

**Retail Sales Index –  
Introduction to the updated series (Base: Year 2015 = 100)  
And methodological notes**

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## Introduction

### Introduction to Series (Year 2015 = 100)

The Retail Sales Index (RSI) is the official short-term indicator of changes in the level of consumer spending on retail goods. It measures the trend in the level of average weekly sales for each month, after allowances are made for calendar composition. The RSI is compiled and published every month by the Central Statistics Office (CSO).

Commencing with January 2015, the index is compiled with respect to a new base year (Base Year 2015 = 100) using updated base weights taken from the 2015 Annual Services Inquiry (ASI), replacing the former series (Base Year 2010 = 100).

The methodology has not changed in any substantial way from the previous series (Base Year 2010 = 100) but all weights have been updated:

- Updated Base Weights – *See Appendix 1*
- Updated Trading Day Weights – *See Appendix 2*
- Updated Product Turnover (Deflator) Weights
- Size Class Thresholds – *See Appendix 3*

The revised series (Base year 2015 = 100) has been compiled using these new weights and the original thresholds. Back series commencing with 2015 are available on the CSO website<sup>1</sup>.

#### Purpose

The primary purpose of the RSI is to provide a short-term indication of changes in the value and volume (or quantity) of retail sales in Ireland. In doing so the RSI provides a leading monthly indicator on economic activity. It provides an accurate and objective measure of retail trading and supplies a valuable guide to consumer spending behaviour in the Irish economy. More generally, in conjunction with several other monthly and quarterly economic indicators published by the CSO, the RSI offers a valuable tool for better understanding the general economic climate and performance in Ireland.

#### Scope

The reporting unit is the enterprise, where an enterprise is defined as the smallest legally independent unit, allowing enterprises to provide a single overall retail sales figure each month. It also ensures that any new branches opened or closed by respondents are automatically included in the index. All enterprises are eligible for selection i.e. no size cut-off is applied to the enterprise population. Data is compiled and published at national level only i.e. NUTS 1 level<sup>2</sup>

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<sup>1</sup> [http://www.cso.ie/px/pxeirestat/Database/eirestat/Retail%20Sales%20Monthly%20Series/Retail%20Sales%20Monthly%20Series\\_statbank.asp?SP=Retail%20Sales%20-%20Monthly%20Series&Planguage=0](http://www.cso.ie/px/pxeirestat/Database/eirestat/Retail%20Sales%20Monthly%20Series/Retail%20Sales%20Monthly%20Series_statbank.asp?SP=Retail%20Sales%20-%20Monthly%20Series&Planguage=0)

<sup>2</sup> Nomenclature of Territorial Units

## Legal basis

The RSI is a statutory inquiry, collected under the Statistics (Retail Sales) Order 2016 No. 118/2016. The survey is also conducted in compliance with Council Regulation (EC) No. 1165/98 and Commission Regulation No. 472/2008 concerning short-term statistics.

## Coverage

Retail Sales Index is now classified in accordance with the statistical classification of economic activities in European Communities, i.e. NACE Rev. 2<sup>3</sup>.

Retailing is the resale (sale without transformation) of new and used goods mainly to the general public for personal or household consumption or utilisation, in shops, department stores, stalls, mail-order houses, door-to-door sales persons, hawkers, consumer cooperatives, auction houses etc. Most retailers take title to the goods they sell, but some act as agents for a principal and sell either on consignment or on a commission basis.

The retail sector as defined for the purposes of the RSI is:

<b>Business Group Description</b>	<b>NACE REV. 2 code</b>
Motor Trade (Excluding wholesale)	45
Non specialised stores with food, beverages or tobacco predominating	47.11
Department Stores	47.19
Food, Beverages and Tobacco in specialised stores	47.2
Fuel	47.3
Pharmaceutical Medical and Cosmetic Articles	47.73-5
Clothing, Footwear and Textiles	47.51, 47.71-2
Furniture & Lighting	47.59
Hardware Paints & Glass	47.52
Electrical Goods	47.41-3, 47.54
Books, Newspapers & Stationery	47.61-2
	47.53, 47.63-5,
Other Retail Sales	47.76-8
Bars	56.3

<sup>3</sup> (For more information on the new NACE Rev. 2 classification and a detailed breakdown of the codes see <http://www.cso.ie/px/u/NACECoder/NACEItems/searchnace.asp>).

For national purposes the RSI coverage differs from that specified by EU regulation owing to the inclusion of the retail trade and repair of motor vehicles and motorcycles (NACE 45) and Bars (NACE 56.3).

The RSI excludes sales by

- Internet / Online retailers which are solely or at least 50% online,
- street stalls and markets,
- street based newspaper vendors
- other retailing activities not conducted from permanent business premises.
- mail-order
- second hand and repairs of personal, electrical and household goods
- direct retail sales of non-distribution enterprises (e.g. manufacturing enterprises with no separate sales establishments)
- sales of wholesale businesses are also excluded.

The RSI does include internet/online sales of enterprises which have a presence in Ireland but these sales are included under the primary activity of the enterprise.

E.G. online grocery sales are included in Non Specialised Stores.

## **Activity Classifications**

Retail Sales Index is classified in accordance with the statistical classification of economic activities in European Communities, i.e. NACE Rev. 2 as was the previous series.

## **Population and Sample size**

The Annual Services Inquiry 2015 estimated there were approximately 38,000 enterprises in the Irish retail sector as defined for RSI purposes. In total, a sample selection of 3,000 enterprises has been drawn to represent the entire population. In practice however, owing to non-response and non-relevant (enterprises which have ceased trading etc.) only a total of about 1,750 enterprises respond in any given month. This gives an average sampling fraction of over 5%, however this fraction can differ significantly from sector to sector and within size class. To reduce burden the sample is concentrated on the larger enterprises and where possible one response is required from a multiple rather than from the individual shops. If coverage is viewed from a turnover perspective, the coverage is considerably higher, with an average sampling fraction of approximately 50%.

## **Calendar Corrections**

The RSI is a monthly turnover index. This presents a comparability problem as months differ in length i.e. the number of days in each month. Each month also varies in the breakdown of those days ie could be 4 or 5 Mondays. This is critical for retail trade as a higher volume of trade is generally conducted on Fridays and Saturdays. Therefore an extra Friday or Saturday in a month could significantly inflate the turnover generated in that month. It is reasonable to expect months with extra days and, in particular, months with 5 Fridays or 5 Saturdays to have a higher turnover.

To overcome this variation, the RSI indices are compiled using standardised reporting periods (SRPs) of 4, 4 and 5 weeks, i.e. the first two months of every quarter comprises of 4 weeks while the third month has 5 weeks. With this SRP approach the number of days in every month is equalised. So not only does each month have a standardised number of weeks, turnover is “trading day” adjusted so that effectively, each of those weeks are identical – every week begins with a Sunday and finishes on a Saturday.

For each period, enterprises have the option of reporting their turnover using either the standardised month or the actual calendar month. About 30% of respondents, particularly large enterprises, supply data corresponding to the 4-4-5 pattern. The remaining enterprises provide calendar month data. This calendar month is then adjusted using calendar correction factors to the standardised month.

These calendar correction factors are based directly on trading day micro data provided by enterprises on the RSI sample. Every 5 years, as part of the rebasing process, enterprises are asked to distribute the average weekly sales over the 7 days of the week. This data is then compiled to construct the trading day weights (see appendix 2). These fixed trading weights are then used to calculate calendar correction factor for each month.

The 4-4-5 pattern adds up to 364 day year and consequently requires a re-calibration every 5<sup>th</sup> or 6<sup>th</sup> year (depending on when leap years fall) to account for the missing week. Here the exact 52 week year is replaced by an exact 53 week year. This additional week is added to February, replacing the 4-4-5 pattern with a 4-5-5 pattern for the 1<sup>st</sup> quarter of the re-calibrated year.

### Index formula

The RSI is calculated using a modified fixed weight Laspeyres index:

$$\left[ \frac{\sum W_{m-1} \left( \frac{T_m}{T_{m-1}} \right)}{\sum W_0} \right] \times 100$$

Where:

$W_0$  and  $W_{m-1}$  are the base weights and updated weights (or values) respectively  
 $T_m$  and  $T_{m-1}$  are aggregated turnover values for the current and last period respectively.

In the case of the RSI, 12 distinct sets of “seasonal” base weights are used, one for each month of the year. The compilation of the index for the current month ( $m$ ) is based on the percentage change in average weekly sales (based on a matched sample) over the corresponding monthly period of the previous year ( $m-1$ ).

## **Volume indices (Constant prices)**

Retail sales volume indices exclude the effects of retail price changes. The unadjusted<sup>4</sup> volume indices are calculated by deflating each value indices using specially constructed deflators calculated for each individual index. The deflators used for the RSI are calculated based on a combination of current prices gathered for the Consumer Price Index (CPI) and deflator baseweights<sup>5</sup> constructed using product micro data gathered from enterprises as part of the rebasing process.

## **Seasonal adjustment**

Retail sales are subject to a high degree of seasonality, particularly for individual businesses. To facilitate interpretation of underlying trends value and volume indices are adjusted to remove these seasonal fluctuations.

Seasonal adjustment is conducted using the direct seasonal adjustment approach. Under this approach each individual series is independently adjusted, e.g. aggregate series are adjusted without reference to the component series. Each individual seasonally adjusted series is calculated based on unadjusted data spanning from January 2010 to the current period.

The adjustments are completed by applying the X-13-ARIMA model, developed by the U.S. Census Bureau to the unadjusted data. This methodology allows seasonal factors to be estimated whilst also taking into consideration factors that impact on the quality of the seasonal adjustment such as:

- Calendar effects, e.g. the timing of Easter,
- The phase shift effect, i.e. the fact the reporting period of the RSI does not coincide with the calendar month and
- Outliers, temporary changes and level shifts in the series.

## **Confidentiality**

The retail turnover data provided by respondent enterprises are treated as strictly confidential in accordance with Part V of the Statistics Act, 1993 and cannot be accessed under the terms of the Freedom of Information Act, 1997. Data are not disclosed by the CSO to any other Government Department or outside body. The CSO wishes to express its appreciation for the co-operation and assistance received.

## **Limitations**

The RSI is designed as a short-term indicator, so while it provides good estimates of year-on-year change, it should not be used to examine long term or structural changes in the retail sector. The Annual Services Inquiry, also published by the CSO, is more suited to this purpose.

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<sup>4</sup> These indices are trading day adjusted as a result of the 4-4-5 pattern of data recording.

<sup>5</sup> The baseweights are distributions of COICOP (Classification of individual consumption by product) classified products to the various indices which are based on NACE Rev. 2 classifications.

The RSI publishes indices on the level of retail sales for each month. It does not provide any information on actual € values of turnover generated. Annual Services Inquiry provides structural data such as annual estimates on the value of turnover for each of the retail sectors.

The RSI provides breakdowns at NACE Rev.2 or economic activity level but does not provide any information at product level.

The RSI cannot provide breakdowns at regional level or size class level.



# **METHODOLOGY**

# Chapter 1

## Cells & Groups

**Keywords:**

- Cell
- Business Group
- Combined Group

Before the Retail Sales methodology can be described we must first define what we mean by (a) a cell (b) a Business Group and (c) a Combined Group.

### (a) Cells (Size Classes)

Within each Business Group there are 4 Size Classes. These Size Classes are defined according to annual turnover i.e. enterprises are categorised into 4 groups (or size classes) according to their turnover. The turnover thresholds are the same for all Business Groups.

The 4 size classes are:

Size Class	Annual Turnover Thresholds
1	Turnover $\leq$ € 499,000
2	€ 500,000 $\leq$ Turnover $\leq$ € 999,000
3	€ 1,000,000 $\leq$ Turnover $\leq$ € 4,999,999
4	€ 5,000,000 $\leq$ Turnover

All enterprises in the same Business Group and same Size Class are collectively known as a cell. For example, all enterprises with a NACE code of 45 and annual turnover less than €499,999 belong in the same cell. A cell total is calculated by summing the Calendar Corrected Turnover for all enterprises in that cell.

## (b) Business Groups

To calculate a Business Group Relative the cell totals must first be calculated. A “cell” refers to a collection of enterprises that belong to the same “Size Class” in the same “Business Group”. There are 13 Business Groups in the RSI. The Business Groups are defined according to the NACE<sup>6</sup> Rev. 2 classification system.

The 13 Business Groups are:

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<b>Business Group Description</b>	<b>NACE REV. 2 code</b>
<b>1</b> Motor Trade	45
<b>2</b> Non specialised stores with food, beverages or tobacco predominating	47.11
<b>3</b> Department Stores	47.19
<b>4</b> Food, Beverages and Tobacco in specialised stores	47.2
<b>5</b> Fuel	47.3
<b>6</b> Pharmaceutical Medical and Cosmetic Articles	47.73-5
<b>7</b> Clothing, Footwear and Textiles	47.51, 47.71-2
<b>8</b> Furniture & Lighting	47.59
<b>9</b> Hardware Paints & Glass	47.52
<b>10</b> Electrical Goods	47.41-3, 47.54
<b>11</b> Books, Newspapers & Stationery	47.61-2 47.53, 47.63-5,
<b>12</b> Other Retail Sales	47.76-8
<b>13</b> Bars	56.3

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<sup>6</sup> Statistical classification of economic activities in the European Community

### (c) Combined Groups

A Combined Group is a combination of Business Groups. There are 9 combined business groups compiled for the Retail Sales Index. The table below lists these groups and their constituent parts. A Business Group may form part of one or more Combined Groups.

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<b>Combined Groups</b>	<b>Business Group Combinations</b>
<b>1</b> All Business	1 - 13
<b>2</b> All Business Ex Motor Trades	2 - 13
<b>3</b> All Business Ex Motor Trades & Bars	2 -12
<b>4</b> Motors & Fuel	1 and 5 2 - 4 and 6 -
<b>5</b> All Business Ex Motor Trades , Fuel & Bars	12
<b>6</b> Food	2 and 4
<b>7</b> Non Food ( Excl Motor & Fuel & Bars)	3 and 6 - 12
<b>8</b> Household Equipment (G_47_NF_Other2)	8 - 10
<b>9</b> Books, Newspapers, Stationery & Other Goods (G_47_NF_Other1)	11 and 12

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### Calendar Corrected Turnover

**Keywords:**

- Standardised month
- Calendar Corrected Turnover
- Calendar Correction factor
- Trading Day Weight

#### The Standardised Month

Differences in calendar composition (the number of trading days and the breakdown of those days in each calendar month) are a source of month to month variation in retail sales. This variation causes problems for comparability. In order to overcome this problem, adjustments are made to some of the actual turnover figures of responding enterprises in order to standardise the accounting period.

Each month participants in the survey are requested to return their turnover figure (inclusive of VAT) for the reference month. Respondents are offered the option of responding in:

1. a 4-4-5 week pattern

or

2. on a calendar month basis.

By a 4-4-5 week pattern we mean that each quarter has exactly 13 weeks, distributed so that the first 2 months have exactly 4 weeks each while the third month has exactly 5. Data returned on a calendar month basis will require adjustment to this standardised pattern. If a responding enterprise opts to return data in a 4-4-5 week pattern, their data may still require adjustment if the week pattern selected does not match the CSO methodology e.g. having a 5-4-4 week pattern.

The Retail Sales uses the following 4-4-5 week pattern:

Quarter	4 week month	4 week month	5 week month
1	January	February	March
2	April	May	June
3	July	August	September
4	October	November	December

This 4-4-5 pattern adds up to exactly 52 weeks or 364 days ((13 weeks \* 7 days) \* 4 quarters) and consequently leaves a shortfall of 1 day for every normal year and 2 days for every leap year. This shortfall is carried forward until a full week has been unaccounted for. This takes 5 or 6 years depending on how the leap years fall. The full shortfall is then added to give a 53 week year. The extra week is added to the first quarter to give a 14 week quarter or 4-5-5 pattern, in other words the extra week is added to February.

During a 53 week year the RSI uses the following pattern:

Quarter	4 week month	4 week month	5 week month	5 week month
1	January		February	March
2	April	May		June
3	July	August		September
4	October	November		December

This re-calibration occurred in Q1 2010 and in Q1 2015.

If a respondent's reporting period differs from the 4-4-5 week pattern, the turnover figure for that enterprise will be converted to the "standardised month".

There are 3 possible scenarios.

*Scenario 1:*

Respondent provides turnover figures for a period that corresponds exactly with the standardised month. In this instance the figure is not amended in any way and therefore the actual turnover figure received will not have a calendar correction factor applied i.e. actual turnover = calendar corrected turnover.

Scenario 2:

Respondent provides a figure on a 4 or 5 week pattern but that pattern differs from the standardised month used to calculate the RSI. In this case a manual adjustment is made to the turnover figure before it is keyed into the system.

Example:

Enterprise XYZ provides data on a 4-4-5 week pattern. However the 5 week month occurs in the second month of the quarter instead of the third month. Taking Quarter 3 2016 as an example, August is the 5 week month rather than September. So we could say that Enterprise XYZ provides data on a 4-5-4 week pattern.

Figures for Quarter 3 2016 are as follows:

Month	Actual pattern	"Standard" pattern	Turnover
Jul	4 weeks	4 weeks	€ 80,000
Aug	5 weeks	4 weeks	€ 100,000
Sep	4 weeks	5 weeks	€ 80,000

In order to bring these figures into line with our standardised month, we must remove a weeks trading from the August figure and add it to the September figure. To do this we assume that turnover is evenly distributed across all weeks of the month and we re-distribute it pro-rata.

The amended figures are calculated as follows:

Month	Actual Turnover	Adjustment	Amended Turnover
Jul	€ 80,000	None	€ 80,000
Aug	€ 100,000	- 1week (€20,000)	€ 80,000
Sep	€ 80,000	+ 1week (€20,000)	€ 100,000
Q 3	€ 260,000		€ 260,000

Scenario 3:

Respondent provides data on a calendar month basis. Turnover figures are from the 1st of the month to the 28th/30th/31<sup>st</sup> and so will have extra days in comparison with the standard month in 4 week month or will have fewer days in 5 week periods. Turnover from these enterprises will have a "Calendar Correction Factor" (CCF) applied.

The adjustment to standardise calendar composition (i.e. calculate Calendar Corrected Turnover) is carried out by applying a Calendar Correction Factor (CCF).

$$CCT = \left( \frac{T}{CCF} \right)$$

where:

*T* is actual Turnover



## Calendar Correction Factors (CCFs)

We noted earlier that differences in calendar composition are a source of variation for retail sales and this variation poses a difficulty for comparisons. This is important as sales on Fridays and Saturdays are generally higher than on other days of the week and therefore months containing 5 Fridays or 5 Saturdays normally have a higher turnover than those with only 4. Adjustments are made for these trading day variations by applying fixed Calendar Correction Factors (CCFs).

As enterprises are offered the option of returning data on a “calendar month” basis or on a “4-4-5 week” basis, any returns that don’t match the standardised 4-4-5 week accounting periods require adjustment. For example, enterprises that return their data on a calendar month basis during a standardised 4 week month will have extra days and fewer days during a standardised 5 week month. These returns must be adjusted to the standardised 4-4-5 week pattern.

There are 2 inputs necessary to calculate Calendar Correction Factors:

### 1. Trading Day Weights (TDWs)

The daily trading weight is an estimate of the proportion of weekly sales that occur on a given day. Within each Business Group, Trading Day Weights sum to 1 for the week. These weights are based on results from the Product and Trading Day Survey 2011 with 2010 as the reference period. Retailers were asked to estimate the percentage of turnover attributed to each day of the week for an average week. These Trading Day Weights or factors are unique to each Business Group. For Non-specialised stores where trading patterns differ significantly between size classes, distinct sets of TDWs are used to distinguish between these size classes – *See Appendix 2 for Trading Day Weights used in the current series.*

### 2. Composition of the month

That is, the number of days in the month (28, 29, 30 or 31) and what those days are (Mondays, Tuesdays etc.).

Calendar Correction Factors (CCFs) are calculated as follows:

$$\left( \frac{N \pm \left( \sum TDWs \right)}{N} \right)$$

where:

$N$  is number of weeks in the standardised month (i.e. 4 or 5)

$\sum TDWs$  is the sum of the trading day weights (TDWs) for the days that must be added or subtracted only.

**Example 1:**

Motor Trades – August 2016

**August 2016**

Mon	1	8	15	22	29
Tue	2	9	16	23	30
Wed	3	10	17	24	31
Thur	4	11	18	25	
Fri	5	12	19	26	
Sat	6	13	20	27	
Sun	7	14	21	28	

In our model the standardised August has 4 weeks (*see The standardised month*) and consequently 4 Mondays, 4 Tuesdays, 4 Wednesdays etc. Enterprise XYZ in the Motor Trades sector returns turnover figures of €100,000 for August 2016 on a calendar month basis and consequently includes sales for 5 Mondays, 5 Tuesdays and 5 Wednesdays (*see shaded area in calendar*). In order to compare turnover from this calendar month with a 4 week month it is necessary to strip out the extra days.

The Trading Day Weights for the extra days in question are (*see Appendix 2 - Trading Day Weights*):

Business Group 01 – Monday	0.19
Business Group 01 – Tuesday	0.19
Business Group 01 – Wednesday	0.18
Total	0.56

In other words, for the motor trades sector, sales during Monday, Tuesday and Wednesday normally account for 56% of weekly turnover.

This gives an August 2016 CCF for Motor Trades of 1.14 i.e.

$$\left( \frac{4 + (0.56)}{4} \right)$$

Calendar Corrected Turnover (CCT) is then calculated by applying this CCF to actual turnover.

$$CCT = \left( \frac{T}{CCF} \right)$$

where:

*T* is actual turnover

Applying this CCF to actual turnover effectively reduces monthly turnover for the enterprise by 14% i.e. calendar corrected turnover is 14% lower than actual turnover.

In this case Enterprise XYZ would have a calendar corrected turnover of €87,719 for August 2016.

### Example 2:

Motor Trades – September 2014

#### September 2014

Mon	1	8	15	22	29
Tue	2	9	16	23	30
Wed	3	10	17	24	
Thur	4	11	18	25	
Fri	5	12	19	26	
Sat	6	13	20	27	
Sun	7	14	21	28	

In our model the standardised September has 5 weeks (*see The standardised month*) and consequently 5 Mondays, 5 Tuesdays, 5 Wednesdays etc. Enterprise XYZ in the Motor Trades sector (Business Group 01, Sub-Group 2) returns turnover figures for September 2014 of €100,000 on a calendar month basis and consequently includes sales for only 4 Wednesdays, 4 Thursdays, 4 Fridays, 4 Saturdays and 4 Sundays (*see shaded area in calendar*). In order to compare turnover from this calendar month with a 5 week month it is necessary to include these missing days.

The Trading Day Weights for the missing days in question are (*see Appendix 2 - Trading Day Weights*):

Business Group 01 – Wednesday	0.19
Business Group 01 – Thursday	0.19
Business Group 01 – Friday	0.20
Business Group 01 – Saturday	0.05
Business Group 01 – Sunday	0.00
Total	0.63

In other words, for the motor trades, sales for Wednesday to Sunday normally account for 63% of weekly turnover.

This gives a September 2014 CCF for Motor Trades of 0.87 i.e.

$$\left( \frac{5 - (0.63)}{5} \right)$$

Applying the CCF yields a CCT higher than actual turnover.

$$CCT = \left( \frac{T}{CCF} \right)$$

In this case Enterprise XYZ would have a calendar corrected turnover of €114,943 for September 2014.

## Chapter 3

### Calculating Weights & Updated Values

**Keywords:**

- Base Weights
- Updated Values

#### Base Weights

The current base for the Retail Sales Index is the year 2015. The weights that correspond to the base period are referred to as base weights. The base weights for the current series are derived from the Annual Services Inquiry (ASI) 2015. By convention, base year weights are expressed as 100 i.e. Base Year = 100.

#### Monthly Base Weights

The Retail Sales Index is calculated using a seasonal basket of weights i.e. a different set of monthly weights are used for each month, or in other words, for each Business Group there are 12 different base weights, one for each month of the year – *See Appendix 1*. These monthly weights reflect the changing relative importance of different Business Groups throughout the year. For example, consumers typically spend more on Clothing & Footwear in September because of the return to school. More new cars are purchased in January than any other month with the introduction of new registration plates. In order for such seasonal peculiarities to be accurately reflected in the “All Businesses” index, we require a different base weight for each month of the base year.

The base weights are derived from the Annual Services Inquiry (ASI) turnover data where the wholesale element of sales in retail outlets and the associated VAT is removed from the total turnover figure. However, the ASI can only provide annual turnover data for each Business Group. The monthly pattern of retail sales needed to convert annual ASI turnover data to a set of monthly turnover figures is derived from micro data collected for the RSI in 2015.

#### Average Weekly Turnover

The Retail Sales Index is calculated on a 4-4-5 week basis, i.e. each quarter has exactly 13 weeks, distributed so that the first 2 months have exactly 4 weeks while the third month has exactly 5. The monthly turnover calculated by applying sales patterns from the Retail Sales Index is converted into

Average Weekly Turnover by dividing the monthly turnover figure by the appropriate number of weeks. The average weekly turnover for each Business Group is used as the Base Year Weight for the respective Business Group.

### **Updated Values**

Base Weights are updated every month after their base period passes. Updating is done by applying the appropriate relative (*See Chapter 4*) to the weight. An updated weight is generally referred to as an Updated Value. So by convention, “Weights” typically mean base weights and “Updated Values” mean any updated weights thereafter.

$$W_{T-1}(R_m) = W_m$$

Where:

$W_{T-1}$  is an Updated Value from the same month in the previous year.

$W_m$  is the Updated Value for the current month  $m$ .

$R_m$  is Relative for the current month  $m$ .

## Chapter 4

### Calculating a Relative

**Keywords:**

- Cell Relative
- Matched samples
- Group Relative

**What is a relative?**

The ratio of the turnover for a single group (enterprise, cell or business group) between two particular time periods is called a relative. For the Retail Sales Index, the relatives in question are annual turnover relatives.

**Calculation of the Cell Relative**

Before a group relative (or business group relative) can be calculated the 4 cell relatives (or size class relatives) must first be calculated for that group.

Once calendar corrected turnover cell totals are calculated they can be compared with previous periods. A cell total for the current month  $CT_m$  is compared with the cell total for the previous month  $CT_{m-1}$  (i.e. the corresponding month in the previous year) to produce the cell relative  $R_c$ .

$$R_c = \left( \frac{CT_m}{CT_{m-1}} \right)$$

Where:

$R_c$  is the cell relative

and

$CT_m$  is current cell total

and

$CT_{m-1}$  is previous cell total

The cell relatives for each size class are applied to their respective base cell weights each month to produce updated weights (known as updated values). These updated values are subsequently used in the calculation of the following year's monthly indices. This process continues until the index is rebased and new base weights are introduced.

**Example 1: January 2015 compared with January 2016**

Business Group - Motor Trades  
 Size Class - 1

There are 4 enterprises in this cell.

**Motor Trades – Size Class 1  
 January 2015**

<b>Enterprise Name</b>	<b>Calendar Corrected Turnover (€)</b>
AAA	9,000
MMM	12,400
CCC	8,500
XYZ	21,000
	50,900

The total calendar corrected turnover for this cell is €50,900

**Motor Trades – Size Class 1  
 January 2016**

<b>Enterprise Name</b>	<b>Calendar Corrected Turnover (€)</b>
AAA	10,000
MMM	15,000
CCC	9,000
XYZ	23,000
	57,000

The total calendar corrected turnover for this cell is €57,000



Then:

$$CT_m = €57,000$$

and

$$CT_{m-1} = €50,900$$

$$R_c = \left( \frac{57,000}{50,900} \right) = 1.119843$$

### **Matched samples**

Cell totals are calculated on a matched sample basis. This means an enterprise will only be included in the calculation of the cell total if there are figures for both current and previous months.

In other words, if in January 2016 there are only 3 returns instead of 4 in the cell, then only the same 3 enterprises will be included when calculating a matching  $CT_{t-1}$  (Jan 2015).

Even though there are 4 returns in the cell for January 2015, because there are only 3 in January 2016, only the matching 3 enterprises will be included in the calculation for January 2015 and January 2016 so that the 2 totals can be meaningfully compared. If this matching isn't done, then non-response could lead to a negative cell relative  $R_c$  where no actual decline has occurred.

### **Example 1b: January 2015 compared with January 2016 again**

Business Group - Motor Trades  
Size Class - 1

This time assume Enterprise CCC doesn't return a turnover figure for January 2016, then the total cell turnover  $CT_t$  is €48,000 instead of €57,000.

**Motor Trades – Size Class 1  
January 2016**

<b>Enterprise Name</b>	<b>Calendar Corrected Turnover (€)</b>
AAA	10,000
MMM	15,000
CCC	9000
XYZ	23,000
	48,000

If €48,000 is compared with the January 2015 total (€50,900) on a non-matched sample basis, we get a cell relative of 0.943026 which clearly doesn't make any sense as the turnover has increased for every enterprise where we have comparable data. Therefore, the corresponding cell total must be calculated for January 2015 by excluding the turnover for Enterprise CCC.

**Motor Trades – Size Class 1  
January 2015**

<b>Enterprise Name</b>	<b>Calendar Corrected Turnover (€)</b>
AAA	9,000
MMM	12,400
CCC	8,500
XYZ	21,000
	42,400

Excluding Enterprise CCC data, we get a cell total of €42,400.

Then:

$$R_c = \left( \frac{48,000}{42,400} \right) = 1.132075$$

## Group Relatives

### (a) Business Group Relatives

Each Business Group relative ( $R_{bg}$ ) is the weighted arithmetic average of the 4 size class or cell relatives  $R_c$ . It is calculated by dividing the sum of the current cell weights for that Business Group by the sum of the previous cell weights.

$$R_{bg} = \left[ \frac{\sum W_m}{\sum W_{m-1}} \right]$$

Where:

$R_{bg}$  is the Business Group relative

$W_m$  and  $W_{m-1}$  are the cell weights (or updated values) for the respective business group

The relatives for each of the Business Groups are calculated in this manner.

### (b) Combined Group Relatives

A Combined Group Relative is calculated in the same way as a Business Group Relative, except instead of comparing cell weights, the relevant Business Group weights are compared.

$$R_{cg} = \left[ \frac{\sum W_m}{\sum W_{m-1}} \right]$$

Where:

$R_{cg}$  is the Combined Group relative

$W_m$  and  $W_{m-1}$  are the Business Group weights (or updated values) for the respective Combined groups.

## Chapter 5

### Updating Unadjusted Value Indices

The monthly base year value indices are calculated along with the monthly base year weights at the beginning of the series. Thereafter, the unadjusted value indices are updated each month. The formula for updating an unadjusted Business Group value index is:

$$VAL_m = (VAL_{m-1} \times R_{bg})$$

Where:

$VAL_m$  is unadjusted Business Group value index for current period

$VAL_{m-1}$  is the unadjusted Business Group value index for previous period

$R_{bg}$  is Business Group relative for current period

The Combined Group and All Businesses Indices are updated in the same way.

## Chapter 6

### Updating Unadjusted Volume Indices

Value indices are a function of price and quantity. Consequently, interpretation of value indices can be difficult as a change in the value of turnover, may be the result in an actual increase or decrease in sales, the result of inflation or deflation or a combination of both.

Volume indices exclude the effects of retail price changes and so may be thought of as quantity indices i.e. price effects are held constant. Unadjusted volume indices are calculated by deflating unadjusted value indices using specially constructed retail price indices derived from the Consumer Price Index (CPI).

The monthly base year volume indices are calculated at the beginning of the series. Thereafter, the unadjusted volume indices are updated each month. The formula for updating an unadjusted volume index is:

$$\left( \frac{P_o}{P_m} \right) \times VAL_m$$

Where:

$VAL_m$  is an unadjusted value index for the current period.

$P_m$  and  $P_o$  are price deflators for the current and the base period respectively.

The price deflators  $P$  are price indices taken from the CPI. In most cases these indices are specially constructed price sub-indices, using weights derived micro data collected from the Trading Day and Product Profile Survey 2015 – *See Appendix 3*.

## Chapter 7

### Seasonal Adjustment

#### Background

Retail sales are subject to a high degree of seasonality, particularly for individual businesses. Typically businesses have higher sales close to holiday periods such as Christmas, although the motor trade would be an obvious exception to this pattern. To facilitate interpretation of underlying trends value and volume indices are adjusted to remove these seasonal fluctuations.

Seasonal adjustment is conducted using the direct seasonal adjustment approach. Under this approach each individual series is independently adjusted, e.g. aggregate series are adjusted without reference to the component series. Each individual seasonally adjusted series is calculated based on unadjusted data spanning from January 2015 to the current period.

Seasonal adjustment for the Retail Sales series is complicated by the complex calendar effects induced by the Retail Sales Inquiry's use of the 4-4-5 standardised reporting period. Each year each standardised month changes its position relative to the calendar month. The twelve standard periods total to 52 weeks or 364 days compared to 365 days in a year (or 366 in a leap year). Consequently each year the standardised months used by the Retail Sales slip back one (or two days) every year. Every five or six years an extra week is added to February to cater for this slippage.

The slippage of the standardised months relative to the corresponding calendar months operates on a cyclical basis. The cycle should have a cycle of seven years but because of leap years the actual cycle is 28 years.

Each individual Retail Sales series or sub-index is seasonally adjusted separately using the model that best fits the characteristics of that series. Individual series models will be reviewed once every 12 months and series models and parameters are adjusted if required.

The revised series are published on the CSO web – [www.cso.ie](http://www.cso.ie). Distinct seasonal factors are calculated for each Business Group and each Combined Group. This reflects the different seasonal patterns exhibited by different Business Groups and Combined Groups. For example, sales in the Motor Trades are low in December, contrasting with sales of Food Beverages & Tobacco, which usually increase in the lead up to Christmas. Separate factors are also calculated for the value and volume series.

## Modelling Methodology

The adjustments are completed by applying the X-13-ARIMA model, developed by the U.S. Census Bureau to the unadjusted data. This methodology allows seasonal factors to be estimated whilst also taking into consideration factors that impact on the quality of the seasonal adjustment such as:

- Calendar effects, e.g. the timing of Easter,
- The phase shift effect, i.e. the fact the reporting period of the RSI does not coincide with the calendar month and
- Outliers, temporary changes and level shifts in the series.

Please look at <https://www.census.gov/srd/www/x13as/> for additional information on the X-13-ARIMA software.

## Identifying and Treating Outliers, Temporary Changes and Level Shifts

Outliers, temporary changes and level shifts are abrupt changes in the underlying series that can affect the quality of the seasonal adjustment if not treated correctly. The X-13-Arima seasonal adjustment program identifies any outliers, temporary changes or level changes and removes them from the original series before the seasonal adjustment factors are calculated. Once the seasonal adjustment factors are calculated these outliers, temporary changes and level shifts are then re-introduced so they are present in the final seasonally adjusted series.

## Estimating Calendar Effect

The calendar effects induced in the series by the 4, 4, 5, recording period can be estimated and removed using the X-13-Arima seasonal adjustment program. The model of a retail sales series  $y_t$  may be represented as follows:

$$y_t = \sum_i \beta_i x_{it} + z_t$$

Where  $\sum_i \beta_i x_{it}$  is the regression effect, and  $z_t$  is the regression error term fitted by an ARIMA model.

In retail sales the following calendar (regression) effects are adjusted for:

1. The phase shift effect resulting from year to year movement of the standard recording periods.
2. Easter effects, resulting from the Easter holiday moving between the Retail Sales' standardised 'March' and 'April' periods.
3. An October Bank Holiday effect resulting from the holiday moving between the Retail Sales' standardised 'October' and 'November' periods.

In order to estimate these regression effects 16 separate regressors were included initially in the regression model for each series. There are 12 phase shift regressors, 3 Easter regressors and 1 October

Bank Holiday regressors. For each series 10 of the phase shift regressors ('January' – 'September' and 'December') are formally tested for statistical significance using the standard t-test. The 'November', 'October' and October Bank Holiday regressors are jointly tested using the log likelihood ratio test. The 3 Easter regressors are similarly jointly tested. Only regressors that are proven to be statistically significant are included in the final regression model.

Once the calendar effects are adjusted for the seasonal factors are then calculated the X-13-Arima seasonal adjustment program.

## Contact Points

For further information, please contact:

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CSO on the Web               <http://www.cso.ie/en/index.html>



# APPENDIX

## Appendix 1 Updated Baseweights (2015)

<b>Retail Business - NACE Rev 2.0</b>	<b>Jan</b>	<b>Feb</b>	<b>Mar</b>	<b>Apr</b>	<b>May</b>	<b>Jun</b>	<b>Jul</b>	<b>Aug</b>	<b>Sep</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
Motor Trade	44%	41%	41%	34%	30%	25%	39%	29%	30%	26%	22%	15%
Non Specialised Stores	21%	23%	22%	25%	26%	27%	22%	25%	28%	28%	27%	26%
Department Stores	3%	2%	3%	3%	3%	4%	3%	3%	3%	3%	4%	6%
Food, Beverages & Tobacco in Specialised Stores	2%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	4%
Fuel	3%	3%	3%	4%	4%	4%	3%	4%	4%	4%	4%	3%
Pharmaceutical, Medical and Cosmetic Articles	5%	6%	5%	6%	6%	7%	6%	6%	6%	7%	7%	8%
Clothing, Footwear and Textiles	5%	5%	5%	7%	7%	8%	7%	8%	7%	8%	8%	11%
Furniture and Lighting	1%	1%	1%	1%	1%	2%	1%	2%	2%	2%	2%	2%
Hardware, Paints and Glass	2%	2%	2%	2%	2%	3%	2%	2%	2%	2%	2%	2%
Electrical Goods	4%	3%	3%	3%	3%	3%	3%	3%	4%	4%	5%	6%
Books, Newspapers and Stationery	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	2%
Other Retail Sales	6%	7%	6%	7%	7%	8%	6%	7%	8%	8%	10%	12%
Bars	3%	4%	4%	4%	5%	5%	4%	5%	5%	5%	4%	5%
<b>All Business</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

## Appendix 2: Updated Trading Day Weights

Business Group	Cell	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	All	0.19	0.19	0.19	0.20	0.20	0.03	0.00
2	All	0.13	0.12	0.13	0.15	0.17	0.18	0.12
3	All	0.12	0.12	0.13	0.16	0.17	0.19	0.11
4	All	0.13	0.13	0.14	0.16	0.20	0.18	0.08
5	All	0.13	0.13	0.14	0.18	0.20	0.13	0.10
6	All	0.13	0.13	0.14	0.15	0.17	0.17	0.11
7	All	0.10	0.11	0.12	0.16	0.17	0.22	0.12
8	All	0.13	0.13	0.14	0.15	0.15	0.17	0.12
9	All	0.15	0.14	0.15	0.15	0.15	0.17	0.10
10	All	0.14	0.14	0.14	0.16	0.17	0.16	0.09
11	All	0.14	0.14	0.14	0.15	0.17	0.16	0.09
12	All	0.14	0.14	0.14	0.17	0.19	0.14	0.08
13	All	0.08	0.08	0.09	0.12	0.19	0.27	0.17

Please note due to rounding the rows may not add to one.

### Appendix 3 - Updated Cell Size Class Thresholds

Size Class	Annual Turnover Thresholds
1	Turnover $\leq$ € 499,000
2	€ 500,000 $\leq$ Turnover $\leq$ € 999,000
3	€ 1,000,000 $\leq$ Turnover $\leq$ € 4,999,999
4	€ 5,000,000 $\leq$ Turnover

## Appendix 4 - NACE Rev. 2 Business & Combined Group Descriptions

<b>Business Group Description</b>	<b>NACE REV. 2 code</b>
<b>1</b> Motor Trade	45
<b>2</b> Non specialised stores with food, beverages or tobacco predominating	47.11
<b>3</b> Department Stores	47.19
<b>4</b> Food, Beverages and Tobacco in specialised stores	47.2
<b>5</b> Fuel	47.3
<b>6</b> Pharmaceutical Medical and Cosmetic Articles	47.73-5
<b>7</b> Clothing, Footwear and Textiles	47.51, 47.71-2
<b>8</b> Furniture & Lighting	47.59
<b>9</b> Hardware Paints & Glass	47.52
<b>10</b> Electrical Goods	47.41-3, 47.54
<b>11</b> Books, Newspapers & Stationery	47.61-2
<b>12</b> Other Retail Sales	47.53, 47.63-5, 47.76-8 47.91
<b>13</b> Bars	56.3

<b>Combined Groups</b>	<b>Business Group Combinations</b>
<b>1</b> All Business	1 - 13
<b>2</b> All Business Ex Motor Trades	2 - 13
<b>3</b> All Business Ex Motor Trades & Bars	2 -12
<b>4</b> Motors & Fuel	1 and 5
<b>5</b> All Business Ex Motor Trades , Fuel & Bars	2 - 4 and 6 - 12
<b>6</b> Food	2 and 4
<b>7</b> Non Food ( Excl Motor & Fuel & Bars)	3 and 6 - 12
<b>8</b> Household Equipment (G_47_NF_Other2)	8 - 10
<b>9</b> Books, Newspapers, Stationery & Other Goods (G_47_NF_Other1)	11 and 12