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Demographics and the Portuguese economic growth

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Portugal has suffered an impressive decline in fertility (from 3.2 children per woman in 1960, to 1.2 in 2014), along with an increase in longevity (an almost 15 years increase in life expectancy between 1960 and 2013). This has produced an aged population, with a large old age dependency ratio: Eurostat estimates that there were 30.3 people aged 65+ per 100 people aged 15-64 in 2014. Despite the decreasing numbers of young dependents, a rising overall dependency ratio has existed since the beginning of this century.

Simultaneously, both gross domestic product (GDP) and GDP per capita growth rates have been low, or even negative during the 2000's. Naturally, there are many reasons for this, but what is the influence of demography on economic growth? Should we expect the ageing of population to be playing a positive or a negative role? Can we blame it for at least a small proportion of our economic woes?

During the 19th and 20th Centuries, there were opposing views about the impact of demography on economic growth.

The existence of diminishing returns to labour would imply that an ever-increasing number of workers would not be accompanied by a growth rate of output at the same pace, therefore leading to decreasing output per capita. Two authors that fit in with this line of thought are Malthus and Ehrlich. Another argument that defends that population growth is adverse to economic growth can be found in the growth model of Solow, where a high population growth tends to decrease capital per worker (capital dilution), thus reducing economic growth.

On the other hand, Keynes and Alvin Hansen defended that population growth is an important source of economic progress, creating growing demand and investment incentives. A shrinking population produces smaller incentives for investment and the economy would therefore stagnate – which is known as secular stagnation. This type of argument, which links population size and growth to economies of scale, innovation and technological progress was common amongst other authors (Simon 1977 [as cited in Boulier 1979] and Kremer 1993, for example).

Empirical studies (Kuznets 1967, Kelley 1988) had trouble finding robust evidence to support any of these positions and subsequent research settled on a population neutralism (Bloom and Canning 2006) that considered that population growth cannot explain the differences in growth rates of different countries. However, when not only total population growth was considered, but also its age structure, the importance of demographics started to show (Lindh and Malmberg 1999, Prskawetz et al. 2007). It is not so much the size of the population that matters, but its age structure.

There are three main ways that population ageing influences economic growth: labour supply, savings and investment, and productivity.

Effects of ageing on economic growth

Effects of ageing on economic growth mediated by the labour supply

The effect of ageing on economic growth driven by labour supply corresponds to an accounting effect that results from the more rapid growth in the quantity of workers, rather than that of the total population of consumers. The initial stages of population ageing, whereby the decrease in the proportion of children reduces the overall dependency ratio, and the proportion of the working age population increases, creates a demographic dividend (Bloom et al. 2003) with a positive impact on economic growth, as long as the large and increasing labour supply is absorbed by the market. Not only are there more people in working age, but by having less children, women are also more available to join the workforce.

The reduction in mortality, together with the decrease in fertility enlarges the cohorts at higher ages and reduces the cohorts at younger ages. This eventually generates a decrease in the proportion of working-age people and a growing proportion of people exiting the labour force into retirement. The effect on the total dependency ratio is not immediately obvious, as children are also counted as dependents, and their number is decreasing. If the proportion of workers increases, keeping the productivity per worker constant, then output per capita increases, otherwise it decreases.

There are several ways of compensating for the reduction in the proportion of working-age individuals. What matters for output growth is not really their age, but the fact that they are working. The solution, then, is to increase the number of workers, employing

people who were not working before. If retiring individuals were only replaced by young people entering their working-age years in a population in an advanced stage of ageing, then the number of workers would necessarily fall. However in an economy with unemployment, the larger outflows from employment into retirement may be compensated by larger inflows from unemployment. This way, population ageing will not decrease production, even for similar productivity rates. This becomes more viable the closer the substitutability between younger and older workers is, and studies show that this substitutability is somewhat limited (Eichhorst et al. 2014, Salem et al. 2010). Another way to counteract the decrease in the number of workers by demographic reasons is to bring to the labour market groups of the population that have traditionally low participation rates that discourage early retirement and create better work-life balance conditions.

Effects of ageing on economic growth mediated by savings and investment

Ageing is recognised to be a determinant of savings behavior, and if there is a positive relation between savings and investment which should be a channel that influences the effect of ageing on economic growth.

Authors such as Coale and Hoover (1958) argued that higher population growth and an increase in the number of children decrease the ability to save and therefore the growth of output. Conversely, in an ageing society, we should expect families to have a higher ability to save. Therefore, this view is optimistic about the effect of population ageing on growth, as long as savings are invested productively. However, this "dependency effect" (Prskawetz et al. 2007) should include the increase in the proportion of the dependent elderly, and in this case, the positive effect of ageing is smaller.

There is also another, more pessimistic, view: which is based on the life-cycle theory (Ando and Modigliani 1963), or on the permanent income hypothesis (Friedman 1957). This view used to argue that the saving behaviour of individuals changes throughout life: in periods when earnings are higher, people save to fund consumption in periods of lower earnings, and therefore younger and older people save less than the middle-aged. When the effect of more people entering retirement dominates the effect of the decrease in the proportion of the younger generations, then, according to these models, savings should suffer. Some critics argue that saving rates do not decrease significantly after retirement,

as there is a bequest motive, whereby people want to leave their savings to their heirs. But even accepting that individual age saving profiles do not change much, lower growth rates resulting from a decrease in the size of the labour force should have a negative feedback on savings, merely based on the positive relation between income and savings (Lindh 1999).

The IMF (2005) estimates that an increase in 1% of the elderly dependency ratio generates a decrease of 1.5% of GDP in savings in industrial countries. Meredith (1995) finds that changes in the elderly dependency ratio typically have greater effects on savings than changes in the youth dependency ratio.

There is, however, a second dividend that may manifest itself if the first dividend is used to improve the conditions for ageing to incentivise the formation of capital. If consumers and policymakers are forward-looking, then they react to longer retirement periods with an increase in savings (Kinugasa and Mason 2007). This is possible because reduced fertility allows for a larger accumulation of wealth during working years (Kelley and Schmidt 1996, Schultz 2005), and also the decrease in the working age population increases the marginal product of labour and corresponding wages (Kinugasa and Mason 2007). Therefore, a second dividend arises from the investment of these additional assets. If investment is made in the domestic economy, then the result will be more physical capital per worker, and a more rapid growth in output per worker and in wages. If investment is made abroad, then the result will be an increase in the current account and in national income, with a higher growth in per capita income (Mason 2005). Of course, if instead of expecting longer retirements periods, people expect longer working lives, then the incentive to increase savings in each working year is lower, but the result is more working years with the corresponding higher saving rates

Assuming that savings increase, this may not automatically be translated into investment and growth. A declining youth dependency ratio is associated with declining investment demand (Higgins 1998) and the decrease in the number of workers exerts pressure that creates a lower marginal product of capital and less lucrative investments (Baker et al. 2005). This has an adverse effect on innovation and growth. In a world of high savings and low investment, interest rates would be low, but growth would not result from this scenario.

In addition to private savings, public savings also need to be considered. A large weight of pensions in public expenditures is particularly responsible for pressure on the deterioration of public savings and a consequent decline in national savings.

Effects of ageing on economic growth mediated by productivity

The ageing of the population changes the age composition of workers, and by doing so the overall productivity of labour changes in line with the productivity performance of those age categories that become more or less abundant.

Looking at the age-productivity profile, it is easy to find studies that concluded that there is a decline in some abilities with age, after a certain stage (Verhaegen and Salthouse 1997). The ages when the creative output peaks seem to be between 30 and 40 years' old (Lehman 1953, Miller 1999), although it varies among different areas of activity. The innovation that leads to economic growth is the one that is applied, but in the adoption of new technologies there is also evidence of a gap between younger and older generations (Charness and Boot 2009). Technological and organisational changes require adaptability, which is a skill that tends to decrease with age (Bonsang et al. 2012). At the aggregate level, the negative association between the likelihood of technology adoption and the share of older workers in firms need not reflect a lower propensity of older workers to adopt to new technologies, but rather it is also explainable by a lower incentive for employers to invest in the training of workers with lesser remaining work life (Wasiluk 2014).

There are, nevertheless, skills that improve with age, such as: management skills, work planning skills, conscientiousness, independence and experience (Bonsang et al. 2012). When the value of these skills outweighs that of abilities that tend to decline with age, then job performance increases with age. Accelerating technological change may increase skills obsolescence and render experience less important, but it is still not inevitable that productivity decreases with age.

At an aggregate level, Tang and MacLeod (2006) find that a higher share of workers aged 55 or older exerts a negative effect on the level of output per worker. Feyrer (2007) finds that the cohort of workers aged 40-49 has a large positive impact on productivity and

Burtless (2013) associates higher aggregate productivity with an increase in the proportion of those aged 35-50.

Ageing changes not only the age structure of the workforce, but also its relative dimension. As mentioned in the previous section, a decrease in the working age population with an actual decrease in the number of workers, *ceteris paribus*, increases capital density and therefore, the marginal product of labour, that is to say, labour productivity.

The idea that population ageing may deliver a second dividend is based on the conditions that the previous ageing stage creates to increase savings that may continue after the first dividend is exhausted, as we saw in the previous subsection. Furthermore, part of these conditions reflect the relation between ageing and human capital. Human capital results from both education and health. A population that lives longer, and is healthier, benefits more from investment in education, and as parents have fewer children, they may invest more in their education. Parents start to value more quality rather than the quantity of children (Becker et al. 1990; Galor 2011). This delays entrance into the labour market, but it enhances the productivity of workers. A population which is healthier should also be more productive (Bloom et al. 2004), with consequent higher economic growth and higher longevity, which must result from individuals being healthier on average. Nevertheless it is necessary to evaluate how much this will impact on productivity and growth, as while there is a decline in the disability of individuals aged 65 and more is well documented, but there are signs that the same has not been happening with those aged 50-64 (Martin et al. 2010).

The influence of demography on economic growth in Portugal

After 2010, the total Portuguese population has been decreasing (Fig. 1). Very low fertility and migration flows have worked in tandem in recent years. Net migration, which used to contribute to the increase in population size, decreased radically in 2010, and has been negative since then. The total fertility rate[1] has been below the 2.1 babies per woman replacement level since 1982, and is currently approximately 1.2 (Fig. 2). Such low

[1] The total fertility rate is the average number of children a woman would have, given prevailing birth rates.

fertility rates over an extended period of time would inevitably lead to a decline in population.

The active population (those who are either working or unemployed) decreased after 2008, although it saw a slight rise in 2010. The working age population (15-64) has been decreasing since 2008, in absolute terms. In relative terms, as a proportion of total population, it has been decreasing since 1999, and it has just exhausted its demographic dividend[2]. If we prefer to consider the working age population as being those aged 20-64, then it started decreasing in absolute terms in 2010, and in relative terms in 2007. Such demographic changes have translated into youth and old-age dependency ratios which, when combined, are already producing a rise in the total dependency ratio (Fig. 3), which is higher in Portugal when compared with the European average, of even with the average of Southern European countries.

Van der Gaag and De Beer (2015) calculated the demographic dividends (or demographic burdens) for the European Union countries during the period of 2000-2010, and made a projection for 2010-2020. For Portugal, this shows, in fact, a transition from a demographic dividend to a demographic burden. It should be pointed out that all the countries are projected to face a demographic burden in this second period and, in this study, Portugal is not amongst the most affected.

Using their methodology – which had already been used by Denton and Spencer (1997) - we decompose the growth in per capita income between 1998 and 2013 in different components, to see which part of it is due to the evolution of demography. The effect of ageing on growth which is manifested by our calculus is the accounting effect, which is working through the labour market.

Gross domestic product per capita can be decomposed into several components which make up the labour input:

$$GDP\ per\ capita = \frac{\text{WAP}}{\text{Pop}} \times \frac{\text{workers}}{\text{WAP}} \times \frac{\text{hours}}{\text{workers}} \times \frac{\text{GDP}}{\text{hours}}$$

Where *GDP* is the gross domestic product, *Pop* is total population, *workers* is the number of individuals working, *WAP* is the working age population (15-64 years old), and *hours*

[2] We are referring here to the first demographic dividend.

is the average annual hours actually worked per worker. Data for *workers* and for *hours* are from OCED Statistics, and the rest is from the official statistics of Portugal.

$\frac{\text{WAP}}{\text{Pop}}$, being the share of working-age population in the total population is a purely demographic component. $\frac{\text{workers}}{\text{WAP}}$ and $\frac{\text{hours}}{\text{workers}}$ are respectively the employment effect and the hours (or labour utilisation) effect, and $\frac{\text{GDP}}{\text{hours}}$ is the productivity effect.

Note that our employment effect does not exactly match the employment rate concept, as we are considering the total number of workers, not just those aged 15-64. It is important to do this, as if more people aged 65+ keep on working, then we want to capture this.

The results are presented in Table 1 and in Fig. 4. Table 1 displays the chain indexes of each component, which translate into the contributions of the different components to the annual percentage change in real GDP per capita, as shown in Figure 4.
The change in the proportion of people in working age in the total population has contributed negatively to the recent evolution of per capita output.

In addition to this, the contribution of employment is clearly negative during the years of the crisis. This effect mainly reflects the high rates of unemployment during this period, and it also incorporates changes in participation rates.

The hourly productivity component is that which shows a more regularly positive contribution. We must note that this is a residual component that is itself influenced by the ageing of population in ways that our study does not allow us to quantify precisely. Several demographic elements may have played a part in the evolution of productivity in Portugal. It is known that both reduced fertility and more longevity are responsible for an increase in the investment in education, which in turn should be reflected in higher productivity. In Portugal, the expected number of years in education over a lifetime increased from 16.5 to 18 in a decade (Eurostat). Together with the increase in the number of healthy years (Table 2), years in education produce a potential increase in aggregated productivity.

Also, the change in the age structure of workers will possibly affect overall productivity. This is not accounted for in our calculus. If, as suggested, the proportion of people aged 35-50 is associated with a higher level of productivity, Portugal should have had a

considerable increase in productivity since the 1980's. Only very recently has this proportion ceased to increase (Fig. 5).

As seen above, the changing age structure also has consequences for economic growth that is mediated through savings and investment. Nevertheless, it is hard to think of an indicator that shows that the Portuguese demography has been encouraging, or discouraging private savings and investment. The decreasing trends of these variables (Fig. 6) were already observable when the total dependency ratios were still decreasing. A more sophisticated analysis would be needed to determine such a relation.

Conclusions

The low Portuguese economic growth rates of the 2000's are a result of several causes. Ageing of the population may potentially be one of them. Are we facing Alvin Hansen's "secular stagnation" due to demographics?

One and a half decades is a relatively short period of time to see the effect of demographics, but our decomposition exercise still shows that the contribution of pure demographics – the change in the proportion of people in working age in the total population - to the recent evolution of per capita output may not be large, but it is consistently negative. Population ageing also impacts economic growth through the other channels that were explained in the first part of this paper, and some of those mechanisms may have produced a positive influence on growth, namely demographic inducement for rising levels of human capital. We are aware that some complexities may not have been addressed in this analysis, particularly feedback effects.

Considering that the first economic dividend is already exhausted, it is thus important to guarantee that a proper environment exists which allows Portugal to reap a potential second dividend of population ageing. Financial markets need to work well, providing proper saving mechanisms and channeling savings into investment. Pension reforms need to be accomplished to improve national savings and to incite labour market participation. The education system must also respond adequately to the demand for higher education and the healthcare system must be able to sustain a high participation in the labour market.

A positive labour market development would be the use of unemployed labour resources. A rise in employment and an increase in productivity are needed to compensate the

demographic burden. It is possible that the interaction between these two objectives brings difficulties: as currently unemployed individuals may have lower than average productivity levels, and thus the use of their labour services may decrease average aggregate productivity.

The consequences of ageing on economic growth are mixed. There are valid concerns about the impact of ageing on per capita output, but, however, it also causes positive effects and it is thus possible to transform these challenges into opportunities.

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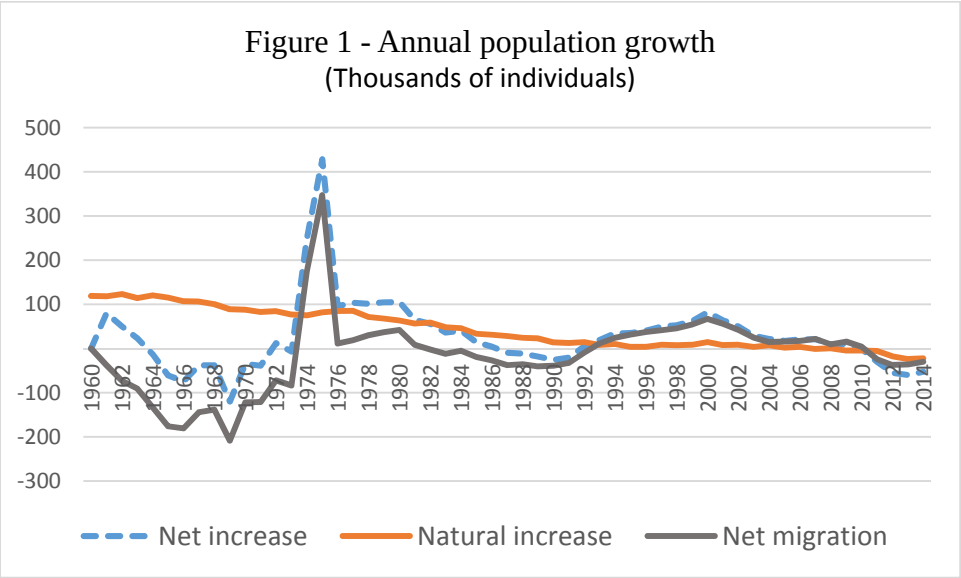
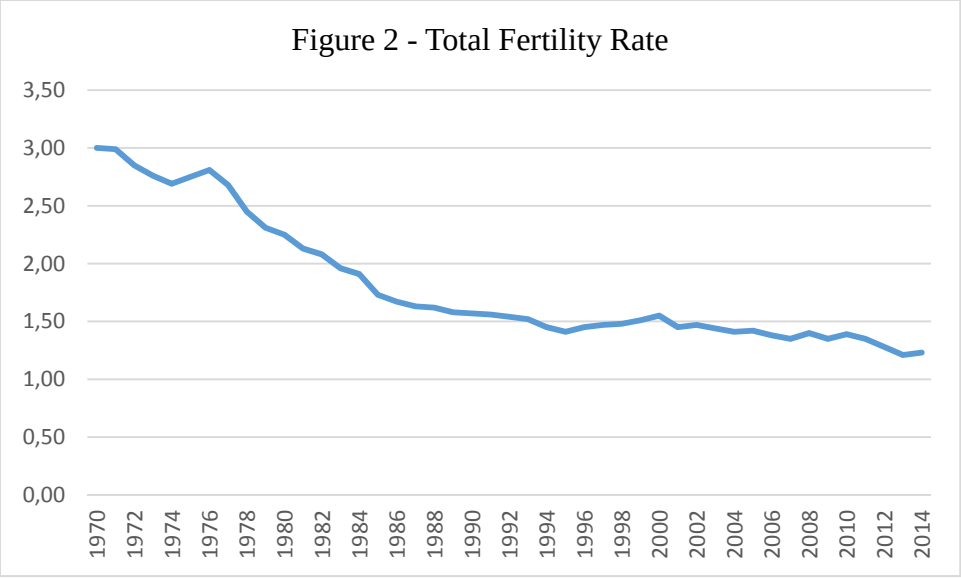
Figures



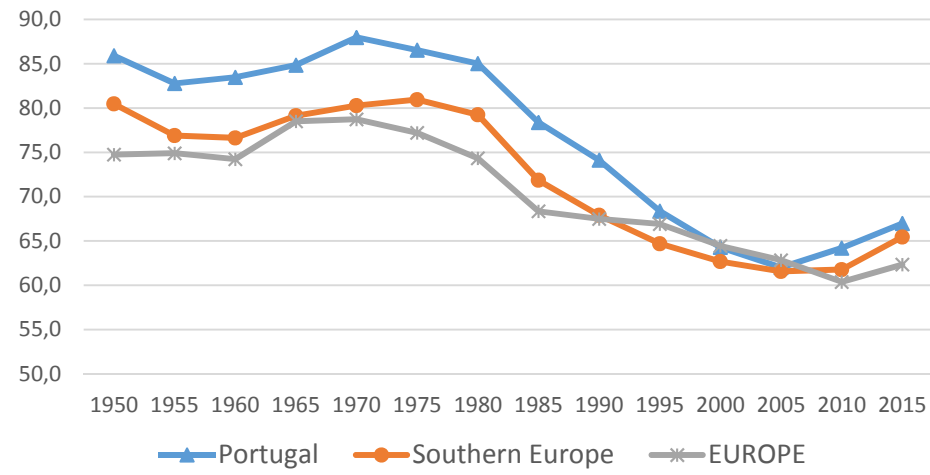
Data Sources: Official Statistics of Portugal - Deaths Statistics, Live Births Statistics and Annual Estimates of Resident Population;
Source: PORDATA



Data Sources: Official Statistics of Portugal - Demographic Indicators

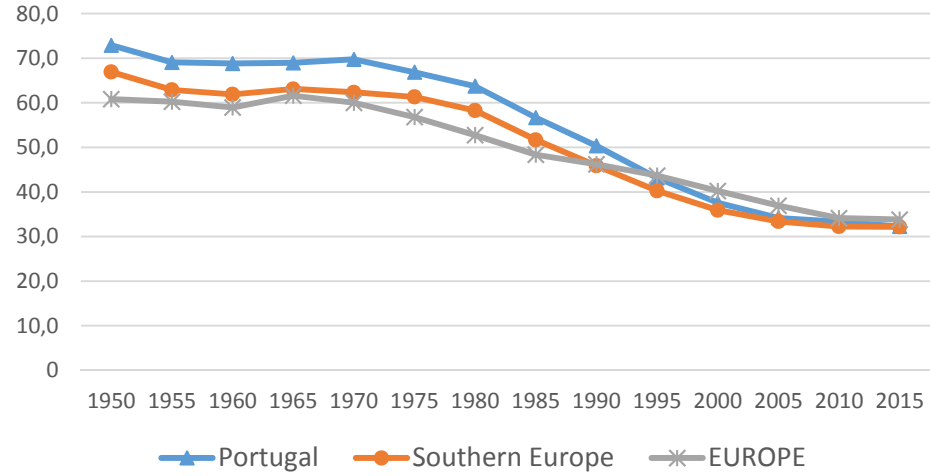
Source: PORDATA

Figure 3.a Total Dependency Ratio



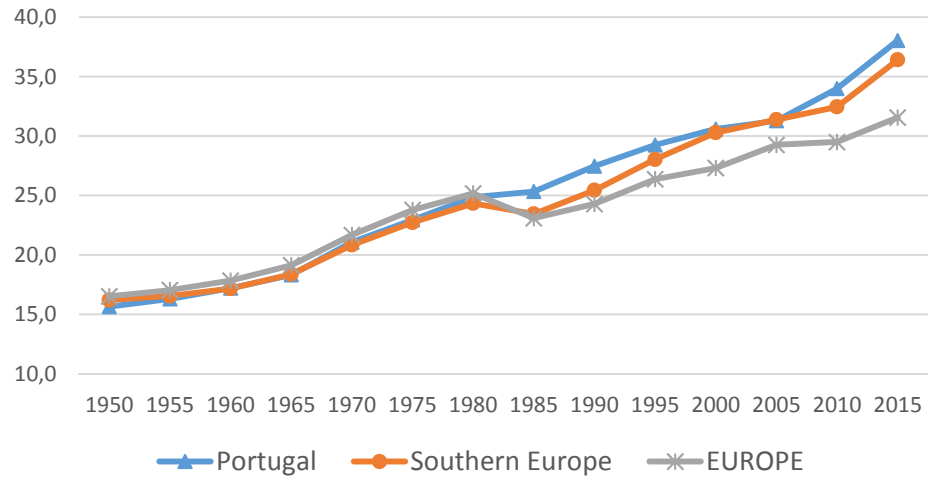
Definition: People under 20 or 65+, divided by individuals aged 20 to 64, multiplied by 100.

Figure 3.b Child Dependency Ratio



Definition: People under 20, divided by individuals aged 20 to 64, multiplied by 100.

Figure 3.c - Old Age Dependency Ratio



Definition: People aged 65+, divided by individuals aged 20 to 64, multiplied by 100.

Source: United Nations, Population Division

Figure 4 - Changes in the components of real GDP per capita

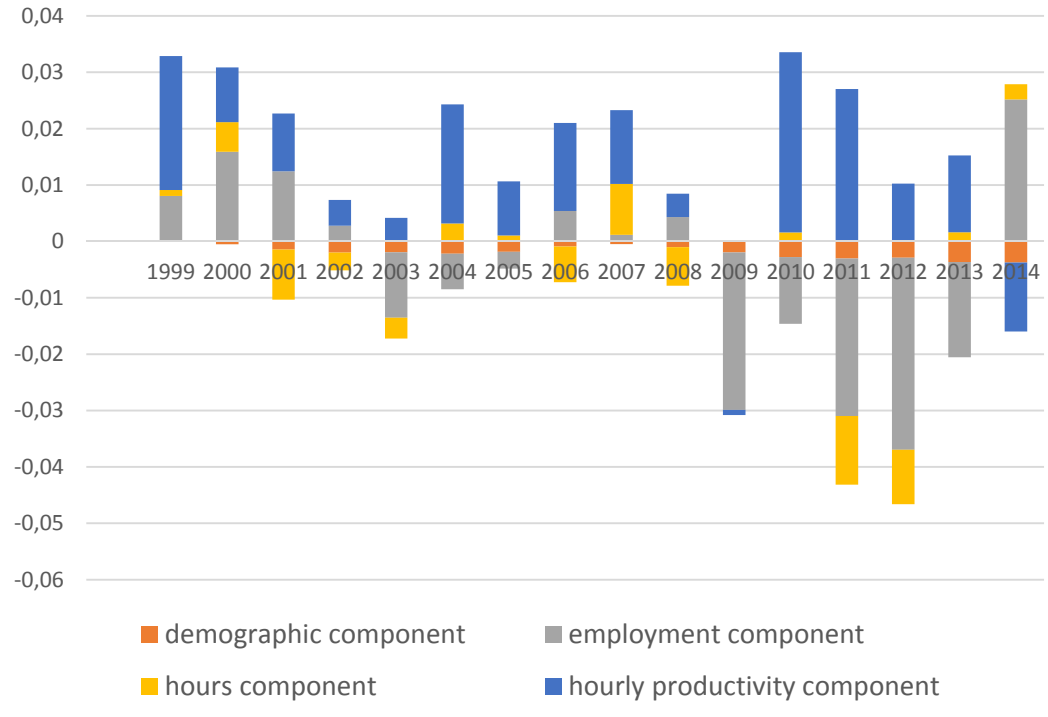
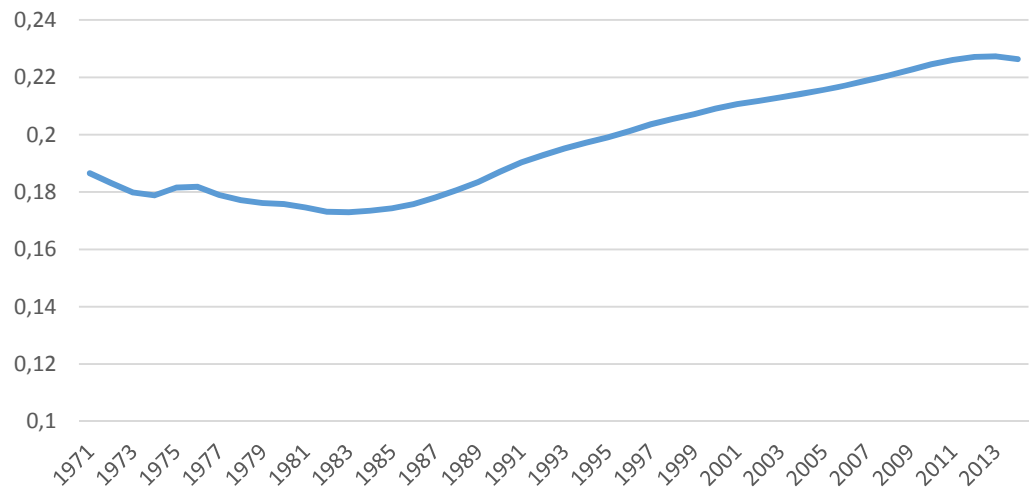
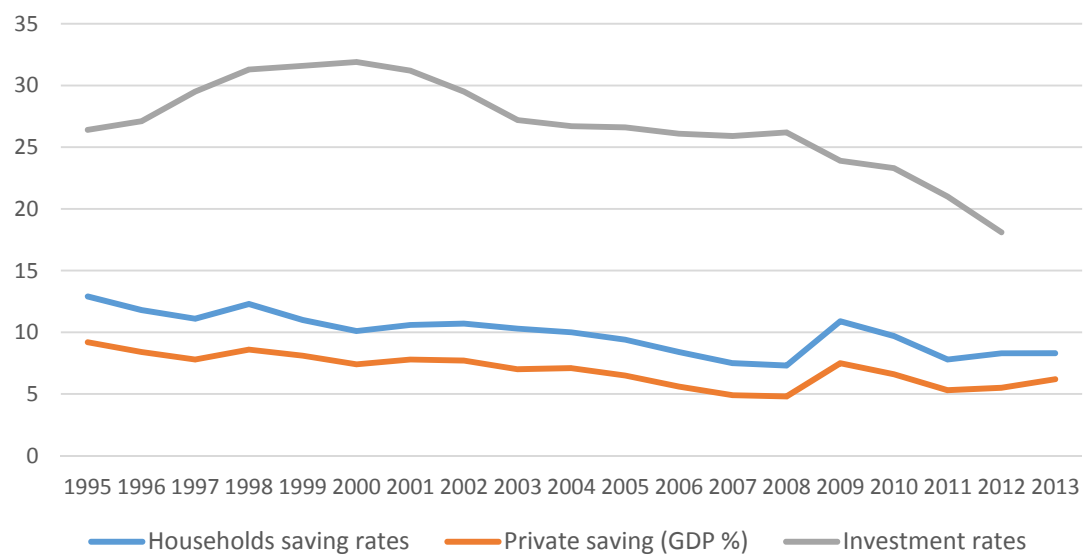


Figure 5 - Proportion of population aged 35 to 50 in the total population



Data source: Official Statistics of Portugal - Annual Estimates of Resident Population

Figure 6 - Investment and saving rates



Proportion - %
Data source: Official Statistics of Portugal – National Accounts (Base 2011)
Source: PORDATA

Tables

Table 1 Components of the growth of the Portuguese output per capita

Year	Real GDP per capita index	Demo-graphic component index	Employ-ment component index	Hours component index	Hourly productivity component index
1999	1.033	1.000	1.008	1.001	1.024
2000	1.031	0.999	1.016	1.005	1.010
2001	1.012	0.999	1.012	0.991	1.010
2002	1.002	0.998	1.003	0.997	1.005
2003	0.987	0.998	0.988	0.996	1.004
2004	1.016	0.998	0.994	1.003	1.021
2005	1.006	0.998	0.997	1.001	1.010
2006	1.014	0.999	1.005	0.994	1.016
2007	1.023	1.000	1.001	1.009	1.013
2008	1.001	0.999	1.004	0.993	1.004
2009	0.969	0.998	0.972	1.000	0.999
2010	1.019	0.997	0.988	1.002	1.032
2011	0.983	0.997	0.972	0.988	1.027
2012	0.964	0.997	0.966	0.990	1.010
2013	0.994	0.996	0.983	1.002	1.014
2014	1.012	0.996	1.025	1.003	0.988

Author's calculations.

Table 2 - Years of Healthy Life

	2006	**2013**
Women	57.9	62.2
Men	60.0	63.9

Source: Eurostat

Table 3 – Activity and employment rates

Year	Activity Rate %	Employment Rate %
2014[a]	58.8	62.6
2013[a]	59.3	60.6
2012[a]	60.2	61.4
2011[a]	60.5	63.8
2010[b]	54.6	61.2
2009[b]	55.6	61.4
2008[b]	57.4	62.0
2007[b]	57.3	62.2
2006[b]	57.3	62.1
2005[b]	57.2	61.9
2004[b]	57.5	61.6
2003[b]	58.0	61.9
2002[b]	58.8	61.9
2001[b]	59.0	61.5
2000[b]	58.6	61.0
1999[b]	57.8	60.5
1998[b]	57.4	60.3

[a] 2011 series
[b] 1998 series
Source: Official Statistics of Portugal