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« The food Euro » : what food expenses pay for ?

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As supplement to its sectorial studies about the contributions of the various stages of the food chain to the formation of the consumer prices, the Observatory develops a macroeconomic approach wich decomposes the french food final expense into remunerations in every industry group. Realised for the first time on the last fifteen years, this analysis highlights substancial changes in the formation of the value of food, due to evolutions of prices and of production and distribution processes.

This paper is inspired by USDA-ERS study about the « food dollar » (Canning, 2011).

The objective of this analysis is to measure the complete distribution of € 100 of food expenses in France, into :

- the formation of added value in every industry group of the economy, which participates, directly or not, to the production and the distribution of food ;
- the importations of food products ;
- the importations of inputs used, directly or not, in the food chain ;
- the taxes on food products et on inputs used, directly or not, in the food chain.

A the heart of the method of the analysis : the notion of added value.

The added value, for an industry group, a firm, or economy as a whole, is the difference between the production and the inputs consumptions (goods and services processed or completly consumed in the production process), let :

$$V_A = P - C_I$$

Added value, in the firm, the industry group or in the whole economy, is a resource divided into :

- the gross remuneration of salaried labour (noted S below : wages and et social insurance contributions ;
- the gross remuneration of capital : gross operating profit (GOP), wich includes the various forms of incomes of capital : interests, rents, dividends…, and the resources allocated to self-financing ;
- the « mixed income » : it is the GOP of individual firms (in agriculture, particulary), it pays at the same time the capital and the non-salaried labor.

Thus : $V_A = P - C_I = L + GOP$

An important accounting equalitiy for our analysis is the one wich links added value to final consumption at the level of the whole economy. To simplify, let us consider an economy without foreign trade nor production for fixed assets [1]. Then the equality is obvious : as the added value is the difference between production and inputs consumptions, it is equal to the part of the production wich is not used as inputs consumptions and, thus, available for final consumption :

Thus : $V_A = P - C_I = C_F$

On this global equality are based the calculations allowing to decompose the « food euro » (final consumption of food products) into added values, importations and taxes on products.

The food expense analyzed here

The food consumption is analyzed with the inputs-outputs matrix (IOM) of the national accounts, wich allows to know the ressources (production and importation of various products) used for intermediate (inputs) or final consumption in every industry group. In the nomenclature of this source, the domestic products of food final consumption come from (*via* trade and transport) the *Food-processing* industry group and, for non-processed food (fresh fruits and vegs, eggs, fresh fish), from the *Agriculture and Fishery* industry group. The food expense analysed with french IOM cannot include food services, wich is included in *Hotel and restaurants* industry group in the nomenclature.

[1] Cf. pp. 5 and 6 for a more detailed presentation of the method.

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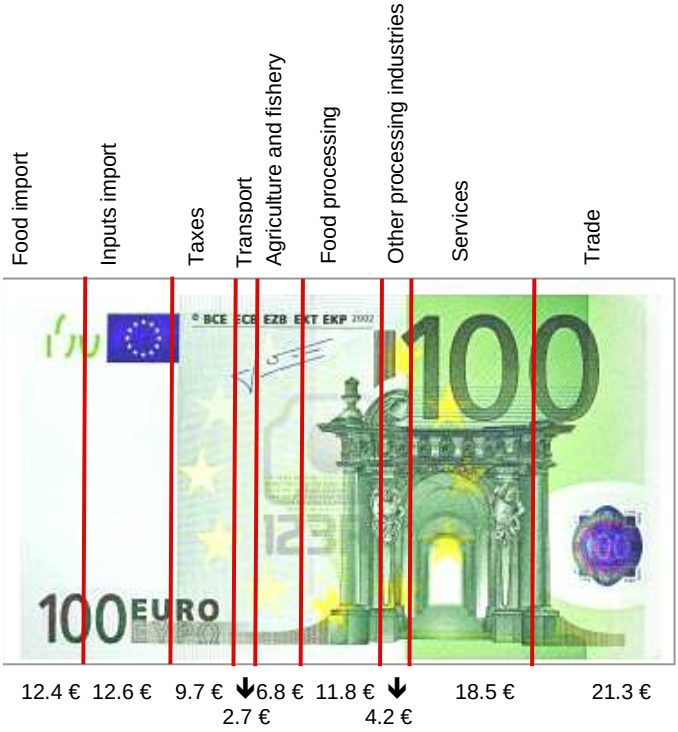
The food euro 2009

At the time of the writting of this paper (end 2012), 2009 is the most recent year for which the sources for the calculations are available.

The food euro 2009 into added values

The figure below illustrates the distribution of € 100 of food expense into taxes and importations, then into added values in the various industry groups of the national economy.

Figure 1. Food euro decomposed into added values in 2009



Source : INSEE. Calculations INRA, FranceAgriMer

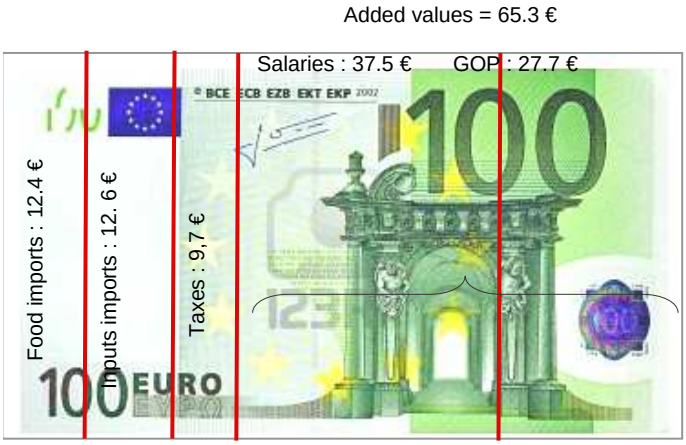
So, in € 100 € of food consumption in 2009, € 25 pay for food importations or of for inputs importations - on wich we will return further - , about € 10 are due to taxes (VAT, taxes on alcoholic beverages, taxes on fuels…).
The rest, € 65.3, is added values induced in the industry groups of the national economy, with an important amount for *Services* (€ 18.5) and *Trade* (€ 21.,3).
The part of trade includes the added values induced by food consumption in wholesale trade (of agri-food products and various inputs) and in food retail trade.
The *IOM* distinguishes about thirty *Services* industry groups. Those whose products are the most used as inputs consumption by the *Agriculture* and the *Food-processing* industry groups are: accounting and legal services, assistance to management, advertising and marketing studies, temporary staff services, rent of equipments, repair, and maintenance of vehicles, computing services… Note that the activity of crops services companies is included into *Agriculture* and not into *Services* industry group.
In the *IOM*, 80% of the consumption of domestic food products come from food-processing industry , but the added value generated in this group by € 100 of food expense is only € 11.8, due to the weight of inputs consumption(77% of the production).
Farms products are widely used as inputs of food-processing industry, but the national *Agriculture* industry group contributes only for 6.8% to the value of the food final consumption expenses.

This results from the processed characteristic of the food, - with various goods and services added to raw material -, and from the prices ratio between agriculture and others industry groups.
We indicated the important weight of importations: the quarter of our food expenses goes there. They are divided almost by half into food importations, - which contribute directly to food consumption -, and inputs importations. Imports of inputs are composed of imported products used in particular by the industry groups of the food chain. So, in 2009, 18% of inputs for *Agriculture* industry group is imported, it is mainly products from chemical and petroleum refinage industries (46% of imported inputs for agriculture, of which fertilizers, fuels…) or agricultural commodities and processed products (21%, of wich food for animals).
In the *Food-processing* industry group, the importations are 13% of the inputs consumptions, and they are mainly agricultural commodities or processed products (54% of imported inputs of *Food processing* industry group). They manly come from European union, this one supplies in 2009 more than 70% of french importations in raw or processed agri-food products [Agreste, 2011].
But the « food euro » also pays for importations in any good used in all the industry groups, in proportion of its incoporation in the value of food products ; for example : the imported oil from wich was produced the fuel used in the *Transport* industry group for transport of animal food to cattle farms which produce bulls, which are processed into meat consumed in France…

From added values to salaries and gross operating profit in 2009

As the *IOM* gives the distribution of added value of every industry group into « salaries » and « *GOP* », it is possible to distribute the « food euro » added value into these two remunerations :

Figure 2. The food euro in salaries and GOP in 2009



Source : INSEE. Calculations INRA, FranceAgriMer

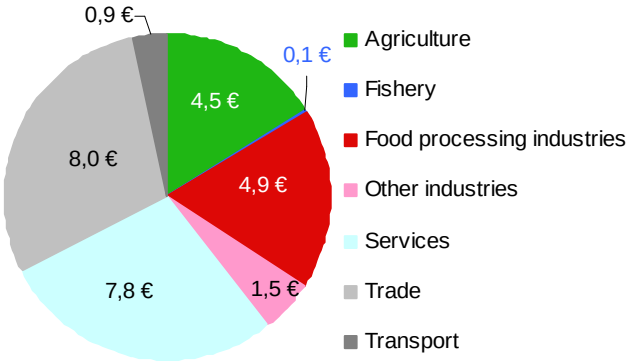
Remunerations and employment induced by food demand in industry groups in 2009

In the figure 2 above, the salaries and the *GOP* induced by food expenses are grouped all industry groups taken together. The source data allow to present these remunerations in every industry group (figures 3 et 4).

So, € 100 of food expenses in 2009 generate a little less than € 5 of **gross operating profit** in *Agriculture and fishery* industry group (the part of fishery is marginal).

In this industry group as in the others, the *GOP* taken into account is *before* subsidies, these being payed by tax-payers and not by consumers. Moreover, the *GOP* of *Agriculture* industry group is widely a « mixed income », remunerating , at the same time the farmers'capital and not-salaried labour.

Figure 3. GOP induced by € of 100 food expenses in 2009

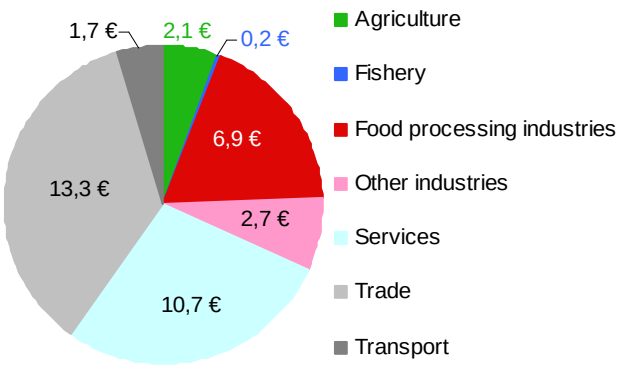


Source : INSEE. Calculations INRA, FranceAgriMer

In theory, the *GOP* in every industry group should be, if the available data allowed it, decomposed into incomes allocated to capital owners (for example : dividends) or net mixed income of capital and non-salaried labour, interests, corporate taxes, savings or self-financing, as realised in other studies for all industry groups taken together [Cotis, 2011]. According this source, all the industry groups taken together, the part of the net incomes allocated to the owners of the capital in the *GOP* is about 25%, part which increased appreciably since the end of 1970s.

The **salaries** induced by food expenses in 2009 are concentrated in *Trade* and *Services* industry groups (€ 24 for € 100 of food expenses). The share of *Agriculture* industry group is low, due to the low presence of salaried staff in agriculture.

Figure 4. Salaries induced by € 100 of food expenses in 2009



Source : INSEE. Calculation INRA, FranceAgriMer

The *IOM* gives the **number of employments**, salaried or not, (but not measured in full-time equivalent) in every industry group, and, of course, the added values by group. We deduce from it the *employment / added value ratio* by group, which, applied to the added values induced by the food expense, allows to estimate the number of employments generated by this expense (in the hypothesis where this ratio remains the same in the same industry group, whatever is the destination of its production : final or input consumption, exports, formation of fixed assets). So, in 2009, about 2 millions of employments are induced by the final food demand, which of the third in the *Trade*, a little more in the *Agriculture-fishery* and *Food processing* and about the quarter in *Services* plus *Transports*.

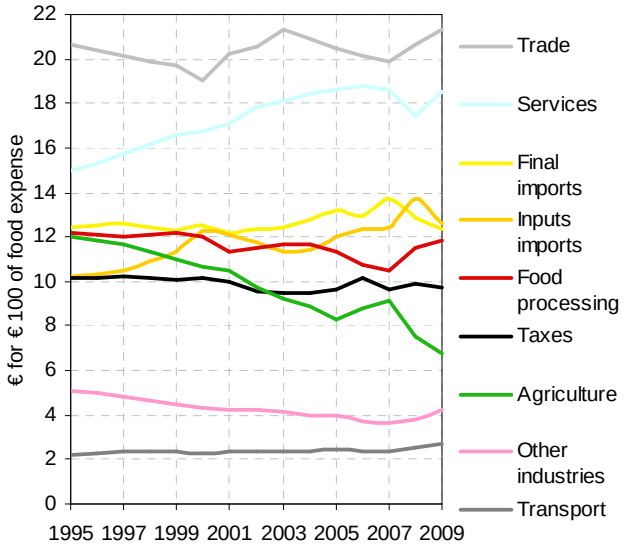
The food euro since 1995

The composition of the « food euro » was modified appreciably during relatively long period.

Long trend : increasing share of importations, diminution of agriculture

The results of 2008 and 2009 must be carefully compared with these of 1995-2007. In 2008, the industry groups nomenclature changed, and tobacco products industry is now included in *Food-processing industry* . Corrections were realised on source data 2008-2009 to link them with the previous data but the continuity of the series is not absolutely guaranteed.

Figure 5. Evolution of euro food components 1995-2009



Source : INSEE. Calculations INRA, FranceAgriMer

In spite of these reserves, heavy trends are perceptible over the period. First, some components of the food euro are in sharp rise :

- the inputs importations, evolution linked to the price of energy and, more recently, of agricultural commodities ;
- the final imports, at least until 2007 ;
- the added value induced in the *Services*, which goes from 15% of « food euro » to more than 18% in 2007 as in 2009, under the influence of evolutions evoked further.

To these evolutions corresponds the decline of the added value induced by the food demand in the *Agriculture and fishery* industry group. This one loses 3 points over the period, with a regular slope until 2005 and then more irregular.

The long trend followed by the weight of the agricultural added value in the « food euro » reflects essentially the trend of agricultural prices, decreasing under the influence of the CAP reforms which, since 1992, move the european agricultural prices closer to the world prices, replacing prices support by direct subsidies.

This fundamental change in the mode of agricultural support lowered the share of the agriculture in the « food euro », other things being equal.

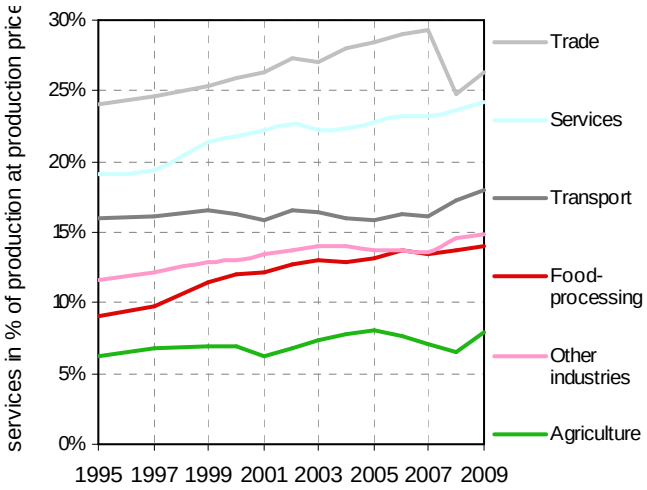
The increasing trend of the share of *Services* industry group in the « food euro » can be linked to the following evolution in the food chains :

- some are specific to the food chains : the sanitary safety and « traceability » increased the incorporation of services

(computing, controls) in the processes of production and distribution.
- some concern food chains as well as other industries : development of advertising and market studies, outsourcing of some steps of the processes of production and distribution, entrusted to services companies (temporary staff, management support).

But the composition of the « food euro » in added values is not limited to which only induced in food chains. The increasing share of services in the production of any industry influences the structure of the food expense in terms of added value. The trend to the increase of the services share in the production of every industry group from 1995 to 2009 (figure 6) summarizes this evolution:

Figure 6. Services share in the industry groups production



Source : INSEE. Calculations INRA, FranceAgriMer

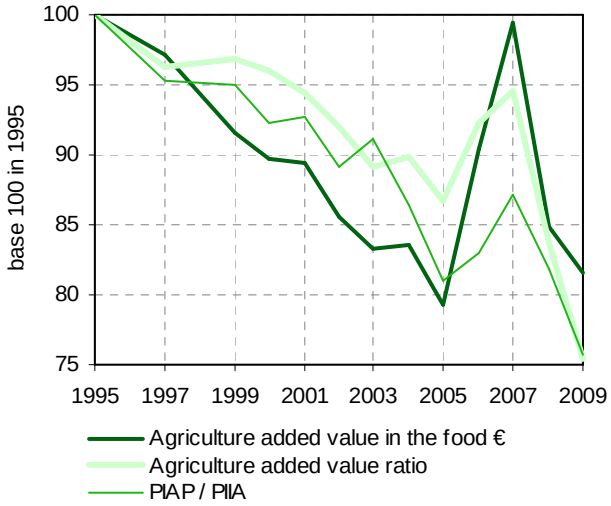
It should be noted that in the french national accounting, the banking and insurance services appear as inputs consumptions of the industry groups for one part of the interests and premiums that these industry groups pay, corresponding only to the costs of these services ; the other part is an use of the *GOP* of the industry groups, remunerating the capital of the financial services [Malherbe F., 2012].
The increasing weight of services in all the industry groups spreads step by step, *via* B to B relations, in all products, to those satisfying the food final demand.

The variations of the agriculture share in the « food euro »

Besides the role of the technical coefficients (ratios between input consumption and production), the share of the added value of an industry group in the « food euro » depends on the added value ratio of this industry group (added value / production). It is particulary the case for *Agriculture* industry group.

Figure 7 compares the evolutions of this ratio and of the share of agriculture in the « food euro » : they are very close. These variations of added values (in the « food euro » and for the industry group in general) are also compared to the evolutions of the ratio « PIAP / PIIA » between prices index of agricultural products (PIAP) and prices index of inputs for agriculture (PIIA).

Figure 7. Share in the « food euro » and added value of Agriculture ; ratio PIAP / PIIA



Source : SSP, INSEE. Calculation INRA, FranceAgriMer

The agriculture share in the « food euro » decreases rather regularly until 2005, then raises clearly from 2006 to 2007, due to « prices scissors » become favorable, the agricultural prices increase (PIAP evolution) getting the upper hand on that of the prices of the inputs for agriculture (PIIA evolution).

In 2008, the continuation of the rise of the agricultural prices comes along with a new increase of the prices of the raw materials (in which, those used for animal feed) and the « prices scissors » deteriorate the agricultural added value. In 2009, the decrease of the agricultural prices is more important than the concomitant backflow of the prices of the inputs, and so, the added value falls again.

It should be noted that from 2010 to 2012, the ratio PIAP / PIIA raises a little, from 81 to 84 in base 100 in 1995 : this could improve the share of the agriculture in the sharing of the added value of the « food euro », but probably without modifying appreciably the trend.

In conclusion

Trade and services are major components of the food value : the food value chain is not limited to a linear path from agriculture to consumer, via only food processing industries and food trade.

Due to CAP reform, the share of agriculture in the consumer prices of the food is low, but this is also due to the increasing incorporation of services in the food chain.

This macroeconomic approach completes the main analysis of the observatory, sectorial and in terms of « filières » (food chains).

It highlights the contributions of all the industry groups to the value of our food, by estimating the remunerations induced in the economy by our food expenses.

It will regularly be updated, according to the availability of sources.

For further information

Elements of method

1st step : calculation of the coefficients linking final demands of products and « internal » added values (production menus non imported intermediate consumption) of every industry group.

In all wich follows, the added values are without subsidies, including direct subsidies to products in agriculture (because we analyze the consumer's expense, and not the tax payer's one).

At the scale of the whole economy, we have the accounting equality :

$$P + X = C^I + C^F + E + F$$

were P is the production, X the importations, C^I the inputs consumptions, C^F the final consumptions, E the exportations and F the fixed assets formation.

Considering that :

- the elements C^F, E et F of the final demand are divided into D_{INT} : final demand of products of internal (domestic) market, and D_X : final demand of imported products ;
- the inputs consumptions are divided into C^I_{INT}, supplied by internal market, and C^I_X, coming from importations ;
- the importations X cover importations X_D for final demand finale, and so, $X_D = D_X$; and importations X_{CI} for inputs consumption,

the former equality becomes:

$$P - (C^I_{INT} + C^I_X) + X_{CI} = D_{INT}$$

The difference between production P et inputs consumptions $C^I_{INT} + C^I_X$ being equal to the added value VA, we get the following equality between, on one hand, the added value and imports of inputs, on the other hand, the final demand for domestic (internal) products:

$$VA + X_{CI} = D_{INT}$$

Let VA_{INT} be the first term, which is the value added to the domestic inputs, or « internal added value » :

$$VA_{INT} = D_{INT}$$

We try to decompose this equality into industry groups.
This implies to calculate the matrix $[W]$ formed with the shares w_{ij} of internal added value of the industry group i in the final demand for product j, such as :

$$\begin{bmatrix} w_{11} & \cdots & w_{1j} & \cdots & w_{1n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ w_{i1} & \cdots & w_{ij} & \cdots & w_{in} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ w_{n1} & \cdots & w_{nj} & \cdots & w_{nn} \end{bmatrix} . \begin{bmatrix} D_{INT_1} \\ \cdots \\ D_{INT_j} \\ \cdots \\ D_{INT_n} \end{bmatrix} = \begin{bmatrix} VA_{INT_1} \\ \cdots \\ VA_{INT_i} \\ \cdots \\ VA_{INT_n} \end{bmatrix}$$

or $[W]\,[D_{INT}] = [VA_{INT}]$.

This matrix is calculated form the « internal » IOM, wich presents for every industry group, its production and its inputs consumptions of the various domestic products. From this data, we calculate :

- the matrix $[A_{INT}]$ of « internal » technical coefficients a_{ij} , ratios of the inputs consumptions in every domestic product i in the production of every industry group j,
- the matrice $[V'_{INT}]$ of coefficients of added value in the production of every industry group.

So, we have the following equality :

$$[A_{INT}]\,[P] = [C^I_{INT}]$$

and, as :

$$[P] - [C^I_{INT}] = [D_{INT}]$$

then:

$$[P] - [A_{INT}]\,[P] = [D_{INT}]$$

or:

$$[P] = [1\text{-}A_{INT}]^{-1}[D_{INT}]$$

Besides, we have:

$$[VA_{INT}] = [V'_{INT}]\,[P]$$

Thus, we can express the intenal added values as follows:

$$[VA_{INT}] = [V'_{INT}]\,[1\text{-}A_{INT}]^{-1}[D_{INT}]$$

And the wanted matrix, linking final demands for the various products to the added values of the various industry groups is :

$$[W_{INT}] = [V'_{INT}]\,[1\text{-}A_{INT}]^{-1}$$

So, we can exprim any element of the final demand in domestic products, as the final consumption in domestic food products, in the form of a sum of « internal » added values in the various industry groups.

2nd step : additions of importations of food products and decomposition of the internal added values into added value at producers prices and imported inputs.

The « IOM of imported products » gives directly the final consumption in imported food. The « internal IOM » gives for every industry group the amount of imported inputs and the added value at producers' prices (without trade and transport margins and taxes, unlike the purchasers' prices). So, we can decompose the « internal » added values of the final food demand, into added value at producers' prices, and into imported inputs.

3erd step : trade and transport margins taken into account

In national accounts, the margins are the productions of trade and transport industry groups ; their amounts are given by the table of « resources and uses » established by the national statistic service (INSEE). As production of aforesaid industry groups, margins are the object of a final demand, decomposable into added values in the various industry groups, by the mean of IOM, as any other final demand. These added values included in the margins are added to those previously calculated.

Final step : taxes on products taken into account

The taxes included into the value of the final consumption at purchasers'prices are calculated by balance, form the following equality :

Taxes
= final consumption at purchasers' prices
– final consumption of domestic products at producers'prices
– final consumption of imports
– margins

So, the final food consumption is decomposed into added values in the various industry groups, importations of inputs, importations of food products and taxes on products.

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Abstract

By means of calculation realised on the inputs-outputs matrices of the national accounting, the amount of the french food consumption is decomposed into importations, taxes on products and added values induced in every industry group.

From the added values, the remunerations induced in the various industry group by the food demand are calculated : salaries, gross operating profit ; imports and taxes being « remunerations to abroad and State ».

The results shows the relatively thin share of the agriculture in the distribution of the added value induced by the food demand, and the weight more significant of *Services* and *Trade* industry groups.

So, for € 100 € of food expenses in France in en 2009, the added value formed in the *Agriculture and fishery* industry group is € 6.8. Those of *Services* and *Trade* are, respectively, € 18.5 and € 21.3

The importations represent a quarter of the « food euro » in 2009, with € 12,4 for food imports and € 12,6 € for imports of inputs.

The share of a given industry group in the « food euro » depends on two elements :

- the technical coefficients linking the input consumption in product from this given industry group with the products used in the production and the distribution of food,
- the ratio of value added of this given industry group.

In this matter, the decrease of agricultural prices due to the CAP reforms since 1992 mostly explains the decreasing trend of added the value induced in agriculture by food demand, noticed here from 1995 to 2009.

In 2007 and in 2008, the rise of commodities prices, in wich agricultural products, has, depending on years, different effects on the share of the agriculture in the « food euro » : favorable to agriculture in 2007, the « prices scissors » become unfavorable in 2008.

The decrease of the agricultural added value in the « food euro » becomes more marked in 2009 under the influence of a new fall in agricultural prices.

In addition to this « prices effects » on the distribution of the « food euro », there are more structural evolutions in the formation on the value of the food products, in particular the increasing incorporation of services.

It takes place not only in the food-processing sector but also in the whole of industry groups (other processing industry, trade, transport, services themselves), of which a part of their products, including services (temporary labour, advertising, marketing studies, bank and assurance services…), is used as inputs at various levels of the formation of the value of food products.