

QUARTERLY SERIES FOR THE PORTUGUESE ECONOMY: 1977-2014



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Quarterly series for the Portuguese economy: 1977–2014

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Abstract

This article presents quarterly historical series (1977-2014) which are consistent with the latest version of National Accounts published by Statistics Portugal. The provided information covers a wide set of variables and corresponds to the quarterly historical series update, regularly published by Banco de Portugal. It includes the data for 2014 and incorporates the revision of the previous data according to ESA 2010. Simultaneously, we describe in detail the methodological procedures applied in the construction of the series, aiming at a greater comparability over time. The series released in this paper are distributed in three blocks: expenditure, disposable income and the labour market.

JEL: C82, E01

1. Introduction

Historical series are essential to the development of studies and economic analysis. The characterization of the historical evolution of macroeconomic aggregates and its cyclical behaviour requires a consistent database. The forecasting models, as typically predict the evolution of the economy using cyclical frequencies, are another major user of this type of information. Banco de Portugal has contributed to this topic by disseminating long time series for several areas of the Portuguese economy. Pinheiro *et al.* (1999) published annual historical series for a wide set of variables covering the period 1947–1995. Previously, Banco de Portugal had already released annual estimates of National Accounts, for the period 1910–1958 in Batista *et al.* (1997).

Castro and Esteves (2004) published, for the first time, long quarterly series for the Portuguese economy (base 1995, ESA 95¹), beginning on 1977. An update of these series has been published annually by Banco de Portugal². It should be noted that the Statistics Portugal (*INE*) releases, on a regular and consistent basis, the official Portuguese National Accounts data for the period from 1995 onwards.

The revision of National Accounts data is a regular procedure in order to continuously improve the quality and reliability of data³. Revisions may arise due to two major reasons: the incorporation of additional statistical information; and the change of sources or methodologies. Nevertheless, the revisions (especially those motivated by methodological changes) hinder data comparisons over time. Since the first release of quarterly historical series, *INE* made three National Accounts base changes (namely from 1995 to 2000, then to 2006, and more recently to the base 2011)⁴. The last one

1. ESA — European System of National and Regional Accounts — is the regulation of Eurostat that defines the conceptual and methodological framework for the National Accounts estimation by the European Union member states.

2. The last publication of these series included data from 1977 to 2013 (base 2006, ESA 95) and occurred in Economic Bulletin — June 2014.

3. For an analysis of reviews of the Quarterly National Accounts see Cardoso and Rua (2011).

4. The change of base year of the National Accounts occur periodically and aim at incorporating new statistical sources and updating the methodological procedures. The basis of national accounts does not necessarily coincide with the reference year in chain-linked volume data.

occurred simultaneously with the changeover to ESA 2010, which implied several significant methodological changes⁵. In September 2014, *INE* (as other European statistical institutes) released series according to ESA 2010 retropolated since 1995.

This article presents quarterly historical series (1977–2014) which are consistent with the latest data released by *INE* (base 2011, ESA 2010). The released database covers a wide set of variables which are distributed in three blocks: expenditure (GDP and main aggregates), disposable income and labour market. On this context, we revise and reassess the methodological procedures previously used.

Generally, we followed the methodology described in Castro and Esteves (2004). However, given the aforementioned revisions and methodological changes, some adjustments were required. It should be noted that it is not feasible to recalculate all series using the detail considered by *INE* in the estimation of the most recent data⁶. In particular, for the period prior to 1995, we imposed the implied growth rates of the annual historical series of Banco de Portugal [Pinheiro *et al.* (1999)] on the major macroeconomic aggregates. As much as possible, the procedures adopted for the period prior to 1995 are similar to those used by *INE* for the posterior period; for instance, the series are seasonally and calendar effects adjusted.

The remainder of this article is organised as follows. Section 2 specifies the annual and infra-annual statistical sources used in the construction of the quarterly series. Section 3 explains the general methodological procedures: the retropolation of annual and quarterly series, the temporal disaggregation method and the seasonal and calendar effects adjustment applied to the data. Specific methodological procedures and selected quarterly indicators are described in section 4. Final remarks are presented in Section 5.

The series are available in electronic format along with Economic Bulletin — June 2015. For the first time, the corresponding annual series, which resulted from aggregating the quarterly series, are also published.

5. See INE (2014a) and INE (2014b) for a presentation of the new National Accounts series (annual and quarterly, respectively), including methodological notes.

6. Over the past few years, some specific adjustments in the methodology were made, which have been described in the notes accompanying the annual updates of the series.

2. Data

In this section we identify the annual and quarterly data used in the construction of the database. In general terms, the quarterly series (1977–2014) are compatible with the National Accounts annual series (base 2011, ESA 2010) published by the *INE*, and were back-calculated using the rates of change of Annual Historical Series of Banco de Portugal (AHS) [Pinheiro *et al.* (1999)] for the period 1977–1995.

Annual data:

In the expenditure and disposable income blocks, the series for the period 1995–2014 correspond to the National Accounts data released by *INE*. These values match the ones in Quarterly National Accounts (QNA) for the expenditure block, and the Quarterly Sector Accounts (QSA) for the disposable income series.

For the period prior to 1995 (National Accounts data) or 1992 (for some labour market series), we used the AHS rates of change as benchmark.

Quarterly data

Taking into account the variety of methods used, we classify the quarterly series according to the available information and the applied methodology. The quarterly series published in this article may be arranged in three groups:

- i) Quarterly seasonally and calendar effects adjusted data published by *INE* since the 1st quarter of 1995: Expenditure block, that is, Gross Domestic Product (GDP) and its components. For the mentioned period, the quarterly figures published matched the ones in QNA.
- ii) Not seasonally adjusted data published in a quarterly basis by *INE*: household disposable income and its components from the 1st quarter of 1999, and employment and unemployment data published in the Labour Force Survey (LFS) of *INE* since the 1st quarter of 1992⁷. In these cases, the published values are adjusted for seasonality and calendar effects and therefore may differ from the respective series published by *INE*. The

7. These data were treated in order to correct the existing time series breaks in the Labour Force Survey (see section 4.3).

corresponding annual series are identical to the *INE*'s series, since it is assumed that the seasonal and calendar effects offset in the year.

- iii) Data according to ESA 2010 not released by *INE* on a quarterly basis: data for the period prior to 1995, in the expenditure and labour market blocks, or 1999, in the disposable income block, as well as, for the period after 1995, any detailed data of National Accounts (for example, the employment measured in full time equivalents) only released on an annual basis. In these cases the procedure consists on disaggregating the annual retropolated figures in quarterly data using the best related quarterly indicator (see section 3 on econometric procedure and section 4 on the selected indicators and specific procedures).

In the case of expenditure, the Quarterly National Accounts series in ESA 79 were used in the construction of indicators for the period before 1995. As no compatible quarterly series for the whole period 1977–1995 were available, it was necessary to make use of various QNA publications (see section 4.1). For disposable income components, there are only quarterly data from *INE* since 1999, so the series for the period were obtained through temporal disaggregation methods using indirect indicators evaluated case by case (see section 4.2). For the labour market and considering the period before 1992 quarterly series were built based on older LFS, imposing the evolution of Annual Historical Series.

The data incorporate the available information at the end of June 2015, including the versions of QNA and QSA released on the 24th of that month.

3. General methodology

In this section, we discuss general methodological procedures used in construction of quarterly and annual long series. The description of the methods takes into account the segmentation referred in the previous section. Thus, after explaining the procedure for the calculation of annual series we describe the econometric methodology applied in the calculation of the series based on data not published quarterly by *INE* (case *iii* of the previous section). The topic of the seasonality and calendar effects correction, directly connected to the case where only the not adjusted data are released by *INE* (case *ii*), is approached in section 3.2.2.

Overall, the strategy adopted in the construction of a historical series, annual or quarterly, is to keep unchanged the most recent period, and calculate

the previous values using the chained rates of change of the old series, preserving thus its evolution. As there are several blocks of data overlapping for the same period (for example, in the case of QNA in ESA 79) we considered for each period the implicit rate of change in the latest publication.

3.1. Construction of annual series

Taking into account the availability of more detailed and comparable annual data that quarterly, in particular to the rearmost period, we adopted a general methodology that favours the use of such information. So, in a first stage, we built up the annual series consistent for the period 1977–2014, which were used as restriction in the calculation of long quarterly series.

For the period 1995–2014 were considered the *INE* National Accounts at current prices and in volume (as chained to year reference 2011) to the expenditure, and at current prices for disposable income (the QSA are only released in nominal data). Regarding the labour market, the annual series measured as full time equivalent correspond to the *INE* for the period after 1995, while the series in number of individuals (Labour Force Survey concept) for the period from 1992 correspond to annualize the quarterly figures.

The previous methodology of compiling the annual series, based on Castro and Esteves (2004)⁸, implied that the evolution of the main volume aggregates in the period prior to 1995 was changed when revised data were published for the most recent period. In addition, the periodic update of the volume data for a more recent reference year implied that in the more remote years, the discrepancy between the rates of change in volume of the main aggregates (by aggregating the previous year's prices) and the implied rate in AHS increased as long as the expenditure structure was furthest from the year of reference.

As it is not feasible to reconstruct the series with comparable sources and methods to those used in the most recent period, it is necessary to consider hypotheses. It is assumed that the change of base and adoption of ESA 2010 (which, in addition to other changes afforded small differences in concepts) have an impact mainly on the levels of data and not in its development (growth rate). Additionally, it is not possible impose the AHS growth rates for both the

8. The method consisted in maintaining the growth rates of the Annual Historical Series at more detailed level. The most aggregated data were obtained by summing up the elementary data at current prices and ate previous year's prices after retropolation.

major aggregates and their subcomponents and simultaneously guarantee the additivity of the series, we decided to preserve the annual rates of change for main agregados⁹. Finally, as in Castro and Esteves (2004), it was necessary to make some adjustments in AHS in order to achieve greater consistency in the concepts used.

In a first stage,, using the latest levels released by INE, we calculate the data, as referred above for the main aggregates and their subcomponents, ie, starting from 1995, the data were back calculated by chaining retrospectively until 1977, supported by the AHS change rates.

Formalizing, let us consider:

$z_t^{AHS,cp}$: the value of the variable z , in year t , at current prices in the AHS;

$z_t^{AHS,pyp}$: the value of the variable z , in year t , at prices of the previous year in the AHS;

z_t^{cp} : the value of the variable z , in year t , at current prices (quarterly long series);

z_t^{vol} : the value of the variable z , in year t , in chained linked volume data, reference year 2011 (quarterly long series).

We have:

$$z_{t-1}^{cp} = \frac{z_t^{cp}}{\frac{z_t^{AHS,pc}}{z_{t-1}^{AHS,cp}}}, \quad t = 1978, \dots, 1995, \quad (1)$$

and

$$z_{t-1}^{vol} = \frac{z_t^{vol}}{\frac{z_t^{AHS,pyp}}{z_{t-1}^{AHS,cp}}}, \quad t = 1978, \dots, 1995. \quad (2)$$

It should be noted that the weights structure in 1995 (the common year) of the *INE* series differs from the structure of the AHS, creating discrepancies between aggregates so calculated and the sum of the elementary items. This

9. This option is similar to that assumed in the calculation of QNA chained volume series from the data at current prices and at previous year's prices of Annual National Accounts.

discrepancy after retropolation of data, appears both in nominal and in volume data. In chained volume data, discrepancies tend to increase we move away from the reference year, reflecting not only changes in the weighting structure, but also the change of relative prices of subcomponents compared to the base year (in this case 2011). In general, the solution adopted was to distribute the discrepancy obtained by the subcomponents, in order to ensure that data sum up.

Analytically, being Z the aggregate concerned, and z_i with $i = 1, \dots, N$, its N sub-aggregates (Z and z_i and calculated using equations (1) and (2)). The discrepancy at time t , d_t , is equal to:

$$d_t = Z_t - \sum_{i=1}^N z_{i,t}, \quad t = 1977, \dots, 1994 \quad (3)$$

The elementary item i with distribution of discrepancy (z_i^{dd}) is then obtained in the following way:

$$z_{i,t}^{dd} = z_{i,t} + d_t w_{i,t}, \quad t = 1977, \dots, 1994, \quad (4)$$

where $w_{i,t} = \frac{z_{i,t}}{\sum_{i=1}^N z_{i,t}}$ is the weight of component i in the sum of the components, if we consider a proportional distribution of the discrepancies, or $w_{i,t} = 1$ e $w_{j,t} = 0$, $\forall j \neq i$, if we choose a selective distribution.

Thus, it is ensured:

$$Z_t = \sum_{i=1}^N z_{i,t}^{dd}, \quad t = 1977, \dots, 1994 \quad (5)$$

After this adjustment, the aggregate can be obtained by summing, continuing to observe the AHS growth rates. The selective distribution was applied whenever was detected a considerable imbalance between the weights of the elementary items or in the case where any item is intended to keep unchanged the elementary. In general, the profile of the series is very similar to that obtained before distribution of the discrepancies.

Imposing the additivity simplifies the use of these series, allowing to calculate any intermediate aggregates at current or constant prices by sum

of their components and also to decompose the variation of the aggregates in the contributions of its subcomponents.

Besides the general methodology that supported the construction of the annual series, it is interesting to analyze in detail some decisions taken in each data set.

In the case of the expenditure, the major aggregates for which we imposed the nominal and volume growth rates and volume of the AHS were: GDP, private consumption, public consumption, gross fixed capital formation (GFCF), exports and imports. As mentioned earlier, it was decided to adjusting the data so that, simultaneously, the total results from the sum of its components at current prices and “constant prices” of 2011 and at the same time comply with the Annual Historical Series rates of change. The only exception is the case of GDP “constant prices”, where it remains a discrepancy between GDP and the sum of its components, due to the change in the structure of weights in GDP¹⁰.

Changes in inventories is a particularly difficult series to backdate because of their nature (is the change in the stock of products, so its interpretation in terms of volumes and prices becomes ambiguous) and its high volatility. Consequently, there is no a unique retropolation method of this series, usually yielding results substantially different according to the choice (eg use previous levels, obtain as difference or imposing contributions to the GDP growth). In the period before 1995, the series of changes in inventories presented resulted from the application of economic reasonableness criteria on the results obtained according to several possible methods of backward calculation. In particular, the annual series of changes in inventories at current prices was obtained by difference between GDP and the sum of the components. The series thus obtained was later deflated by GDP deflator also retropolated based on Annual Historical Series, to estimate the changes in inventories in volume. It remained so the aforementioned discrepancy between GDP in volume (with rates of change coincide with those in AHS) and the sum of its main components. It should be mentioned that the results for the changes in inventories at current prices were not substantially different considering the various alternatives tested retropolation, contrary to what happened with the estimates in volume.

10. In the Quarterly National Accounts currently released there is also a discrepancy in the volume data (between GDP and the sum of its components) due the non-additivity of aggregates at constant prices.

The backward calculation of the annual series of disposable income was made in a similar manner to the expenditure. In this case, we maintain the growth rate of disposable income and its components except for corporate and property income (component that accommodated the discrepancies between the total income and the sum of components arising from structural differences between the AHS and the annual national accounts in 1995).

With regard to the labour market, and considering the National Accounts concept, the rates of change of total employment, employees and self-employed for AHS were taken as a reference. The annual series, according to the LFS concept, rates of change for change for employment and unemployment of the AHS were imposed, given the different nature (regarding periodicity of samples and methodologies) of the LFS surveys prior to 1992.

3.2. *Construction of quarterly series*

For keeping consistency between quarterly and annual figures remain, we have to impose a set of restrictions. In particular, it is intended to guarantee consistency between the aggregation of quarterly figures and the annual value.

In the case of flow variables (nominal or volume) it was imposed that the sum of quarterly figures ($q_{i,t}, i = 1, \dots, 4$) in year t was equal to respective annual value (Q_t):

$$\sum_{i=1}^4 q_{i,t} = Q_t, \quad \forall t. \quad (6)$$

This restriction was applied when disaggregating annual figures of volumes of expenditure and nominal disposable into quarterly figures.

For temporal disaggregation (from annual to quarterly) of deflators, we imposed that the average of quarterly deflators in year t ($p_{i,t}$), weighted by the share of their quarterly volume in the annual volume was equal to the annual deflator (P_t).

$$\sum_{i=1}^4 \frac{q_{i,t}}{Q_t} p_{i,t} = P_t, \quad \forall t. \quad (7)$$

The expenditure series at current expenditure rates were subsequently obtained as the product of chained volume by deflators (restrictions (6) and

(7) guarantee equality between the sum of the quarterly nominal values and the respective annual value¹¹.)

A simple average restriction was applied to labour market series work. Let $q_{i,t}$ ($i = 1, \dots, 4$) be the value of the variable in the quarter i of year t , and Q_t the respective annual value, we have:

$$\frac{\sum_{i=1}^4 q_{i,t}}{4} = Q_t, \quad \forall t. \quad (8)$$

3.2.1. General procedure of quarterly disaggregation

The econometric methods of temporal disaggregation of time series allow calculate series of higher frequency from data with a lower frequency. Specifically, they are useful when we want produce quarterly series from annual data. The use of related indicators (quarterly variables whose evolution is correlated with the variable we want to quarterly disaggregate) is common in these procedures. This approach was introduced by Chow and Lin (1971) and gave rise to various subsequent developments within the same approach being widely used by statistical offices within Quarterly National Accounts framework. Without loss of generality, considering the case where it is desired to obtain quarterly series from annual series, the method consists of a linear regression that relates each variable we want to quarterly disaggregate y , with one or more variables (related indicators) whose statistical information exists at least on a quarterly frequency, x . This is:

$$y = x\beta + \varepsilon, \quad (9)$$

where β is a vector of coefficients and ε a residual random variable with zero mean and variance-covariance matrix $\sigma^2\Omega$.

The estimation of quarterly figures requires that we impose a restriction of annual aggregation (defined by the C matrix) for converting the quarterly series (y) into its annual series (Y). I.e.,

$$Cy = Y, \quad (10)$$

11. This does not happen if the restriction imposed on deflators considers the annual deflator as the simple average of the quarterly deflators.

where $C_{(n \times T)}$, with $T = 4n$ (T is the number of years), is the matrix defined by:

$$C = \begin{bmatrix} c^T & \mathbf{0} & \dots & \mathbf{0} \\ \mathbf{0} & c^T & \dots & \mathbf{0} \\ \vdots & & & \vdots \\ \mathbf{0} & \mathbf{0} & \dots & c^T \end{bmatrix}$$

where c^T is a vector of dimension (1×4) which defines the type of restriction and annual $\mathbf{0}$ is a null vector of size (1×4) .

The composition of vector c^T depends on the nature of the variables to quarterly disaggregate. Turning to the restrictions referred in subsection 3.2., we have the following options:

- * $c^T = [1 \ 1 \ 1 \ 1]$ when the quarterly disaggregation procedure imposes the restriction (6);
- * $c^T = [\alpha_1 \ \alpha_2 \ \alpha_3 \ \alpha_4]$ with $\sum \alpha = 1$, and $\alpha_i = \frac{q_{i,t}}{Q_t}$ is the share of quarter i volume of quarter in the respective annual volume when the restriction imposed is (7);
- * $c^T = [0,25 \ 0,25 \ 0,25 \ 0,25]$ when the restriction imposed is (8).

As y is unknown, the model (9) can not be directly estimated. However, its parameters can be obtained from the corresponding annual model (i.e., expressed in terms of annual variables). Considering (9) and (10), the annual variable Y can be expressed by:

$$Y = Cx\beta + C\varepsilon \iff Y = X\beta + u, \quad (11)$$

where $X = Cx$ is the matrix of the annual values of the related indicators and $u = C\varepsilon$ is a random variable with variance-covariance matrix $\sigma^2 C\Omega C$. β is estimated by the GLS method (Generalised Least Squares).

The quarterly estimates, \hat{y} , sare given by the expression

$$\hat{y} = x\hat{\beta} + \Omega C^T (C\Omega C^T)^{-1} (Y - X\hat{\beta}), \quad (12)$$

and can be decomposed into two components: one is simply the product of the coefficients estimated by quarterly indicators ($x\hat{\beta}$); and the other is a function of the annual deviation ($Y - X\hat{\beta}$). This function (depending on Ω)

determines how the errors of the annual model are distributed by quarters. Since in practice Ω is not known, this matrix is estimated by assuming some hypothesis about the behavior of errors. In the literature it has been proposed various alternatives (which resulted for different parameterizations of the Ω matrix), corresponding to some variants for the solution of the disaggregation problem, initially developed by Chow and Lin (1971)¹². In these estimates we opted in general for the method described in Litterman (1983) that assumes that the errors follow an $AR(2)$ with unit root¹³, which equals take an $AR(1)$ in the model with variables in first differences.

In the absence of related indicators with quarterly frequency for the reference variable, or when potential indicators revealed little correlated, it was decided to quarterly disaggregate (annual) data without recourse the related indicator. The method adopted consists of an algebraic procedure that seeks smoothed series by minimizing the square of differences in quarterly figures subject to adequate annual restriction [see Boot *et al.* (1967)].

3.2.2. Correction for seasonal and calendar effects

The presented series are adjusted for seasonality and calendar effects. This means that the series are seasonally adjusted whenever a seasonal pattern is identified and adjusted for calendar effects (for example, Easter effect) when they reveal significant. For the more recent period, this correction is only applied to the disposable income and the labour market series, since in the case of expenditure *INE* publishes data adjusted for these effects. For the period previous to 1995, the selected indicators were adjusted for those effects and later used to quarterly disaggregate the annual series.

The seasonal and calendar effects adjustment is made using the *JDemetra+* software (provided by Eurostat and of free access) with the *X13-Arima* method, considering a calendar with holidays for Portugal and by imposing an annual

12. See Cardoso (1999) for a summary of the temporal disaggregation methodologies or Santos Silva and Cardoso (2001) for an extension of this type of methodology to the use of dynamic models.

13. This parametrization is more flexible and allows a greater smoothing in the distribution of annual errors by quarters. It should be noted, however, that in cases where the annualized indicator is a good approximation to the annual variable, results the Litterman method or the original procedure of Chow and Lin (1971) (which assumes an $AR(1)$ process) are very similar.

restriction (it is assumed that the annual estimates are more accurate because they are calculated in greater detail). The method *X13-Arima* is also used by *INE* in the Quarterly National Accounts [see *INE* (2014b)].

4. Specific procedures and associated indicators

Tables 1 to 4 summarize the sources and data used in the database production. The first column identifies the quarterly variables (some of them are not disclosed, since they were only used for intermediate calculations). The next column provides the sources of the annual series used as constraints in the disaggregation procedure. The associated indicators selected for the period 1977 – 1995 are displayed in the third column. There are not quarterly series compiled in accordance with ESA 2010 for this period, which implies that all the series were calculated using the temporal disaggregation method. The last column explains how the series for the most recent period were obtained. In particular, note that the series on the expenditure side correspond to the QNA series published by *INE*.

The group of chosen indicators resulted from a prior analysis of the available indicators considering, especially, the correlations between the annual indicators and the annual series which we intend to disaggregate into quarterly data.

4.1. Expenditure

As mentioned before, the information regarding the expenditure block, from the 1st quarter of 1995, exactly matches the data published in the latest release of the Quarterly National Accounts. For the period before 1995, we disaggregated into quarterly figures the chain linked volume series and the deflators series, and implicitly obtained the series at current prices.

Since consistent series according to ESA 79 are not available for the entire period from 1977 to 1995, we used the implicit growth rates in three overlapping datasets of the Quarterly National Accounts to build the expenditure indicators¹⁴. The series thus calculated and, where necessary

14. Specifically, for the period 1977:1–1985: 4, we used the implicit rates in the publication of the 4th quarter of 1993 (data from 1977: 1 to 1993: 4); for the period 1986: 1–1987: 4 we took into account the implicit rates in the publication of the 4th quarter of 1995 (data from

Quarterly variable	Annual source 1977 - 1994	Indicador/ Calculations before 1995	Calculations since 1995 (quarterly and annual series)
<i>Chain linked volume data</i>			
Private consumption (residents)	AHS	by aggregation	QNA - <i>INE</i>
Durables	by aggregation	by aggregation (vehicles + non-vehicles)	QNA - <i>INE</i>
Vehicles	AHS + dd	vehicles sales - sa	
Non-vehicles	AHS + dd	private consumption - QNA ESA79 - sa	
Non durables	by aggregation	by aggregation (rents+fuels+other)	QNA - <i>INE</i>
Housing rents	AHS	with no prior associated indicator	
Fuels	AHS + dd	gasoline sales - sa	
Other	AHS + dd	private consumption - QNA ESA79 - sa	
Public consumption	AHS	public consumption - QNA ESA79 - sa	QNA - <i>INE</i>
GFCF	AHS	by aggregation	QNA - <i>INE</i>
Machinery and equipment (a)	AHS + dd	GFCF mach. equip. - QNA ESA79 - sa (e)	QNA - <i>INE</i>
Transport material	AHS + dd	GFCF transp. mat. - QNA ESA79 - sa (e)	QNA - <i>INE</i>
Construction	AHS + dd	GFCF construction - QNA ESA79 - sa	QNA - <i>INE</i>
Other	AHS + dd	GFCF - QNA ESA79 - sa	QNA - <i>INE</i>
Changes in inventories (b)	CurPric/GDP Defl (d)	with no prior associated indicator	QNA - <i>INE</i>
Investment	GFCF + CI	by aggregation	QNA - <i>INE</i>
Exports of goods and services	AHS	by aggregation	QNA - <i>INE</i>
Goods	AHS + dd	exports - QNA ESA79 - sa	QNA - <i>INE</i>
Tourism and other services (c)	AHS + dd	by aggregation (tourism+other)	QNA - <i>INE</i>
Tourism (c)	AHS	overnight stays from non residents - sa	
Other	by difference	exports QNA ESA79 sa	
Imports of goods and services	AHS	by aggregation	QNA - <i>INE</i>
Goods	AHS + dd	imports - QNA ESA79 - sa	QNA - <i>INE</i>
Tourism and other services (c)	AHS + dd	imports QNA ESA79 sa	QNA - <i>INE</i>
GDP	AHS	sum of the quarterly components	QNA - <i>INE</i>

TABLE 1. Quarterly associated indicators - Expenditure (volume)

Sources: *Associação do Comércio Automóvel de Portugal*, *Direção Geral de Energia e Geologia*, *INE* and Banco de Portugal.

Notes: "AHS": retropolated series using the Annual Historical Series; "AHS + dd": retropolated series using the Annual Historical Series with distributed discrepancies; "sa": Seasonally and calendar effects adjusted series; "QNA": Quarterly National Accounts.

(a) Corresponds to the QNA series "GFCF in Other machinery and equipment and weapon systems". (b) Includes Acquisitions less disposals of valuables. (c) The tourism series includes goods and services. (d) The annual volume series was obtained by dividing the series at current prices by the GDP deflator. (e) For the period prior to 1986, this series was retropolated using the GFCF in machinery, equipment and transport material series of the QNA compiled according to ESA 79.

footnote The methods used at the time were not equivalent to the current ones. Specifically, the data were not adjusted for calendar effects. adjusted for seasonal and calendar effects, were used as an indicator to estimate the quarterly pattern of the annual series previously computed. For some

1986: 1 to 1995: 4); finally, for the period 1988: 1–1995: 4, we employed the implicit rates in the publication of the 4th quarter of 1998 (data from 1988: 1 to 1998: 4).

Quarterly variable	Annual source 1977 - 1994(a)	Indicator/ Calculations before 1995	Calculations since 1995 (quarterly and annual series)
Deflators			
Private consumption (residents)	AHS	implicit	QNA - <i>INE</i>
Durables	by aggregation	implicit	QNA - <i>INE</i>
Vehicles	AHS + dd	all items CPI - sa	
Non-vehicles	AHS + dd	all items CPI - sa	
Non durables	by aggregation	implicit	QNA - <i>INE</i>
Housing rents	AHS	with no prior associated indicator	
Fuels	AHS + dd	energy CPI - sa	
Other	AHS + dd	all items CPI - sa	
Public consumption	AHS	public consumption defl. - QNA ESA79 - sa	QNA - <i>INE</i>
GFCF	AHS	implicit	QNA - <i>INE</i>
Machinery and equipment (b)	AHS + dd	GFCF mach. equip. defl. - QNA ESA79 - sa	QNA - <i>INE</i>
Transport material	AHS + dd	GFCF transp. mat. defl. - QNA ESA79 - sa	QNA - <i>INE</i>
Construction	AHS + dd	GFCF construction defl. - QNA ESA79 - sa	QNA - <i>INE</i>
Other	AHS + dd	GFCF deflator - QNA ESA79 - sa	QNA - <i>INE</i>
Changes in inventories (cur.pric.)(c)	GDP - comp. (e)	with no prior associated indicator	QNA - <i>INE</i>
Investment	GFCF + CI	implicit	QNA - <i>INE</i>
Exports of goods and services	AHS	implicit	QNA - <i>INE</i>
Goods	AHS + dd	exports deflator - QNA ESA79 - sa	QNA - <i>INE</i>
Tourism and other services (d)	AHS + dd	implicit	QNA - <i>INE</i>
Tourism (d)	AHS	all items CPI - sa	
Other	by difference	exports deflator - QNA ESA79 - sa	
Imports of goods and services	AHS	implicit	QNA - <i>INE</i>
Goods	AHS + dd	imports deflator - QNA ESA79 - sa	QNA - <i>INE</i>
Tourism and other services (d)	AHS + dd	imports deflator - QNA ESA79 - sa	QNA - <i>INE</i>
GDP	AHS	implicit	QNA - <i>INE</i>

TABLE 2. Quarterly associated indicators - Expenditure (Deflators)

Sources: *INE* and Banco de Portugal.

Notes: "AHS": retropolated series using the Annual Historical Series; "AHS + dd": retropolated series using the Annual Historical Series with distributed discrepancies; "CPI": Consumer Price Index; "QNA": Quarterly National Accounts; "sa": Seasonally and calendar effects adjusted series.

(a) This column presents the annual sources of the series at current prices since the annual series for all the deflators were obtained implicitly (that is, dividing the series at current prices by the volume series). (b) Corresponds to the QNA series "GFCF in Other machinery and equipment and weapon systems". (c) Includes Acquisitions less disposals of valuables. (d) The tourism series includes goods and services. (e) The annual series at current prices resulted from the difference between GDP and the sum of its components.

variables, we had to consider other indicators since the same level of detailed disaggregation was not available in the former QNA (ESA 79).

In particular, the QNA releases did not include the disaggregation of private consumption into durables and non-durables for the period prior to 1986. So the volume series for the durable consumption was computed as the sum of the vehicle series (converted into quarterly data using the car sales as indicator) and non-vehicle series (which reflects the quarterly pattern of total private consumption). For the respective deflators, we used the consumer price index

(CPI) as associated indicators (see Tables 1 and 2). Similarly, to calculate the quarterly non-durable consumption series we considered the sum of housing rents (which has a smoother pattern and was disaggregated with no prior indicator), fuels and other non-durable goods (for these series, the indicators employed were gasoline sales and QNA private consumption, respectively). Once again, we use the consumer price indices as indicators for the deflators series calculations.

This problem also arises with GFCF variables. For the period before 1986, GFCF in machinery and equipment and GFCF in transport material were published as a unique series. So we retropolated each one, from 1986 back to 1977, using the implicit growth rates in the aggregate. The quarterly changes in inventories (CI) series, in volume and at current prices (for the period prior to 1995), were obtained by applying the temporal disaggregation method with no associated indicator to the annual values (calculated as described in section 3.1).

It should be mentioned that the external trade disaggregation reported in this paper is slightly different from the one published by *INE*. Although the total exports and imports figures match the ones in QNA, the tourism and other services series (both for exports and imports) here disclosed include mostly services but also the component of goods purchased by tourists (while *INE* incorporates this component in the exports/ imports of goods). We opted to consider tourism as a whole since it has a distinct nature of the remaining trading goods. In particular, for prediction purposes, it is more appropriate to consider this variable as a whole.

4.2. *Disposable income*

Our series for the disposable income block are calendar and seasonal effects adjusted, and for this reason they may differ from the ones published by *INE*.

Aiming to seasonally adjust the compensation of employees series, we computed a seasonally adjusted proxy¹⁵ for this variable and used it as an associated indicator (this proxy is available since 1995).

15. This variable corresponds to the difference between the compensation of employees paid by the total economy and the compensation of employees paid by "Public administration, defence, education, human health and social work activities", both seasonally adjusted and published by Eurostat based on information provided by *INE*.

Additionally, some series in this block present a high volatility and an unstable seasonal pattern. In such cases, we run the temporal disaggregation procedure on these series using the respective four quarter moving average as indicator. Specifically, we considered this option for the other corporate and property income and the direct taxes series. Also, for an accurate treatment of information, some data were analysed at a more detailed level than the one that *INE* publishes¹⁶.

Quarterly variable	Annual source		Indicator/ Calculations before 1995 or 1999	Calculations since 1995 or 1999
	1977 - 1994	1995 - 2014		
<i>Current prices</i>				
Compensation of employees	AHS	QSA - <i>INE</i>	by aggregation	by aggregation
General government	AHS		with no prior associated indicator	with no indicator
Private sector	by difference		comp. per empl. × employees (b)	<i>proxy INE</i> - sa
Corporate and property income	by aggregation	QSA - <i>INE</i>	by aggregation	by aggregation
Mixed income	AHS	QSA - <i>INE</i>	by aggregation (rents+other)	QSA - <i>INE</i> - sa
Housing rents	see Table 1		see Table 1	
Other	by difference		GDP at current prices	
Received interest (resources)	AHS	<i>INE</i> (detail)	received interest - BdP	<i>INE</i> (detail)
(-) Paid interest (uses)	AHS	<i>INE</i> (detail)	paid interest - BdP	<i>INE</i> (detail)
Other	by difference	<i>INE</i> (detail)	GDP at current prices	4Q mov. average (c)
Domestic transfers	AHS	<i>INE</i> (detail)	priv. consumption at current prices	QSA and BoP - sa
External transfers	AHS	BoP	external transfers - BoP - sa	BoP sa
(-) Direct taxes	AHS	QSA - <i>INE</i>	GDP at current prices	4Q mov. average (c)
(-) Social Security contributions	AHS	<i>INE</i> (detail)	compensation of employees	formula
Disposable income	AHS	QSA - <i>INE</i>	by aggregation	by aggregation
Adjustment pension entitlements(D8)(a)		QSA - <i>INE</i>		QSA - <i>INE</i> - sa
Disposable income (D8 adjustment)		by aggregation		by aggregation

TABLE 3. Quarterly associated indicators - Disposable income

Sources: *INE* and Banco de Portugal.

Notes: "AHS": retooled series using the Annual Historical Series; "QSA": Quarterly Sector Accounts; "*INE* (detail)": Detailed data of the QSA; "BoP": Balance of Payments; "sa": Seasonally and calendar effects adjusted series;

(a) Adjustment for the change in pension entitlements. (b) The selected indicator was calculated by the product of the compensation per employee in the private sector series and the employees in the private sector series. (c) Aiming a seasonally adjusted series, we used the four quarter moving average as the associated indicator.

For the period prior to 1999 (1995 for the compensation of employees series), there are no quarterly series available for the disposal income block. Since we favour the temporal disaggregation methods with associated indicators, we computed the correlations between the available variables and the disposable

16. For that purposes, we used (not seasonal adjusted) detailed data of the Quarterly Sector Accounts, kindly provided by Statistics Portugal (*INE*).

income annual series, which allowed us to select some indirect indicators. The results pointed out GDP and private consumption at current prices (calculated as explained in section 4.1) as suitable indicators for three variables of this block (see Table 3).

The compensation of employees for the private sector series was computed taking the product of the series “compensation per employee” and “employees” (see section 4.3 for a calculation description of this variable), both for the private sector, as indicator. We used the CPI to obtain the quarterly compensation per employee series, which implies considering inflation an indicator for the development of the average wage calculations. Both paid and received interest series, which include the FISIM¹⁷ adjustment, were quarterly disaggregated using effective paid and received interest amounts as indicators. These correspond to the product of the average stocks of credits and deposits for different maturities and their respective interest rates (these data had already been used in Castro and Esteves (2004)).

The quarterly series of disposable income (from 1977 to 2014) does not include the adjustment for the change in pension entitlements, which was introduced in the National Accounts due to the implementation of ESA 95. This variable presents a very irregular behaviour and there is no information that enables its retropolation back to 1977. So we opted to disclose two series for both the disposable income and the savings rate, including the adjustment series starting only in 1995. It should be noted that, despite its volatility, the adjustment variable assumes really small values, so its impact on the savings rate series is reduced, particularly when we analyse the series pattern (see Chart 1 for the savings rate series with and without this adjustment).

4.3. *Labour market*

In the labour market block, we consider two sets of series: the full-time equivalent series, relevant to compute some national accounts data, in particular, the compensation per employee series; and the series measured in number of individuals, which allow the construction of a consistent long time series for the unemployment rate.

The existence of time series breaks, caused by methodological and sample changes in the Labour Force Survey, precludes the comparison of results over

17. Financial Intermediation Services Indirectly Measured.

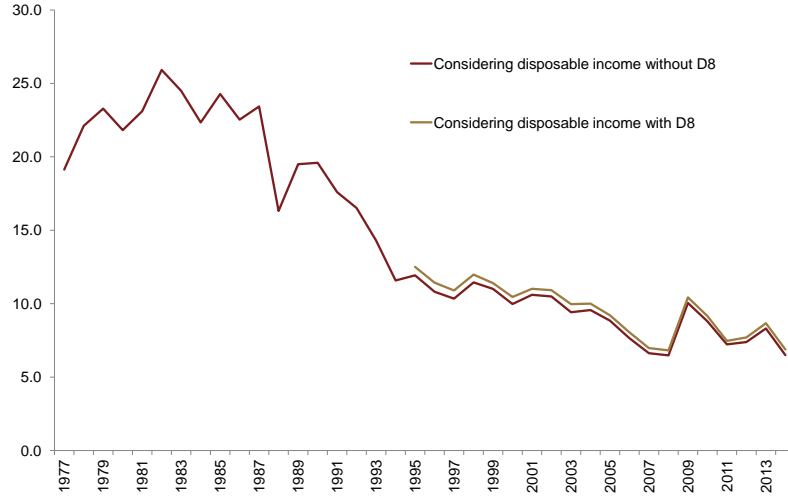


FIGURE 1: Savings rate

Sources: *INE* and Banco de Portugal.

Notes: D8 corresponds to the adjustment for the change in pension entitlements.

time and their direct use to produce long time series. In constructing these series for both employment and unemployment (LFS concept), during the period 1977–2014, we employed results from different LFS versions¹⁸ and the annual information available. Specifically, for the period beginning in 1992, we started with the results of the most recent LFS version (data since 2011), and successively applied the implicit growth rates in the latest release for each quarter. Then the long time series was seasonally adjusted. The results of the LFS - 1998 (Census 2001) were provided by *INE* up to the 1st quarter of 2011 for the main variables, allowing us to use the implicit growth rate in the end of this sample (i.e. the growth rate from the 4th quarter of 2010 to the 1st quarter of 2011) to link the results from the LFS–2011 (Census 2011) to the LFS – 1998 (Census 2011) and produce the series back to 1998. With this adjustment, the correction in the unemployment rate, compared to the one

18. We will use the first year of each version (methodology) to identify the LFS used, so, for instance, the LFS–2011 corresponds to the results of the survey first applied in 2011

reported in the 1998 version of the survey, was of +1 percentage point (p.p.) in 2010, the last year released, and +0.5 pp. in 1998, the initial year. When *INE* moved from LFS–1992 to LFS – 1998, neither the calculation of the impact from the changes in the survey nor any result that would enable the series backward estimation were published. So we used the annual growth rate of the National Accounts’ employment series in 1998 as constraint and assumed the change in the unemployment rate presented in Castro and Esteves (2004).

Quarterly variable	Annual source (a)		Indicator/ Calculations before 1992 or 1995	Calculations since 1992 or 1995
	1977 - 1994	1995 - 2014		
<i>Full-time equivalent</i> (National Accounts concept)				
Total employment	AHS	ANA – <i>INE</i>	total employment - LFS - sa	total employment (QNA)
Employees	AHS + dd	ANA – <i>INE</i>	total employment - LFS - sa	employees (QNA)
Other forms of employment	AHS + dd	by difference	by difference	by difference
<i>Thousand individuals</i> (Labour Force Survey concept)				
Employment	AHS	LFS - ret. series	total employment - LFS - sa	LFS - ret. series - sa
Unemployment	AHS	LFS - ret. series	unemployment - LFS - sa	LFS - ret. series - sa

TABLE 4. Quarterly associated indicators - Labour market

Sources: *INE* and Banco de Portugal.

Notes: "AHS": retropolated series using the Annual Historical Series; "AHS + dd": retropolated series using the Annual Historical Series with distributed discrepancies; "ANA": Annual National Accounts; "LFS": Labour Force Survey; "ret. series": retropolated LFS series back to 1992; "sa": Seasonally and calendar effects adjusted series; "QNA": Quaterly National Accounts.

(a) Considering the Labour Force Survey concept, note that the annual figures, for the period after 1992, result from aggregation (average) of quarterly figures. For the period prior to 1992, the annual constraint is given by each variable’s implicit growth rate in the Annual Historical Series.

For the period prior to 1992, the data and choices from Castro and Esteves (2004) were used, having these been adjusted according to the most recent data. Since the LFS results prior to 1992 presented different characteristics, in particular, a higher volatility, we preferred, for this period, to impose the historical growth rates of employment and unemployment in the calculations of the annual figures. The quarterly series from the Labour Force Surveys prior to 1992 (after being seasonally adjusted by time blocks) were used to quarterly disaggregate the annual series from 1977–1992 which are consistent with the most recent figures. Both the total labour force and the unemployment rate implicitly result from the employment and unemployment series.

Regarding the National Accounts concept, we selected total employment and employees (measured in number of individuals) from the Quarterly National Accounts dataset as indicators to disaggregate into quarterly figures

the employment series for the period after 1995. The long time series computed according to the LFS concept were used as indicators for the period prior to 1995.

It should be noted that, similarly to the other series of this database, the unemployment rate only differs from the one currently published in the LFS due to seasonality corrections.

5. Final remarks

In this article we present quarterly historical series (1977–2014) which are consistent with the latest version of National Accounts published by *INE*. Simultaneously we reassess the methodology used in Castro and Esteves (2004), taking into account the available information and the revisions and methodological changes observed in the scope of national accounts (which had already motivated specific adjustments in the estimation of these series). In particular, we tuned some procedures in order to avoid changes in the main aggregates' evolution pattern (for the period prior 1995) whenever the 1995 figures were revised, for instance, due to the change of the reference year in the chained linked volume data. So, this article gathers in a single document an updated and detailed description of the procedures used during the construction of the database.

The main change from the previous methodology consists in imposing, for the period prior to 1995, the implicit growth rates of the Annual Historical Series from *Banco de Portugal* on the main macroeconomic aggregates. At the same time, we assured the additivity of nominal and volume series using a discrepancy distribution procedure. This method allows the construction of intermediate variables by aggregating (by sum) their components as well as the exact decomposition of the total variation into its subcomponents' contributions.

Additionally, in the previous version, some disposable income series (for the period before 1999) were quarterly disaggregated with no prior associated indicator, due to the absence of Quarterly Sector Accounts series. As a consequence, the variables presented a smooth pattern during that period. In order to increase the comparability with the data for the period 1999–2014, we introduced associated indicators in the construction of the quarterly pattern of the disposable income series.

The released dataset is adjusted for seasonally and calendar effects and it is available in electronic format along with the Economic Bulletin - June 2015. The database will continue to be updated and published annually with the June Economic Bulletin, which will include a note with a data presentation and possible methodological adjustments.

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