9

Splicing National Accounts, 1958–2015

National accounts rely on complete information on quantities and prices to compute GDP for a single benchmark year, which is, then, extrapolated forward on the basis of limited information for a sample of goods and services. To allow for changes in relative prices and, thus, to avoid that forward projections of the current benchmark become unrepresentative, national accountants periodically replace the current benchmark with a new and closer GDP benchmark. The new benchmark is constructed, in part, with different sources and computation methods.[1]

9.1 National Accounts in Spain

In Spain's national accounts, benchmarks for 1958 (CNE58) and 1964 (CNE64) were derived using OECD criteria, while the United Nations System of National Accounts (SNA) was used for all the rest (CNE70, CNE80, CNE86, CNE95, CNE00, CNE08, CNE10) (Table 9.1).[2] Detailed sets of quantities and prices (derived from the closest input-output table) were employed to compute GDP at the benchmark year (1958, 1964, 1970, 1980, 1986, 1995, 2000, 2008, 2010).[3]

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Table 9.1 Spain's national accounts, 1954–2015

	Benchmark year	Coverage
CNE58	1958	1954–1964
CNE64	1964	1964–1972
CNE70	1970	1964–1982
CNE80	1980	1970–1985
CNE86	1985/86	1964–1997
CNE95	1995	1995–2004
CNE00	2000	1995–2009
CNE08	2008	1995–2013
CNE10	2010	1995–2015

Note Direct estimates only refer to years after the benchmark. *Sources* IEF (1969), INE (various years)

Differences in a new benchmark year between 'new' and 'old' national accounts stem from statistical (sources and estimation procedures) and conceptual (definitions and classifications) bases. Once a new benchmark has been introduced, newly available statistical evidence would not be taken on board to avoid a discontinuity in the existing series (Uriel 1986: 69) so the coverage of new economic activities may explain the discrepancy between the new and old series. Furthermore, discrepancies between 'new' and 'old' benchmarks for the year in which they overlap also stem from statistical (sources and estimation procedures) and conceptual (definitions and classifications) differences. As a result, the consistency between the new and old national account series breaks.

The obvious solution to this inconsistency problem would be *recompilation*, that is, computing GDP for the years covered by the old benchmark with the same sources and procedures employed in the construction of the new benchmark. However, national accountants do not follow such a painstaking option.

A simple solution, widely used by national accountants (and implicitly accepted in international comparisons), is the *retropolation* approach, in which the new series (Y^R) results from accepting the reference *level* provided by the most recent benchmark estimate (Y_T) and, then, re-scaling the earlier benchmark series (X_t) with the ratio between the new and the old series for the year (T) at which the two series overlap (Y_T/X_T).

$$Y_t^R = (Y_T/X_T) * X_t \quad \text{for} \quad 0 \leq t \leq T \tag{9.1}$$

For example, in order to obtain CNE70 estimates for 1964–1969, Spanish national accountants projected backwards (*retropolated*) the new 1970 GDP level (CNE70) with the rates of variation derived from the old benchmark series (CNE64). The *retropolation* approach was also adopted to derive series levels for the years 1964–1979 in both the 1980 and the 1986 benchmarks (CNE80 and CNE86).[4]

The choice of the *retropolation* procedure was made on the arguable assumption that growth rates originally calculated could not be improved (Corrales and Taguas 1991). Underlying this approach is the implicit assumption of an error level in the old benchmark's series whose relative size is constant over time. In other words, no error is assumed to exist in the old series' rates of variation that are, hence, retained in the spliced series Y_t^R (de la Fuente 2014). Official national accountants have favoured this procedure of linking national accounts series on the grounds that it preserves the earlier benchmark's rates of variation.[5] The *retropolation* approach pays no regard to the unpredictable but significant effects of using a set of relative prices from the old benchmark to project the level of the new benchmark backwards.

The main methodological discontinuity in Spanish national accounts occurred when the SNA substituted for the OECD method in the late 1970s. Table 9.2 provides the values of each benchmark series at base years and the ratio between each pair of adjacent 'new' and 'old' benchmark values. Substantial discrepancies are noticeable between CNE64 (constructed with OECD criteria) and CNE70 (derived with SNA criteria), benchmarks within a period of fast growth and deep structural change (Prados de la Escosura 2007).

It is worth noting that the most recent benchmark usually provides a higher GDP level for the overlapping year, as its coverage of economic activities is wider. Thus, the backward projection of the new benchmark GDP level with the available *growth rates*—computed at the previous benchmark's relative prices—implies a systematic upward revision of GDP *levels* for earlier years.[6] The evidence in Table 9.2 highlights the

Table 9.2 GDP at market prices: alternative estimates (Million Euro at current prices)

	[I]	[II]	[III]	[IV]	[V]	[VI]	[VII]	[VIII]	[IX]	[X]	[XI]	[XII]	[XIII]	[XIII]	[XIV]
	CNE10	CNE08	CNE00	CNE95	CNE86	CNE80	CNE70	CNE64	[(I)/(II)]	[(II)/ (III)]	[(III)/ (IV)]	[(IV)/ (V)]	[(V)/ (VI)]	[(VI)/ (VII)]	[(VII)/ (VIII)]
1964					7265	7360	7225	**6543**					0.9871	1.0187	1.1042
1970					15806	15772	**15483**	13607					1.0021	1.0187	**1.1379**
1980					91161	**91409**	91264						0.9973	**1.0016**	
1986				175625	**194271**	192009						0.9040	**1.0118**		
1995	459337	446795	447205	**437787**	419387	413788			1.0281	0.9991	1.0215	**1.0439**	1.0135		
2000	646250	629907	**630263**	610541					1.0259	0.9994	**1.0323**				
2008	1116207	**1087788**	1088124						1.0261	**0.9997**					
2010	**1080913**	1045620							**1.0338**						

Sources IEF (1969), INE (various years) impact of successive one-side upward revisions, which widens the gap over time. In fact, the GDP figure obtained by the cumulative re-scaling different national accounts subseries from 2010 backwards (that is, using the r*etropolation* approach) is 28.4% higher for 1970 than the one computed by CNE64 (and 24.6% higher than the one directly calculated for 1964).[7]

Would it be reasonable to expect such an underestimate from a direct GDP calculation on the basis of 'complete' information about quantities and prices of the goods and services in the old benchmark? Can the direct measurement of GDP level at an early benchmark year be really improved through the backward projection of the latest benchmark year with earlier benchmarks' annual rates of variation?

The challenge is to establish the extent to which conceptual and technical innovations in the new benchmark series hint at a measurement error in the old benchmark series. In particular, whether the discrepancy in the overlapping year between the new benchmark (in which GDP is estimated with 'complete' information) and the old benchmark series (in which reduced information on quantities and prices is used to project forward the 'complete' information estimate from its initial year) results from a measurement error in the old benchmark's *initial* year estimate, or it is the cumulative result of the emergence of new goods and services not considered in the old benchmark series.

An alternative to the *retropolation* method is provided by the *interpolation* procedure that accepts the levels computed directly for each benchmark year as the *best* possible estimates—on the grounds that they have been obtained with 'complete' information on quantities and prices—and distributes the gap or difference between the 'new' and 'old' benchmark series in the overlapping year T at a constant rate over the time span in between the old and new benchmark years.[8]

$$Y_t^I = Y_t \ast \left[\left(Y_T / X_T \right)^{1/n} \right]^t \quad \text{for } 0 \le t \le T \qquad (9.2)$$

Being Y^I the linearly *interpolated* new series, Y e X the values pertaining to GDP according to the new and old benchmarks, respectively; t, the year considered; T, the overlapping year between the old and new benchmarks' series; and n, the number of years in between the old (0) and the new benchmark (T) dates.[9]

Contrary to the *retropolation* approach, the *interpolation* procedure assumes that the error is generated between the years 0 and T. Consequently, it modifies the annual rate of variation between benchmarks (usually upwards) while keeps unaltered the initial level that of the old benchmark. As a result, the initial level will be probably lower than the one derived from the *retropolation* approach.

In Spanish national accounts, a break in the linkage of GDP series through *retropolation* was introduced in CNE86, when national accounts were spliced using the *interpolation* approach and the GDP differential between CEN86 and CEN80 in 1985 was distributed at a constant rate over the years 1981–1984 (expression 16) (INE 1992). However, a new national accounts benchmark in 1995 (CNE95) did not bring along a splicing of CNE95 and CNE86 series.[10] In later benchmarks (CNE00, CNE08 and CNE10), the *interpolation* method was resumed, but only after adjusting upwards the old benchmark for methodological changes.[11] Thus, the gap between, say, CNE10 and CNE00-08, in the year 2010, was decomposed into methodological and statistical plus other differences.[12] Firstly, CNE00-08 series for 1995–2009 were adjusted upwards for methodological discrepancies with CNE10. Then, the *residual* gap, due to statistical and other differences, was distributed at a constant rate (using expression 16) over the in-between benchmark years, 2001–2009.[13] As a result, no officially spliced GDP series are available at the present for the entire national accounts era.

9.2 Splicing National Accounts Through Interpolation

A straightforward procedure would be, then, splicing the all benchmark series available by accepting the levels directly computed for each benchmark year and distributing the gap between each pair of adjacent benchmark series at their overlapping year at either a constant rate over the time span between them. This solution has the advantage of being transparent and linking different benchmarks equally.

Nonetheless, before computing and comparing alternative splicing results, pre-1980 national accounts need to be examined because, as mentioned earlier, it is during the transition between OECD and SNA methodologies when larger disparities between adjacent benchmarks series emerged in overlapping years. By examining the way OECD (CNE64) and SNA (CNE70) benchmarks were constructed, an attempt to reconcile their differences can be made.

In pre-1980 official national accounts, annual nominal series of, say, industrial value added were usually obtained through back and forth extrapolation of the benchmark year's gross value added with an index of industrial production that was, then, reflated with a price index for industrial goods. Projecting industrial real value added with an index of industrial production amounts to a single deflation of value added, in which the same price index is used for both output and inputs.[14] However, only if prices for output and intermediate inputs evolve in the same direction and with the same intensity, real value added is accurately represented by an industrial production index. In periods of rapid technological change (or external input price shocks), significant savings of intermediate inputs do take place while relative prices change dramatically, and, hence, the assumption of a parallel evolution of output and input prices does not hold.[15] This description applies well to Spain in the 1960s and 1970s, when the country opened up to foreign technology and competition and suffered the oil shocks.[16] Fortunately, alternative estimates of gross value added at constant prices derived through the Laspeyres double deflation method[17] are available for industry and construction over the years 1964–1980 (Gandoy 1988).[18] Gandoy's value added series exhibit higher real growth rates than CEN70 series since her implicit value added deflator grows less than the national accounts' deflator (biased towards raw materials and semi-manufactures).[19] This is what should be expected in a context of total factor productivity growth, such as was the case of Spain in the 1960s and early 1970s, with output prices growing less than inputs prices, as inputs savings resulted from efficiency gains (Prados de la Escosura 2009).[20]

Thus, CEN70 series for GDP have been revised for 1964–1980. Firstly, Gandoy Juste (1988) alternative value added estimates for industry and construction (GVA_i^G and GVA_c^G) were substituted for those in official national accounts (GVA_i^{cen70} and GVA_c^{cen70}).[21] CNE70 value added figures for agriculture (GVA_a^{cen70}) and services (GVA_s^{cen70}) were kept.[22] Total gross value added was reached by adding up sectors' gross value added.

$$GVA^T = GVA_a^{cen70} + GVA_i^G + GVA_c^G + GVA_s^{cen70} \tag{9.3}$$

GDP at market prices was derived, in turn, by adding taxes on products net of subsidies to total gross value added.

CEN70 GDP estimates on the expenditure side were also adjusted. While Gandoy (1988) provides alternative value added series at factor cost for industry (VA_{fci}^G) and construction (VA_{fcc}^G), Gómez Villegas (1988) presents new series for fixed domestic capital formation in industry (GCF_i^G) and construction (GCF_c^G). Thus, in order to adjust the aggregate figure for investment in CNE70 (GCF^{cen70}), I firstly computed the share of value added at market prices (VA_{mp}) allocated to investment in industry and construction, according to Gandoy (1988) and Gómez Villegas (1988), (GCF_i^G/VA_{mpi}^G and GCF_c^G/VA_{mpc}^G), which implied adjusting value added to include taxes on production and imports net of subsidies.[23] Then, I applied this share to the difference between the value added estimates at factor cost in Gandoy's (VA_{fci}^G and VA_{fcc}^G) and in CEN70 (VA_{fci}^{cen70} and VA_{fcc}^{cen70}).

$$GCF_i^{add} = \left(GCF_i^G / VA_{mpi}^G\right) * \left(VA_{fci}^G - VA_{fci}^{cen70}\right) \tag{9.4}$$

$$GCF_c^{add} = \left(GCF_c^G / VA_{mpc}^G\right) * \left(VA_{fcc}^G - VA_{fcc}^{cen70}\right) \tag{9.5}$$

So the additional investment—that is, the portion of gross capital formation not included in CNE70—was obtained. Thus,

$$GCF^{add} = GCF_i^{add} + GCF_c^{add} \tag{9.6}$$

And the revised figure for gross capital formation was derived as,

$$GCF^{1970R} = GCF^{cen70} + GCF^{add} \tag{9.7}$$

Then, I adjusted private consumption figures in CEN70 for the changes introduced in gross capital formation. That is, I assumed that the additional value added in industry and construction (derived by deducting CNE70 value added from Gandoy's estimates) *less* the additional investment (GCF^{add}) accrued to private consumption, since the values for net exports of goods and services (NX^{cen70}) and public consumption ($GOVT^{cen70}$) provided by CEN70 were obtained from a sound statistical basis.[24] That is,

$$CONS^{add} = \left(\left(VA^{G}_{fci} + VA^{G}_{fcc}\right) - \left(VA^{cen70}_{fci} + VA^{cen70}_{fcc}\right)\right) - GCF^{add} \tag{9.8}$$

And the revised figure for total private consumption was reached as,

$$CONS^{1970R} = CONS^{cen70} + CONS^{add} \tag{9.9}$$

Lastly, the new estimates of GDP at market prices were obtained as,

$$GDP^{1970R}_{mp} = CONS^{1970R} + GCF^{1970R} + GOVT^{cen70} + NX^{cen70} \tag{10.1}$$

How are interpolated, then, earlier, pre-1980, national account benchmark series? CNE70^{R} series have been accepted for the years 1964–1969, rather than distributing the difference in 1970 between CNE70^{R} and CNE64 over these years. The reason of this choice is that CNE70^{R} series have been mainly derived through double deflation, as opposed to CNE64 single deflation series. CNE70^{R} and CNE58 series were, in turn, interpolated by distributing their gap in 1964 over 1959–1963.[25] Lastly, in order to I derived a single series for GDP and its components for the pre- and post-1980 series, I distributed their gap in the overlapping year, 1980, over 1971–1979. Aggregated GDP figures result from adding up its previously spliced components.[26]

This strict *interpolation* procedure has, nonetheless, the shortcoming of deviating from official national accounts series for the years 1995–2009. The reason is that, as observed above, in post-2000 Spanish national accounts its splicing is performed in two stages: firstly, the old benchmark series are adjusted upwards for methodological changes in the new benchmark; and, then, the remaining statistical gap is distributed at a constant rate over the years between the new and the old benchmarks.

Thus, an alternative to deriving GDP series through strict *interpolation* appears, namely accepting the official *interpolation* linkage for 1995–2010 and interpolating the different benchmark (CNE58 to CNE95) series for the previous years, 1958–1995.[27]

It is worth noting, however, that, in CNE10 series, the GDP level for 1995 is higher (4.9%) than the one originally computed with complete information in CNE95 (Table 9.3). What share of this gap is attributable to methodological differences? The CNE10 linkage procedure consisted in adjusting the CNE00 series for methodological differences back to 1995 and, then, distributing the remaining, mostly statistical, gap over 2001–2009, under the assumption that no statistical error exists in 2000. Thus, the entire discrepancy in 1995 between CNE10 and CNE95 could be attributable to methodological differences.[28] Should pre-1995 series, resulting from splicing all previous benchmarks (CNE58–CNE95), be raised, then, by a fixed ratio (1.0492)? This option does not seem reasonable, as it can be conjectured that the impact of methodological changes would be larger the closer the year's estimate to CNE10 benchmark year, 2010. A compromise solution would be to distribute the entire gap over the 1954–1994 series. Therefore, I have

Table 9.3 Real GDP Growth: Alternative Splicing, 1958–2010 (annual average rates %)

	Hybrid linear interpolation	Retropolation
1958–1964	5.9	6.2
1964–1970	6.4	6.2
1970–1980	4.9	3.7
1980–1986	1.9	1.5
1986–1995	3.7	3.2
1995–2000	4.1	4.0
2000–2010	2.2	2.2

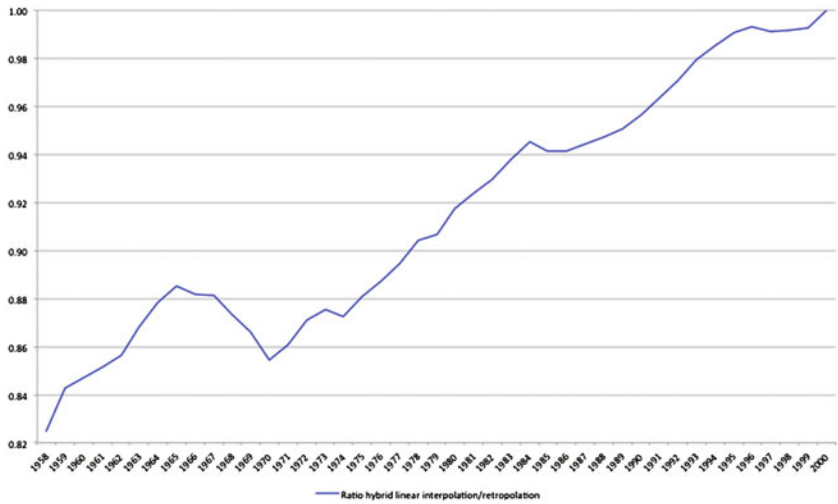

Fig. 9.1 Ratio between hybrid linearly interpolated and retropolated nominal GDP series, 1958–2000. *Sources* See the text

spliced the pre- and post-1995 series through a 'hybrid' *interpolation*, with an adjustment for methodological differences as described above.

Figure 9.1 presents the ratio between the figures for nominal GDP obtained by splicing national accounts through 'hybrid' linear *interpolation* and those derived through *extrapolation*. It can be observed how the over-exaggeration of GDP levels derived through *retropolation* cumulates as one goes back in time, reaching around one-fifth by the late 1950s.

Once GDP series at current prices were obtained, the next task was to deflate them in order to obtain GDP volume indices. Deflators for each CNE benchmark GDP series were also spliced through 'hybrid' linear *interpolation* as well as through *retropolation*. Interestingly, deflators derived through alternative splicing methods do not exhibit the far from negligible differences observed for current values.

Figure 9.2 presents the evolution of GDP at constant prices, expressed in log form, using alternatively the interpolated and retropolated series over 1958–2000. It can be observed that their differential widens

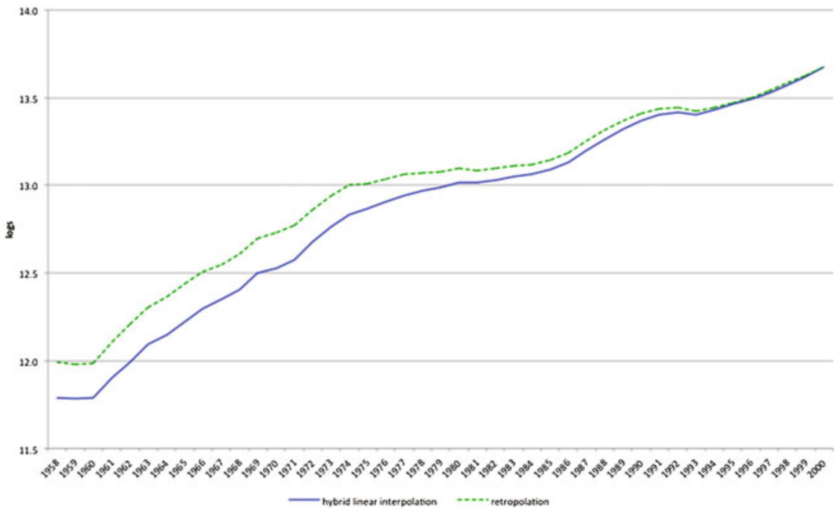

Fig. 9.2 Real GDP, 1958–2000 (2010 Euro) (logs): alternative estimates with hybrid linear interpolation and retropolation splicing (logs). *Sources* see the text

significantly over time suggesting lower levels and faster growth for GDP estimates derived through interpolation.[29]

Table 9.3 compares the resulting GDP growth rates between National Accounts benchmark years derived by splicing national accounts alternatively with 'hybrid' linear interpolation and retropolation approaches. GDP estimates derived through the interpolation procedure cast higher growth rates over the entire time span considered than those estimates resulting from the conventional retropolation method. The annual cumulative rate per person over 1958–2000 is 4.5% compared to a 4.0% for the retropolated series, respectively. The main discrepancies correspond to period 1970–1995, and particularly during the 1970s, in which the interpolated series exhibit a more than one-third faster growth rate. The implication is that, in the period of rapid expansion 1958–1974, Spain's delayed Golden Age, and, again, between Spain's accession to the European Union (1985) and the eve of the Great Recession (2007), the interpolated series grew faster that the retropolated ones. However, it is during the so-called transition to democracy period (1974–1984), when the positive growth differential between the interpolated and the retropolated series reached its peak (2.3 and 1.3%, respectively). As a result, the deceleration following the exceptional growth of Spain's delayed Golden Age was less dramatic than suggested by conventional narrative. It is worth comparing the results to another alternative to the retropolation procedure provided by the 'mixed splicing', in which Ángel de la Fuente (2014, 2016) proposes an intermediate position in which an initial error in the old series, stemming from the insufficient coverage of emerging economic sectors, grows at an increasing rate. Unfortunately, the correction to the growth rate of the original series implies an arbitrary assumption about its size (see the discussion in Prados de la Escosura 2016).

Since de la Fuente (2016) favours Gross Value Added (GVA, equivalent to GDP at basic prices), the comparison is carried out in terms of real GVA (Fig. 9.3). It can be observed that the results from 'mixed splicing' are not far apart from those I obtained through hybrid linear interpolation. Discrepancies only appear in the pre-1980 period for which de la Fuente (2016) linked his series to Uriel et al. (2000) GDP series spliced through retropolation.

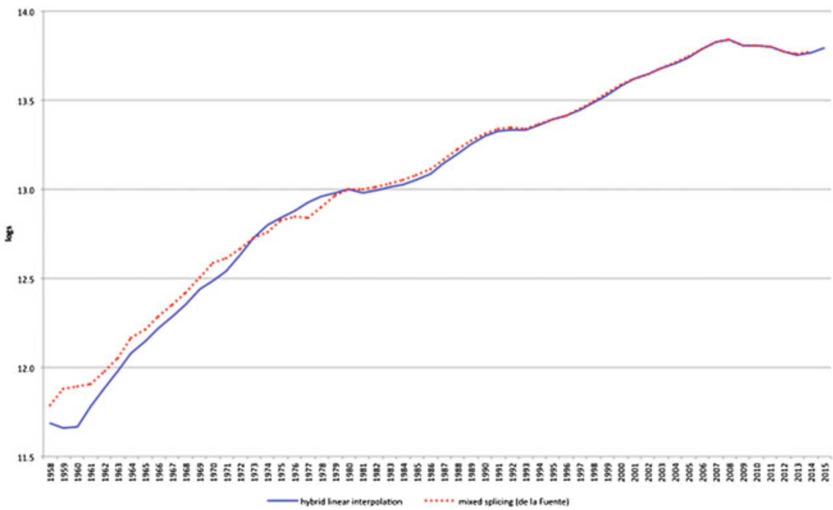

Fig. 9.3 Real gross value added, 1958–2015 (2010 Euro) (logs): alternative estimates with hybrid linear interpolation and mixed splicing, 1958–2015. *Sources* Hybrid linear interpolation, see the text; Mixed splicing, de la Fuente (2016)

Notes

1. Improving the comprehensiveness, reliability and comparability of national accounts estimates through the use of new statistical sources, the inclusion of new concepts and the adoption of new computation procedures, often due to the adoption of new or updated international standards, are the technical reasons provided by national statistical offices for their periodical revisions of national accounts' benchmarks and the resulting breaks in GDP time series.
2. At the turn of the century, the European System of Accounts (ESA) replaced the SNA, being SNA93 and ESA95 fully consistent. Series constructed with different benchmarks' prices and quantities are named after the year, e.g. CNE70, that is, *Contabilidad Nacional de España* (National Accounts of Spain) with 1970 as the base year.
3. For all these benchmark years, input-output tables are available, except for 1964 and 1986, for which the closest ones are those for 1962 and 1966, and 1985, respectively.
4. Such is the approach implicitly supported by Uriel (1986) and Uriel et al. (2000). This procedure has the advantage of being less time consuming and not altering the yearly rates of variation resulting from the 'old' benchmark series.
5. For the case of Spain, cf. Uriel (1986), Corrales and Taguas (1991), INE (1992), Uriel et al. (2000). In the Netherlands, a pioneer country in national accounts, it was only after the 1993 SNA classification that the *retropolation* method was challenged (den Bakker and van Rooijen 1999).
6. This linkage procedure helps to understand the one-sided upward revisions Boskin (2000) finds in US national accounts.
7. This percentage increase for 1970 results from successively multiplying the ratios of adjacent benchmarks at overlapping years, that is, CNE10/CNE08 in 2010, CNE08/CNE00 in 2008, CNE00/CNE95 in 2000, CNE95/CNE86 in 1995, CNE85/CNE80 in 1985, CNE80/CNE70, in 1980, and CNE70/CNE64 in 1970, [1.0338 * 0.9997 * 1.0323 * 1.0439 * 1.0118 * 1.0016 * 1.1378 = 1.2841]. If alternatively, CNE10/CNE00 in 2010 is used, the results alter slightly [1.0254 * 1.0323 * 1.0439 * 1.0118 * 1.0016 * 1.1378 = 1.2741] (see Table 9.2).

8. Maddison (1991) presented the first methodological discussion along these lines and spliced GDP series through *interpolation* for the case of Italy.
9. An alternative to the linear interpolation is a nonlinear one, in which the gap between the new and old series at the overlapping year is distributed over the old series at a growing, rather than at a constant, rate. However, there are hardly any significant discrepancies between the linearly and nonlinearly interpolated series (Prados de la Escosura 2016). Therefore, in order to keep consistency with the official national accounts from 1995 onwards and facilitate updating insuccesive years, I have chosen to use the linear interpolation.
10. The National Statistical institute (INE) never produced a new spliced series of the latest base-year CNE00 back to 1964, 1970, or 1980. The Quarterly National Accounts provided spliced series from 1980 onwards but without a detailed explanation of the splicing procedure.
11. No mention of any methodological adjustment was made in the splicing through interpolation of CNE80 and CNE86.
12. It should be noted that since there were minor methodological and statistical changes between CNE00 and CNE08, the major revision embodied in CNE10 led to a new interpolation between CNE00–CNE08 and CNE10 that was extended over the years 1995–2009.
13. The same procedure was applied to the gap between CNE00 and CNE95 in 2000, and CNE08 and CNE00 in 2008, with the statistical gap distributed over the intermediate years 1996–1999, and 2001–2007, respectively. The Spanish Statistical Institute notes, 'The [remaining] differences between both estimates [CNE00 and CNE95 in the year 2000] are due to the statistical changes, and given that information is not available regarding how and at what time they have been generated, it is assumed that this has occurred progressively over time, from the beginning of the previous base' (INE 2007: 5).
14. Cf. Cassing (1996) for a discussion of alternative deflation procedures. See, alternatively, David (1962) and Fenoaltea (1976) for a defence of single deflation as a way of avoiding negative values of real value added.
15. In the dual approach to computing total factor productivity (TFP), over time changes in TFP are measured as the differential between the rate of variation of the output price and that of weighted input prices. In other words, a faster decline (less marked increase) of output prices than of inputs prices, due to input savings, reflects TFP growth.

16. The 1950s, especially since 1953, were years of rapid growth and structural change in which double deflation would make a difference over single deflation. Unfortunately, lack of data prevents this option.
17. By double deflation is meant that real gross value added is obtained as the difference between output at constant prices and intermediate consumption at constant prices, that is, each of them independently deflated with their own price indices. For a theoretical discussion of double deflation, cf. David (1962), Sims (1969), Arrow (1974) and Hansen (1975).
18. Cf. also Gandoy and Gómez Villegas (1988). Occasionally, when strong discrepancies between output and inputs prices were observed, and data availability allowed it, CNE70 used double deflation but, in any case, never over the years 1978–1981. In the case of agriculture, real value added was properly assessed in CNE70, as the purchases of industrial and service inputs represented a small share of final output. As for services, the difficulties to produce double-deflated value added series, comparable to those for agriculture and manufacturing, persisted over time.
19. Cf. Krantz (1994).
20. Although, fortunately, from 1980 onwards, CNE80 provided industrial value added computed through the standard double deflation procedure, double-deflated value added figures for construction and services were still problematic. Cf. INE (1986) for a discussion of CNE80.
21. Also van Ark (1995) chose Gandoy (1988) series over the original national accounts. Among van Ark's reasons are the downward bias in the growth rates of industrial production indices and its failure to adjust to the emergence of new products and quality changes.
22. For the reasons to keeping original CNE70 gross value added for agriculture and services, see Chap. 11, note 2. For a discussion of the problems in measuring services' gross value added through double deflation, see Mohr (1992).
23. In practical terms, the adjusted was carried out with the ratio between GDP at market prices and factor cost.
24. Actually, $CONS^{add}$ equals the differential between the revised GDP estimates (GDP^{r}_{mp}) and CNE70 GDP (GDP^{cen70}_{mp}) plus the estimated additional investment (GCF^{add}).
25. There is no discrepancy between CNE58 and CNE64 estimates at their overlapping year, 1964. It is worth noting that in absence of double

deflation in CNE58, splicing through interpolation provides a correction of its series that somehow amounts to an allowance for efficiency gains.

26. It is worth mentioning that the resulting discrepancies between obtaining GDP through aggregation of its spliced components and splicing GDP directly are negligible. Thus, additive congruence has not been imposed. By additive congruence is meant that the addition of the different components of a given magnitude (output or expenditure) must be equal to its aggregate value (GDP). This is obtained by distributing, proportionally to their relative weight, the deviations of the addition of the linked components' values from the aggregate magnitude (Cf. Corrales and Taguas 1991). This is implicitly done, however, for each of the subcomponents of GDP components.
27. As mentioned above, for the years 1980–1986, CNE86 provides spliced series derived from interpolating CNE86 and CNE80.
28. Unfortunately, national accounts explanatory notes do not address this issue.
29. The following discussion applies to all estimates derived through the retropolation approach, including Uriel et al. (2000) and Maluquer de Motes (2008, 2016), who erroneously uses the CPI as an alternative to the GDP implicit deflator. See my discussion of Maluquer de Motes estimates (Prados de la Escosura 2009).

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