POTENTIAL GROWTH OF THE SPANISH ECONOMY

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Abstract

This paper presents an estimate of the Spanish economy's potential growth. This estimate is based on a production function methodology that includes certain refinements on previous versions and generates less procyclical potential output growth estimates than those traditionally considered in the literature. As a result, the (positive) output gap estimated in expansions is higher and that estimated in recessions is lower. According to these results, given the available population projections and under the assumption that total factor productivity (TFP) and structural unemployment will behave in line with historical patterns, the Spanish economy's potential growth is expected to recover gradually over the coming years but, in line with projections by international organisations, to lower rates than those in the expansion period. However, per capita growth rates fully recover to the pre-crisis levels, which highlights the importance of population projections in shaping the Spanish potential growth.

Keywords: potential growth, output gap, Spain.

JEL classification: E23, E32, E13, O47, O52.

Resumen

Este documento presenta una estimación del crecimiento potencial de la economía española. Dicha estimación está basada en una metodología de función de producción que incorpora algún refinamiento con respecto a versiones anteriores y genera crecimientos del *output* potencial menos procíclicos que los tradicionalmente considerados en la literatura. Como resultado, el *output gap* (positivo) que se estima en las expansiones es más elevado y el que se estima en las recesiones es menor. De acuerdo con estos resultados, dadas las proyecciones disponibles de población y bajo el supuesto de que la evolución de la productividad total de los factores y del desempleo estructural se comportarán en línea con los patrones históricos, el crecimiento potencial de la economía española se recuperaría de forma gradual en los próximos años, pero alcanzaría, en línea con lo proyectado por otros organismos internacionales, tasas más reducidas que las del período de expansión previo. Las tasas de crecimiento potencial per cápita, no obstante, convergerían gradualmente hacia el nivel alcanzado en dicho período, lo que refleja la importancia de las proyecciones de población en la determinación del crecimiento potencial de la economía española.

Palabras clave: crecimiento potencial, brecha de producción, España.

Códigos JEL: E23, E32, E13, O47, O52.

INDEX

1 Introduction

The growth of an economy's potential output is fundamental to economic analysis. It acquires particular significance when what is sought is knowledge of the economy's cyclical position or assessment of the fiscal policy stance. Indeed, this variable is necessary for calculating the structural component of the budget deficit, in keeping with the regulations of the Stability and Growth Pact at the European level and with the Budgetary Stability and Financial Sustainability Law at the national level.

However, potential output is not observable, meaning it has to be estimated. Such an estimate is not free from controversy and involves a high degree of uncertainty. There is a wide variety of methodologies that can lead to highly differentiated results when calculating this variable. One common feature of the various methodologies available is that they tend to result in estimates of potential growth of a highly procyclical nature. In boom periods they offer results that might be overestimating potential output and, conversely, in recession periods they might reduce it excessively.

Against this background, this paper presents an estimate of the Spanish economy's potential output that involves a revision of the estimates presented in Hernández de Cos et al. (2011). For that purpose, the standard production function methodology in the literature is used, which enjoys the essential advantage of allowing for analysis of the determinants of potential growth. Potential output for the observed period (1980-2015) is estimated, being extended to the usual projection horizon in the Research Department's forecasting exercises, in which full macroeconomic aggregates (2016-2017) are available, and at a medium-term horizon.

The most substantial methodological changes in this revision are as follows: (i) the structural component of the unemployment rate, an essential ingredient in the estimation of potential output, is estimated using a micro-grounded Phillips curve ratio devised by Galí (2011) that results in a lower procyclicality of structural unemployment and, therefore, of potential output; (ii) in the medium-term projections, the forecasting of the variables relating to the labour market, investment and productivity is based on a convergence rule at the equilibrium level, in keeping with the neoclassical exogenous growth model with technological progress (see Solow, 1957).

Our results indicate that the potential growth of the Spanish economy would recover gradually in a medium-term horizon, but, in line with projections by international organisations, to lower rates than those in the expansion period. However, in per capita terms the projected growth rates are similar to those of the 2001-2008 period, reflecting the importance of population projections. Also, it is worth emphasizing the high uncertainty surrounding these projections as well as the non-inclusion of the potential effects of structural reforms implemented in recent years. For this reason, estimates of potential growth based on alternative scenarios partially incorporating the possible effects of structural reforms are also discussed.

The paper is structured as follows. The second section briefly describes the production function methodology. The third section describes the new methodology used to estimate the structural component of the unemployment rate. Section 4 details the approach adopted to construct medium-term projections of potential output. The fifth section presents the results obtained and a comparison with the estimates of some international organisations available for Spain. Finally, the sixth section draws the main conclusions.

2 The production function methodology

An economy's potential output may be estimated using different methodologies which, essentially, may be classified as those using statistical procedures to estimate the trend of the economy's output stripping out cyclical factors, and those based on the use of a production function for estimating potential output. It is this second approach that is used in this paper, given that it is grounded in sounder theoretical concepts that allow, in turn, for analysis of the sources of growth.

The analysis departs from an aggregate production function:

$$Y = F(K,L,T) \qquad [1]$$

where Y is production, K the stock of capital, L employment and T the technological level, i.e. that portion of production that is not explained by developments in employment and capital.

Output growth can thus be separated into factor accumulation and technological growth. Specifically, taking logarithms and deriving in respect of time:

$$g_Y = \left(\frac{F_K K}{Y}\right) g_K + \left(\frac{F_L L}{Y}\right) g_L + \left(\frac{F_T T}{Y}\right) g_T \qquad [2]$$

where $g_Y = \frac{\dot{Y}}{Y}$, $g_K = \frac{\dot{K}}{K}$, and $g_L = \frac{\dot{L}}{L}$ refer to the growth rates of GDP, capital and employment, respectively. Note that, in turn, the growth rate of employment is determined by the growth rates of the population of working age, the participation rate, the unemployment rate and hours worked per employee (see the Annex for more details). Moreover, F_K and F_L are the social marginal products of capital and employment.

Finally, $\left(\frac{F_T T}{Y}\right) g_T = g$ represents the portion of growth attributable to technological change or TFP growth. More specifically, we shall assume that technological progress is neutral following Harrod, i.e. that it increases output in the same way as the employment factor does, whereby $Y = F(K,L,T) = \tilde{F}(K, TL)$ and therefore $F_T T = F_L L$ (see, for example, Uzawa, 1961). We choose this option because it ensures the existence of the steady state in the neoclassical growth model we will use in Section 4 for the long-term projections (see Barro and Sala-i-Martin, 2004, pp. 53-54).[1]

It is assumed that the marginal products of the factors are given by their prices. That is to say, $F_K = r$ (interest rate) and $F_L = w$ (wages), whereby $F_L L = w_L$ refers to wages in the economy. Further, we can define s_L as the share of labour income in production, i.e. $s_L = \frac{wL}{Y} = \frac{F_L L}{Y}$.

As a result, under constant returns to scale in the aggregate production function, it can be assumed that all the economy's income can be distributed among the productive factors $Y = rK + wL$, meaning that output growth is decomposed as:

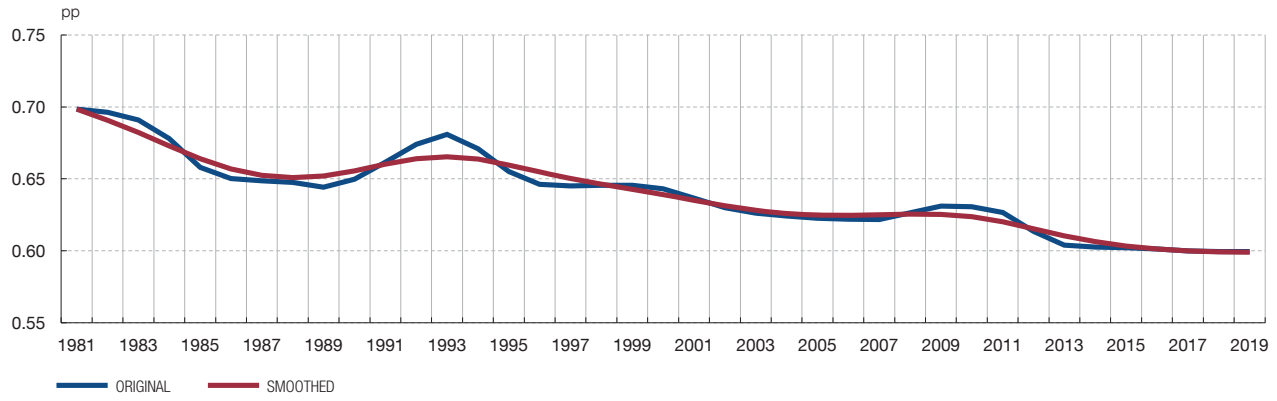
$$g_Y = g + (1 - s_L)\, g_K + s_L g_L \qquad [3]$$

1 Acemoglu (2002) considers an endogenous growth model in which the resulting technological change is neutral following Harrod.

In practice, a discrete time version of equation [3] is used in which the growth rates are replaced by differences in logarithms of the variables between the years t y t–1, and s_L refers to the arithmetic mean of the share of labour income in production between t y t–1 (Thörnqvist, 1936).

In our case, to calculate s_L we use annual National Accounts data to 2015, the projections of the Banco de España's DG Economics, Statistics and Research to 2017[2] and, from that year onwards, the share holds constant (see Chart 1).[3] The time variability of the elasticity of output with respect to labour is usually ignored by international organisations as they usually assume a constant elasticity of 0.65 (see, for instance, Havik et al., 2014, or Johansson et al., 2013).

ELASTICITY OF OUTPUT WITH RESPECT TO LABOUR (a) **CHART 1**



SOURCES: Instituto Nacional de Estadística and Banco de España.

a It refers to the arithmetic mean of the share of labour income in production between t and t-1 periods.

In this setting, the estimate of the economy's potential output, which we can denote as Y*, requires the evaluation in potential values of each of the production function components: employment, capital and technology (see the Annex for more details on each production function component). It is worth noting that, unlike the estimates presented in Hernández de Cos et al (2011), no distinction is drawn between the market and non-market economies.[4]

After the estimate of potential output, the output gap is defined as the difference, in percentage terms, between actual output and estimated potential output.

$$OG = (Y–Y^*) / Y^* \qquad [4]$$

Two stages may be distinguished in the estimation of potential output using the production function approach. In the first, its potential levels are obtained for the period observed, to which a projection horizon habitual to macroeconomic projection exercises (around two years) is added, i.e. for the 1980-2017 period in this case. In the second stage, each component is extended to a

2 See "Quarterly report on the Spanish economy". Economic Bulletin, March 2015.

3 Note that this assumption breaks the declining trend of the share of labour income in output documented by Karabarbounis and Neiman (2014), and observed in Spain since 1980 (see Chart 1).

4 Previously, the exercise was conducted solely for the market economy. To obtain the potential output of the economy as a whole, the output of the public sector and indirect taxes net of subsidies was added to the former.

lengthier time horizon as from 2017 under certain convergence assumptions. Estimates are thus available for a long-term projection horizon, which may prove relevant for identifying the challenges for economic growth at this time horizon and the possible economic policies for addressing them. Section 4 details the fundamentals behind this second stage while the annex explains how the potential levels of each component of the production function are estimated.

3 An estimate of the structural unemployment rate

One of the key aspects of the methodology for estimating potential output based on a production function is the estimate of the structural component of the unemployment rate (commonly known as the NAIRU). This is a crucial ingredient for determining the economy's potential output[5].

Friedman (1968) coined the term of natural rate of unemployment (or structural rate of unemployment) as the level of unemployment compatible with secular wage inflation, i.e. which can be maintained over the long term owing, for example, to technological progress. Indeed, the term NAIRU (Non-Accelerating-Inflation Rate of Unemployment) refers to the unemployment rate compatible with constant inflation. For the sake of simplicity, we shall refer in this paper to the natural rate of unemployment as the structural rate of unemployment or NAIRU interchangeably.

The estimate of the structural component of the unemployment rate is based on a Phillips curve, i.e. the negative relationship between nominal wage inflation (π^w_t) and unemployment (U_t) documented for the first time by Phillips (1958) for the United Kingdom and by Samuelson and Solow (1960) for the United States. Subsequently, Friedman (1968) included inflationary expectations in this relationship, considering the changes in wage inflation ($\Delta\pi^w_t$) as a dependent variable instead of inflation per se. However, none of the foregoing formulations were soundly grounded in theoretical models and were based solely on an empirical observation. Conversely, Galí (2011) includes a Phillips curve in a Neo-Keynesian model with theoretical micro-foundations that includes forward-looking agents and a wage indexation process with the CPI. This is the Phillips curve relationship we consider in this paper to estimate the structural component of the Spanish economy's unemployment rate.

The traditional methodology for estimating the Phillips curve was based on an accelerationist Phillips curve of the style proposed by Friedman (1968). However, in Spain's case this approach resulted in highly procyclical NAIRU estimates, i.e. in situations in which there was a rapid worsening of the actual unemployment rate, the estimates offered significant increases in the NAIRU.[6] Intuitively, the difference between actual unemployment and the NAIRU (NAIRU gap) tended towards zero very quickly when the changes in wage inflation were very small. Chart 2 shows the relationship between the change in wage increases and the unemployment rate in Spain for the period 1980q1-2015q4.

As can be seen, the relationship between changes in wage increases and the unemployment rate does not appear to be very robust in the Spanish case. Indeed, the correlation between both variables is not statistically different from zero.

5 See the annex for more details on the other components of potential employment.

6 Indeed, there was some concern throughout 2012 over the NAIRU estimates at the meetings of the European Commission's Working Group on Output Gaps, and analysis of this matter in the 2013 work programme was set as a priority. As a result, at present the European Commission also uses a forward-looking specification based on Galí (2011).

ACCELERATIONIST PHILLIPS CURVE

CHART 2

SOURCE: Banco de España.

Nonetheless, the relationship between wage inflation (increases in wages in nominal terms) and the unemployment rate (see Chart 3) appears to be clearly negative, especially bearing in mind two differentiated periods, 1980q1-1996q3 and 1996q4-2015q4. The first period is characterised by high wage inflation rates and the second shows more moderate inflation rates. In light of this pattern, a range of statistical tests (e.g. Zivot y Andrews, 1992) are conducted to verify whether wage inflation is a stationary series in Spain and to determine the existence of structural breaks in this series. The results of these tests indicate the presence of a structural break in 1996q3 which, once taken into account, allows the stationarity of wage inflation to be substantiated. From a purely statistical standpoint, this enables the Phillips curve relationship to be estimated directly with nominal wage inflation.

PHILLIPS CURVE

CHART 3

SOURCE: Banco de España.

As a result of the foregoing, it is opted to estimate the NAIRU on the basis of the Phillips curve micro-founded in the model by Galí (2011). This model relates wage inflation to the NAIRU gap (the difference between actual unemployment and the NAIRU). This specification entails less procyclical estimates of the structural component of the unemployment rate because it does not make it necessary to close the NAIRU gap in situations in which wage inflation varies little. Thus, the problem with the traditional methodology, which estimated excessive increases in the structural component of the unemployment rate, especially in situations of a rapidly deteriorating

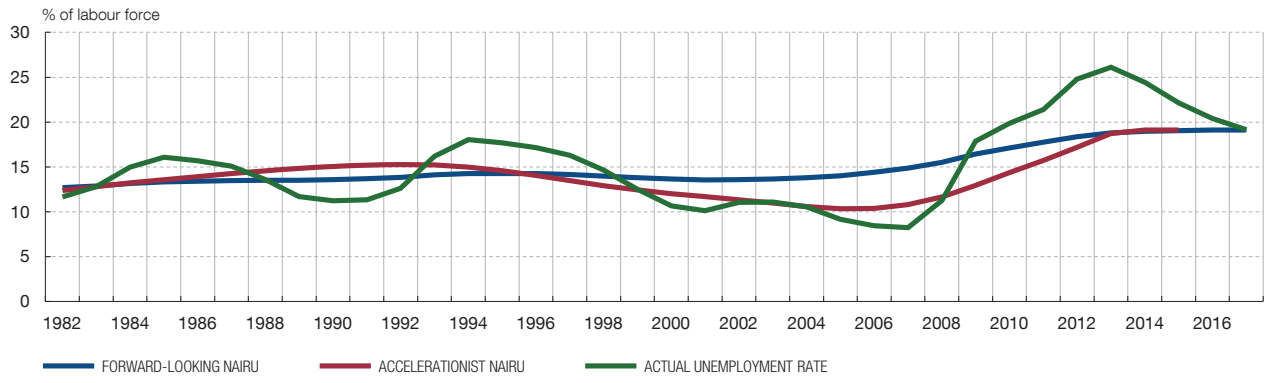
labour market, is resolved. Moreover, the use of quarterly (instead of annual) data provides for greater accuracy in the estimates and for a better identification of the Phillips curve parameters. Specifically, the relationship to be estimated is given by:[7]

$$\pi^{w}_{t} = \tau' d_{t} + \gamma \pi_{t-1} + \phi_{0} U^{c}_{t} + \phi_{1} U^{c}_{t-1} + \varepsilon_{t} \qquad [5]$$

where π^{w}_{t} is nominal wage inflation, π_{t-1} is inflation in the previous period (to which wages are indexed) and U^{c}_{t} is the cyclical component of the unemployment rate, or what is tantamount to this, the NAIRU gap (difference between the actual (U_{t}) and structural (U^{*}_{t}) unemployment rate). Finally, $\tau' d_{t}$ refers to the deterministic component that reflects the structural change identified in the wage inflation series for 1996q3. Note that the relationship postulated in [5] included in a model of non-observable components that is estimated by means of the Kalman filter to estimate the non-observed variables of the model, i.e. the cyclical (U^{c}_{t}) and structural (U^{*}_{t}) components of the unemployment rate (see for example Gordon, 1997).[8]

As a consequence of this methodological change, the estimates available for the NAIRU are revised, growing by around 4.5 pp during the crisis period (2007-2013) compared with 8 pp under the estimates arising from the traditional Phillips curve methodology. Set against this, it is found with the new specification that the NAIRU fell to a lesser extent during the expansion phase prior to the economic crisis compared with the estimated decline of around 5 pp using the previous procedure. This difference means that with this methodology the growth rate of potential output during the expansion is comparatively lower than before and higher during the recession. In any event, with both methodologies similar levels of the NAIRU – in the interval between 18% and 19% – are estimated in the most recent period (see Chart 4).

NAIRU ESTMATES: NEW AND PREVIOUS METHODOLOGY **CHART 4**



SOURCE: Instituto Nacional de Estadística and Banco de España.

7 See Galí (2011) for further details on the derivation of this Phillips curve.

8 To that end, the model is completed with an AR(2) specification for the cyclical component and a unit root model for the structural component or NAIRU.

4 Medium-term projections

To estimate medium-term potential growth, it was opted to introduce a simple convergence rule into the equilibrium level of each variable on the basis of their past values, taking the available population projections as exogenous. Against this background, medium-term projections of potential output should be understood as the return to equilibrium of the latest cycles in the absence of economic policy measures that may affect the behaviour of TFP and of the NAIRU[9]. To determine the path of the main macroeconomic aggregates, the equilibrium conditions of the neoclassical growth model are used (Solow, 1957), as it is considered that, despite its simplicity in the baseline assumptions, it satisfactorily characterises the main stylised facts of the developed economies.[10]

The main prediction of the neoclassical model is that, in equilibrium or steady state, the economy's per capita output and capital[11] will grow at a rate that is constant and equal to the (exogenous) growth of technology:

$$g_{Y/L} = g_{K/L} = g_T \qquad [6]$$

Departing from this steady state prediction, our procedure to project the Spanish economy's potential growth in the long run rests on the following elements:

Firstly, the Spanish economy's equilibrium technological growth rate is set. Specifically, it is assumed that the annual growth rate of TFP in equilibrium is 0.8%.[12] To set this figure, the 1982-2014 period is taken as a reference because it includes two full business cycles and it is assumed that it represents sustainable (equilibrium) growth for the Spanish economy (see the Annex for more details on TFP developments in Spain). We consider that this assumption is plausible given that, in the long run, annual TFP growth of 1% is usually considered for the European countries (see for example European Commission, 2012). In particular, it is to be expected that recent structural policies will increase TFP relative to its past values (see National Reforms Programme 2013-2014) and, above all, it would be desirable for additional structural reforms to promote a more efficient allocation of resources that were to result in further increases in the growth of TFP. In the next section, we present an alternative scenario in which TFP grows above 0.8%.

Secondly, the long-term (or steady state) levels of the various components of the employment factor are set. Note that the growth of potential output will be given by the sum

9 Notably, using the new procedure does not give rise to significant changes in the projected equilibrium values for the various components relative to the methodology used in Hernández de Cos et al (2011). Presumably, this is due to the fact that the latter implicitly incorporated convergence into the observed historical mean, although this was not made explicit.

10 We acknowledge, however, that it is based on the exogenous technological growth assumption that may be considered unsatisfactory in respect of identifying the sources of long-term technological growth (see for example Acemoglu, 2008).

11 Note that we refer to the variables in per capita terms, although strictly we will use output and capital per employee throughout the paper.

12 Note that TFP growth is g = 0.007, but equilibrium technological growth given our assumption of neutral technical change following Harrod is $g_T = g / s_L$

of technological growth and employment growth ($g_Y = g_L + g_T$). Specifically, the population projections disseminated by INE, whose estimates originate in the 2011 Census and assume that the past trends of migratory flows will continue, are taken as given. Further, a stationary value of 14% is set for the structural unemployment rate, coinciding with the average for the reference period selected (see Section 3 for more details on estimating the structural unemployment rate). Once again, it should be borne in mind that the recently implemented labour market structural reforms might have reduced this equilibrium level of the structural component of the unemployment rate. Moreover, a figure of 79% is assumed for the participation rate in the long term according to the cohorts model used by the European Commission (see Carone, 2005). Lastly, for total hours worked, a gradual slowdown is assumed in the declining trend observed in Spain since 1980, until arriving at a figure of 1640 hours per annum per employee (around 34 hours per week).

Thirdly, and given the need to estimate an annual potential growth path, a convergence path towards equilibrium values must be set. Accordingly, a pre-requisite in the new procedure is the setting of the year in which the long-term values will be attained. The year 2026 has been set as it is assumed that the current expansion will last as long as the previous one observed [between 1994 and 2007, according to the cycle dating by Berge y Jordá (2013)[13]]. This assumption may prove reasonable insofar as growth cycles based on potential or trend variables are more symmetrical than real ones (see Zarnowitz, 1992). However, the degree of inherent uncertainty associated with this assumption is very high.

The existence of upside and downside risks in the above-mentioned assumptions for the construction of the medium- and long-term projections should be stressed. On one hand, the INE population projections might be revised in both directions depending on the migration movements observed in the coming years in response to the economic situation. This would also have consequences for the projections of the participation rate. On the other, TFP might grow more than observed in the past three decades if the catalyst role of the crisis in respect of structural reforms becomes more anchored; nonetheless, TFP might expand at lower rates if there is a return to the dynamics of the decade prior to the crisis characterised by negative growth rates. Something similar might occur with the NAIRU if the labour reforms launched in recent years are capable of changing the traditional pattern of labour adjustments. In order to illustrate the potential effects of structural reforms, we also present three alternative scenarios in which potential growth would be above our baseline figure. These scenarios are based on alternative assumptions about population projections and different equilibrium values for the structural unemployment rate and TFP growth.

13 A linear convergence process is assumed for each component at its equilibrium value between 2017 and 2026. The only exception to this linear convergence is the NAIRU in line with Havik et al. (2014). Specifically, linear convergence in the NAIRU is applicable as from 2021, but until then the changes in the NAIRU are given by the mean of the change in the previous period and the change resulting from applying a linear convergence to its equilibrium value.

5 Results

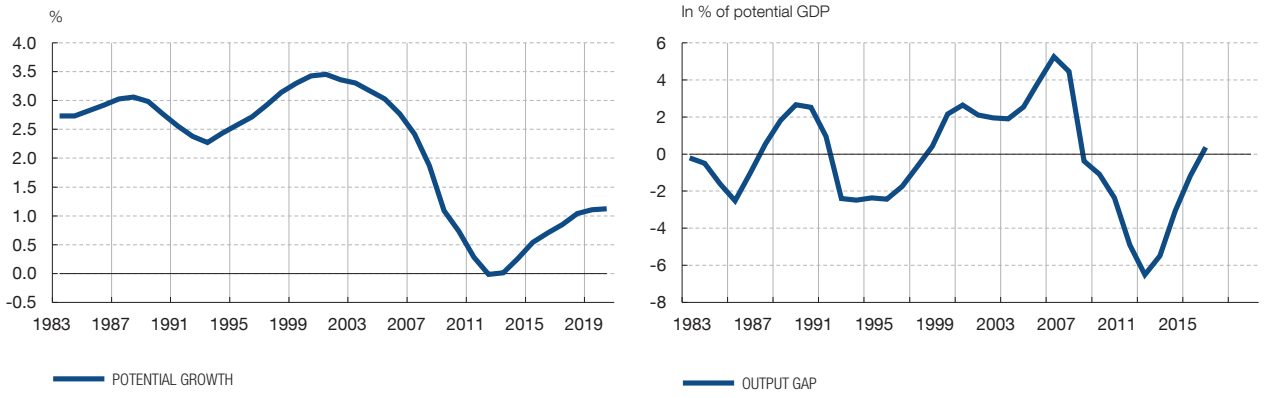
Below are the main results of the potential output estimate obtained from the application of the methodology analysed in the foregoing sections and a comparison of these results with the estimates published by other international agencies for Spain.

5.1 Potential growth in Spain to 2020

Chart 5 shows the estimates of potential growth (1983-2020) and of the output gap (1983-2017). As can be seen, a substantial effect of the crisis on potential growth is estimated: from 2008, it stood below 1% per annum compared with rates close to 3% over the previous 25 years. Furthermore, the resulting output gap, above 5% in 2007, suggests a considerable overheating of the Spanish economy in the expansion period. This estimate is in line with those of Alberola et al. (2014) and Borio et al. (2013) for the same period based on methodologies other than the production function that incorporate financial variables to identify potential growth. The output gap would stand at a historical low in recent years, signalling the depth of the double-dip recession that the Spanish economy experienced.

POTENTIAL GROWTH AND OUTPUT GAP

CHART 5



SOURCE: Instituto Nacional de Estadística and Banco de España.

Table 1 gives estimates of potential growth and the contributions of its main components are several sub-periods. The estimated growth of the Spanish economy's potential output averaged close to 3% in the 1983-2007 period, although there were changes in the relative contribution of its determining factors. In the 1980s, TFP was the main source of growth.[14] Subsequently, and until the onset of the crisis in 2007, it was due to the accumulation of productive factors, specifically to a strong increase in the population and in the participation rate, along with an intense capital accumulation process.

14 This period was characterized, among other things, by a trade liberalization process and their subsequent exposure to foreign competition, an increase in the skills of the population and a change in the production structure in favor of the industry (see Garcia-Delgado , 1993).

POTENTIAL GROWTH OF THE SPANISH ECONOMY

TABLE 1

Rates of change (%)

	1983-1990	1991-2000	2001-2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Potential growth	2.9	2.8	3.1	1.9	1.1	0.7	0.3	0.0	0.0	0.3	0.5	0.7	0.9	1.0	1.1	1.1
Contributions to potential growth																
Employment	0.0	1.0	1.6	0.8	0.2	-0.1	-0.4	-0.7	-0.7	-0.5	-0.4	-0.3	-0.1	0.0	0.1	0.1
Capital	0.9	1.1	1.6	1.3	1.0	0.8	0.5	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5
TFP	2.0	0.7	-0.1	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5	0.6	0.7	0.6	0.6	0.6	0.6
MEMORANDUM ITEMS: rates of change in the original variables																
Output gap (a)	-0.1	-0.6	2.9	4.4	-0.4	-1.1	-2.4	-4.9	-6.5	-5.5	-3.1	-1.2	0.4	—	—	—
Potential GDP per capita	2.6	2.4	1.4	0.2	0.3	0.3	-0.1	-0.1	0.4	0.6	0.7	0.8	1.0	1.2	1.3	1.3

SOURCE: Banco de España.

a Level difference in percentage points between the actual and the potential GDP.

The economic crisis is expected to have exerted a significant adverse impact on potential output. This took the form, above all, of a high increase in structural unemployment, a strong slowdown in population growth, as a result of the loss of momentum in the influx of immigrants, and the reduction in the contribution of the stock of capital arising from the impact of the crisis on investment. As a result, the Spanish economy's potential growth is estimated to have stood at around 0.6% during the crisis and in the years immediately following it (average over 2008-2017), given the lag with which some of these adverse effects arise.

For the medium term, a pick-up in the Spanish economy's potential output growth is estimated, but it is expected to stand at significantly lower rates than those of the previous expansionary cycle. However, per capita growth rates fully recover to the pre-crisis levels, which highlights the importance of population projections in shaping the Spanish potential growth. The international agencies that publish detailed projections of potential output for Spain over this medium-term horizon[15] broadly coincide with these conclusions, although there are slight differences in the composition of this potential growth (see next section).

5.2 Comparison with other international organizations

We next discuss potential growth (and output gap) estimates by other international agencies for the Spanish economy. Specifically, the estimates relating to the European Commission's (EC) Autumn 2014 forecasting exercises, the estimates of potential output published in the IMF's October 2014 World Economic Outlook and the figures from the OECD's Economic Outlook No. 96 are considered.[16]

The EC estimates are based on the production function approach described in Section 2, but considering a constant elasticity of output with respect to the labour factor. Further, the

15 Note that both the IMF and the EC have released potential growth estimates and contributions for Spain up to 2019, whereas the OECD does not publish detailed information for this period.

16 The EC data are available at http://goo.gl/Dl4xq1, those of the IMF at http://goo.gl/69K6RL and those of the OECD at http://goo.gl/CBbHyn.

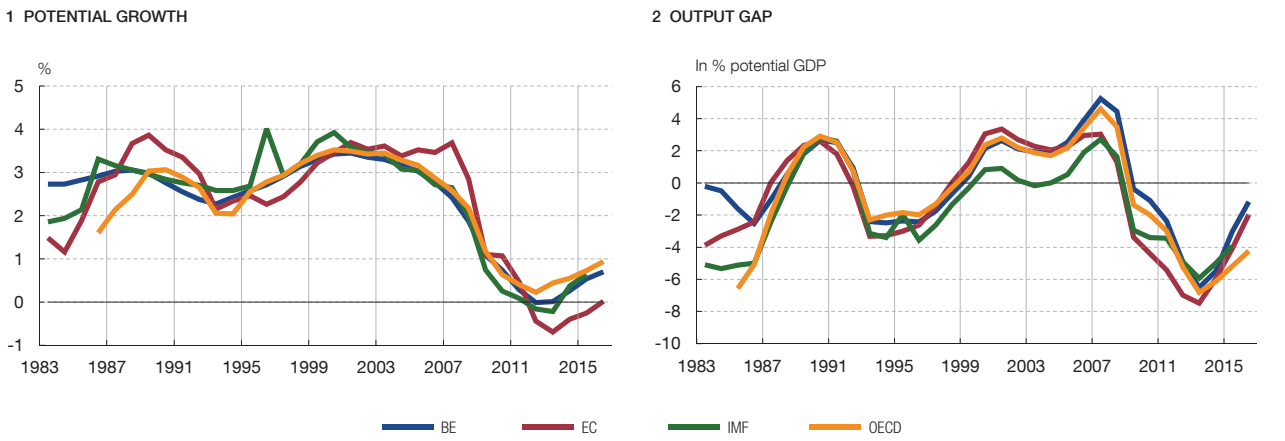
potential level of some components is obtained differently. For instance, in the Phillips curve model that the EC users to estimate the NAIRU, wage inflation measured in terms of changes in real unit labour costs is considered instead of changes in nominal wages.[17] Moreover, the potential level of TFP is estimated using a bivariate filter that includes TFP and capacity utilisation, while in this paper a univariate filter is considered. A detailed description of the methodology used by the EC is given in Havik et al. (2014).

The OECD also considers the production function approach with constant elasticity. The main difference in the production function considered by the OECD compared with that described in Section 2 is that it includes human capital as an additional productive factor. Specifically, the contribution of the labour factor incorporates the contribution of human capital measured in terms of average years of education of the population of working age. Johansson et al. (2013) and the references therein describe in detail the methodology used by the OECD.

Finally, the IMF does not base itself on any "official" methodology to estimate potential growth. The approach adopted by the IMF is based on combining the judgement of specialised analysts in each country with the estimates resulting from different methodologies (production function, multivariate statistical filters, models, etc.). However, for the European countries the estimates are usually based on a production function approach, as discussed in Medas et al. (2014) for the Spanish case.

Chart 6 shows the potential growth and output gap estimated for Spain by the EC, the IMF and the OECD. Generally, the estimates in this paper (BE) are similar to those published by the other agencies over the course of the entire period, both in terms of potential growth and of output gap. Nonetheless, it should be stressed, first, that the potential growth estimated by us

POTENTIAL GROWTH AND OUTPUT GAP PROJECTIONS OF DIFFERENT INTERNATIONAL ORGANIZATIONS CHART 6



SOURCES: European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, Instituto Nacional de Estadística and Banco de España.

17 Technically speaking, the dependent variable in the Phillips curve must be stationary. The change in real unit labour costs is stationary while the nominal wage inflation considered in this paper is stationary only after taking into account the structural change in the series (see Section 4).

evidences lower variability over the course of the cycle, which is reflected in slight differences in the resulting output gaps. For example, the lower potential growth estimated in this paper for the years 2000-2007 results in a bigger output gap in 2007. Moreover, during the years 2015-2016, in which the potential growth estimates are based not only on different methodologies but also on different macroeconomic forecasts at each agency, the BE's potential growth estimate stands at the average point of the estimates of the three agencies considered. Accordingly, the average of the potential growth estimates of the EC, IMF and OECD for 2016 stands at 0.5%, which matches the estimate in this paper for that year.

Table 2 presents the estimates available for the years 2017-2019. Specifically, the estimates in this paper (BE) are presented alongside those of the European Commission (EC), documented in Havik et al. (2014), and those of the International Monetary Fund (IMF), published in Medas et al. (2014). According to these estimates, the path of recovery of potential growth initiated in 2013-2014 is expected to continue in the coming years but to attain potential growth rates for the Spanish economy lower than those in the previous expansionary period.

POTENTIAL GROWTH OF THE SPANISH ECONOMY PROJECTIONS **TABLE 2**

Rates of change (%)

	2017			2018			2019		
	BE	CE	FMI	BE	CE	FMI	BE	CE	FMI
Potential growth	0.9	0.4	0.9	1.0	0.7	1.1	1.1	0.9	1.2
Contributions to potential growth									
Employment	-0.1	-0.4	0.1	0.0	-0.2	0.3	0.1	-0.1	0.3
Capital	0.4	0.3	0.3	0.4	0.4	0.3	0.5	0.4	0.3
TFP	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.6
Memorandum items									
NAIRU-CPH (a)	19.1	21.2	19.2	18.8	21.2	18.5	18.5	21.2	17.8

SOURCES: European Commission, International Monetary Fund and Banco de España.

a In levels.

With regard to the composition of this growth, the three agencies coincide in projecting capital contributions below the contributions observed in previous decades, owing perhaps to the collapse in investment during the crisis and the deleveraging process in which the Spanish economy is immersed. As for employment, the IMF alone estimates a positive contribution to potential growth, owing to significant reductions in the NAIRU that offset the negative population projections. In our case, the projected reduction in the NAIRU is not sufficient to offset the declines in population projected by INE, meaning that employment is not expected to contribute positively to potential growth. The EC, for its part, estimates negative contributions by employment to potential growth because it does not foresee reductions in the NAIRU before 2019. Finally, the three agencies coincide in placing TFP as the main source of potential growth in the medium/long term. Specifically, according to the projections shown in Table 2, between one-half and two-thirds of the Spanish economy's potential growth in 2019 will have its source in improvements in this variable.

5.3 Alternative scenarios

Medium-term estimates of potential growth are subject to a high degree of uncertainty and depend crucially on the assumptions adopted. In particular, three of these assumptions are especially important in the determination of the results. Firstly, the demographic assumptions. Indeed, it should be borne in mind that the estimate of long-term potential growth in per capita terms is in line with those for the period 2001-2007, which is indicative of the fact that it is essentially the negative trend in population that lies behind the low potential growth projected. The medium- and long-term demographic projections are, however, subject to high uncertainty, in particular in relation to the projection of migratory flows. A more/less favourable trend in these flows would increase/reduce the potential growth estimates presented here. Secondly, the assumptions adopted in relation to the path of the structural unemployment rate or the NAIRU are also most significant. As was indicated in Section 4, given the difficulty of projecting this variable, a convergence over the estimation horizon towards the historical average is assumed. This is also the case for TFP, the long-term trend of which has been anchored in the estimated historical average. A greater reduction in the structural rate of unemployment or a higher increase in TFP, associated for example with the reforms already undertaken or pending, would improve the economy's potential growth outlook.

In order to illustrate the potential effects of structural reforms, we present below three alternative scenarios for the medium-term projections. The first scenario considers more optimistic projections of population based on an increase in entries from abroad that would be compatible with a better economic situation. To be more concrete, we consider the population scenario discussed in Matea (2015). The second scenario imposes a lower equilibrium level for the NAIRU under the assumption that the labor market reforms undertaken in recent years would reduce the structural component of unemployment. In particular, we consider the minimum level of the NAIRU in our sample, i.e. 12%. Finally, in scenario 3 we consider the potential effects of structural reforms facilitating the reallocation of resources across sectors and firms as well as investment in high-tech goods that would generate higher TFP growth. Specifically, we impose an annual TFP growth of 1.5%, which coincides with the annual TFP growth observed over the 1983-1994 business cycle.

POTENTIAL GROWTH OF THE SPANISH ECONOMY PROJECTIONS IN ALTERNATIVE SCENARIOS **TABLE 3**

Rates of change (%)

	Scenario 1					Scenario 2					Scenario 3				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Potential growth	0.8	0.9	1.2	1.3	1.4	0.7	0.9	1.2	1.3	1.3	0.7	0.9	1.2	1.4	1.5
Contributions to potential growth															
Employment	-0.2	-0.1	0.2	0.2	0.3	-0.3	-0.1	0.2	0.2	0.2	-0.3	-0.1	0.0	0.1	0.1
Capital	0.3	0.4	0.4	0.5	0.5	0.3	0.4	0.4	0.5	0.5	0.7	0.7	0.7	0.8	0.8
TFP	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8
Memorandum items															
Potential GDP per capita	0.7	0.8	1.1	1.2	1.3	0.8	1.0	1.3	1.4	1.5	0.9	1.1	1.4	1.5	1.7

SOURCE: Banco de España.

Table 3 presents the resulting potential growth (and its composition) under the three scenarios described above for the period 2016-2020. In all the three scenarios potential growth is between 2 and 4 pp. higher than the baseline scenario in 2020. Scenario 3, based on higher annual TFP growth, results in the highest potential growth. This is so due to the assumptions of the neoclassical growth model, in which TFP growth plays a role through capital and TFP. On the other hand, this difference is even more pronounced in per capita terms, confirming the importance of TFP as a determinant of per capita income in the long run. Finally, while the alternative scenarios of population and NAIRU lead to similar potential growth rates, per capita growth is higher in the case of a further reduction of the structural component of unemployment. However, these scenarios should be interpreted with caution because of the complexity that entails the estimation of the potential effects of structural reforms on productivity growth and the NAIRU.

6 Conclusions

This paper addresses the estimate of the Spanish economy's potential output. The methodology is based on the standard production function in the literature. However, two main changes are introduced into the estimate with respect to previously available estimates. First, an estimate of the NAIRU based on the Phillips curve micro-grounded in the neo-Keynesian model developed in Galí (2011). Further, in order to provide estimates over a medium-term horizon, it was chosen to introduce convergence rules based on the implications of the steady state of the neoclassical growth model. The main advantage of introducing these methodological revisions is that less procyclical potential output estimates are generated than with other alternatives. As a result, the estimated output gap is greater in expansions and smaller in recessions.

According to the methodology proposed in this article, the Spanish economy's potential growth stood at close to 3% per annum during the period 1980-2007. Over the course of the European Union accession process, the growth of TFP accounted for most of this growth. Subsequently, the accumulation of employment and capital offset the reduction in TFP growth rates. During the crisis period, the increase in structural unemployment, the slowdown in population growth and the decline in investment in physical capital gave rise to a significant fall in potential growth. Looking ahead, a gradual recovery is projected in the Spanish economy's potential growth which, however, would be at lower rates than in the pre-expansion period. Such rates are in line with the estimates by international agencies such as the European Commission, the International Monetary Fund and the OECD. Demographics play a crucial role in these developments. Indeed, the projections of long-term potential growth in per capita terms are in line with those of the expansionary period.

In any event, it should be underscored that these estimates are based on a simple growth accounting exercise and, therefore, they depend crucially on the assumptions made, in particular about the future course of the population, the structural unemployment rate and TFP. Accordingly, identifying the sources of this growth beyond the accumulation of productive factors is beyond the scope of this paper. Along these same lines, nor is the potential impact on the economy's potential growth of the structural reforms pursued in recent years and those that may be launched in the future. In any case, for illustrative purposes, we also discussed three alternative scenarios incorporating some of the effects of the structural reforms and resulting in higher potential growth rates than those of the baseline scenario. These scenarios illustrate the importance of these reforms for enhancing the economic growth outlook.

ANNEX. Detailed analysis of the components of potential output

A more detailed description is given below of the procedure for estimating the potential components of employment (except the NAIRU, which was already described in Section 3), the stock of capital and TFP.

Potential employment

To calculate the economy's potential employment, the starting point is the following expression:

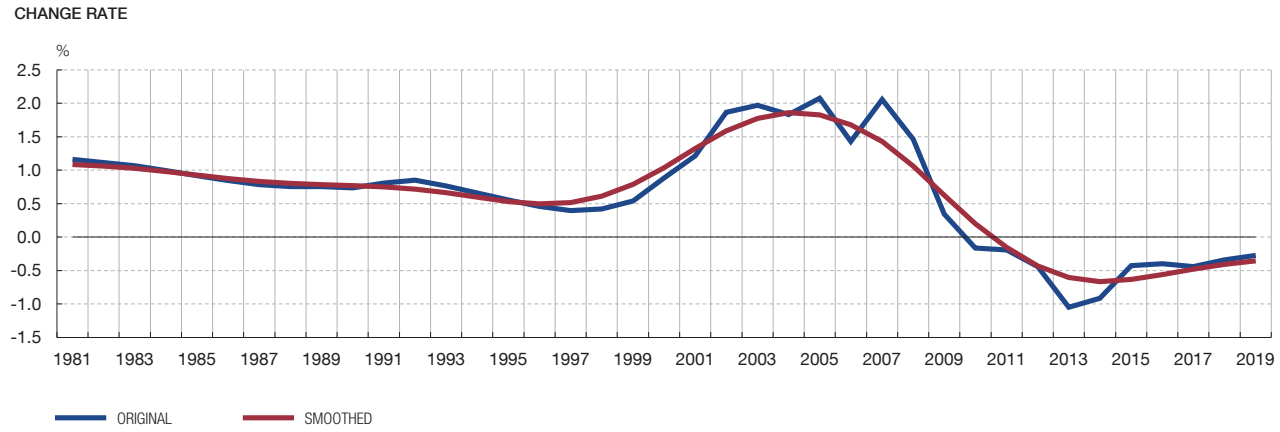
$$L = PA \cdot (1–U) = POB \cdot TA \cdot (1–U) \quad [7]$$

where the level of employment (L) is defined as the labour force (PA) multiplied by the inverse of the unemployment rate (U) and where, additionally, use is made of the decomposition of the labour force as the product of the population aged 15-64 (POB) and the participation rate (TA). Further, employment is measured as total hours worked, meaning that in the previous expression, L, it should be multiplied by hours worked per employee. Starting with this breakdown of employment, the economy's potential employment is calculated by estimating the potential values of each of the above-mentioned components: population, participation rate, unemployment rate and hours worked.

In the case of **population,** the population of working age, i.e. that aged 15-64, provided by INE in its annual National Accounts estimates is used.[18] In principle, population is a variable that is affected in a limited way by the business cycle, at least in the short term, since current fecundity decisions would only affect the growth of the working-age population 16 years later and mortality rates depend chiefly on other structural variables. However, in recent years migratory flows have accounted for an essential portion of population changes in Spain and these flows do appear to respond to the cyclical situation (Izquierdo et al., 2014). In particular, 2013 was the first year of the time series in which the total Spanish population fell in year-on-year terms (it did so in 2010 in the case of the 15-64 cohort), which is in contrast to the demographic expansion recorded in the pre-crisis period, with annual average increases in the total population of around 2% as a result of the intense migratory inflows. The strong slowdown in net migration commencing in 2008, which was initially due to the abrupt decline in immigrant inflows and, more recently, to the rise in emigrant outflows, lies behind this phenomenon. Hence, to prevent the cyclical component of population from affecting estimates of potential output, the HP filter is used on the original population series to obtain a smoothed series (see Chart A.1). For the long-term projection period and according to INE estimates, the stabilised declines in population – at around -1% – are expected to extend to the end of the period.

18 It is worth mentioning that this population series is fully consistent with that estimated by the EPA (Spanish Labour Force Survey), meaning there are no consistency problems with the unemployment series which, as we shall see later, are drawn from this survey.

WORKING AGE POPULATION (a) **CHART A.1**

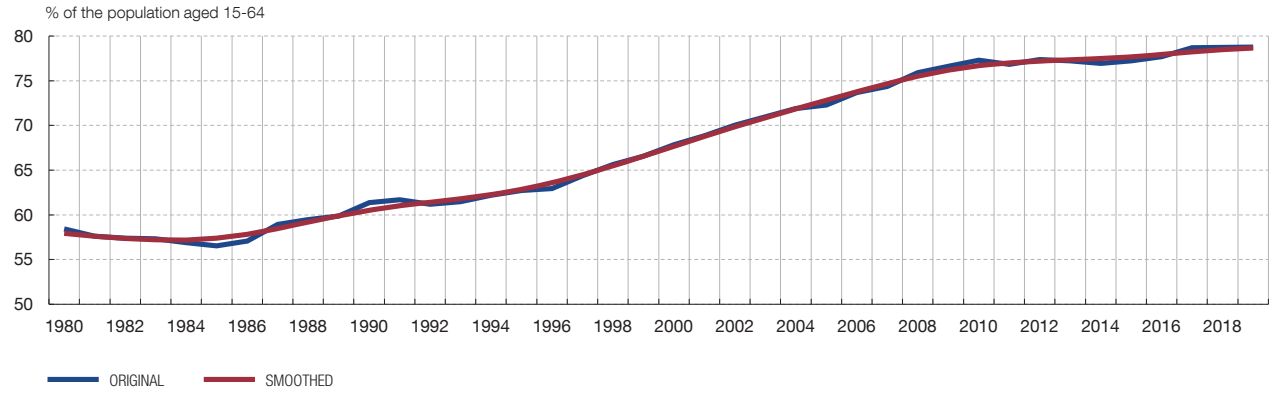


SOURCES: Instituto Nacional de Estadística and Banco de España.

a Population aged 15-64.

As regards the **participation rate,** for the calculation of potential output this is defined as the sum of those employed (per National Accounts) plus the unemployed (estimated by the EPA) as a proportion of the population aged 15-64. This definition therefore replaces EPA employment with National Accounts employment in order to ensure consistency with the National Accounts GDP estimates. As to estimating the potential course of this variable, the behaviour of the participation rate may also be somewhat cyclical (abandonment of the labour market at times of high unemployment due to discouragement or the need for inactive individuals to join the market in the face of a situation in which there is high unemployment among the household unit main breadwinners). To avoid these cyclical effects, it has been opted to subject the series obtained to a HP filter (see Chart A.2).

PARTICIPATION RATE **CHART A.2**



SOURCE: Instituto Nacional de Estadística and Banco de España.

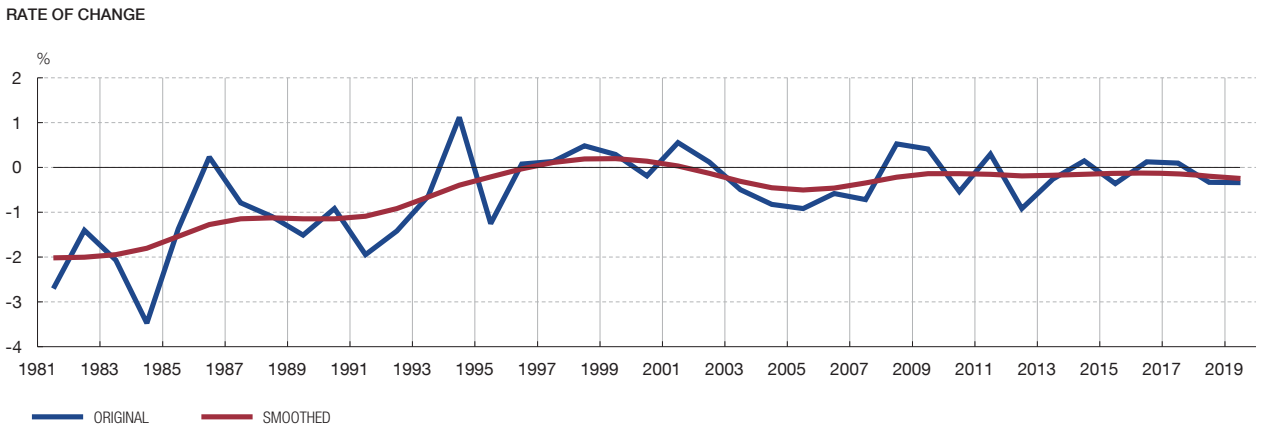
Lastly, to express potential employment in terms of total hours worked, the information available in National Accounts estimates on hours **worked per employee**[19] is used. Once

19 Total hours divided by number of persons employed.

again, in this case we cannot rule out some cyclical component in the behaviour of this variable, associated, for example, with greater or lesser intensity in the use of overtime or the resort to part-time labour, meaning that a smoothing of the series is required to avoid cyclical oscillations. For such smoothing the HP filter is also used. As can be seen in Chart A.3, hours per employee have been moving on a negative trend, interrupted at the start of the crisis when the variable experienced slight upward tensions. As to their projection, with economic recovery there is a return to the process of reduction in the number of hours per employee, but at a far lesser pace than that which characterised the 1980s. In this respect, it should be recalled that the structure of the Spanish labour market, and in particular the high proportion of temporary employment, leads employment adjustments to come about chiefly in terms of the number of jobs and not in hours per employee. For this same reason, during the recovery, and in particular in the medium term, growth in the use of the labour factor is expected to be concentrated in an extensive increase in employment, without there being any foreseeable strong changes in hours worked per employee.

HOURS PER PERSON EMPLOYED

CHART A.3



SOURCE: Instituto Nacional de Estadística and Banco de España.

Stock of capital

Unlike the case with employment, the stock of capital is not a variable that can be directly estimated from National Accounts; accordingly, other sources must be resorted to. Specifically, to calculate this variable, resort is normally had to gross fixed capital formation, whereby the stock of capital can be obtained resorting to the following accumulation formula (Hulten y Wyckoff, 1981):

$$K_t = (1 - \delta_{t-1})\, K_{t-1} + I_t \qquad [8]$$

where K is the stock of capital, δ is the rate of depreciation and I is gross fixed capital formation[20]. In each period of time the stock of capital is obtained as the sum of the stock of capital of the initial period discounting the portion that has depreciated plus new acquisitions of investment goods.

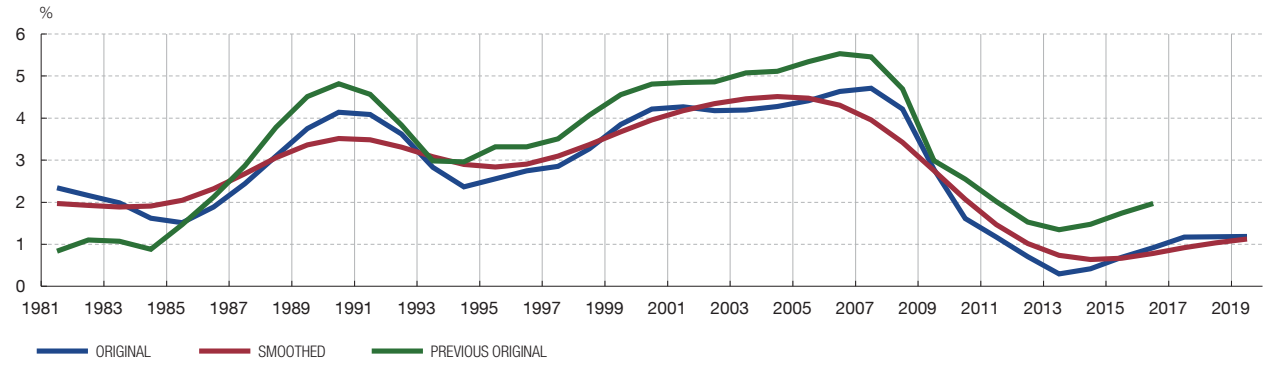
20 Note that the stock of capital is estimated by sector of activity and type of asset with different rates of depreciation, subsequently aggregating all the components (see Más et al., 2014 for more details).

The statistical source used is the Instituto Valenciano de Investigaciones Económicas (IVIE), which provides a stock-of-capital series that runs to 2012. This latter figure is extended for subsequent years on the basis of the observed course of investment, following National Accounts figures.[21]

To obtain the economy's potential output, the economy's potential stock of capital must also be obtained. Most studies that apply the production function methodology identify the potential stock of capital with its observed counterpart, given that the correlation of the latter to the business cycle is scant[22]. However, in our case, on adjusting the different stocks of capital for productivity, the assets that most depreciate gain in weight, meaning that the stock of capital used shows a significant positive correlation with the business cycle. Accordingly, it is not possible to identify the economy's potential stock of capital with its observed counterpart, since that would in that case induce a procyclical bias to potential growth. To avoid this problem, the economy's potential stock of capital is approximated by smoothing the observed stock of capital with an HP filter that strips out the fluctuations of this variable in the frequency of the business cycle (see Chart A.4).

CAPITAL STOCK

CHART A.4



SOURCE: EU-KLEMS, Instituto Valenciano de Investigaciones Económicas, Instituto Nacional de Estadística and Banco de España.

Total Factor Productivity (TFP)

TFP is defined as that portion of output that cannot be justified by the existing endowment of productive factors and by the combinations thereof determined by current technology[23].

21 For greater details, see Hernández de Cos et al (2011). In that paper, potential capital was estimated using, however, the EUKLEMS source, which only had data to 2008. As a direct result, the contributions of capital to potential growth are slightly lower than those previously estimated (around 0.5 pp on average in the backward-looking series to 2008 and 0.2pp in the latest years). Indirectly, TFP estimates have been affected, owing to their residual nature. Hence, the lower contributions of capital to potential growth have been partly offset by higher estimated contribiutions in the case of TFP.

22 The explanation for this scant correlation lies in the magnitude of the depreciation rate: if it is very low (the useful life of the investment good is very protracted), the weight the investment in the stock accounts for is very small and, therefore, the stock is scarcely affected by the cyclical fluctuations of the flow.

23 Accordingly, TFP is a measure of the extent of economists' lack of knowledge about the productive process. However, its non-observable and residual nature has not prevented theoretical and empirical analysis from having sought to identify its determinants. In particular, this variable has been related to technological innovation and, therefore, to indicators such as investment in R+D+i, patent approvals, etc. It may also reflect the institutional environment in which firms operate, meaning that indicators of the degree of competition of product markets or of the degree of labour market rigidity are also crucial. The quality of the human capital firms use is another of the determinants that may lie behind the behaviour of this residual. Lastly, the quality of physical capital is a determinant that has also been analysed in the literature and, specifically, as part of the role infrastructure plays in facilitating the productive task that private firms perform.

Consequently, the most usual means of obtaining a TFP series in the observational period is as a residual of output (Y), employment (L) and the stock of capital (K).

Specifically, the growth of TFP can be obtained from the following expression in which all the variables are observable:

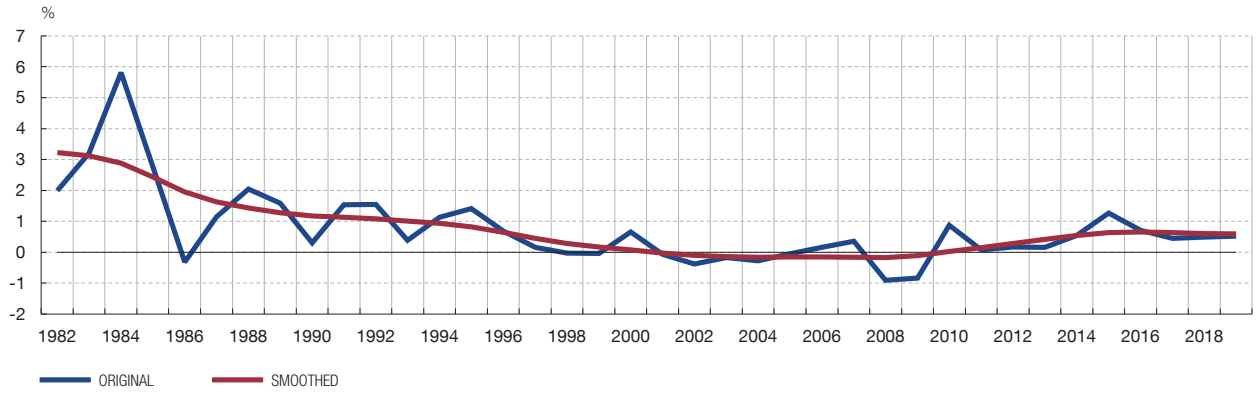
$$g = g_Y - (1 - s_L)\, g_K - s_L\, g_L \qquad [9]$$

where g srefers to TFP growth and the remaining elements are defined in the main text.

TFP thus estimated poses two basic problems regarding its use in estimating potential output. Firstly, given its residual nature, it may have excessive oscillations in the higher frequencies, since it encompasses all the output and primary productive factor measurement errors. Secondly, it may also show some correlation with the business cycle. Specifically, there is empirical evidence for many countries showing that TFP evidences positive correlation with the cycle. This may be due to various factors, although the most recurrent justifications are that the stock of capital is not always used with the same intensity[24] and nor does the labour factor always perform its tasks with the same effort. Indeed, there is evidence that a labour hoarding effect arises in recessions, whereby firms prefer not to fire employees even though activity has diminished, since both firing and hiring workers has a cost (Burnside et al., 1993).

In Spain's case the empirical evidence does not show there to be a positive correlation between TFP (estimated residually) and the cycle owing, above all, to the particularities of the labour market, which have most of the adjustment fall on temporary employment. However, it does show high variability in the short term, as can be seen in Chart A.5. Moreover, the stock of capital series is not adjusted for the use that is made of it, although the behaviour of this latter variable is strongly cyclical. Hence, in order to strip out – at least in part – this effect, it is opted to apply the HP filter to TFP to obtain its potential value.

TOTAL FACTOR PRODUCTIVITY BEHAVIOR **CHART A.5**



SOURCES: Instituto Nacional de Estadística and Banco de España.

24 As indicated in the previous section, there is a variable that measures the degree of capacity utilisation in industry which shows a very high positive association with the business cycle.

References

ACEMOGLU, D. (2002). "Labor —and capital— augmenting technical change", mimeo, MIT.

— (2008). *Introduction to Modern Economic Growth,* Princeton University Press, Princeton, New Jersey.

ALBEROLA, E., Á. ESTRADA and D. SANTABÁRBARA (2014). "Growth and imbalances in Spain: a reassessment of the output gap", *SERIEs,* 5, pp. 333-356.

BARRO, R., and X. SALA-I-MARTIN (2004). *Economic growth,* MIT Press, Cambridge, Massachusetts.

BERGE, T., and O. JORDÁ (2013). "A chronology of turning points in economic activity: Spain, 1850-2011", *SERIEs,* 4, pp. 1-34.

BORIO, C., P. DISYATAT and M. JUSELIUS (2013). *Rethinking potential output: Embedding information about the financial cycle,* BIS Working Papers, 404.

BURNSIDE, C., M. EICHENBAUM and S. REBELO (1993). "Labor Hoarding and the Business Cycle", *Journal of Political Economy,* 101, pp. 245-273.

CARONE, G. (2005). *Long-term labor force projections for the EU25 Member States: a set of data for assessing the impact of ageing,* DG ECFIN, European Economy, Economic Papers, 235.

CASELLI, F. (2005). "Accounting for cross-Country income differences", in P. Aghion y S. Durlauf (eds.), *Handbook of Economic Growth,* 1, Elsevier, Amsterdam, North Holland.

EUROPEAN COMISSION (2012). "The 2012 ageing report, Economic and budgetary projections for the 27 EU Member States (2010-2060)", *European Economy,* 2.

FRIEDMAN, M. (1968). "The Role of Monetary Policy", *The American Economic Review,* 58, pp. 1-21.

GALÍ, J. (2011). "The Return of the Wage Phillips Curve", *Journal of the European Economic Association,* 9, pp. 436-461.

GARCÍA DELGADO, J. (1993). *Lecciones de Economía Española,* Editorial Civitas.

GORDON, R. (1997). "The Time-Varying NAIRU and its Implications for Economic Policy", *Journal of Economic Perspectives,* 11, pp. 11-32.

HAVIK, K., K. MC MORROW, F. ORLANDI, C. PLANAS, R. RACIBORSKI, W. ROGER, A. ROSSI, A. THUM-THYSEN and V. VANDERMEULEN (2014). *The production function methodology for calculating potential growth rates and output gaps,* Economic Papers, 535, European Comission.

HERNÁNDEZ DE COS, P., M. IZQUIERDO and A. URTASUN (2011). *An estimate of the potential growth of the Spanish economy,* Documentos Ocasionales, n.º 1104, Banco de España.

HULTEN, C., and F. WYKOFF (1981). "The measurement of economic depreciation", in Ch. Hulten (ed.), *Depreciation, Inflation, and the Taxation of Income from Capital,* The Urban Institute, Washington, DC, pp. 81-125.

IZQUIERDO, M., J. F. JIMENO and A. LACUESTA (2014). "La emigración de españoles durante la Gran Recesión (2008-2013)", *Cuadernos Económicos del ICE,* 87, pp. 223-239.

JOHANSSON, A., Y. GUILLEMETTE, F. MURTIN, D. TURNER, G. NICOLETTI, C. MAISONNEUVE, P. BAGNOLI, G. BOUSQUET and F. SPINELLI (2013). *Long-Term Growth Scenarios,* OECD Economics Department Working Papers, 1000, OECD Publishing.

KARABARBOUNIS, L., and B. NEIMAN (2014). "The global decline of the labor share", *The Quarterly Journal of Economics,* pp. 61-103.

MÁS, M., F. PÉREZ-GARCÍA and E. URIEL (2014). "El stock y los servicios del capital en España y su distribución territorial y sectorial en el período 1964-2012", Documento de trabajo, Fundación BBVA.

MATEA, M. LL. (2015). *La demanda potencial de vivienda principal,* Documentos Ocasionales, n.º 1504, Banco de España.

MEDAS, P., P. LÓPEZ-MURPHY, C. DELONG, M. SAIYID, V. LLEDO and K. HONJO (2014). "What is Spain's sustainable growth rate?", in *Spain Selected Issues,* IMF Country Report, 14/193.

PHILLIPS, A. (1958). "The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957", *Economica,* 25, pp. 283-299.

SAMUELSON, P., and R. SOLOW (1960). "Analytical Aspects of Anti-Inflation Policy", *The American Economic Review,* 50, pp. 177-194.

SOLOW, R. (1957). "Technical change and the aggregate production function", *The Review of Economics and Statistics,* 39, pp. 312-320.

THÖRNQVIST, L. (1936). "The Bank of Finland's Consumption Price Index", *Bank of Finland Monthly Bulletin,* 10, pp. 1-18.

UZAWA, H. (1961). "Neutral inventions and the stability of growth equilibrium", *Review of Economic Studies,* 28, pp. 117-124.

ZARNOWITZ (1992). *Business Cycles: Theory, History, Indicators, and Forecasting,* University of Chicago Press, NBER Books, National Bureau of Economic Research.

ZIVOT, E., and D. ANDREWS (1992). "Further evidence on the Great Crash, the oil price shock, and the unit-root hypothesis", *Journal of Business and Economic Statistics,* 10, pp. 251-270.

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