices

GDT provides price indices at various levels of aggregation, ranging from indices at the individual product group/contract level through to the GDT Price Index at the highest level.

The GDT Price Index measures the movement of all published prices for products sold on GDT, whereas the individual product indices describe the movement in prices for a specific product.

Each product group offered on GDT has a price index for each of the six contract periods, as well as an overall index covering all contract periods.

Below is an example of the indices calculated for GDT. The fields containing 'n.a.' indicate that a product group was not offered or sold for a specific contract period.

Table 2: GDT Price Indices

Changes in Price Indices	Contract 1	Contract 2	Contract 3	Contract 4	Contract 5	Contract 6	All Contracts
Anhydrous Milk Fat (AMF)	n.a.	4.4%	-5.6%	7.6%	7.0%	-6.3%	3.6%
Butter	4.8%	-0.7%	-0.3%	-0.5%	n.a.	n.a.	-0.3%
Butter Milk Powder (BMP)	n.a.	5.2%	4.9%	3.7%	n.a.	n.a.	4.8%
Cheddar (Ched)	n.a.	n.a.	0.0%	3.0%	n.a.	n.a.	2.1%
Lactose (LAC)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Milk Protein Concentrate (MPC70)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Rennet Casein (RenCas)	n.a.	-5.9%	-6.5%	-2.6%	n.a.	n.a.	-5.0%
Skim Milk Powder (SMP)	-0.5%	2.3%	3.6%	6.6%	6.1%	n.a.	3.3%
Whole Milk Powder (WMP)	-2.2%	12.5%	6.0%	5.1%	4.3%	5.6%	7.7%
All Products	-1.3%	7.3%	3.5%	5.3%	5.2%	4.0%	4.9%

Calculation of GDT Price Indices

The GDT Price Indices are chain-linked Fisher indices. This means that the index level 'today' is given by the previous index level multiplied by the Fisher index of price changes between the two trading events. The Fisher methodology determines the index of price changes as the geometric mean of the Laspeyres and Paasche Indices.

$$\text{Fisher} = (\text{Laspeyres} * \text{Paasche})^{1/2}$$

The Laspeyres price index is the ratio of weighted prices between two time periods where the weights are given by the quantities sold in the *earlier* time period:

$$\text{Laspeyres} = \frac{\text{Prices of trading event 2 weighted by quantities of trading event 1}}{\text{Prices of trading event 1 weighted by quantities of trading event 1}}$$

Using the example given in Table 3, the Laspeyres calculations would be as follows:

$$\text{Laspeyres} = \frac{(3030 * 1000) + (4040 * 1000)}{(3000 * 1000) + (4000 * 1000)} = 1.01 \text{ (i.e. 1\% price change)}$$

The Paasche price index is the ratio of weighted prices between two time periods where the weights are given by the quantities sold in the *later* time period:

$$\text{Paasche} = \frac{\text{Prices of trading event 2 weighted by quantities of trading event 2}}{\text{Prices of trading event 1 weighted by quantities of trading event 2}}$$

Using the example given in Table 3, the Paasche calculation would be as follows:

$$\text{Paasche} = \frac{(3030 * 725) + (4040 * 1275)}{(3000 * 725) + (4000 * 1275)} = 1.01 \text{ (i.e. 1\% price change)}$$

In this example, the Laspeyres and Passche give the same result, but more generally they will give slightly different results. The Fisher index uses the geometric mean to average the two measures:

$$\text{Fisher} = (1.01 * 1.01)^{1/2} = 1.01 \text{ (i.e. 1\% price change)}$$

The chain-linked Fisher index is calculated as the previous index level multiplied by the Fisher index of price changes between the two trading events. For example, if the previous index value after trading event 1 was 1500 then the chain-linked index level after trading event 2 would be 1500 * 1.01 = 1515.

Table 3: Trading Event Quantities

	Trading Event 1		Trading Event 2		
	Quantity Sold	**Price**	**Quantity Sold**	**Price**	**Price Changes**
Product 1	1000	$3,000	725	$3,030	1%
Product 2	1000	$4,000	1275	$4,040	1%
Total	2000		2000		

Imputing missing closing prices

As shown above, the price indices for a trading event are calculated by comparing the change in the published prices from the previous trading event. Problems of missing values arise when the product was not sold in the previous event as there will be no closing price or quantity values. This means that even if a product has quantity sold in the latest trading event, there is a risk the product will be excluded from the calculations.

International best practice is to include as much information as possible by imputing the missing values. This is possible where a product has previously been sold on GDT. In these cases, the imputation method sets the imputed quantity as the quantity sold at the most recent trading event where the product was sold and sets the imputed price using the most comparable price available.

A technical note describing the imputation method and other aspects of the index calculations is available on request from help@globaldairytrade.com

Backdating index data

GDT began publishing price indices in April 2010 and from that date onward we have included products in the GDT Price Index as they have been introduced to the platform. Any new products will also be included in the GDT Price Index as they are introduced to GDT.

For the period prior to April 2010, the GDT Price Index includes prices for only AMF, SMP and WMP as these were the only products being sold on GDT at that time. To provide a ten year price perspective back to 1999, the prices of the three products prior to their introduction to GDT use the USDA Dairy Market News prices for Butter Oil, SMP and WMP respectively. USDA Oceania average prices for WMP are used prior to August 2008, USDA Oceania average prices for SMP are used prior April 2010, and USDA Western Europe Butter Oil average prices for AMF are used prior to December 2009.