METHODOLOGY
RETAIL SALES INDEX
(IVCM, by its Spanish acronym)

Operations Sub directorate
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TABLE OF CONTENTS

1. INTRODUCTION

The aim of The National Statistics Institute (INE) is to improve quality standards and is constantly reviewing statistical needs. In this context, it provides users a new indicator for measuring changes in retail sales.

The Retail Sales Index (IVCM), base year average 2005 = 100, will provide knowledge on the main operational features of companies involved in the retail sector by measuring short-term changes of the sector's activity. The new indicator is published more than 30 days after the end of the reference period.

2. CONCEPTUAL FRAME

2.1. Objective

The purpose of this indicator is to measure the short-term evolution of the retail trade sector by collecting data of the sales reported by retail companies.

2.2 Uses of the information

The information provided by the indicator of retail sales contributes to the decision making process of government authorities and private sector, as well as the measurement of the evolution and trends of the retail trade sector, in the calculation of national accounts. It also has an important role in the evaluation of competitiveness of the different sub sector of the retail trade.

2.3. Classification of activities

The structure of the IVCM is determined by the classification of the country's retail activities, considering the sector's features and the need to build a comparable index at national and international level. The IVCM structure is based on the International Standard Industrial Classification of all economic activities ISIC Rev. 3, divisions 50 and 52, which allow the classification of a company within an activity according to the line(s) of products that such company sells.

The IVCM structure is built by grouping the lines of products in subclasses of trade. These subclasses, in turn, form classes of trade, which are classified under types of trade.

The classification of enterprises by type of trade -non-specialized and specialized- depends on the number of product lines traded and the corresponding turnover. A company that sells more than five product lines and in which none of them represent more than 50% of the total turnover, belongs to the non-specialized trade, otherwise, it falls under the specialized trade group.

The tagging by classes of trade -two within the non-specialized trade and twelve in the specialized- is performed according to the sales level or turnover of each one of the twelve product lines that make up the IVCM. The company that concentrates in one line of products over 50% of its total sales falls in the class corresponding to such line of business.

The subclasses of trade, in turn, refer exclusively to the class known as supermarkets: Mega markets correspond to those that have 54 or more registers and Traditional Supermarkets, which have between 3 and 53 registers.

Additionally, the goods traded in the retail market are classified in Durable and Non Durable. This subdivision is based on the time of consumption, therefore, a product that quickly disappears when it is used (short life) is classified as a non-durable good while a long life product is regarded as a durable good.

The following retail activities are not included in the IVCM:

- Sales of second-hand goods, except second-hand vehicles
- Sales performed at stalls (mobile units) and open-air markets/fairs
- Sales performed by post or electronic mail only
- Repair of personal and household goods

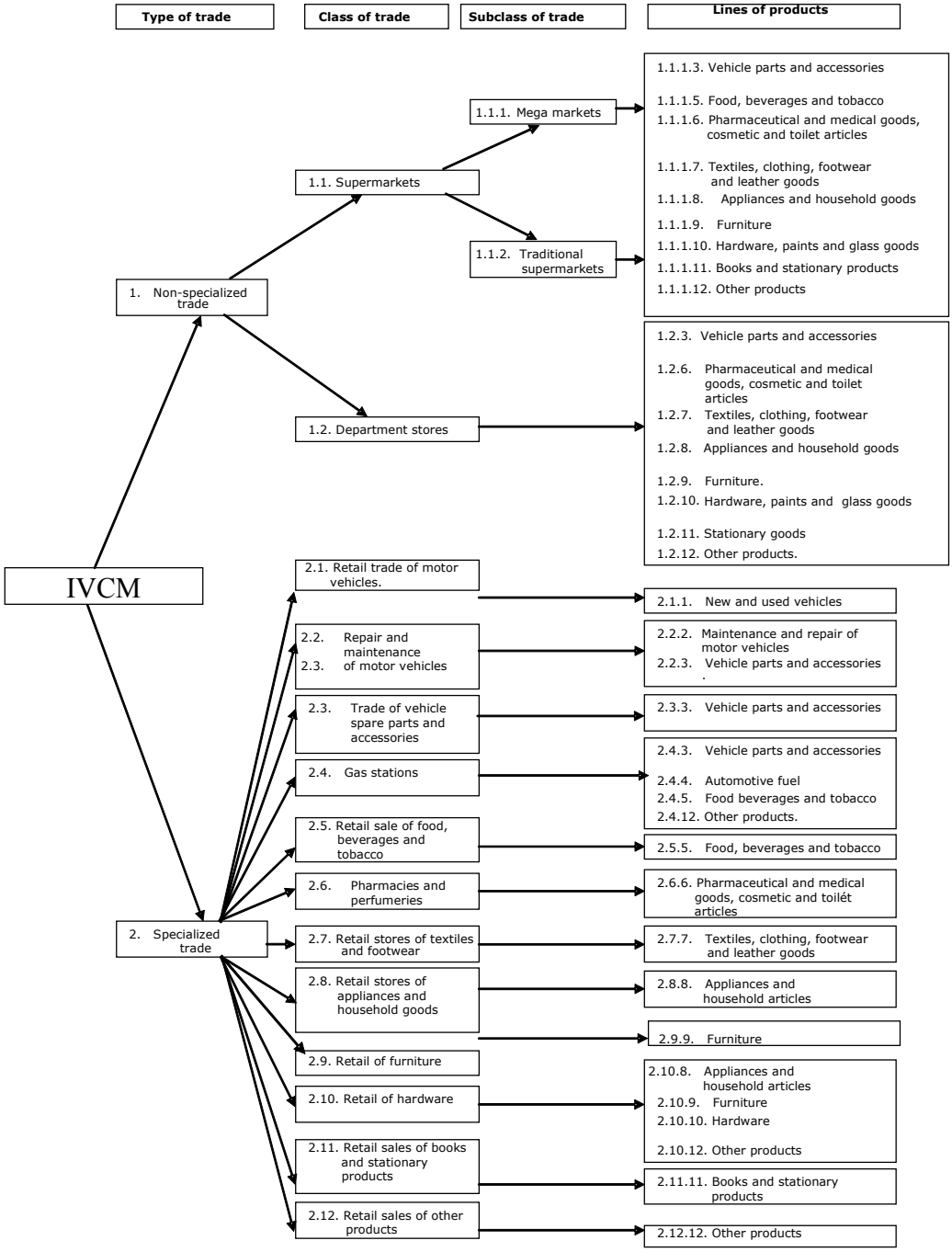
Also, small businesses with annual sales that together cover 5% of cumulative sales of their corresponding class are excluded.

3. COVERAGE

The IVCM coverage is national, collecting the information monthly through a survey questionnaire created specifically for this purpose and addressed to a sample of retail companies that operate within the country's boundaries. In order to optimize the financial resources, low turnover companies are excluded. Therefore, the coverage reaches 95% of the accumulated sales reported by each Class of Trade in 2005 and corresponds to 79,951 companies.

Supermarkets coverage is 100%. That is, all establishments that have three or more checkout registers at national level are surveyed. This information comes from the Supermarket Sales Index published by INE on a monthly basis.

Figure 1 Structure of retail trade and repair activities within the IVCM



3.1. Definitions

The following definitions apply to the Retail Sales Index (IVCM):

Retail trade and repair activities: This concept refers to sales of new and used products which have not been transformed and that are bought by the general public for personal or domestic consumption.

Specialized trade: Companies selling less than five lines of products, among of which one of them accounts for over 50% of the total turnover; the line of product that accounts for over 50% of total sales determines the main activity of the company.

Non-specialized trade: Companies that sell over five lines of products, among of which none of these accounts for over 50% of total sales. In this case, Supermarkets and Department Stores fall into this type of trade.

Mega market: Subdivision of the Supermarkets class, made up by large area stores that sells multiple lines of consumer products through a self-service system, having installed 54 or more cash registers.

Traditional supermarket: Subdivision of the Supermarkets class, made up by establishments that sell food, beverages and tobacco mostly, through a self-service system, having between 3 and 53 cash registers.

Department stores: Large area stores that usually sell over five lines of products and where none of them concentrate over 50% of total sales. These lines of products are mainly textiles, footwear, household appliances, furniture, and perfumes. These goods are sold in different sections or departments, clearly identifiable, under the direction of a single management.

Consumer good: Perishable goods bought by final consumers for direct consumption, without the need of submitting them to prior transformation processes. These goods are classified in:

- ***Non-durable consumer goods***: Final goods that disappear when consumed, such as beverages.
- ***Durable consumer goods***: Final goods whose lifetime goes beyond present consumption, such as television sets.

3.2 Statistical Unit

The statistical unit is an independent company that has a single taxpayer identification number (RUT, by its Spanish acronym) and accounting of its own, being able to carry out its activities in one or more commercial establishments.

The taxpayer's principal activity is the one that has the highest volume of sales in the registry of Chile's tax bureau SII (Servicio de Impuestos Internos) for the year 2005. This main activity will be revised annually, at the time the sample is updated with the new available information. This information comes

from SII registry of recent years and from the data collected through the monthly surveys.

3.3. Unit of measure

The unit for measuring the activity is total monthly sales, excluding VAT. The advantage of this unit of measure is that is simple, straightforward and that therefore can be informed without delay (quick response). Only the VAT is excluded, since it is difficult for companies to report monthly net sales without indirect taxes, particularly those affecting the sale of liquors, tobacco and fuels.

4. SAMPLE DESIGN

It is not easy to address the trade sector, given the heterogeneity of sales linked to this activity and companies' instability over time. It is then necessary to adopt special methods of selection to tackle the first problem, and mechanisms to update the sample on an annual basis to address the second.

4.1. Target population

As mentioned above, all companies classified under Retail Trade and Repair Services, ISIC Rev. 3, make up the target population.

4.2. Sample framework

Since there isn't an up-to-date, refined administrative registry of the sector under study, a nameless registry (*innominados* [1] of the SII - Annual Statement of Income Tax - Form 22 and Monthly Statement VAT - Form 29) is used to build the sample framework.

To generate the final framework, companies that together manage 95% of sales[2] of the different types and classes of trade are considered. This is due to the low contribution that some companies have over the total turnover and the fact that analyzing extremely small units, which are also highly unstable over time (therefore affecting the quality and timing of the indicator), is extremely difficult.

Given the importance of supermarkets within the country, INE carries out a census of all such establishments that have three or more cash registers, and whose activity is the retail trade, on a monthly basis. Thus, the universe of supermarkets have been included in the sample (forced inclusion - FI).

[1] This refers to the absence of prior identification of a company, except for the assignment of a fictitious taxpayer unique identification number (RUT) by the SII.
[2] Companies are classified by turnover (ascending order).

4.3. Stratification

In order to secure a good representativeness of the classes of trade existing nationwide, stratification by classes of trade is applied to the sample frame.

There is a special case within the classes of trade with a different treatment: the sale of new vehicles; the maintenance and repair of motor vehicles; and the sale of spare parts and accessories of motor vehicles are grouped in the same stratum, since they all fall under the same activity.

By examining the behaviour of corporate annual sales, which is the unit of measure, it is possible to realize that there is a high level of heterogeneity and asymmetry; that is, there is a great number of taxpayers that report a low level of sales and a few with high volume of sales. Because of this, a second stratification is carried out, by company size (big, medium and small) and by sales within each class of trade.

The following ranges are identified to define the size of the company:

Table 1 Company size by sales range

Size	Sales (Chilean pesos)	
	minimum	maximum
Small-size	0	124.294.584
Medium-size	124.294.585	497.178.337
Big-size	497.178.338	-

As a way to improve representativeness and reduce the sampling error that comes from the dispersion observed in sales, once stratum have been arranged by variable of interest, the larger sample units are divided into a "segment to be surveyed" (TC), comprising the universe of forced inclusion (IF) companies, while the rest become part of the "segment to be sampled" (TM).

The cut-off point for these two segments is defined according to their contribution to total sales and by the sampling error resulting from removing, from the sample framework, those companies that notoriously affect estimates' accuracy. These companies become part of the universe to be surveyed (IF companies).

Since the goal is to obtain an appropriate number of units in the sample to ensure a good contribution to sales of IF companies, achieving an appropriate size for the sample, with a minimum sampling error, which is easy to handle according to the requirements of a short-term economic indicator, the following measures were taken:

a) Within each class of trade, companies were arranged from bigger to smaller according to their turnover.

b) Their sales were arranged by classes of trade.

c) A first cut-off point was determined for each class of trade according to a minimum contribution in sales of 50%, considering each stratum features.

d) The behaviour of sales was studied in the following classes of trade: food, beverages and tobacco; furniture and other products in specialized stores, where it was necessary to include a high number of companies to cover the proposed contribution to sales. it was observed that given the similar level of turnover, a low concentration exists within the bigger companies. Thus, in such cases it wasn't necessary to achieve a 50% of the sales contribution by class.

e) The coefficient of variation for each stratum was calculated and discussed according to its precision, resulting on the removal from the sample framework all those enterprises that strongly affect the estimates' accuracy, becoming part of the units that are necessarily included in the sample (IF).

4.4. Sampling and information unit

The sampling unit is the company officially registered and authorised to trade goods and services under the Retail Trade and Repair Activities category, and performing its commercial activity within Chile's boundaries.

The variable of interest considered for the sample study is annual sales declared through the VAT monthly declaration (Form 29, SII) of each taxpayer performing some kind of commercial activity.

4.5. Sample size

The first estimate of the sample of retail trade companies, at national level, is drawn from the stratification by classes described in the section 4.3, using a simple random sampling with a 5% sampling error as the maximum accepted, distributing the sample size proportionate to the sales of each group. The following algorithms were used:

Sample size

$$n=\frac{\left(t^2*N*Q\right)}{\left(\left(t^2*Q\right)+\left(P*N*e_r^2\right)\right)}$$

Where:

- n : Sample size
- t : T-Student statistical test with 95% confidence level
- e_r : Relative error
- P : Unit proportion in this class
- Q : Sample proportion of population not in this class
- N : Population size

Distributing the sample size proportionally by the turnover reported in each stratum.

$$n_h = n * \frac{\sum_{i=1}^{k} y_{hi}}{\sum_{h=1}^{H}\sum_{i=1}^{k} y_{hi}}$$

Where:

n_h : Size of stratum *h*.
n : Sample size
$\sum_{i=1}^{k} y_{hi}$: Sum of the sales reported by companies of random selection in stratum *h*.
$\sum_{h=1}^{H}\sum_{i=1}^{k} y_{hi}$: Sum of sales reported by randomly selected companies in all stratum.

However, the final size of each stratum was subject to the accuracy of the sample at stratum-level. Because of this, we had to increase or decrease the number of companies in some of the stratum to strengthen their representativeness and secure the accuracy required for the study.

To determine the relevant sample precision, we calculated different coefficients of variation, using the following algorithm:

Coefficient of variation of stratum *h*

$$CV_h = \frac{\sqrt[2]{V\left(\hat{Y}\right)_h}}{\sum_{i=1}^{k} y_{hi}}$$

Where:

CV_h : Coefficient of variation of stratum *h*
$V\left(\hat{Y}\right)_h$: Sample variance of sales in stratum *h*
$\sum_{i=1}^{k} y_{hi}$: Sum of sales in stratum *h*.

Sample variance of corporate sales

$$V\left(\hat{y}\right) = \sum_{h}^{H} N_h * (N_h - n_h) * \frac{S_h^2}{n_h}$$

$V\left(\hat{y}\right)$: Estimated sample variance of sales.

S_h^2 : Sales quasi-variance from companies in stratum *h*

N_h : Number of companies in stratum *h*

n_h : Sample size of stratum *h*.

Quasi-variance of sales of companies in stratum *h*

$$S_h^2 = \frac{N_h}{\left(N_h - 1\right)} * \sigma_h^2$$

Where:

S_h^2 : Quasi-variance that measure dispersion in sales of companies in stratum *h*.

N_h : Number of companies in stratum *h.*

σ_h^2 : Variance of sales in stratum *h*.

Variance of sales in stratum *h*

$$\sigma_h^2 = \frac{\sum_{i=1}^{k}\left(y_{hi} - \bar{y}_h\right)^2}{N_h}$$

Where:

σ_h^2 : Variance of sales in stratum *h*.

y_{hi} : Sales of the *i-th* company in stratum *h*.

$\bar{y}_h$: Arithmetic mean of sales in stratum *h*.

N_h : Number of companies in stratum *h*.

The estimate of the theoretical sampling at national level, which was obtained from stratification by class of trade according to ISIC Rev. 3, is 2,203 companies, with a 95% coefficient of confidence, and therefore it contains 2.8% of all units of the sample frame.

The biases not attributable to the sample and that depend on the sector's dynamics and complexity can be summarized as follows:

- Quality of the universe directory.
- Emergence of new activities and new product lines.
- Forms of trading.
- Companies' geographic location.

Table 2 Effective sample by type and class of trade

Group	Sample frame	Sample			
		Total	IF	Companies	Coefficient of variation %
Total	79.951	2.203	665	1.538	0,96
Non-specialized trade	348	347	316	31	0,17
Supermarkets 1/	304	304	304	-	-
Department stores	44	43	12	31	0,17
Specialized trade	79.603	1.856	349	1.507	1,12
Automotive	1.806	252	65	187	1,31
Gas stations	513	126	58	68	1,35
Food	45.902	440	24	416	3,97
Pharmacies	357	110	40	70	0,93
Textiles	3.123	140	38	102	3,68
Appliances	671	128	19	109	2,17
Furniture	860	111	8	103	6,73
Hardware	1436	209	50	159	0,64
Stationary and bookstores	897	75	12	63	4,14
Other specialized stores	24.038	265	35	230	3,96

1/ This class of trade is included as census of three or more registers.

4.6. Method of selection

The selection of sampling units is done separately for each stratum, so the companies belonging to the segment to be surveyed must be included in the sample (forced inclusion).

A systematic selection is performed in order to ensure a full coverage within each stratum *h*, using the following algorithm:

Where:

$$K_h = \frac{N_k}{n_k}$$

K_h : Factor used for the systematic selection of sampling units in stratum *h*.

N_k : Number of sample units in stratum *h*.

n_k : Sample size of stratum *h*.

Subsequently, an element of the numbered list of companies in the stratum is selected randomly and the K_h factor is added to the number chosen. As such, you can go through the whole stratum obtaining the remaining sampling units.

4.7. Expansion factors

The IVCM methodology considers the calculation of two types of expansion factors, one referring to companies in the forced sampling (IF) and one, regarding companies that have been included randomly.

Once the survey addressed to retail companies has been carried out, sales of each sampling stratum are expanded independently. This because there isn't a direct relationship between the real taxpayer ID (RUT) and sales within the sample framework, given the confidentiality entrusted by law to the SII, which prevents from carrying out an individual expansion by company.

To perform the mentioned expansion, companies in the forced sampling (IF in Spanish) are considered first, since they are self-represented sampling units and thus its expansion factor is 1.

The algorithm for calculating the expansion factor of companies in the forced sampling is as follows:

$$FE(IF)_h = \frac{\sum_{i=1}^{K} y(IF)_{h,i}}{\sum_{i=1}^{K} y(IFe)_{h,i}}$$

Where:

$FE(IF)_h$: Expansion factor of forced sampling (IF) companies in *stratum h*.

$\sum_{i=1}^{K} y(IF)_{h,i}$: Sum of sales of the sample framework corresponding to IF companies (forced sampling) in stratum *h*.

$\sum_{i=1}^{k} y(IFe)_{h,i}$: Sum of sales of the sample framework corresponding to successfully included IF companies (forced sampling) in *stratum h*.

As described in Section 4.3., a second stratification is performed within the random sample to homogenize the variable under study, according to size (companies' turnover). This is particularly relevant when performing the expansion, since it must be done with the same level of detail to obtain a better estimation of total monthly sales, as companies of different sizes will have their own expansion factor.

The algebraic expression of the expansion factor for companies in the random sampling (TA) is as follows:

$$FE(TA)_{h,m} = \frac{\sum_{i=1}^{K} y(TA)_{h,m,i}}{\sum_{i=1}^{k} y(TAe)_{h,m,i}}$$

Where:

$FE(TA)_{h,m}$: Expansion factor for companies in the random sample (TA) in stratus *h*, size *m.*

$\sum_{i=1}^{K} y(TA)_{h,m,i}$: Sum of sales of the sample framework corresponding to TA companies in *stratum h*.

$\sum_{i=1}^{k} y(TAe)_{h,m,i}$: Sum of sales of the sample framework corresponding to successfully included TA companies in stratum *h*, size *m*.

It is worth pointing out that, as the data is processed on a monthly basis, if there is a delay or no response from a company, an estimation of the corresponding monthly sales is calculated. The expansion factors will remain unchanged and will only be subject to modifications when performing the annual update of the sample.

4.8. Sample update

The sector under study presents considerable dynamism in relation to the companies' opening and closing and to the behaviour of annual sales levels within the different stratum, so it is necessary to perform an annual update of the sample to avoid loosing representativeness over time.

To meet the above-mentioned objective, an updated sample framework is built annually using the same criteria described in sections 4.2 and 4.3. Subsequently, the number of commercial companies and their sales are reviewed for each stratum *h*, identifying annual changes compared to the previous framework.

The sampling process is performed as a sample completely independent from the previous year. After determining the sample size and its associated errors, the old and the new samples are compared by stratum to calculate the difference in the number of sampling units.

The units selected in the sample framework (2005) are regarded as a panel to be updated annually. When making the selection of companies, units that have shown stability over time are maintained and new ones are added if the new sample size calls for it, verifying their location and activity.

The purpose of updating the sample each year is to establish the market changes in order to efficiently estimate monthly sales by means of the sample. However, in order to give consistency and stability to the indicator, only sample units presenting problems during the monthly data collection are replaced. Also, new units are included into the former selection if the new sizes of the stratum require it, or decreasing the number of units if the stratum has lost relevance in terms of sales and is overrepresented in the new sample.

To follow up the companies that have problems and cannot longer be part of the sample, a track record of changes is maintained (changes of unique taxpayer ID (RUT), activity, mergers, bankruptcy, shut downs, and so on). The aim of such record is to use this information when updating the sample.

Also, it is important to note that the status of forced sampling units (IF) is not permanent and that it may vary when the sampling is updated, depending on the turnover and the new sampling error. If the sampling error decreases, these sampling units enter the random sample category. Updating is done once a year, so companies defined as forced sample units will stay as such for at least a year and will provide information on a monthly basis.

On the other hand, if a company's sales report a sharp decrease, there is a chance that it will stay out of the sample frame, since the cut-off is done by considering 95% of the accumulated sales by stratum.

5. Imputation

Companies that are imputed on a monthly basis, according to international techniques, are:

- Those that have not reported during the month; these company are monitored after the publication of the index, so as to correct the data when the information arrives, and to find out the company's situation (has it ceased operations definitively or the lack of data is a circumstantial matter?)

- In case of transitory shutdowns, companies need to be subject of imputation until they restart operations, thus the monthly monitoring is necessary.

- In cases of permanent shutdowns, sales of the affected companies will be imputed until the next update of the sample.

The imputation is applied to sales, without expansion. This imputation consists in determining the twelve-month variation of companies belonging to the same line, group and expansion factor, applying that variation to sales in month t-12 of the company that is not reporting. Its purpose is to guarantee that companies are alike in a way that does not affect the indicator's behaviour.

This is the calculation formula:

$$Variación = \frac{\sum y_{h,l,t}}{\sum y_{h,l,(t-12)} - y^{*}_{h,l,(t-12)}}$$

Where:

$y_{h,l,t}$ = sale of the company of group *h*, line of products *l*, time *t* and equal factor of expansion.

$y^{*}_{h,l,(t-12)}$ = sales in t-12, of the company that is not reporting in *t*, group *h* and line *l*.

The following imputation is used;

$$y^{*}_{h,l,t} = \left(y^{*}_{h,l,(t-12)}\right) \cdot \left(Variation\right)$$

6. Weights of the indicator

IVCM weightings correspond to sales by type and class of trade over total expanded sales of retail trade and repairs. Therefore, there will be weightings of the twelve lines of products and of the two type of consumer good.

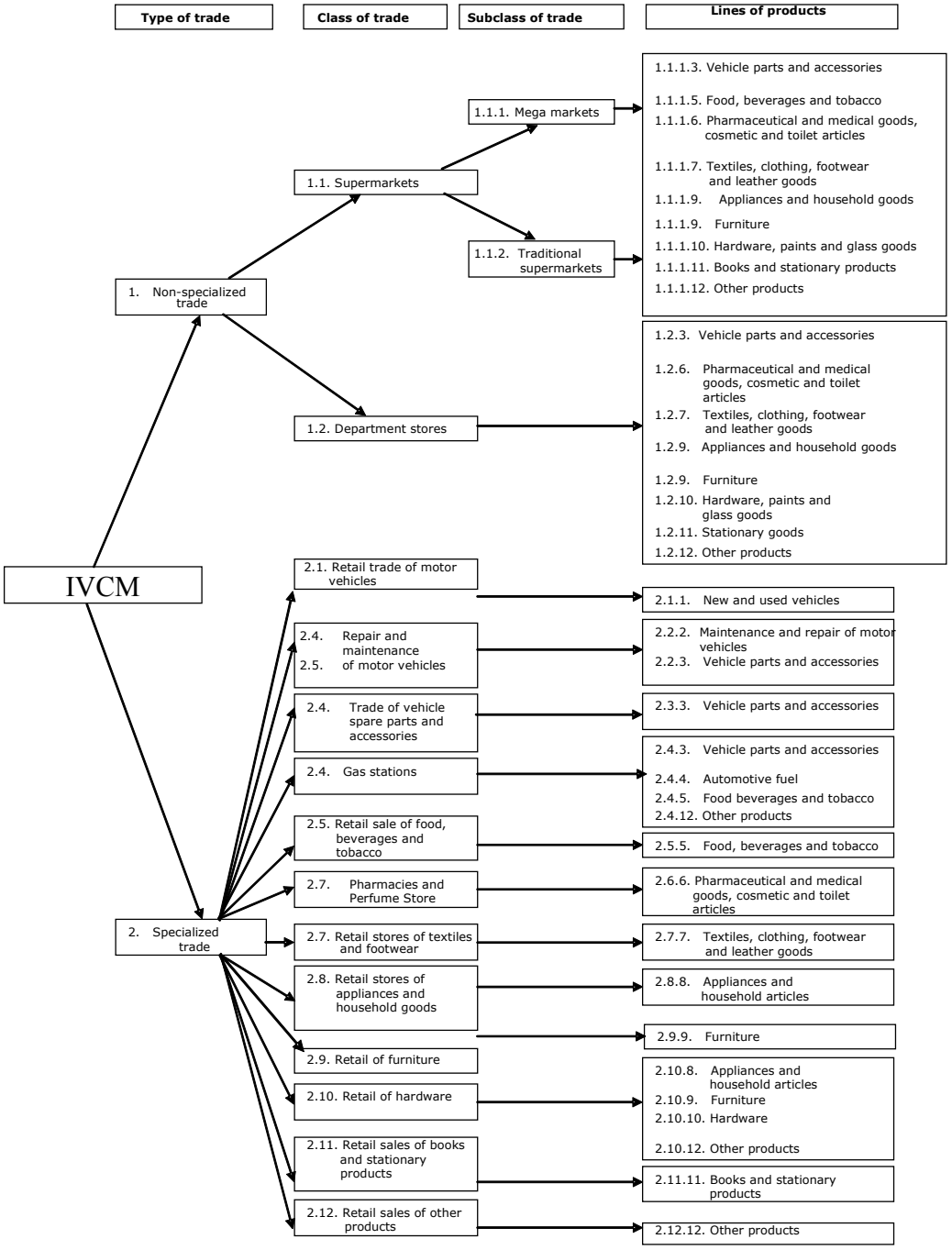
Supermarkets' weightings correspond to expanded sales according to the census of supermarkets that have three or more registers; that is, estimated data on sales of the universe.

The weights to calculate the IVCM are presented according to three disaggregations: by type of trade, lines of products and consumer goods.

6.1. Weighting by type of goods:

The base for calculating IVCM weights by type of trade corresponds to sales classified by lines of products, which are grouped into the corresponding subclasses and classes for each type of trade. (See Figure 2 below).

Figure 2 Structure of retail trade and repairs, by type of trade



a) The algorithm to calculate weights of the lines of products belonging to the trade subclasses (mega markets and supermarkets), is as follows:

$$W_{z,h,c,l} = \frac{\sum_{i=1}^{12} \hat{Y}_{z,h,c,l,i}}{\sum_{l=1}^{L} \sum_{i=1}^{12} Y_{z,h,c,l,i}}$$

Where:

$W_{z,h,c,l}$: Weight of the line of product *l*, within the subclass of trade *c, belonging to the class of trade h* and type of trade *z*.

$\sum_{i=1}^{12} \hat{Y}_{z,h,c,l,i}$: Sum of the monthly sales estimates (*i*) performed in the base year, of the line of products *l,* subclass of trade *c*, belonging to the class of trade *h and* type of trade z*.*

$\sum_{l=1}^{L} \sum_{i=1}^{12} \hat{Y}_{z,h,c,l,i}$: Sum of the monthly sales estimates (*i*) performed in the base year, of all the lines of products*, within the* subclass of trade *c*, belonging to the class of trade *h and* type of trade z*.*

b) The algorithm to calculate weight of the lines of products that directly make up a class is as follows:

$$W_{z,h,l} = \frac{\sum_{i=1}^{12} \hat{Y}_{z,h,l,i}}{\sum_{l=1}^{L} \sum_{i=1}^{12} \hat{Y}_{z,h,l,i}}$$

Where:

$W_{z,h,l}$: Weight of the line of product *l*, belonging to the class of trade *h* and type of trade *z*.

$\sum_{i=1}^{12} \hat{Y}_{z,h,l,i}$: Sum of monthly sales estimates (*i*), in base year, of the line of products *l, group h*, which belong to the type of trade *z*.

$\sum_{l=1}^{L} \sum_{i=1}^{12} \hat{Y}_{z,h,l,i}$: Sum of monthly sales estimates (*i*) in base year of all lines of products *of the group h*, which belong to the type of trade *z*.

As general rule, the different weights calculated for the base year used ten decimals and a check-up is carried out for each disaggregation:

$W_{h,1} + ... + W_{h,l} + ... W_{h,L} = 1$

Where:

$W_{h,1}$: Weight of the first line of product *1 of the class of trade h*.

$W_{h,l}$: Weight of the *l-th* line of product, *class of trade h*.

$W_{h,L}$: Weight of the last line of product *1 of the class of trade h*.

c) The following is the algorithm used to calculate the weighting of the subclasses of trade:

$$W_{z,h,c} = \frac{\sum_{i=1}^{12} \hat{Y}_{z,h,c,i}}{\sum_{c=1}^{2} \sum_{i=1}^{12} \hat{Y}_{z,h,c,i}}$$

Where:

$W_{z,h,,c}$: Weight of the subclass of trade *c*, belonging to the class of trade *h* and type of trade *z*.

$\sum_{i=1}^{12} \hat{Y}_{z,h,c,i}$: Sum of the monthly sales estimates (*i*) performed in the base year of *the* subclass of trade *c*, belonging to the class of trade *h, and* type of trade z*.*

$\sum_{l=1}^{L} \sum_{i=1}^{12} \hat{Y}_{z,h,c,i}$: Sum of the monthly sales estimates (*i*) performed in the base year of all subclasses of trade belonging to the class of trade *h, and* type of trade *z.*

d) The following algorithm is used to calculate the weights of the different classes of trade:

$$W_{z,h} = \frac{\sum_{i=1}^{12} \hat{Y}_{z,h,i}}{\sum_{h=1}^{H} \sum_{i=1}^{12} \hat{Y}_{z,h,i}}$$

Where:

$W_{z,h}$: Weight of the class of trade *c* belonging to type of trade *z.*

$\sum_{i=1}^{12} \hat{Y}_{z,h,i}$: Sum of monthly sales estimates (*i*), in base year, of the class of trade *h*, which belong to the type of trade *z*.

$\sum_{h=1}^{H} \sum_{i=1}^{12} \hat{Y}_{h,i}$: Sum of monthly sales estimates (*i*), in base year, of all classes of trade *h* that belong to the type of trade *z*.

e) The following algorithm is used to calculate the weights by type of trade (specialized and non-specialized):

$$W_z = \frac{\sum_{i=1}^{12} \hat{Y}_{z,i}}{\sum_{z=1}^{Z} \sum_{i=1}^{12} \hat{Y}_{z,i}}$$

Where:

W_z : Weight of type of trade *z.*

$\sum_{i=1}^{12} \hat{Y}_{z,i}$: Sum of monthly sales estimates (*i*) in base year of type of trade *z.*

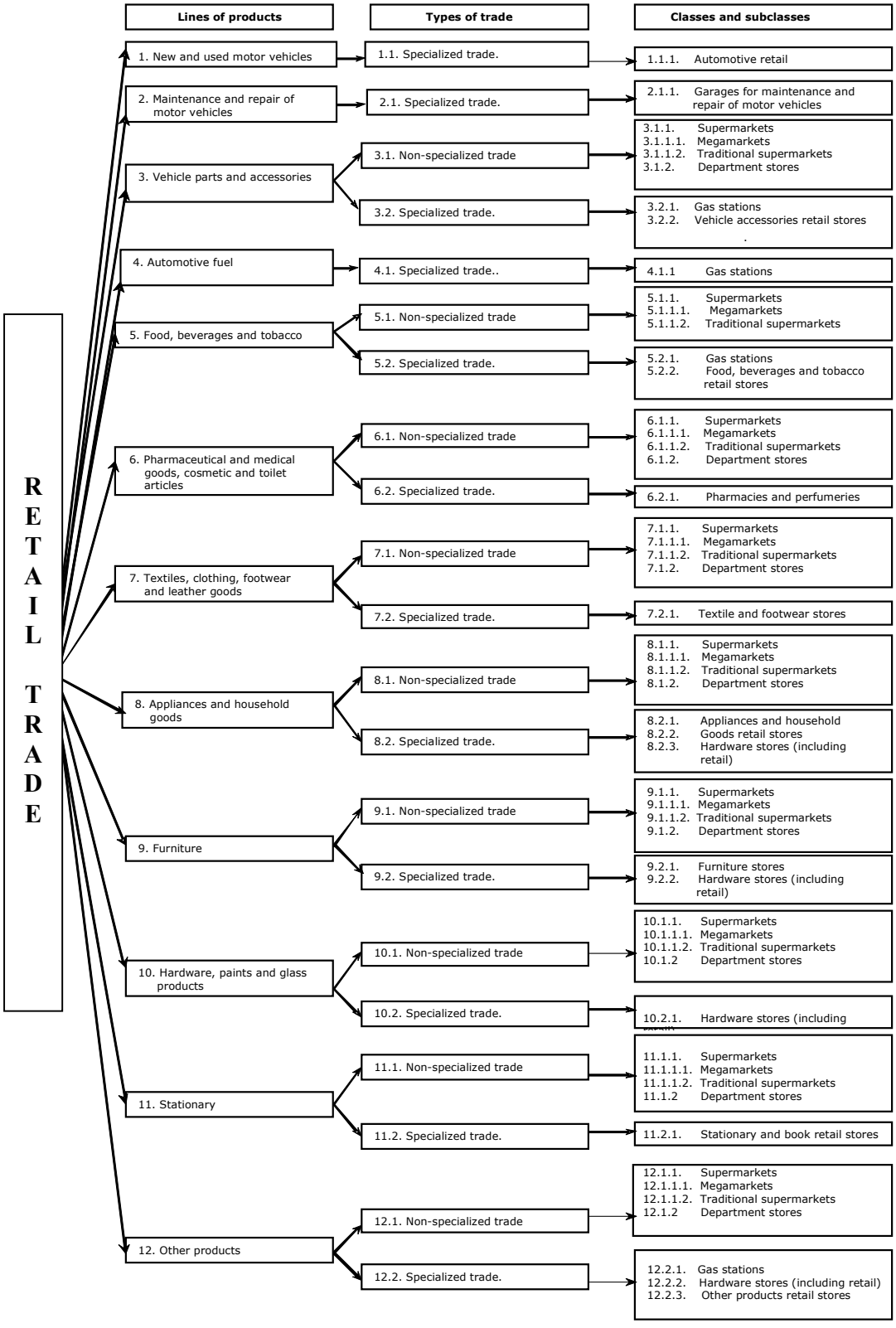
$\sum_{z=1}^{Z} \sum_{i=1}^{12} \hat{Y}_{z,i}$: Sum of monthly sales estimates (*i*) in base year of all types of trade *z*.

6.2. Weights by lines of products:

Weights by lines of products are structured according to Figure 4.

The base for calculating the weights by lines of products corresponds to the subclass of trade. These are aggregated by classes and types of trade in each one of the lines of products.

Figure 3 Structure of the Retail Trade and Repair Activities by lines of Products



a) The algorithm used for calculating weights of the subclasses of trade (mega markets and supermarkets) that sell the line of products *l* is:

$$W_{l,z,h,c} = \frac{\sum_{i=1}^{12} \hat{Y}_{l,z,h,c,i}}{\sum_{c=1}^{2}\sum_{i=1}^{12} \hat{Y}_{l,z,h,c,i}}$$

Where:

$W_{l,z,h,c}$: Weight of the subclass of trade *c*, class of trade *h*, type of trade *z,* where the line of products *l* is sold.

$\sum_{i=1}^{12} \hat{Y}_{l,z,h,c,i}$: Sum of monthly sales estimates in base year by subclass of trade *c*, which makes up the class of trade *h*, type of trade z, where the line of products *l is sold.*

$\sum_{c=1}^{2}\sum_{i=1}^{12} \hat{Y}_{l,z,q,c,i}$: Sum of monthly sales estimates in base year by all subclasses of trade that make up the class of trade *h*, type of trade z, where the line of products *l is sold.*

b) The weight of the different classes of trade selling the line of products *l* is calculated with the following algorithm:

$$W_{l,z,h} = \frac{\sum_{i=1}^{12} \hat{Y}_{l,z,h,i}}{\sum_{h=1}^{H}\sum_{i=1}^{12} \hat{Y}_{l,z,h,i}}$$

Where:

$W_{l,z,h}$: Weighing of class of trade *h*, type of trade *z,* where the line of products *l* is traded.

$\sum_{i=1}^{12} \hat{Y}_{l,z,h,i}$: Sum of monthly sales estimates in base year by class of trade *h*, type of trade z, where the line of products *l is sold.*

$\sum_{h=1}^{H}\sum_{i=1}^{12} \hat{Y}_{l,z,h,i}$: Sum of monthly sales estimates in base year by all classes of trade *h*, type of trade z, where the line of products *l is sold.*

c) The weight of the different types of trade selling the line of products *l* is calculated with the following algorithm:

$$W_{l,z} = \frac{\sum_{i=1}^{12} \hat{Y}_{l,z,i}}{\sum_{z=1}^{Z} \sum_{i=1}^{12} \hat{Y}_{l,z,i}}$$

Where:

$W_{l,z}$: Weight of type of trade *z* where line of products *l is sold*.

$\sum_{i=1}^{12} \hat{Y}_{l,z,i}$: Sum of monthly sales (*i*) estimates in base year by type of trade *z* where the line of products *l is sold.*

$\sum_{z=1}^{Z} \sum_{i=1}^{12} \hat{Y}_{l,z,i}$: Sum of monthly sales (*i*) estimates in base year of all types of trade *z* where the line of products *l is sold.*

d) The following algorithm is used to calculate the weight of each line of products *l*:

$$W_{l} = \frac{\sum_{i=1}^{12} \hat{Y}_{l,i}}{\sum_{l=1}^{L} \sum_{i=1}^{12} \hat{Y}_{l,i}}$$

Where:

W_l : Weight of line of products *l*.

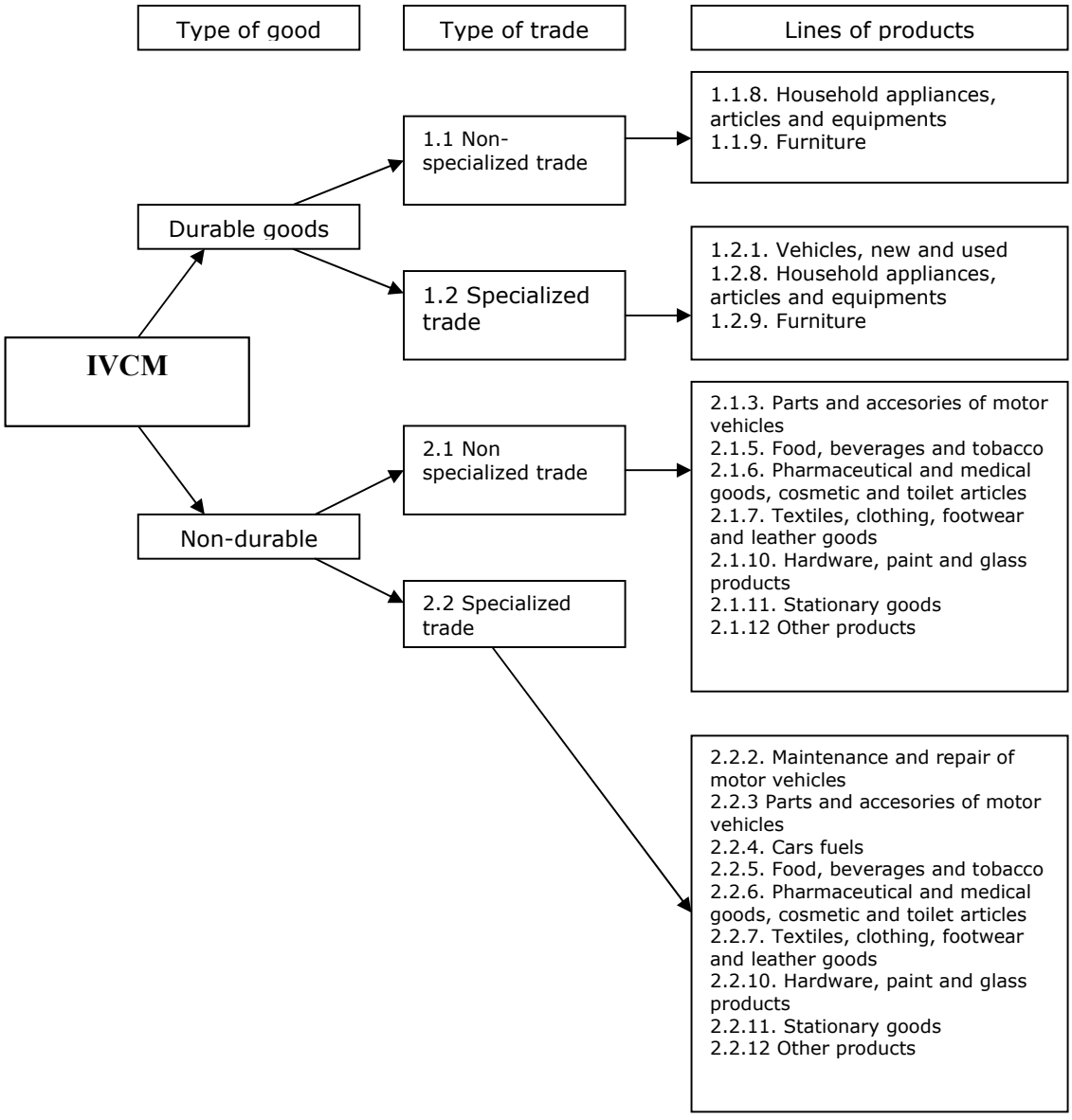
$\sum_{i=1}^{12} \hat{Y}_{l,i}$: Sum of monthly sales estimates (i), in base year, of line of products *l.*

$\sum_{l=1}^{L} \sum_{i=1}^{12} \hat{Y}_{l,i}$: Sum of monthly sales estimates (i), in base year, of all lines of products.

6.3. Weights by type of goods: Durable and Non-durable goods

The methodology of the IVCM considers the classification of traded goods in durable and non-durable. The basis for calculating weightings of this indicator corresponds to the goods that fall under the categories in each line of products. These weightings are added to the two types of commerce and two types of goods. Figure 4 shows the weight structure by type of goods.

Figure 4 Structure of the Retail Trade and Repair by type of goods Durable and Non-durable



a) The following algorithm is used to calculate the weighting of the lines of products:

$$W_{d,z,l} = \frac{\sum_{i=1}^{12} \hat{Y}_{d,z,l,i}}{\sum_{l=1}^{L}\sum_{i=1}^{12} \hat{Y}_{d,z,l,i}}$$

Where:

$W_{d,z,l}$: Weight of line of products *l,* type of trade *z,* where *d* goods are sold.

$\sum_{i=1}^{12} \hat{Y}_{d,z,l,i}$: Sum of monthly sales *i* in base year, of product line *l*, type of trade *Z*, where *d* goods are traded.

$\sum_{l=1}^{L}\sum_{i=1}^{12} \hat{Y}_{d,z,l,i}$: Sum of monthly sales estimates *i* in base year, of line of products *l*, type of trade *z*, where *d* goods are traded.

b) The following algorithm is used to calculate the weight of the types of trade:

$$W_{d,z} = \frac{\sum_{i=1}^{12} \hat{Y}_{d,z,i}}{\sum_{z=1}^{Z}\sum_{i=1}^{12} \hat{Y}_{d,z,i}}$$

Where:

$W_{d,z}$: Weighting of type of trade *z* where *d* goods are traded.

$\sum_{i=1}^{12} \hat{Y}_{d,z,i}$: Sum of estimated monthly sales *i* in the base year, by type of trade z and *d* goods traded..

$\sum_{z=1}^{Z}\sum_{i=1}^{12} \hat{Y}_{d,z,i}$: Sum of estimated monthly sales *i* in the base year, by type of trade *z, d* goods traded.

c) The following algorithm is used to calculate the weights of the types of trade:

$$W_d = \frac{\sum_{i=1}^{12} \hat{Y}_{d,i}}{\sum_{d=1}^{D}\sum_{i=1}^{12} \hat{Y}_{d,i}}$$

Where:

W_d : Weight of good *d.*

$\sum_{i=1}^{12} \hat{Y}_{d,i}$: Sum of monthly sales estimates *i* in base year of *d* type of goods.

$\sum_{d=1}^{D}\sum_{i=1}^{12} \hat{Y}_{b,i}$: Sum of monthly sales estimates *i* in base year of all types of goods.

7. Calculation of the Retail Sales Index (IVCM)

The Retail Sales Index (IVCM) is calculated considering nominal and real terms, and its base year is average 2005=100. It is calculated using the expanded sales of specialized commerce and non specialized department store sales. Sales information provided by Mega markets and Supermarkets with three or more cash registers is also considered.

7.1 Retail Sales Nominal Sales Index

As mentioned above, the base year used for building the nominal sales index is the average of 2005=100. Once data on sales by lines of products has been collected, validated and expanded, the base is created as follows:

$$I^{t}_{z,h,c,l} = \frac{\hat{Y}^{t}_{z,h,c,l}}{\left(\frac{\sum_{i=1}^{12} \hat{Y}^{0}_{z,h,c,l,i}}{12}\right)} * 100$$

Where:

$I^{t}_{z,h,c,l}$: Index in month *t,* of the line of product *l*, subclass of trade *c,* belonging to the class of trade *h* and type of trade *z*.

$\hat{Y}^{t}_{z,h,c,l}$: Sales estimates in month *t,* of the line of product *l*, subclass of trade *c, belonging to the class of trade h* and type of trade *z*.

$\sum_{i=1}^{12} \hat{Y}^{0}_{z,h,c,l,i}$: Sum of the monthly sales estimates, performed in base year 2005=100, of the line of products *l,* subclass of trade *c*, belonging to the class of trade *h and* type of trade z*.*

The base year average is generated for each one of the 12 basic indicators. These refer to the maximum disaggregation of the indicator, corresponding to the lines of merchandises.

The method used to calculate the other nominal sales indexes is by the aggregation of the lines of products or basic indexes according to the disaggregations used for calculating the weights described above.

7.1.1. Retail nominal sales index by type of trade.

To produce the different nominal sales indexes by type of trade, basic indexes already calculated are aggregated, filing in the subclasses and classes of trade where appropriate, and then the indexes are grouped into specialized and non-specialized trade.

a) Nominal sales index by trading subclasses (megamarket and traditional supermarkets) that constitute the supermarket trading class. The following algorithm is used:

$$I^{t}_{z,h,c} = \sum_{l=1}^{L} \left(I^{t}_{z,h,c,l} * W_{z,h,c,l} \right)$$

Where:

$I^{t}_{z,h,c}$: Nominal turnover index in month *t,* by subclass of trade *c, belonging to the class of trade h* and type of trade *z*.

$I^{t}_{z,h,c,l}$: Nominal turnover index in month *t,* by line of products *l*, subclass of trade *c, belonging to the h trading class h* and type of trade *z*.

$W_{z,h,c,l}$: Weight of the line of product *l*, within the subclass of trade *c, belonging to the class of trade h* and type of trade *z*.

b) To calculate the nominal turnover index by supermarkets trading class, the following algorithm is used:

$$I^{t}_{z,h} = \sum_{c=1}^{2} \left(I^{t}_{z,h,c} + W_{z,h,c} \right)$$

Where:

$I^{t}_{z,h}$: Nominal sales in month *t* of the supermarkets trading class, part of the non-specialized trade.

$I^{t}_{z,h,c}$: Nominal sales in month *t,* by subclass of trade *c, belonging to the supermarket class of trade,* non-specialized type of trade.

$W_{z,h,c}$: Weight of the subclass of trade *c*, belonging to the class of trade *h* of the non-specialized type of trade.

The following procedure is used to produce the nominal sales indexes of the other classes of trade making up the specialized and non-specialized types of trade:

a) Nominal sales index of the classes of trade that do not have subclasses of trade.

$$I^{t}_{z,h} = \sum_{l=1}^{L} \left(I^{t}_{z,h,l} * W_{z,h,l} \right)$$

Where:

$I^{t}_{z,h}$: Nominal sales in month *t,* by class of trade *h*, part of type of trade *z*.

$I^{t}_{z,h,l}$: Nominal sales index in month *t,* by line of products *l*, part of the *class of trade h* and type of trade *z*.

$W_{z,h,l}$: Weight of the line of product *l*, belonging to the class of trade *h* and type of trade *z*.

b) To get the nominal sales index by type of trade, specialized and non-specialized, indexes by classes of trade are aggregated as follows:

$$I^{t}_{z} = \sum_{h=1}^{H} \left(I^{t}_{z,h} * W_{z,h} \right)$$

Where:

I_z^t : Nominal sales index in time *t*, type of trade *z*.

$I_{z,h}^t$: Nominal sales in month *t,* by class of trade *h* and type of trade *z*.

$W_{z,h}$: Weight of class of trade *h*, type of trade *z*.

c) To calculate the nominal index in retail sales, indexes corresponding to the specialized and non-specialized trade are aggregated as follows:

$$I^t = \sum_{z=1}^{Z} \left(I_z^t * W_z \right)$$

Where:

I^t : Nominal sales index in time *t*, of consumer goods.

I_z^t : Nominal sales index in time *t*, type of trade *z*.

W_z : Weight of type of trade *z.*

7.1.2 Retail nominal sales index by lines of products

The calculation done in order to obtain the nominal sales index starts from the disaggregation of the lines of products according to where such products are traded. First, an aggregation from the supermarkets class of trade takes places, followed by establishment types and trade type, and then the lines of products comprised in the index.

a) Nominal sales index by supermarkets' class of trade.

$$I_{l,z,h}^t = \sum_{c=1}^{2} \left(I_{l,z,h,c}^t * W_{l,z,h,c} \right)$$

Where:

$I_{l,z,h}^t$: Nominal sales index in month *t,* by supermarkets' class of trade, part of type of trade *z that sells the line of products l*.

$I_{l,z,h,c}^t$: Real sales index in time *t*, of subclass of trade *c*, which makes up the supermarkets *class of trade*, z type of commerce*,* where they sell the line of product *l*.

$W_{l,z,h,c}$: Weighing of the subclass of trade *c*, which makes up the trade class *h*, type of trade *z* where the line of products *l* is sold.

b) To calculate the nominal sales index of the different types of trade according to the line of product traded, an aggregation according to the classes of trade that make up the specialized and non-specialized trade, respectively, is performed by using the following algorithm:

$$I_{l,z}^{t} = \sum_{h=1}^{H} \left(I_{l,z,h}^{t} * W_{l,z,h} \right)$$

Where:

$I_{l,z}^{t}$: Nominal sales index in time *t*, type of trade *z*.

$I_{l,z,h}^{t}$: Nominal sales index in month *t,* by class of trade *h*, part of type of trade *z* that sells the line of products *l*.

$W_{l,z,h}$: Weighing of class of trade h, type of trade z, where the line of products l is traded.

c) To get the nominal sales index for the different lines of products, the indexes corresponding to the type of trade where such merchandises are traded are aggregated as follows:

$$I_{l}^{t} = \sum_{z=1}^{Z} \left(I_{l,z}^{t} * W_{l,z} \right)$$

Where:

I_{l}^{t} : Nominal sales index in time *t*, of product line *l.*

$I_{l,z}^{t}$: Nominal sales index in time *t*, type of trade *z*, where the line of products *l* is traded*.*

$W_{l,z}$: Weight of type of trade *z* where line of products *l is sold*.

d) To calculate the nominal sales index by consumer goods, the corresponding indexes of the lines of products are aggregated as follows:

$$I^{t} = \sum_{l=1}^{L} \left(I_{l}^{t} * W_{l} \right)$$

Where:

I^{t} : Nominal sales index in time *t*, of consumer goods.

I_{l}^{t} : Nominal sales index in time *t*, of product line *l.*

W_{l} : Weighing of the line of products *l.*

7.1.3 Nominal index of Retail Sales by type of goods

To calculate the nominal sales index, the disaggregation by durable and non-durable good is used. Lines of products are aggregated first to form the types of trade according to the type of goods traded to build the index.

a) Nominal sales index by types of trade, according to the type of good traded.

$$I_{d,z}^{t} = \sum_{l=1}^{L} \left(I_{d,z,l}^{t} * W_{d,z,l} \right)$$

Where:

$I_{d,z}^{t}$: Nominal sales index in time *t*, type of trade *z*, where the type of goods *d is traded.*

$I_{d,z,l}^{t}$: Nominal sales index in time *t*, of product line *l*, type of trade *z*, where *d* goods are traded.

$W_{d,z,l}$:Weighting of line of products *l,* in trade type *z,* where *d* goods are sold.

b) Nominal sales index for the different types of goods is obtained by aggregating the indexes by type of trade as follows:

$$I_{d}^{t} = \sum_{z=1}^{Z} \left(I_{d,z}^{t} * W_{d,z} \right)$$

Where:

I_{d}^{t} : Nominal sales index in time *t*, type of good *d*.

$I_{d,z}^{t}$: Nominal sales index in time *t*, type of trade *z*, where the type of goods *d* is traded.

$W_{d,z}$: Weighting of type of trade *z* where the line of products *l is traded*.

c) To calculate the nominal retail sales index, according to this disaggregation, the following algorithm is used.

$$I^{t} = \sum_{d=1}^{D} \left(I_{d}^{t} * W_{d} \right)$$

Where:

I^{t} : Nominal retail sales index over time *t*.

I_{d}^{t} : Nominal sales index of type of good *d* in time *t*.

W_{d} : Weighting of type of goods *d.*

7.2 Real Retail Sales Index

In order to have a sales index for the retail trade activity at constant prices, which allows the measuring of the sector's evolution over time, it was necessary to build a deflator for the nominal sales index. This price deflator was created from the basket of goods used for the Consumer Price Index (CPI).

7.2.1 Calculation of nominal sales deflator

The methodology for calculating the IVCM deflator comprises the following aspects: Product selection out of the CPI and conciliation by lines of products of the IVCM, sources of information, base year, weights and calculation of the price index.

a) Product selection out of the CPI and conciliation with the lines of products of the IVCM

Three hundred eighty nine goods and services that are directly related with the lines of products included in the IVCM were selected out of the 482 goods and services that make up the CPI basket.

b) Sources of information: The indexes of the 389 products are collected on a monthly basis for the CPI calculation.

c) Base year. The base year for the deflator is the same one used for the IVCM, that is, the average 2005=100.

d) Weights. The calculation of the weights for the products that make up the IVCM deflator refers only to lines 1 through 11. These are calculated from the relative weight of the 389 selected products on the CPI basket. Since one product only includes one line, those weights are reweighed at 100% to obtain the weight that each one of them will have on the IVCM deflator.

The following algorithm is used to reweigh lines 1 to 11:

$$K_{l,b} = \frac{W_b}{\sum_{b=1}^{B} W_{l,b}}$$

Where:

$K_{l,b}$: Weight of the *b* good, belonging to line *l* within the IVCM price index.

W_b: Weight of good *b* in the CPI basket.

$\sum_{b=1}^{B} W_{l,b}$: Sum of the weightings of goods *b* pertaining to line *l.*

Line 12 –retail sales of other products- is made up by a number of products that do not bear correspondence to the CPI structure, thus reweighing is not possible.

7.2.2 Calculation of real indexes

Once price indexes by product lines have been calculated, basic nominal sales indexes are deflated to obtain the indexes of real retail sales according to the different disaggregations.

a) The index of real retail sales disaggregated by type of trade is obtained using the following algorithm:

$$I^t_{r,z,h,c,l} = \frac{I^t_{z,h,c,l}}{I^t_{p,l}} * 100$$

Where:

$I^t_{r,z,h,l}$: Real sales index in time *t*, of the line of products *l,* belonging to the subclass of trade *c*, which makes up the trade class *h*, of the type of trade *z*.

$I^t_{n,z,h,c,l}$: Nominal sales index in time *t*, of line of products *l,* belonging to the subclass of trade *c*, which makes up the trade class *h*, of the type of trade *z*.

$I^t_{p,l}$: Price index over time *t*, of product line *l.*

b) The retail sales index (real terms), disaggregated by lines of products, is obtained using the following algorithm:

$$I^t_{r,l,z,h,c} = \frac{I^t_{l,z,h,c}}{I^t_{p,l}} * 100$$

Where:

$I^t_{r,l,z,h,c}$: Real sales index in time *t*, subclass of trade *c*, which makes up the *h trading class of trade* h, z type of trade*,* where they sell the line of product *l*.

$I^t_{l,z,h,c}$: Real sales index in time *t*, of subclass of trade *c*, which makes up the *class of trade h*, type of trade *z,* where the line of product *l is sold*.

$I^t_{p,l}$: Price index over time *t*, of product line *l.*

c) The real retail sales index, disaggregated by type of trade, is obtained using the following algorithm:

$$I^{t}_{r,d,z,l} = \frac{I^{t}_{d,z,l}}{I^{t}_{p,l}} * 100$$

Where:

$I^{t}_{r,d,z,l}$: Real sales index in time t, of product line *i*, *z* type of trade, where *d* goods are traded.

$I^{t}_{d,z,l}$: Nominal sales index in time *t*, of product line *i*, type of trade *z*, where *d* goods are traded.

$I^{t}_{p,l}$: Price index over time *t*, of product line *l.*