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PROJECTIONS FOR THE PORTUGUESE ECONOMY: 2014-16

Projections for the Portuguese economy: 2014-16

1. Introduction

The projections for the Portuguese economy point to a recovery in activity in the period 2014-16, with annual average growth rates of 1.1 per cent in 2014, 1.5 per cent in 2015 and 1.7 per cent in 2016 (Table 1.1). Therefore, the pace of growth is expected to be similar to that projected for the euro area.

In the second quarter of 2013 the fall in economic activity that had begun in late 2010 started to be reversed. However, the first quarter of 2014 was marked by a decline in the level of economic activity, mainly reflecting less favourable developments in exports, together with a significant fall in construction activity. Available data suggest that underlying these developments are several temporary factors, which should be reversed over the following quarters.

The modest recovery in economic activity expected over the projection horizon reflects a gradual rebound in domestic demand and continued strong growth in exports. Domestic demand developments over the next few years should remain conditioned by the fiscal consolidation process and the need to reduce private sector indebtedness. In turn, exports should benefit from a recovery in global economic activity, particularly in the euro area. In this context, Portuguese economy should continue to strengthen its net lending capacity *vis-à-vis* the rest of the world over the next few years.

The risks surrounding the projections for economic activity are on the downside, reflecting both external and domestic risk factors. In turn, overall risk balance is marginally biased upward for inflation.

2. Recent information

This Bulletin was prepared on the basis of information available up to 20 May 2014 (see "Box 1 Projection assumptions", in this *Bulletin*).[1]

Following a continued fall in economic activity in Portugal since end-2010, this trend was reversed as of the second quarter of 2013. This recovery reflected the acceleration in domestic demand, in line with the rising confidence of economic agents, together with the maintenance of substantial export growth.

Table 1.1 • Projections of banco de Portugal: 2014-2016 | Annual rate of change, per cent

	Weights	EB June 2014				EB April 2014			
	2013	2013	2014(p)	2015(p)	2016(p)	2013	2014(p)	2015(p)	2016(p)
Gross Domestic Product	100.0	-1.4	1.1	1.5	1.7	-1.4	1.2	1.4	1.7
Private Consumption	64.6	-1.7	1.4	1.5	1.5	-1.7	1.3	1.1	1.2
Public Consumption	19.0	-1.8	-0.2	-1.4	0.2	-1.7	-0.9	-0.5	0.3
Gross Fixed Capital Formation	14.8	-6.6	0.8	3.7	3.9	-6.6	1.8	4.4	4.5
Domestic Demand	98.9	-2.6	1.4	1.0	1.6	-2.6	1.2	1.2	1.6
Exports	40.7	6.1	3.8	6.1	5.6	6.1	5.3	5.1	5.4
Imports	39.5	2.8	4.6	4.8	5.5	2.8	5.4	4.7	5.1
Contribution to GDP growth (in p.p.):									
Domestic Demand		-2.6	1.4	1.0	1.6	-2.6	1.2	1.2	1.5
Exports		2.3	1.5	2.5	2.4	2.3	2.1	2.1	2.3
Imports		-1.1	-1.8	-2.0	-2.3	-1.1	-2.1	-1.9	-2.2
Current plus Capital Account (% of GDP)		2.6	2.8	4.0	4.3	2.6	3.3	3.7	4.2
Trade Balance (% of GDP)		1.7	2.0	3.0	3.3	1.7	2.6	3.1	3.6
Harmonized Index of Consumer Prices (HICP)		0.4	0.2	1.0	1.1	0.4	0.5	1.0	1.1

Source: Banco de Portugal.
Note: (p) - projected. For each aggregate, this table shows the projection corresponding to the most likely value, conditional on the set of assumptions considered.

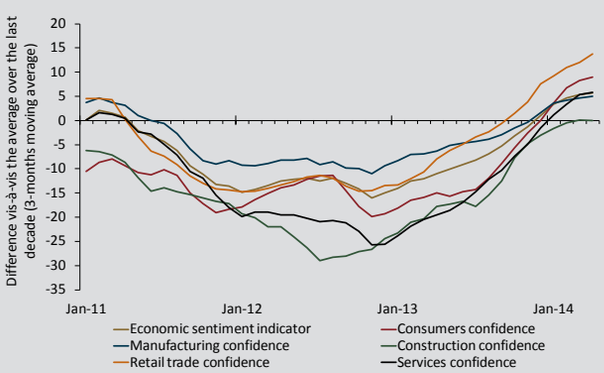
According to the flash estimate released by Statistics Portugal (INE) in mid-May, in the first quarter of 2014 gross domestic product (GDP) dropped by 0.7 per cent from the previous quarter, having grown 1.2 per cent from the first quarter of 2013. Given that the breakdown of changes in GDP by main components is not included in the official release of the flash estimate for GDP, it was not yet available as at the cut-off date for this Bulletin.

Despite the absence of this information, underlying economic activity in the first quarter of 2014 is a year-on-year acceleration in private consumption. In particular, passenger car sales grew 40.5 per cent, in year-on--year terms, in the first quarter of 2014 (after 27.1 per cent in the fourth quarter of 2013). Private consumption recovered amid a continued increase in consumer confidence throughout 2013, exceeding in early 2014 the average of the past decade (Chart 2.1). At the same time, the Employment Survey points to a 1.7 per cent year-on-year growth in employment in the first quarter of 2014, as well as a decline in unemployment for the fourth quarter in a row, standing at 15.1 per cent in the first quarter of 2014 (down from 17.5 per cent in the first quarter of 2013).

Year-on-year growth in gross fixed capital formation (GFCF) seems to have been subdued in the first quarter of 2014. These developments were rather conditioned by the construction component, which continues to weigh on investment behaviour, in an environment of particularly unfavourable weather conditions in early 2014. In turn, GFCF in machinery grew significantly in the first quarter of 2014, on the basis of developments in machinery imports, with a 10.6 per cent year-on-year nominal change, similarly to the previous quarter. Changes in inventories made a positive contribution to the rate of change in GDP in the first quarter of the year, mainly reflecting trade flows associated with fuels, with imports falling much less than exports.

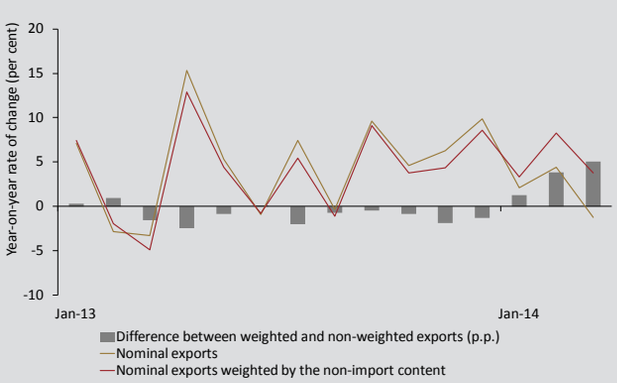
Exports slowed down markedly in the first quarter, mainly reflecting developments in the goods component. According to international trade data, the year-on-year rate of change in nominal exports of goods stood at 1.7 per cent in the first quarter of the year (6.7 per cent in the previous quarter). This deceleration largely reflects a year-on-year drop by approximately 30 per cent in fuel exports (41.0 per cent year--on-year increase in the last quarter of 2013), which was associated with a production stop at a refinery for technical maintenance purposes.[2] Naturally, given the high import content of fuel exports, the impact of these developments on GDP should be rather subdued (Chart 2.2). Excluding energy, exports of goods

Chart 2.1 • Confidence indicators



Source: European Commission.

Chart 2.2 • Nominal exports weighted and non-weighted by the non-import content



Sources: *INE* and Banco de Portugal.
Note: For a description of the methodology see "Box 4.1 - Developments in nominal exports of goods weighted by the non-imported content content" in the April Economic Bulletin 2014.

grew by 5.2 per cent year-on-year (4.1 per cent in the previous quarter).

Data available for the second quarter are still relatively scarce. In this context, short--term projection instruments used by Banco de Portugal point to a substantial increase in GDP from the previous quarter, albeit slowing down compared with the same period in the previous year. This year-on-year moderation in economic activity is in line with the coincident indicator for economic activity calculated by Banco de Portugal. European Commission opinion survey results, available up to April, point to an increase, albeit more subdued than in 2013, in confidence indicators, which, for most activity sectors excluding construction, stand at historically high levels.

In terms of components, underlying the projections for the second quarter is a further rebound in private consumption, with consumption of durable goods remaining highly buoyant. In this respect, data available for April continue to point to very substantial growth in passenger car sales. With regard to GFCF, year-on-year growth should be similar to the previous quarter, with a further significant increase in the machinery and equipment component. Exports of goods are projected to slow down in the second quarter, year-on-year, reflecting, to a large extent, calendar effects related to the fact that Easter had fallen in April 2014 (as opposed to 2013, when Easter was celebrated in March). Such calendar effects are likely to make a negative contribution to the year-on-year change in exports of goods in the second quarter and, in particular, in April. Conversely, exports of tourism services should benefit from this base effect.

Box 1| Projection assumptions

This projection exercise is based on a set of technical assumptions. As regards the international environment, use is made as usual of the information underlying the Eurosystem's projection exercise published by the European Central Bank in the Monthly Bulletin of June 2014 (Table 1).

With respect to external demand for Portuguese goods and services, a significant acceleration is anticipated over the projection horizon amid the gradual recovery of international trade flows worldwide. Albeit less dynamic than in the period prior to the financial crisis, external demand from non-euro area markets will likely continue to increase more than from euro area countries.

Expectations implied by financial markets suggest that the three-month EURIBOR will remain unchanged at historically low levels over the course of 2014 and 2015, rising towards the end of the projection exercise. The long-term interest rate is based upon an estimate of the interest rate implied in the Portuguese government debt, which relies on an assumption for the interest rate associated with new debt issuance. The projection assumes the maintenance of regular financing conditions for the economy.

The assumption about the exchange rates includes the maintenance of the average levels prevailing in the two-week period ending on the cut-off date. This assumption implies, in annual average terms, an appreciation of the euro in 2014, both in nominal effective terms and against the US dollar. As to the price of oil, data on the futures markets point to a fall in its price in US dollars (and in euros) over the projection horizon.

The projections for public finances follow the rule used in the Eurosystem projection exercises, namely by only including the policy measures that have already been approved or that are likely to be approved, and that have been specified in detail. This exercise incorporates the measures included in the State Budget for 2014, the changes introduced following the Constitutional Court decision of December 2013, as well as some of the measures included in the Fiscal Strategy Document that comply with the above criterion.

Taking into account these assumptions, public consumption is likely to decrease in 2014, as a result of the reduction in the number of civil servants, as well as of the impact on the respective

Table 1 • Projection assumptions

		EB June 2014			EB April 2014		
		2014	2015	2016	2014	2015	2016
External demand	yoy	3.5	4.8	5.5	3.7	4.8	5.3
Interest rate							
Short-term (3 month EURIBOR)	%	0.3	0.3	0.4	0.3	0.4	0.7
Implicit in public debt	%	3.5	3.5	3.7	3.5	3.6	3.7
Euro exchange rate							
Effective exchange rate index (1999Q1=100)	aav	104.2	104.4	104.4	103.9	103.9	103.9
Euro-dollar	aav	1.38	1.38	1.38	1.37	1.37	1.37
Oil prices							
in dollars	aav	107.2	102.2	98.2	107.6	102.4	97.8
in euros	aav	77.7	73.9	71.0	78.4	74.5	71.1

Sources: Bloomberg, ECB, Thomson Reuters and Banco de Portugal calculations.
Notes: yoy - year-on-year rate of change, aav - annual average value. An increase in the exchange rate corresponds to an appreciation. The implicit interest rate on public debt is computed as the ratio between interest expenditure for the year and the simple average of the stock of debt at the end of the same year and at the end of the preceding year.

deflator of the decline in wages, in accordance with the technical assumptions for public finances described above. It should however be noted that the projection continues to be influenced by the increase of the number of working hours of civil servants from 35 to 40 hours per week, implemented since the last quarter of 2013. With regard to public investment, a slight recovery is anticipated for 2014, compared with the previously assumed stabilisation.

The projection for 2015 incorporates the 20 per cent reinstatement of the civil servants' wage reduction, as considered in the Fiscal Strategy Document, whose impact on public consumption, in nominal terms, is partly offset by the reduction in the number of staff due to retirements and strict control over hirings.

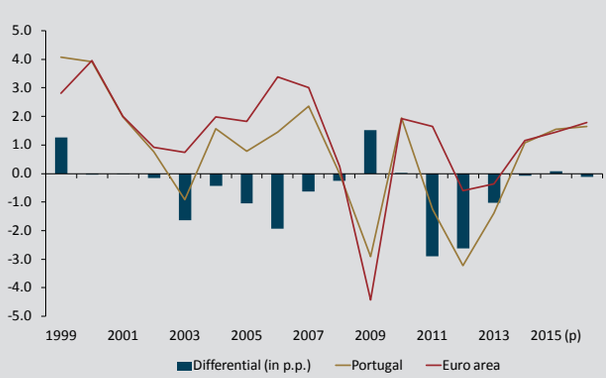
3. Demand, supply and external accounts

Sustained recovery in domestic demand combined with robust export growth

The projections for the Portuguese economy point to a rebound in economic activity in 2014-16. In this period, the Portuguese economy is projected to grow at a similar pace to the euro area (1.0, 1.7 and 1.8 per cent in 2014, 2015 and 2016 respectively) (Chart 3.1).[3] Despite this recovery, at the end of the projection horizon GDP should stand 3 per cent below the level seen prior to the onset of the international financial crisis in 2008 (Chart 3.2).

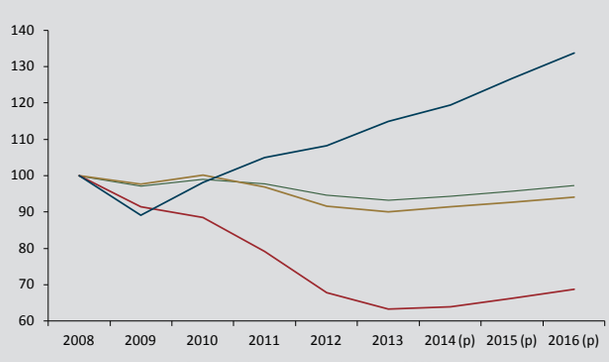
Projected developments in the Portuguese economy are characterised by an acceleration in domestic demand and strong export growth. Gross contributions from the main components to GDP growth are illustrated in Chart 3.3. Chart 3.4 presents net contributions to GDP growth, calculated by subtracting from each demand component the import volume needed to meet such demand (see "Box 2 The role of domestic demand and exports in economic activity developments in Portugal", in this

Chart 3.1 • Evolution of GDP | Annual rate of change, in percentage



Sources: ECB, Eurostat and Banco de Portugal.
Note: (p) - projected.

Chart 3.2 • Evolution of GDP composition | Index 2008=100



Sources: *INE* and Banco de Portugal.
Note: (p) - projected.

Bulletin). The net contribution from domestic demand to GDP growth should increase over the projection horizon, moving from -2.4 p.p. in 2013 to 0.6 p.p. in 2016 (Chart 3.3). Exports should grow strongly over this horizon, amid an acceleration in global trade, while net contributions from exports to GDP growth are likely to stand at around 1 p.p. Consumption and investment decisions by households and firms over the next few years should continue to be conditioned by the need for private sector deleveraging.

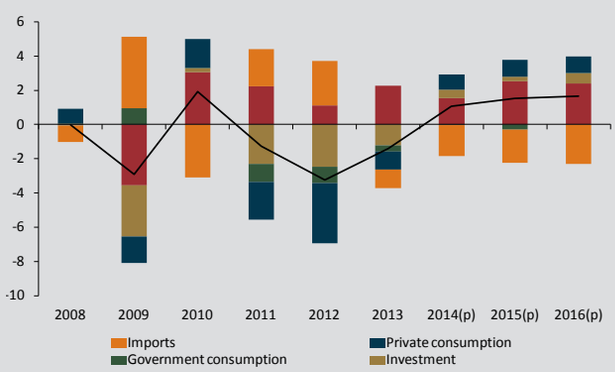
Similarly to the past few years, the weight of domestic demand on GDP should continue to decrease over the projection horizon, as opposed to the growing weight of exports. In 2016 exports are projected to stand at approximately 45 per cent of GDP (12 p.p. increase from 2008), which is one of the most significant aspects of the ongoing adjustment process in the Portuguese economy.

Turning to sectoral developments, private sector activity should grow by 1.6 per cent in 2014 and by around 2 per cent over the remaining horizon, reflecting a pick-up in private domestic demand and strong export growth. In turn, private sector activity is expected to contract further in 2014 and 2015, albeit at a gradually slower pace, and to grow at a virtually zero per cent rate in 2016.

Following a 1.2 per cent fall in 2013, gross value added (GVA) in the main sectors of activity is likely to grow moderately in 2014. Sectoral developments in activity should continue to reflect the ongoing productive restructuring of the Portuguese economy, which is characterised by the transfer of resources from non--tradable sectors to tradable sectors. In this context, GVA in manufacturing and services is projected to recover over the projection horizon, benefiting from the buoyant performance of exports and a pick-up in domestic demand. Construction activity is expected to fall in 2014, albeit to a lesser extent than over the past few years, and to recover somewhat throughout 2015 and 2016.

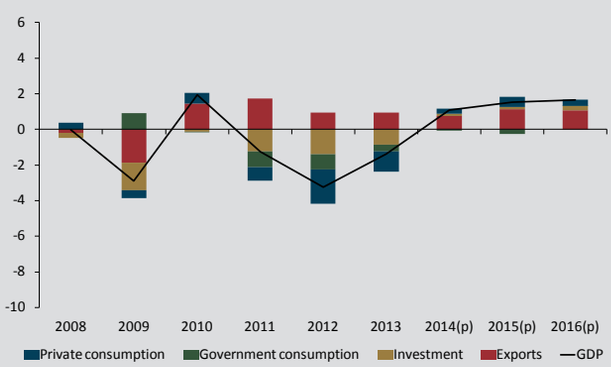
With regard to domestic demand components, projections point to a subdued rebound in private consumption over the projection horizon, after a cumulative fall of approximately 10 p.p. in the 2011-13 period (Chart 3.5). Real disposable income is projected to grow by 0.7 per cent in 2014 (-1.0 per cent in 2013) and by approximately 1.5 per cent in 2015 and 2016. Projected developments in private consumption and disposable income indicate that the savings rate should remain at around 12 per cent over the horizon, which is clearly above the average levels seen since the euro area was launched.

Chart 3.3 • Gross contributions to GDP growth |
In percentage points



Sources: *INE* and Banco de Portugal.
Note: (p) - projected.

Chart 3.4 • Net contributions to GDP growth |
In percentage points



Sources: *INE* and Banco de Portugal.
Note: (p) - projected.

Projected developments in private consumption and disposable income are in line with the continued gradual deleveraging of households. Between 2009 and 2013 household indebtedness dropped by 13 per cent of disposable income (Chart 3.6). Notwithstanding this downward trend, household indebtedness remains high compared with other euro area countries.

GFCF in 2014 is expected to grow by 0.8 per cent, followed by an acceleration to 3.7 and 3.9 per cent in 2015 and 2016 respectively (Chart 3.7). These developments are associated with a pick-up in corporate investment, reflecting a more favourable outlook for domestic and external demand, as well as the need by some firms to renew their capital stock. The fall in corporate investment over the recent period partly reflected the postponement of decisions associated with the continued high uncertainty about the nature of the adjustment process and likely developments in demand conditions. Expected improvements in financing conditions, rising confidence of economic agents (since mid-2013) and reduced uncertainty should thus contribute to a rebound in investment. In turn, the still relatively low capacity utilisation could

Chart 3.5 • Consumption, disposable income and saving rate | Annual rate of change, in percentage

Sources: *INE* and Banco de Portugal.
Note: (p) - projected. The saving rate is expressed as a percentage of disposable income.

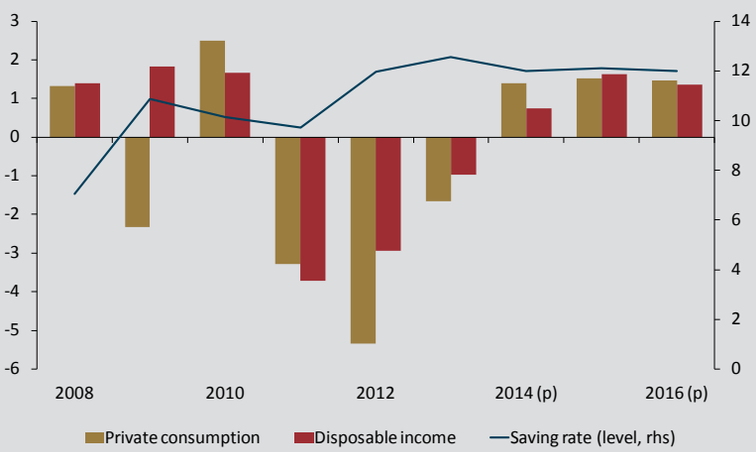
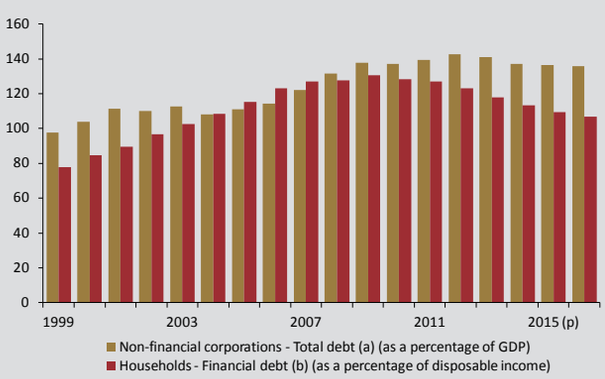
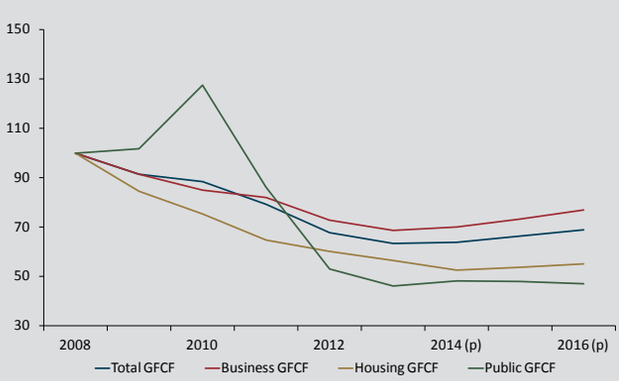


Chart 3.6 • Debt of the non-financial private sector | End of period figures



Source: Banco de Portugal.
Note: (p) - projected. (a) It includes loans granted to non-financial corporations by other institutional sectors; commercial paper and bonds issued by non-financial corporations held by other sectors and trade credits received from other sectors. (b) The financial debt corresponds to loans and debt securities issued by the sector.

Chart 3.7 • Breakdown of GFCF by institutional sectors | Index 2008=100



Sources: *INE* and Banco de Portugal.
Note: (p) - projected.

dampen investment buoyancy. Moreover, the high indebtedness level of non-financial corporations and the need for deleveraging will continue to condition the pace of this recovery. In this context, non-financial corporate indebtedness is expected to gradually fall over the projection horizon, following a small decrease in 2013.

Since the beginning of the Economic and Financial Assistance Programme, developments in credit to non-financial corporations have been considerably heterogeneous, both in sectoral terms and as regards corporate size. In fact, credit has been mostly granted to the most buoyant sectors of the economy, geared towards the production of tradable goods, which will likely continue over the next few years. Furthermore, spreads applied by the banking system to interest rates on loans to non-financial corporations have followed a downward path over the past few months, but remain high compared with the euro area average. This differential *vis-à-vis* the euro area reflects the increased perception of risk by banks and the persistent financial market fragmentation in the euro area, albeit smaller than in the recent past. Over the projection horizon, spreads applied to interest rates on loans to Portuguese non-financial corporations should continue to fall gradually.

Residential investment is projected to fall markedly in 2014, and in the course of the next few months the significant fall seen in the first quarter of the year is not expected to be considerably reversed. For 2015 and 2016, it should recover somewhat, amid a slight increase in household disposable income and improving financing conditions. The cumulative fall in housing investment since the beginning of the 2000s exceeded 60 per cent, which is in line with a structural adjustment of the housing stock, following high investment in the 1990s. Developments in this aggregate over the most recent period are still conditioned by demographic factors. Finally, households' high indebtedness and need to deleverage should condition residential investment developments over the next few years.

As regards public investment, a 5 per cent growth is expected for this year and a decline by around 1 per cent, on average, in the period 2015-16.

Exports of goods and services are projected to grow by 3.8 per cent in 2014 and around 6 per cent in 2015 and 2016, benefiting from a recovery in the world economy, particularly in terms of external demand from the euro area (Chart 3.8). The acceleration in exports in 2015 reflects the effect from the strong acceleration in the energy component expected for the second half of 2014, after a fall of approximately 30 per cent in the first months of the year (see "Chapter 2 Recent information"). Since 2011 Portuguese exports have posted substantial market share gains, reflecting the firms' degree of adaptation to market conditions and the increased effort by Portuguese firms in the tradable goods and services sectors in looking for new markets. In this context, the market share gain of exports of goods and services cumulated over the period 2011-13 was approximately 10 per cent, which implied a recovery in the market share for a level marginally above that seen at the beginning of the euro area. Moreover, recent developments in Portuguese exports reflect a markedly more favourable behaviour than in most euro area economies (Chart 3.9).

Projections point to additional market share gains over the projection horizon, albeit much smaller than those seen over the most recent period. In disaggregated terms, exports developments over the projection horizon reflect significantly buoyant exports of goods and services.

Imports of goods and services are expected to increase over the projection horizon, reflecting this component's historical average elasticity to developments in overall demand weighed by import content. This implies an increased penetration of imports over the projection horizon, reflecting a gradual pick-up in private domestic demand and exports.

Employment is expected to increase by 0.7 per cent in 2014, particularly in the private sector

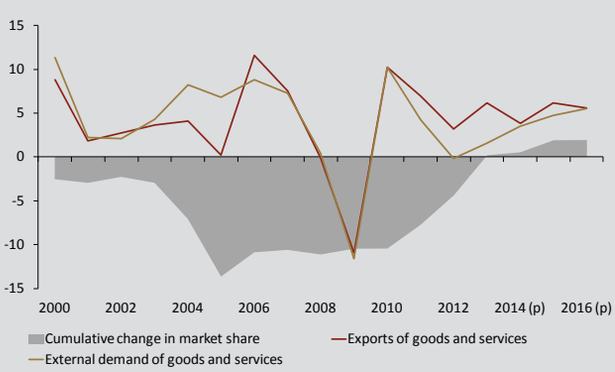
(annual average growth of 1.3 per cent), given that employment is projected to fall in the public sector, albeit less than in 2013. For 2015 and 2016 private sector employment is projected to continue to recover at a slower pace than economic activity, leading to an increase in apparent labour productivity in the private sector by around 1 per cent in annual average terms. According to available data on public finances, employment in the public sector is expected to decrease in 2015 and stabilise in 2016. In this context, the unemployment rate should continue to gradually fall over the projection horizon.

Increase in the external surplus of the Portuguese economy

Particularly important within the current adjustment process of the Portuguese economy is the correction of the external imbalance cumulated in the course of several decades. Macroeconomic projections in this section are consistent with the furtherance of this process and, in particular, an increase in the Portuguese economy's net lending *vis-à-vis* the rest of the world (Chart 3.10). In this context, the combined current and capital account balance is projected to increase, to 2.8, 4.0 and 4.3 per cent of GDP in 2014, 2015 and 2016 respectively. Underlying these developments is a significant improvement in the goods and services account, which posted a positive balance in 2013, for the first time in several decades (Chart 3.11). The projected surplus for the goods and services account over the horizon reflects the combination of buoyant exports with an acceleration in imports, as well as a favourable effect from terms of trade, amid a decline in euro-denominated oil prices (stemming from technical assumptions in this exercise).

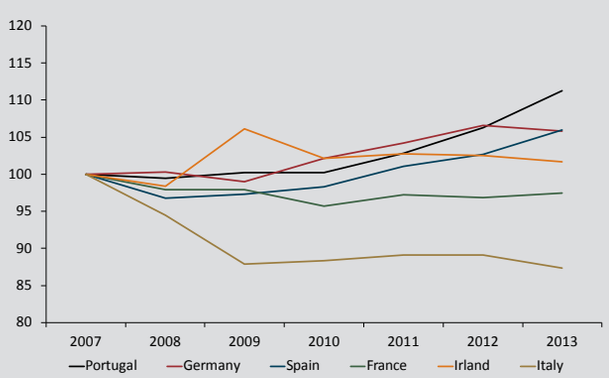
The income account deficit is expected to remain relatively stable over the next few years, given that the slight increase projected for interest rates should be offset by a decline in the international investment liability position, due to the surpluses projected for the current and capital accounts. Projections also point to a virtual stabilisation of the current transfers and capital account over the projection horizon.

Chart 3.8 • Exports and external demand | Annual rate of change, in percentage



Sources: ECB, *INE* and Banco de Portugal.

Chart 3.9 • Market share evolution | Index 2007=100



Sources: BCE, *INE* and Thomson Reuters.

Small revision of projections for activity compared with the April Economic Bulletin

Current projections for the annual GDP growth rate in 2014 correspond to a marginal downward revision by 0.1 p.p. compared with those released in the April 2014 issue of the Economic Bulletin, reflecting more unfavourable developments in the first quarter of the year, particularly in terms of exports. For 2015 projections were revised marginally up, by 0.1 p.p., reflecting an upward revision of household disposable income following the inclusion of the measure published in the Fiscal Strategy Document stemming from the reinstatement of part of the cuts to public servants' wages as of 2015 and the replacement of the Contribuição Extraordinária de Solidariedade (extraordinary solidarity contribution). For 2016 projections remain unchanged. For 2014 projections for inflation were revised down, by 0.3 p.p., reflecting the incorporation of the latest HICP figures, which were lower than anticipated in the April 2014 issue of the Economic Bulletin.

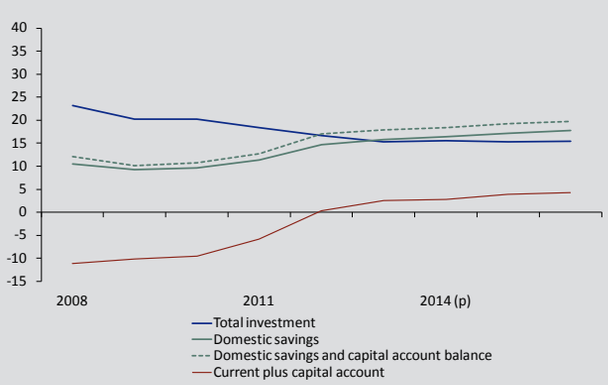
4. Prices and wages

Following a marked deceleration in prices in 2013, which mainly reflected the fading away of the impact of fiscal consolidation measures implemented in 2012, more specifically, the increase in indirect taxes and the regulated prices of a number of goods and services, inflation is projected to remain relatively stable in 2014, at 0.2 per cent (0.4 per cent in 2013). Over the projection horizon, inflation should grow progressively, reaching 1.1 per cent in 2016.

Within a monetary union, it is expected that countries under a structural adjustment process record inflation rates below the average of the remaining members. Following a 0.9 p.p. negative differential *vis-à-vis* the euro area in 2013, underlying the projections for inflation in Portugal is the maintenance of a negative differential over the projection horizon, albeit smaller.

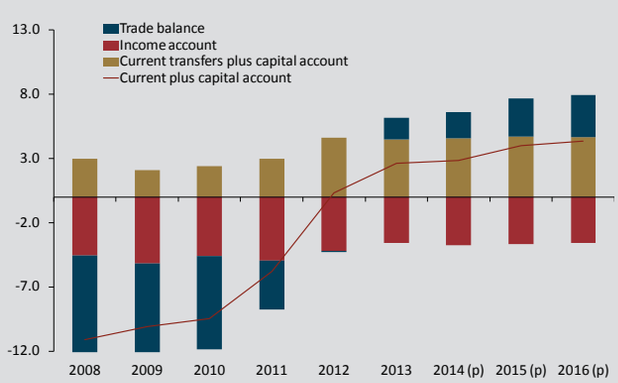
Underlying the projected developments in inflation are mixed behaviours for the energy and non-energy components of the Harmonised Index of Consumer Prices (HICP) (Chart 4.1). With regard to energy goods, prices are projected to drop slightly, reflecting developments

Chart 3.10 • Developments in financial requirements | In percentage of GDP



Source: Banco de Portugal.
Note: (p) - projected.

Chart 3.11 • Current plus capital account | As a percentage of GDP



Source: Banco de Portugal.
Note: (p) - projected.

in euro-denominated oil prices. For the non-energy component, prices are expected to gradually accelerate, from 0.2 per cent in 2014 to 1.3 per cent in 2016. Such muted developments in prices reflect the maintenance of low inflationary pressures, both in external and domestic terms, amid a subdued rebound in global economy and the continued adjustment process of the Portuguese economy. Along with an improvement in labour market conditions, private sector wages are expected to accelerate somewhat, thus contributing to a relatively modest increase in the corresponding labour unit costs.

Against a background of low inflation, the above-mentioned developments in private sector labour unit costs, together with muted growth in the import deflator excluding energy goods, translate into negligible changes in business unit profit margins over the projection horizon.

5. Uncertainty and risks

Projections presented in this bulletin represent the scenario deemed most likely, based on the set of assumptions set out in "Box 1 Framework assumptions". The non-materialisation of such assumptions, as well as the likelihood of events not taken into account in the projections, give rise to risks and uncertainty. The quantified analysis of the risks and uncertainty surrounding the projections is presented in this section.[4]

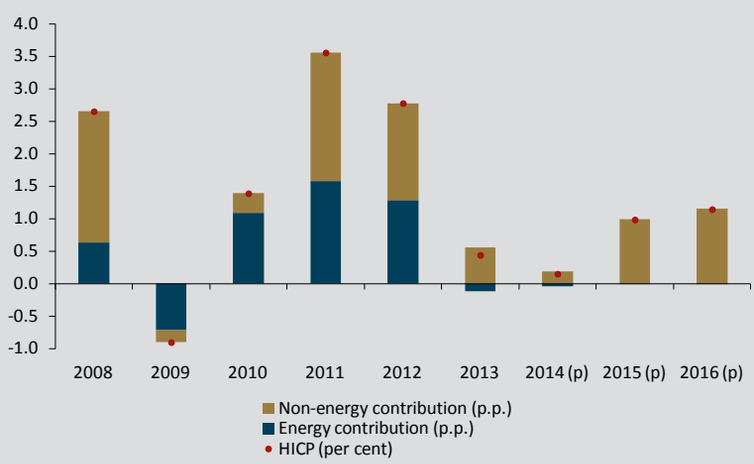
Risks and uncertainty about the international and domestic environment

Over the projection horizon, risk and uncertainty factors emerge, stemming from both the international environment and domestic factors. At international level, a risk factor is the possibility of a more subdued recovery in world activity and global trade flows. In the euro area, there are also risks of a slower recovery in economic activity, amid the further need for fiscal consolidation in a number of economies and the need for private sector deleveraging. As a result of this risk factor, the possibility of a less buoyant external demand for Portuguese goods and services over the entire projection horizon was taken into account, assuming a 55 per cent probability (Table 5.1).

Chart 4.1 • Inflation |

Contribution to the HICP anual rate of change, percentage points

Sources: *Eurostat* and Banco de Portugal.
Note: (p) - projection.



Furthermore, a risk factor associated with oil price developments was also considered, reflecting the possibility of intensified geopolitical tensions in energy-producing countries. In this context, it was considered that there was a 55 per cent probability of oil prices in 2014 and 2015 being higher than projected. Finally, at international level there was a risk factor linked to the possibility of a depreciation in the euro, stemming from a normalisation of the monetary policy in the United States and the possibility of additional non-standard measures in the euro area. There was also a 55 per cent probability underlying this risk factor.

At domestic level, a 55 per cent probability was assigned to market share gains in exports being lower than projected, which would imply less favourable developments in exports. Furthermore, inflation in 2014 was assumed to move downwards, with a 55 per cent probability, owing to a possible narrowing in profit margins, given the evidence observed over the past few months. Finally, there is also the possibility of additional cuts in public consumption according to the Fiscal Strategy Document, but which were not taken into account in the central projections given that they did not comply with the Eurosystem's criteria. In this context, it was considered to be 55 per cent likely that public consumption in 2015 be lower than projected.

Risk of more unfavourable developments in economic activity and inflation marginally higher than projected

This quantification defines risks of less favourable developments in economic activity, stemming from factors associated with both the external and domestic environment (Chart 5.1). As regards consumer prices, the analysis points to the risk of inflation being marginally higher than projected, particularly 2015 and 2016, stemming from risks associated with developments in oil prices and the exchange rate (Chart 5.2).

Table 5.1 • Risk factors - Probability of an outcome below the implicit in the projections | Per cent

	2014	2015	2016
Conditioning variables			
External demand	55	55	55
Oil prices	45	45	50
Exchange rate	55	55	55
Public consumption	50	55	50
Endogenous variables			
Exports	55	55	55
HICP	55	50	50

Source: Banco de Portugal.

Table 5.2 • Probability of an outcome below the projections | Per cent

	Weights	2014	2015	2016
Gross Domestic Product	100	54	56	54
Private consumption	65	51	53	53
GFCF	15	51	54	53
Exports	41	57	59	56
Imorts	40	54	59	58
HICP		49	48	48

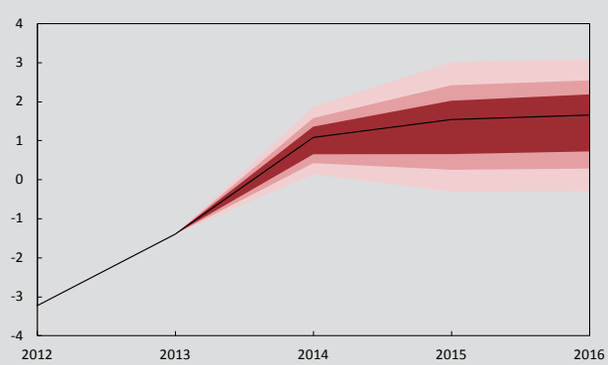
Source: Banco de Portugal.

6. Conclusions

Over the next few years, the Portuguese economy's growth potential will remain conditioned by a number of structural constraints. In this context, of particularly relevance was the postponement of investment decisions over the past few years, which limited the incorporation of new technologies and improved skills in the productive process, the high indebtedness in the economy and need for deleveraging, particularly in the case of non-financial corporations, as well as the decreasing labour force and high long-term unemployment, which imply a permanent fall in cumulated human capital.

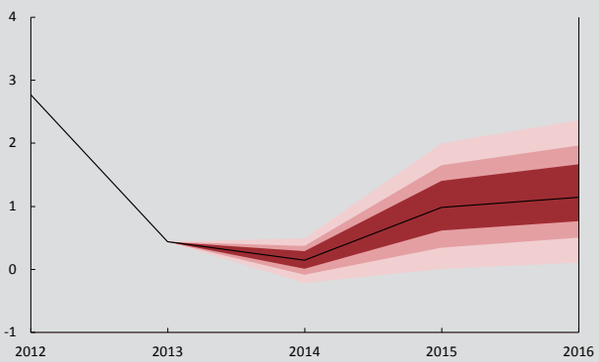
Despite the progress made in the correction of macroeconomic imbalances over the past three years, the structural rebalancing process of the Portuguese economy is still incomplete. In this context, it is crucial to move forward with the fiscal consolidation process, fully complying with the commitments made by authorities under the Stability and Growth Pact of the "Fiscal Treaty". Furthermore, it is imperative to ensure a level of consumption compatible with the income of resident agents, from an intertemporal perspective. Finally, it is crucial to ensure that public policies are geared towards the creation of incentives to innovation, factor mobility and investment in physical and human capital, as well as to guarantee a legal and institutional framework that channels productive resources towards the growing integration of firms in global value chains. Against this background, it is imperative to lay down the conditions to attract new foreign direct investment projects with incorporated technological progress that make it possible to boost productivity and competitiveness within the tradable goods sector in the short to medium term. Only a long-term vision ensuring the intertemporal consistency of policies and between policies, as well as a stable institutional framework, anchoring agents' incentives for a prolonged period of time, can ensure the necessary conditions for sustainable growth and the taking-up of the real convergence process between Portugal and the euro area.

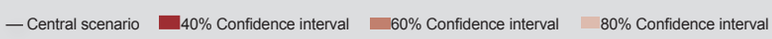
Chart 5.1 • Gross domestic product | Rate of change, per cent



Source: Banco de Portugal.

Chart 5.2 • Harmonised index of consumer prices | Rate of change, per cent





Source: Banco de Portugal.

Box 2 | The role of domestic demand and exports in economic activity developments in Portugal

The analysis of developments in the main macroeconomic aggregates on the demand side is typically assessed in gross terms, *i.e.* not subtracting from each component the import volume needed to meet such demand. Therefore, with this analysis it is not possible to directly determine the role actually played by each demand component in real GDP growth, which would be possible if contributions were assessed in net terms, *i.e.* subtracting their import content. This box presents a breakdown by both gross and net contributions from domestic demand and exports to real GDP growth (Table 1). Both breakdowns are useful for economic analysis, providing a more complete assessment of the role played by each demand component in activity developments.

To calculate the net contribution from domestic demand and export volumes to real GDP growth, the import content of each demand component must be known for each period. However, this information is released only for a number of years and with a considerable time lag, and is not available for the most recent years. As such, the breakdown presented in this box takes into account the import content for 2005. Since then, the degree of penetration of imports has increased, as measured by the growth differential between the import volume and that which would result in the assumption that such import content will be maintained. In this box, it is assumed that the increased penetration of imports was proportionally equal across all final demand components. This assumption does not seem to be excessively restrictive for large aggregates, given that changes in their import content are rather gradual and synchronised over the years for which information is available.[5] According to estimates, the import content of domestic demand stood at around 25 per cent in 2013, while the import content of exports amounted to around 38 per cent.

The breakdown of gross contributions shows that, over the recent adjustment period, contributions from international trade to real GDP growth – as measured by the differential between gross contributions from the export volume and contributions from the import volume, commonly known as net exports – have been systematically positive. These developments unfolded against a background of relatively stable terms of trade and were reflected in the progressive elimination of the goods and services account deficit. Over the projection horizon, the rebound in the domestic demand volume and strong export growth imply an increase in the import volume and a decline in the contributions from net exports to real GDP growth to marginally positive values. Projected developments in the contribution from net exports suggest that the pick-up in

Table 1 • GDP and contributions to growth | In percentage point

	2008	2009	2010	2011	2012	2013	2014(P)	2015(P)	2016(P)
GDP (real growth rate)	**0.0**	**-2.9**	**1.9**	**-1.3**	**-3.2**	**-1.4**	**1.1**	**1.5**	**1.7**
Gross contribution									
Domestic demand	0.9	-3.6	1.9	-5.5	-6.9	-2.6	1.4	1.0	1.6
Net exports	-1.0	0.6	-0.1	4.4	3.7	1.2	-0.3	0.6	0.1
Exports	0.0	-3.5	3.0	2.2	1.1	2.3	1.5	2.5	2.4
Imports	-1.0	4.2	-3.1	2.2	2.6	-1.1	-1.8	-2.0	-2.3
Net of imports contribution									
Domestic demand	0.1	-1.1	0.4	-2.9	-4.2	-2.4	0.3	0.4	0.6
Exports	-0.2	-1.9	1.5	1.7	1.0	1.0	0.8	1.1	1.1

Sources: *INE* and Banco de Portugal. .

domestic demand is in line with a continued goods and services account surplus, given the buoyancy of exports and a slight increase in terms of trade.

The breakdown of net contributions makes it possible to analyse the contributions from domestic demand and exports from a different perspective. Given that contributions are net of imports of goods and services used in their production, they correspond to the actual contribution to GDP growth. As such, 1 per cent growth in exports implies a 0.4 p.p. gross contribution to GDP growth (stemming from the weight of around 40 per cent of exports in GDP) and a net contribution of around 0.25 p.p. (stemming from their import content). Similarly, 1 per cent growth in domestic demand implies a gross contribution to GDP growth of approximately 1 p.p., but a net contribution of around 0.75 p.p..[6] By contrast to gross contributions, the analysis of net contributions does not make it possible to infer on developments in the goods and services account balance.

Developments in the recent past show that exports have made systematically positive contributions and, on average, higher than 1 p.p. per year since 2010. According to current projections, this contribution should stabilise at around 1 p.p. up to the end of the horizon. Conversely, domestic demand made a markedly negative contribution during the 2011-13 period, reflecting the macroeconomic adjustment process undertaken in this period. Over the projection horizon, domestic demand is expected to make a positive contribution, albeit smaller than that of exports, similarly to what has been observed since 2010.

Notes

1.Therefore, it does not include the impact from the recent decision by the Constitutional Court.

2.This stop affected fuel exports in February and March and should also influence the value of exports for April.

3.See the June 2014 ECB Monthly Bulletin.

4.The methodology used in this section is based on the article published in Pinheiro, M. and Esteves, P. (2010), "On the uncertainty and risks of macroeconomic forecasts: Combining judgements with sample and model information", Empirical Economics, pp. 1-27.

5.See Cardoso, F., P. Esteves and Rua, A. (2013) "The import content of global demand in Portugal", in the autumn 2013 issue of Banco de Portugal's Economic Bulletin.

6.As previously mentioned, these estimates are proxies, given that they taken into account proportionally equal growth across all components, both as regards domestic demand and exports.

SPECIAL ISSUE

Main issues on the sustainability of public finances in Portugal in the medium term

The importance of public debt sustainability

Main issues on the sustainability of public finances in Portugal in the medium term

1. Introduction

At the time of completion of the Economic and Financial Assistance Programme (EFAP), where it is necessary to ensure that sustainable market financing is resumed, it is very important to bear in mind the restrictions that will continue to condition the definition of budgetary policies in the next few years.

Government debt sustainability is required to ensure regular access to market financing, inasmuch as investors will only be willing to finance the State if they have an expectation of repayment of such funds. Hence, this text intends to contribute to clarify the nature and magnitude of financial constraints stemming from the need to ensure a sustainable path for Portuguese government debt.

Based on the latest macroeconomic scenario released by Banco de Portugal, the exercise involves estimating the path of public accounts where hypothetically no budgetary measures would be adopted. The comparison between this no-policy-change scenario with what would result from compliance with the European fiscal commitments assumed by Portugal allows the estimation of the adjustment effort to be achieved over the next few years.

The calculations presented clearly show that notwithstanding a considerable budgetary consolidation effort in the past three years, which made possible to reach a primary balance close to balance, the adjustment of public accounts is far from being complete. In fact, in 2013 the public debt ratio[1] reached approximately 130 per cent of GDP and its sustained reduction requires the accumulation of primary surpluses over a number of years. In addition, the pressures that will affect public accounts in the near future, particularly through the rise in interest expenditure and the elimination of transitory measures, are quite significant.

The estimates obtained point to a required additional adjustment of around 4 pp of GDP by 2019.[2] Around a quarter of this adjustment refers to measures aiming at the replacement of wage cuts in the public sector and the extraordinary solidarity contribution (*Contribuição Extraordinária de Solidariedade – CES*) deducted from pensions. In addition, in a medium to long-term horizon, Portugal will face further pressures from ageing-related expenditure, which will also have to be accommodated.

Projections still show that compliance with European commitments leads the government debt ratio to enter a downward path, albeit quite gradual. Also, saving on interest expenditure resulting from a decline in the debt stock in this scenario has a similar magnitude to the budgetary impact resulting from ageing population, according to the latest projections. European rules are thus the appropriate benchmark for conducting the Portuguese fiscal policy.

The text makes no judgment on specific policy measures. Public expenditure and taxation levels, as well as the composition of expenditure and revenue, are political choices. These choices, however, cannot cease to be compatible with the intertemporal financial constraints faced by the public sector. Recognition by political and social agents of such constraints is key for a realistic and consistent debate on policy options.

This text is structured as follows. Section 2 describes the current European fiscal commitments. Section 3 shows recent developments

in public finances in Portugal and Sections 4 and 5 report calculations for medium to long--term budgetary scenarios.

2. European commitments[3]

The definition of budgetary rules within the scope of multilateral surveillance conducted at the European Union level had always underlying an important role for public debt sustainability (see "Box 1. The importance of public debt sustainability" in this article). Initially, the Treaty on European Union established two criteria to evaluate Member States' public finances. On the one hand, it set forth that Member States should avoid excessive fiscal deficits,[4] a deficit being excessive when it exceeds the reference value. On the other hand, it established that the assessment of compliance with budgetary discipline would be carried out on the basis of a criterion that evaluated the ratio of government debt *vis-à-vis* a reference value. The reference values for the deficit and debt were set down at 3 per cent and 60 per cent of GDP, respectively.[5]

In 1997, the European Council approved the Stability and Growth Pact (SGP),[6] composed by a 'preventive arm' establishing the principles on the reinforcement of the surveillance of budgetary positions and the surveillance and coordination of economic policies, and a 'corrective arm' on speeding up and clarifying the implementation of the excessive deficit procedure. Under the SGP, Member States have committed to ensure budgetary positions that are close to balance or in surplus and to take corrective action to reach the objectives of their stability programmes. They have also approved the possibility of imposing sanctions when a Member State does not take action to correct the excessive deficit.

In 2005 the Council approved a revision to the SGP,[7] aimed "...to enhance the governance and the national ownership of the budgetary framework by strengthening the economic underpinnings and the effectiveness of the Pact, both in its preventive and corrective arms...". Within this scope, Member States had to adhere to a medium-term objective (MTO), which was differentiated to take into account the diversity of budgetary positions. Thus, it was specified a range between -1 per cent of GDP and a situation in balance or in surplus, defined in cyclically adjusted terms, net of one-off and temporary measures (structural balance). The revised SGP introduced as a minimum convergence to the MTO an annual adjustment to the structural balance of 0.5 pp of GDP.

From 2011 to 2013 a set of legislation came into force, to substantially reinforce the multilateral budgetary surveillance mechanisms of EU Member States: the six pack[8] (December 2011), the Treaty on Stability, Coordination and Governance – TSCG (January 2013) and the two pack[9] (May 2013). Article 3 of the TSCG sets out that countries should have a budgetary position that is balanced or in surplus. This rule is considered to be respected if the budgetary position of the Member State is at its MTO, with a 0.5 per cent of GDP structural deficit as lower limit, or 1 per cent of GDP if the public debt is quite below the reference value of 60 per cent of GDP. The TSCG also sets down the obligation for those countries whose general government debt exceeds the 60 per cent reference value to reduce the difference relative to the threshold at an average rate of one twentieth per year as a benchmark. This decline is measured on the basis of the past three years for which there are available data or of the last year in which such data exist and the figures forecast by the European Commission for the two following years. The influence of the business cycle on the pace of debt reduction is also taken into account in the assessment of this criterion. Table 2.1 shows the balance required to reduce the government debt ratio by one twentieth of the difference to the reference value for various levels of the debt ratio

Box 1 | The importance of public debt sustainability

Recourse to public debt is crucial for the functioning of a modern economy, allowing the three tasks usually allocated to the government sector to be carried out: macroeconomic stabilisation, promotion of efficiency and redistribution.

As for the first task, during periods of recession, recourse to government debt allows automatic stabilisers to operate and the introduction of countercyclical discretionary measures. In turn, during periods of economic expansion, reducing public debt prevents the economy from overheating, thereby increasing creditworthiness in subsequent recessions.

Public debt is also a fundamental instrument to promote economic efficiency. In particular, recourse to government debt is essential to fund large-scale public investments that increase economic capacity and welfare, allowing part of the associated costs to be shared between generations. In its absence, public investment would require accumulation of financial means through previous saving, and would consequently be postponed or even foregone.

Access to public credit is therefore essential in a modern economy, but must be managed prudently.

Sustainable public debt requires positive primary balances. A positive primary balance means that part of the resources obtained by the public sector is not used in the provision of contemporaneous public goods and services. In situations of intergenerational balance, this difference is offset by using the capital stock accumulated with past investments. However, the higher the government debt, the larger the primary balance needed to ensure its sustainability, *i.e.* a wider differential is required between current taxes and the contemporaneous public services provided. Where the debt is not used to increase the available capital stock or the investments have low social returns, the differential between taxes paid and public services provided offset by using the capital stock tends to decrease, worsening the difficulties faced in keeping the primary balance compatible with debt sustainability.

Countries with high public debt have more vulnerable public finances in periods of recession. In effect, the share of total resources required to service debt increases in these situations, resulting in constraints in access to funding. These in turn prevent the automatic stabilisers from operating adequately and recourse to debt to fund investment, giving rise to pro-cyclical budgetary policies.

The difficulties associated with high government debt increase the perception of sovereign risk and, consequently, the return required by fund providers. The effect of a rise in risk is non-linear, i.e. an increase in risk premia is abrupt both in terms of duration and magnitude, forcing a sudden adjustment of public finances.

These transmission mechanisms contribute to reduce welfare and economic activity in the event of over-indebtedness. Within this context, some authors have pointed out that high public debt ratios imply a reduction in the economic growth rate (i.e. Reinhart and Rogoff (2009, 2010), Cechetti, Mohanty and Zampolli (2010, 2011) or Kumar and Woo (2010)). More recently, Pescatori, Sandri and Simon (2014) have suggested that the debt trajectory is more important to economic growth than the debt level and that countries with high debt levels may not experience a decrease in economic growth if debt is on a downward path. Although these authors do not establish a transmission mechanism, it should not be ruled out that investors may interpret the downward path of debt as a sign of its sustainability and, as such, of a decrease in the associated sovereign risk.

and nominal GDP growth rates. As an example, for a debt ratio of 130 per cent and 1 per cent nominal GDP growth, the budget balance compatible with compliance with the criterion corresponds to a surplus of 2.2 per cent of GDP. The shaded areas show those cases where the balance has to be higher than the MTO, which for Portugal was set at -0.5 per cent of GDP.[10]

In sum, in terms of European commitments, and as far as the deficit criterion is concerned, Portugal should correct its excessive deficit in 2015 and converge towards the MTO at a pace of at least 0.5 pp of GDP per year. As regards the debt criterion, after the abrogation of the excessive deficit procedure, Portugal has a 3-year transitional period (i.e. up to 2018) to start observing the criterion to reduce the difference of the debt ratio to the reference value at an average rate of one twentieth per year as a benchmark

3. Recent developments in Portuguese public finances[11]

In 2009 and 2010 the general government deficit reached historically high levels of approximately 10 per cent of GDP. After that date, the introduction of several budgetary consolidation measures under the EFAP made it possible to reduce the deficit to levels close to 5 per cent of GDP in 2013. With regard to the primary balance, the improvement was even more substantial, given that there was a considerable rise in the ratio of interest expenditure to GDP. In fact, in 2013 the primary balance was only slightly negative, with a positive value being forecast for 2014.

Since the adjustment of public finances took place amid a significant contraction of economic activity, the underlying budgetary position improved more substantially than shown by the headline total and primary balances. Banco de Portugal's estimates for structural balances, i.e. in cyclically adjusted terms and net of one-off and temporary measures, point to increases by 7.0 and 8.5 pp of GDP for the overall and primary balances respectively, with the structural primary balance reaching a positive value of 1.1 per cent of GDP in 2013. This corresponds to an average improvement in the total structural balance of around 2.3 pp of GDP per year (2.8 in the case of the structural primary balance).

Within the scope of this text, it is worth mentioning that the quantification of the budgetary consolidation effort considers a number of measures presented as transitional at the time they were introduced, and whose implementation was warranted by the financial emergency situation. As an example, it is worth mentioning the wage cuts in the public sector and measures to reduce net expenditure on highest pensions, whose impact on the deficit amounts to around 1 per cent of GDP.

Table 2.1 • Overall balance required to reduce the debt ratio by 1/20 of the difference relative to the reference value

		Public debt ratio to GDP					
		70%	**80%**	**90%**	**100%**	**120%**	**130%**
Nominal GDP growth rate	**1.0%**	-0.2%	0.2%	0.6%	1.0%	1.8%	2.2%
	1.5%	-0.5%	-0.2%	0.2%	0.5%	1.2%	1.6%
	2.0%	-0.9%	-0.6%	-0.3%	0.0%	0.6%	1.0%
	2.5%	-1.2%	-1.0%	-0.7%	-0.4%	0.1%	0.3%
	3.0%	-1.5%	-1.3%	-1.1%	-0.9%	-0.5%	-0.3%
	3.5%	-1.9%	-1.7%	-1.5%	-1.4%	-1.1%	-0.9%
	4.0%	-2.2%	-2.1%	-2.0%	-1.8%	-1.6%	-1.5%

Source: Banco de Portugal calculations.
Note: The shaded cells indicate the different combinations of nominal GDP growth rate and public debt ratio where the overall balance that fulfils the debt criterion is higher than the MTO.

Despite the reversal of past expansionary policies and a considerable budgetary consolidation effort over the past three years, the debt ratio rose by 35 pp in the 2010-13 period, to stand at 129.0 per cent at the end of 2013. Several factors played a role in this evolution. To start with, the deficit accumulated over the period, corresponding to 15.7 pp of GDP, of which 12.6 pp related to interest expenditure. In addition, 14.8 pp of the increase in the public debt ratio stemmed from deficit-debt adjustments, associated to a large extent with the accumulation of financial assets, such as deposits (8.1 pp) or the loans for reinforcing banking system stability (3.9 pp). Finally, the contraction of economic activity between 2010 and 2013 added 4.5 pp to the government debt ratio via the denominator effect

4. The medium-term scenario (up to 2019)

This section builds a no-policy-change scenario that aims at determining public finance developments that would materialise in case new budgetary measures were not adopted, but taking into account the specific dynamics affecting the different revenue and expenditure items. This scenario is based on the model that Banco de Portugal regularly uses in its projection exercises. The methodology used for the cyclical adjustment of budget balances corresponds to that adopted in the Eurosystem.[12]

The macroeconomic scenario underlying fiscal projections corresponds to that shown in this Bulletin, extended until to 2019 in the framework of the same model. The rate of change in nominal GDP converges gradually to 3.5 per cent in 2019, with average growth over the 2015-19 period at 3.2 per cent. Projections for interest expenditure are in line with the procedures normally used in Banco de Portugal's forecasting exercises and, given the return to markets, imply a rise in the average interest rate on government debt from 3.5 per cent in 2014 to 4.2 per cent in 2019. This assumption implies a 0.8 pp rise in the ratio of interest expenditure to GDP in the period under review. With regard to deficit-debt adjustments, a value of zero was assumed for the 2014-19 period. However, a certain decumulation of financial assets will most likely occur over this period and pass through favourably to debt ratio developments.

The macroeconomic scenario is kept unchanged in the exercise. This assumption does not result from considering that fiscal policy has no impact on economic activity. In fact, two reasons warrant such option. The first results from the fact that the macroeconomic model used does not incorporate the financial constraints faced by Portugal. In the model used a tax increase or an expenditure cut are always compared to a situation where the absence of such measure is financed through debt issuance. However, there is no such option, since the country faces considerable financial constraints that are only mitigated by the credibility that results from compliance with international commitments. Hence, in the absence of voluntary budgetary adjustment, lack of liquidity and market access would impose a cash advance regime requiring forced correction, certainly more abrupt and disordered. The second reason is that consolidation is being measured in terms of change in structural balances that, by definition, are cyclically adjusted. Under these conditions, the indirect impact on public finance variables of the change in the macroeconomic scenario, induced, in turn, by budgetary measures, is cancelled out, to a large extent, by the cyclical adjustment.

With regard to assumptions on the remaining budgetary variables assumed in the exercise, the consolidation measures for 2015 included in the 2014-18 Fiscal Strategy Document, whose magnitude amounts to 0.8 per cent of GDP, were not taken into consideration in the exercise. In addition, stress should be laid on the following:

– Revenue from taxes and social contributions evolves according to the

macroeconomic scenario and elasticities normally used in Banco de Portugal's projection exercises.

– Expenditure on pensions grows in line with the number of pensioners, the updating of pensions and a composition effect. With regard to the number of pensioners, assumptions reproduce developments projected under the 2012 Ageing Report for the 2015-20 period, *i.e.* a 4.8 per cent growth. With regard to the updates of pensions, the rule defined in the 2006 reform is assumed to be active again as of 2015. The composition effect, in turn, is based in the recent past developments and assumptions for the number of pensioners. Consequently, the ratio of expenditure on pensions to GDP would increase slightly between 2015 and 2020, along the same lines as the results of the Ageing Report (which presents a value of 0.2 pp of GDP). In addition to this base evolution, account was taken of the phasing out of the extraordinary solidarity contribution between 2015 and 2019.[13]

– The evolution of expenditure on wages and salaries depends on the assumptions regarding the number of general government employees (and the respective composition effect), the updates of the wage scale and a drift that mainly captures the effect of promotions and career progressions. As regards these factors, assumptions point to a decline in the number of civil servants by 0.8 per cent in 2015 and a subsequent stabilisation, updates of the wage scale in line with forecast inflation (ranging from 1 to 1.5 per cent) and a drift corresponding to real economic activity growth. It was assumed, along the lines of expenditure on pensions, that the 2011 and 2014 wage cuts (with an estimated total effect of around 11 per cent of wages) would be gradually phased out between 2015 and 2019.

– Intermediate consumption, excluding the component relating to expenditure on previously shadow toll motorways for which the planning included in the State Budget for 2014 was assumed, evolves in line with real economic activity and inflation.

– Social benefits in kind, covering an important part of general government expenditure on health, are also deemed to grow in line with real GDP and forecast inflation. However, it is important to stress that the reversal of wage cuts was assumed to have an impact on the rate of change of expenditure with the payment of services to corporate hospitals of the same magnitude as the effect considered in wages.

– Gross public investment is expected to grow in line with nominal GDP as of 2015,[14] allowing the public capital stock in 2019 to be slightly higher than the 2014 level.

– The remaining revenue and primary expenditure items, of a more residual nature, essentially grow in line with nominal GDP.

The exercise's starting point is a structural balance of -2.6% of GDP in 2014. In terms of the main results of the no-policy-change scenario, it is important to stress that the structural balance would deteriorate by 2.3 pp of GDP, to stand at 4.9 per cent of GDP in 2019. Of this, 0.8 pp of GDP would result from a rise in interest expenditure. The debt ratio would gradually increase very slightly over the considered period, to reach 132.2 per cent at the end of 2019.

Hence, taking into account the starting point considered and assuming that the minimum convergence effort is achieved, Portugal is expected to reach the MTO in 2019. The annual additional effort corresponds to less than a quarter of that achieved in 2011 to 2013. In addition, in a scenario of fulfilment of the deficit criterion, the actual balance is expected to stand at -0.5 per cent of GDP and the government debt ratio at around 121.5 per cent in 2018. Given that nominal GDP growth

stands at around 3.5 per cent, compliance with the structural balance criterion is sufficient for the fulfilment of the public debt reduction criterion (Table 2.1).

Chart 4.1 identifies the type of pressure on public accounts considered in the exercise. According to these estimates, the main pressures on public accounts in the 2015-19 period will emerge via a rise in interest expenditure and the impact of the phasing out of the wage cuts. As already mentioned, the rise in the ratio of interest expenditure to GDP results from full return of market issuance at less favourable rates than financing under the Programme (reflected in a rise in the implicit interest rate on public debt), but also from the still very high debt stock in the context of absence of correction of budget deficits. Hence, as fiscal adjustment is achieved, the additional effort needed to offset the rise in the ratio of interest expenditure to GDP will necessarily decrease. The remaining impact of a no-policy-change scenario has a less significant magnitude (0.4 pp of GDP) and is partly associated with the effect of a rise in pension expenditure, as already mentioned. The trajectory that allows the compliance on an annual basis with the obligations to reduce the structural deficit until reaching the MTO leads to savings in interest expenditure of 0.4 pp of GDP *vis-à-vis* the no-policy-change scenario. Hence, the total amount of budgetary consolidation measures required for fulfilling the European commitments reaches 4.0 pp of GDP. Among this, around 1.1 pp refer to measures replacing the wage cuts and the extraordinary solidarity contribution on pensions.

5. The long-term scenario (up to 2060)

An analysis of the sustainability of public debt requires a simulation exercise over a longer-term horizon. Under a no-policy-change scenario, it seems reasonable to consider, after 2019, the stability of the primary balance as a percentage of GDP plus the impact on public accounts of an ageing population. In differential terms, projections included in the 2012 Ageing Report were therefore used for expenditure on pensions, health, long-term care and education.[15] In addition, the estimated effect on revenue from social contributions was assumed. Figures used are shown in Table 5.1.

Chart 5.1 shows the path of the debt ratio under a no-policy-change scenario, considering the referred assumptions for primary balance developments and, after 2019, a stabilisation of the rate of change of nominal GDP

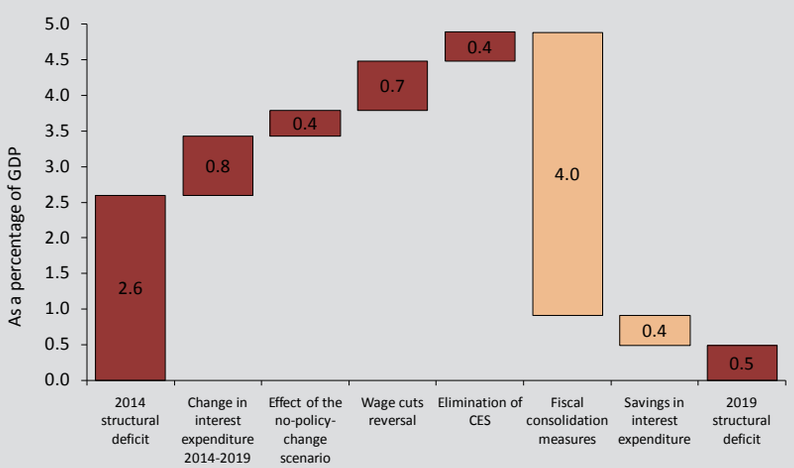


Chart 4.1 • Pressures on public accounts in a no-policy-change scenario

Source: Banco de Portugal calculations.

and the implicit interest rate on debt at 3.5 and 4.2 per cent, respectively, and nil deficit--debt adjustments. As can be observed, the debt ratio would reach 216.7 per cent of GDP in 2060 under these conditions. As regards expenditure on education, a decrease in the number of students does not automatically imply a decrease in expenditure. In effect, the materialisation of these savings would require an explicit decision by policy-makers to close schools and reduce teaching and non-teaching staff. In order to build a no-policy-change scenario, developments in the public debt ratio are also shown without taking into account the savings from education expenditure. Under this assumption, the government debt ratio would stand at 233.3 per cent in 2060.

Under a scenario of compliance with the current European rules, the debt ratio follows a downward trend, fulfilling the criterion for its pace of reduction, with the reference value being reached in 2043 (Chart 5.3). This scenario assumes that, once reached, the MTO would be kept until 2060, which means that ageing-related costs or other budgetary pressures that may arise would have to be offset by measures with an impact of the same magnitude. However, these measures are expected to be not very significant, as savings from interest expenditure derived from a declining debt stock are each year higher than the increase in the deficit derived from an ageing population.[16] This shows that, in principle, compliance with European rules guarantees the future payment of pensions and remaining ageing--related costs, in accordance with the latest projections.

Chart 5.2 also illustrates the impact of postponing budgetary adjustment by three years on developments in the debt ratio. This exercise, which is unlikely to materialise in the current context, would result in an increase in the magnitude and duration of the required adjustment. Indeed, under this scenario, the MTO would only be reached in 2025.

This type of simulation exercise for developments in the public debt ratio has several caveats. One of the most important arises from the fact that it is conducted in partial equilibrium, i.e. within a context where there is no interaction between budgetary variables and the macroeconomic scenario. It is therefore useful to carry out a sensitivity analysis on nominal GDP growth and the implicit interest rate on debt (results are shown in Chart 5.3). According to the simulations, a decrease in the rate of change in nominal GDP by 1 per cent per year from 2019 onwards would lead to an increase of around 15 pp in the debt ratio in

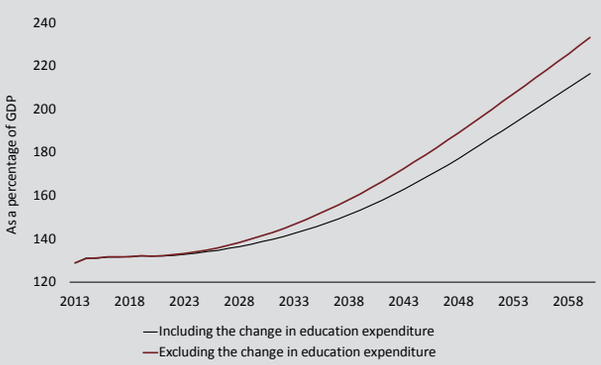
Table 5.1 • Budgetary impact of ageing population

As a percentage of GDP	2010	2015	2020	2030	2040	2050	2060
Pension expenditure	12.5	13.3	13.5	13.2	13.1	13.1	12.7
Health expenditure	7.2	6.5	6.7	7.2	7.7	8.1	8.3
Long-term care expenditure	0.3	0.3	0.3	0.4	0.4	0.5	0.6
Education expenditure	4.7	4.1	3.9	3.5	3.5	3.6	3.7
Social contributions revenue	10.9	11.3	10.6	9.0	8.8	8.6	8.6
TOTAL (Expenditure-Revenue)	**13.8**	**13.0**	**13.9**	**15.3**	**15.9**	**16.7**	**16.7**
Impact in the deficit relative to 2020				*1.3*	*2.0*	*2.8*	*2.8*
Memo items:							
Health expenditure - risk scenario	7.2	6.5	6.8	7.5	8.1	8.5	8.8
Long-term care expenditure - risk scenario	0.3	0.3	0.4	0.5	0.7	1.0	1.3
Total risk scenario	13.8	13.0	14.0	15.6	16.5	17.6	17.8
Difference relative to baseline scenario	*0.0*	*0.0*	*0.1*	*0.4*	*0.6*	*0.9*	*1.2*
Other items not considered:							
Expenditure in unemployment benefits	1.2	1.5	1.3	1.0	0.9	0.8	0.8

Source: European Commission (2012 Ageing Report).

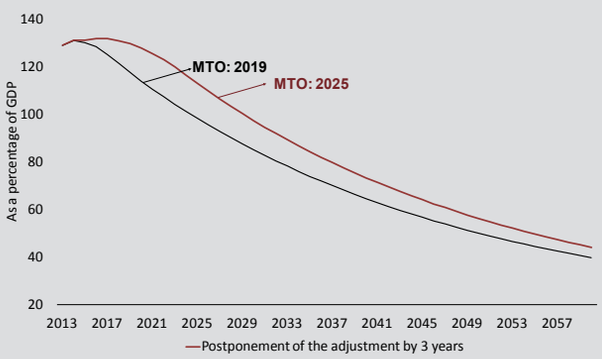
2060, while the symmetric exercise would lead to a decrease of approximately 10 pp in the ratio. The lack of symmetry in results arises from the dynamics of interest payments. As for the implicit interest rate, the sensitivity analysis illustrates the +/-0.5 per cent situation, given that underlying a shock on the average rate is a much more marked change in the marginal rate (i.e. the rate on new government debt issues).[17]

Chart 5.1 • Public debt evolution | Until 2019: No-policy-change scenario; After 2019: Stabilisation of the primary balance as a percentage of GDP and materialisation of the ageing-related fiscal costs



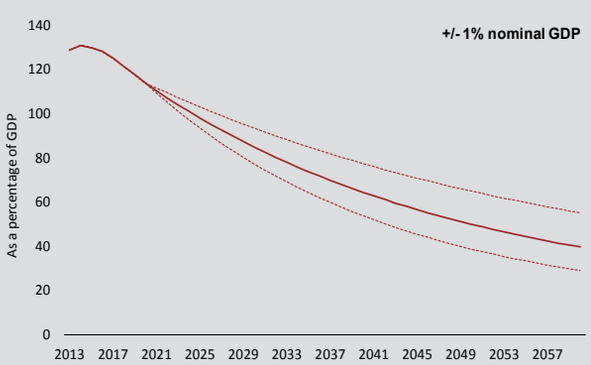
Source: Banco de Portugal calculations.

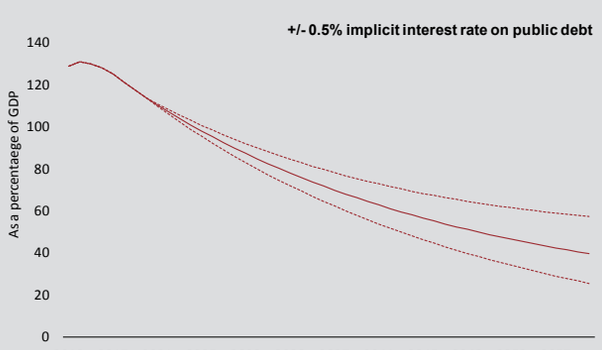
Chart 5.2 • Public debt evolution | Scenario of fulfilment of the European commitments



Source: Banco de Portugal calculations.

Chart 5.3 • Public debt evolution | Scenario of fulfilment of the European commitments: sensitivity analysis





Source: Banco de Portugal calculations.
Note: The scenario up to 2019 is based on the macroeconomic model used at Banco de Portugal. After that year, the exercise assumes a mechanical nature, based on simplified assumptions, allowing a sensitivity analysis.

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Notes

1. Throughout the text the definition of public debt used is in line with the Maastricht concept, i.e. consolidated gross debt of the whole general government sector, at face value and excluding trade credits. In addition, account is not taken of changes emerging from ESA2010, which as regards the debt ratio will have an impact on both the numerator and the denominator.
2. This text was drafted prior to the recent rulings of the Constitutional Court on the measures included in the State Budget for 2014.
3. For further details on the European legislation in force at the fiscal level, see European Commission (2013).
4. Article 104(c) of the Treaty establishing the European Economic Community. This Article was incorporated into the Treaty on the Functioning of the European Union with number 126.
5. Protocol on the excessive deficit procedure.
6. Formally, the Stability and Growth Pact comprises the following documents:
   Resolution of the European Council, 17 June 1997 (97/C 236/01) (OJ C 236, 02/08/1997);
   Council Regulation (EC) No 1466/97 of 7 July 1997 (OJ L 209, 02/08/1997);
   Council Regulation (EC) No 1467/97 of 7 July 1997 (OJ L 209, 02/08/1997);
7. Council Regulation (EC) No 1055/2005 of 27 June 2005 (OJ L 174, 07/07/2005);
   Council Regulation (EC) No 1056/2005 of 27 June 2005 (OJ L 174, 07/07/2005).
8. The six pack is composed of five regulations and a directive. The legal documents are the following:
   Regulation (EU) No 1173/2011 of the European Parliament and of the Council of 16 November 2011;

Regulation (EU) No 1174/2011 of the European Parliament and of the Council of 16 November 2011;

Regulation (EU) No 1175/2011 of the European Parliament and of the Council of 16 November 2011;

Regulation (EU) No 1176/2011 of the European Parliament and of the Council of 16 November 2011;

Council Regulation (EU) No 1177/2011 of 8 November 2011;

Council Directive 2011/85/EU of 8 November 2011.

9. Regulation (EU) No 472/2013 of the European Parliament and of the Council of 21 May 2013;

Regulation (EU) No 473/2013 of the European Parliament and of the Council of 21 May 2013.

10. The exercise assumes that in a medium-term horizon the cyclical component of the balance converges to zero, i.e. the actual and structural balances are identical.

11. For further details on public finance developments in the past few years, see the 2011 and 2012 issues of the Annual Report and the April 2014 issue of the Economic Bulletin of Banco de Portugal.

12. For further details on the implementation of the Eurosystem's methodology in Portugal, see Braz, C. (2006). It is worth mentioning that the value of the structural balance relevant within the scope of European commitments is calculated based on European Commission's methodology. According to the latest European Commission forecasts, the total cyclically adjusted balance amounted to -2.3% of GDP in 2013, compared with -2.7% of GDP in Banco de Portugal's estimates. In addition, in the definition of the structural balance, there may also be differences in the concept of one-off and temporary measures, which are excluded from the computation of this indicator. These differences have played a minor role in the recent past.

13. The extraordinary solidarity contribution is deducted from expenditure on pensions in national accounts.

14. It is also assumed that revenue from sales of buildings, which is deducted from investment expenditure in national accounts, declines gradually.

15. These projections will be revised in the near future, in particular concerning the demographic assumptions, and an increase in ageing-related effects on the budgetary deficit is anticipated.

16. For the 2020 to 2060 period as a whole, the budgetary impact of an ageing population is projected to reach 2.8 pp of GDP, while the decrease in interest expenditure is expected to stand at 3.1 pp of GDP.

17. As an example, the interest rate on new issues would stand at 6.7 per cent, for an increase from 4.2 to 4.7 per cent in the implicit interest rate (assuming that 20 per cent of the debt is repaid per year).

ARTICLES

The 3D Model: a Framework to Assess Capital Regulation[1]

Laurent Clerc[2] | Alexis Derviz[3] | Caterina Mendicino[4] | Stephane Moyen[5] | Kalin Nikolov[6] | Livio Stracca[7] | Javier Suarez[8] | Alexandro Vardulakis[9]

ABSTRACT

This article discusses the contribution of the MaRS WS1 cross-country project, which aims at providing a framework for the positive and normative analysis of macroprudential policies. The analysis relies on a micro-founded model that introduces financial intermediation and three layers of default (3D) into an otherwise standard dynamic stochastic general equilibrium (DSGE) model. A distinctive feature of the model is a clear rationale for capital regulation, which arises as a welfare improving response to excessive risk taking by banks.

1. Introduction

The recent financial crisis questioned the traditional (micro) focus of financial supervision and regulation, and suggested the need to strengthen the preventive (macro-prudential) aspects of financial stability policies. In the spring of 2010, the European System of Central Banks launched a macroprudential research network (MaRS) with the goal of "developing core conceptual frameworks, models and/or tools that would provide research support in order to improve macro-prudential supervision in the European Union (EU)."[10]

This article summarizes the findings of a cross-country project developed in the context of MaRS's primary research topic, that is, macro-financial models linking financial instability and the performance of the economy (WS1).[11] The aim of this project is to build a decision-support tool that provides analytical feedback to policymakers regarding the positive and normative analysis of macroprudential policy, with a specific focus on capital requirements (CRs).

We develop a micro-founded model that introduces financial intermediation and positive equilibrium default rates into an otherwise standard DSGE model. The model economy is populated by households, entrepreneurs and bankers. Borrowing households borrow from banks to buy houses, whereas savers supply deposits to banks. Bankers allocate both their scarce wealth (inside equity) and the funds raised from savings households across two lending activities: mortgage lending to borrowing households and corporate lending to entrepreneurs. Borrowing by households, corporations, and banks features default risk due to the combination of idiosyncratic and aggregate factors. As in the costly state verification setup of Gale and Hellwig (1985), defaults cause deadweight losses.

Households and firms leverage is an endogenous multiple of their net worth. In contrast, banks, which are assumed to obtain their outside funding in the form of government-guaranteed deposits, have their leverage limited by a regulatory capital requirement. Importantly, in spite of the presence of deposit insurance, we assume that depositors suffer some transaction costs if banks fail. This generates a risk premium that acts as an important source of amplification when bank solvency is weak.

The normative results of the project rely on an explicit welfare analysis. Our results document that:

• Large gains from rising CRs when bank risk of failure is significant. Deposits are formally insured, providing an implicit subsidy to lending made by risky banks. Thus, there is a clear rationale for capital regulation, which arises as an optimal response to excessive risk taking by banks;

• Bank-related amplification channels are strong and CRs are effective in shutting them down. In particular under the optimal CRs the economy mimics the behavior of a no bank default economy;

• Countercyclical adjustments mitigate the impact of shocks with high CRs (or low bank risk), but are otherwise counterproductive.

A number of recent papers has focused on introducing bank frictions into otherwise standard dynamic stochastic general equilibrium models (*e.g.* Gerali, *et al.*, 2010; Gertler and Kiyotaki, 2010; Gertler and Karadi, 2011; Meh and Moran, 2010).[12] Most studies overlooks the (harmful) macroeconomic consequences of borrowers' default, including that of banks. Some papers rule out the possibility of default through appropriately chosen financial contracts, as in Kyiotaki and Moore (1997), others allow for default in equilibrium but assume that the losses from default can be completely hedged, as in Bernanke, Gertler and Gilchrist (1999). Therefore, default exists but does not harm at least ex post. Our framework differs from previous models, in that it incorporates a central role for default. Default risk arises from both aggregate and idiosyncratic risk. Contracts are incomplete in that they cannot be made fully contingent on aggregate variables. Thus, default impinges on the balance sheet of the lenders, influencing their optimal behavior and thereby macroeconomic outcomes. This allow us to explore the consequences of default on financial stability and, subsequently, on the real economy.[13] This project focuses on bank capital regulation, the key microprudential policy, that it is arguably also one of the main tools for macroprudential policy.

This article is organized as follows. Section 2 describes the key ingredients and the sources of financial instability embedded into the model. Section 3 comments on the results of three policy experiments and Section 4 concludes.

2. Overview of the 3D Model

We develop a theoretical model which aims to provide a framework for the positive and normative analysis of macroprudential policies. The main features of the model are: financial intermediation takes center stage; there is a clear channel through which financial instability imposes costs on the real economy; positive equilibrium default rates exist for all classes of borrowers (households, firms and banks); there is an explicit welfare analysis of regulatory tools. In what follows, we provide in-depth descriptions of these features.

2.1 Model Details

Chart 2.1.1 presents the structure of the economy.[14] The economy is populated with two dynasties of households which provide risk sharing to their members: patient and impatient. All households consume non-durable goods, invest in housing, and supply labor to the production sector. The members of the two dynasties differ in their discount factor. This type of ex-ante heterogeneity generates credit flows into the economy.[15] Impatient households (borrowers) have

a lower subjective discount factor, which, in equilibrium, generates an incentive to anticipate future consumption to the current period through borrowing. These households borrow from banks to buy houses and optimally decide to default if their house is worth less than their mortgage repayment. Patient households (savers) supply deposits to the banks.

Entrepreneurs are risk neutral agents that own the stock of physical capital. They borrow from corporate banks in order to finance part of their investment in capital. Default occurs if their assets are worth less than their loan repayments.

Bankers are also risk neutral agents that provide inside equity to banks. They allocate inside equity and funds raised from saving households across two lending activities: mortgage lending to borrowing households and corporate lending to entrepreneurs. Banks operate in a perfectly competitive market. All banks enjoy deposit insurance and are subject to regulatory capital requirements. A bank defaults if its loan portfolio is worth less than deposit repayments.

The model features three sectors of production: non-durable goods, physical capital and housing. All sectors of production are standard. Consumption goods are produced by firms that combine capital rented from entrepreneurs and households labor. The production of new capital involves investment adjustment costs, as in Christiano *et al.* (2005). The production of housing is assumed to be similar to the production of physical capital. All firms operate in a perfectly competitive market and are owned by the patient households.

The policy tools present in the model are steady-state capital requirements, counter-cyclical capital buffers and risk weights.

2.2 Sources of Systemic Risk

Default plays a key role in the model. The external financing from all borrowers, including banks, takes the form of non-contingent (non-recourse) loans which are subject to default risk due to borrowers' exposure to both idiosyncratic and aggregate risk factors. For instance, bank default risk arises from imperfect diversification of the loans portfolio (idiosyncratic risk), and also from aggregate real and financial shocks that affect asset prices and the default risk of borrowers (aggregate risk). Defaults are costly in terms of aggregate economic resources.

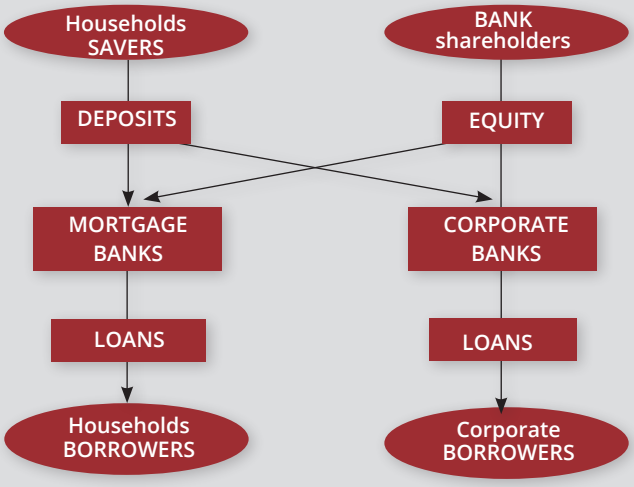


Chart 2.1.1• Structure of the Economy

Source: Authors' calculations.

Aggregate (exogenous) shocks that hit the model economy are amplified through two main channels: a bank capital amplification channel and a bank funding costs amplification channel. Equity funding required to satisfy the capital requirements is exclusively provided by bankers whose wealth comes from retained earnings (bank capital channel). Thus, the aggregate shocks that increase the likelihood that borrowing households and entrepreneurs default reduce bank capital. This limits the supply of bank credit, contributing to a further deterioration of the real economy and creating more defaults which further reduce bank capital. Aggregate shocks that destroy bankers' net worth cause the amplification and propagation of shocks.

Despite the presence of deposit insurance, depositors suffer transaction costs when banks fail. Depositors therefore charge banks for the perceived risk of bank failure (funding cost channel). Shocks that lead to a reduction of bank capital also increase banks' default probability. The fear of bank defaults raises bank funding costs, leading to a further deterioration in the real economy and thus, to an increase in banks' defaults.

The model demonstrates the operation of three interconnected net worth channels, all of which create the potential for amplification and propagation noted in various strands of the existing literature (including the channel operating through the price of housing, *i.e.*, the collateral used by the borrowing households) , as well as distortions due to deposit insurance. While limited net worth typically leads to under-investment, the subsidization linked to deposit insurance creates the potential for an excessive supply of bank credit. Indeed, deposits are formally insured, providing an implicit subsidy to lending made by risky banks. Lending and defaults in the economy turn out to be excessive because bailout expectations increase the willingness of banks to lend cheaply. This implies excessive bank leverage and greater amplification in response to shocks.

3. Policy Exercises

The model presented above is suitable for a non-trivial welfare analysis of requirements imposed on bank lending activity, which is likely to be the core of macroprudential policy. In the following, we summarize the findings of three policy exercises.

For an illustration purpose, we parameterize the model such that it features a leverage of entrepreneurs and households of 70% and 75%, respectively. The annualized default rates by banks, entrepreneurs and households are about 2%, 3% and 0.35%, respectively. Capital requirements on corporate loans are 8% and a risk weight on mortgage loans is 50%. Note that the mechanism of the model is not affected by a particular parameterization, whereas the exact quantitative details strongly depend on the model calibration.

3.1 Higher Steady-State Capital Requirements

What are the macroeconomic and welfare effects of a permanent increase in the capital ratios? We address this question by relying on the model's long-run implications (deterministic steady state) of an increase in the CRs, beginning with the baseline CR of 8% on corporate loans and 4% on mortgage loans.

Chart 3.1.1 reports the social welfare gains as a function of the level of CRs. Social welfare gains are the weighted average of the steady state welfare gains experienced by each group of agents (saving and borrowing households, entrepreneurs and bankers). The weights are equal to the steady-state consumption share of each group of agents. The individual welfare gains are expressed in terms of consumption-equivalent measures, *i.e.*, the percentage increase in steady-state

consumption that would make welfare under the baseline policy (capital requirements on corporate loans of 8% and on mortgage loans of 4%) equal to the welfare level under the alternative CRs.

Chart 3.1.1 documents the sizable social benefits from increasing bank capital from low levels as well as the limited social costs of relatively high bank capital levels. CRs higher than the baseline levels correct the risk-taking incentives of banks and, thus, reduce both bank leverage and the risk of bank failure. A lower risk of bank failure increases the households' perception of safer banks, mitigating the intensity of the bank funding cost channel. The reduction in the cost of deposit together with a reduced social cost of default (bankruptcy cost) have a positive effect on the economy, which initially dominates. However, when bank default is close to zero, the negative effects stemming from the reduction in the supply of credit to the economy weakly dominate.

3.2 Shock Amplification under Different Capital Ratios

How are shocks transmitted under alternative capital ratios? To address this question, we hit the economy with a large depreciation shock, *i.e.*, a shock to the stock of housing and physical capital that implies a persistent collapse in both asset prices. We then explore the economy's response under different capital ratios (high vs low). For the transmission mechanism of other shocks, see Clerc et al (2014).

Chart 3.1 (left panel) reports the response of GDP under the optimal CRs (dashed line) as well as under the baseline CRs (starred line). It also displays the behavior of the model economy in the case of no bank default (solid line). This latter case assumes that banks are not subject to idiosyncratic default risk. Higher capital requirements (dashed line) mitigate the effects of the large decline in asset prices. Further, the economy mimics the dynamics of a no bank default economy.

The right panel of Chart 3.1 reports the response of the economy under low and high CRs in a high financial distress scenario, *i.e.*, 20% larger volatility in the idiosyncratic default risk of banks w.r.t. baseline. Banks that are subject to high financial distress exacerbate the negative effects of the shock. As a result, under the baseline CRs (starred line) the model displays substantial amplification. It is important to highlight that even in the case of high financial distress, higher CRs make the economy behave similarly to a no bank default economy.

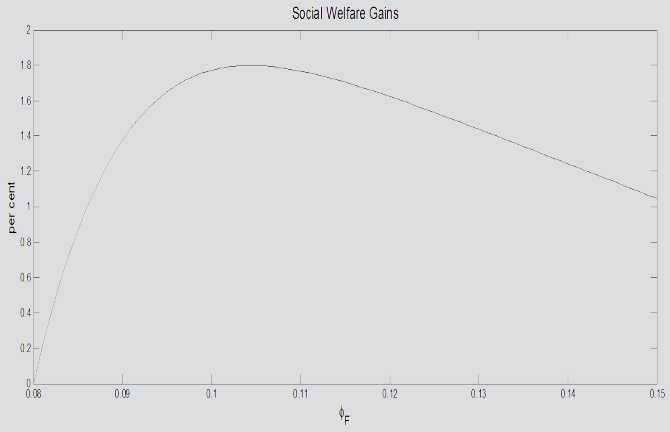


Chart 3.1.1 • Social Welfare Gains w.r.t. capital requirements on corporate loans (ΦF), where capital requirements on mortgage loans are ΦH =0.5 ΦF

In percentage points

Source: Authors' calculations.

3.3 CCB Release at Different Steady-State Capital Ratios

Can a capital ratio reduction help in a crisis? Chart 3.3.1 reports the response of GDP to a depreciation shock under constant CRs (dashed line) like in the previous analysis, and under CRs that are cyclically adjusted (solid line). In this latter case, the capital requirements vary according to the percentage deviation of total credit from its steady state level, in a symmetric fashion, with a coefficient of 0.3. We consider the behavior of the economy under low CRs (left panel) and high CRs (right panel).

Allowing for adjusting CRs in response to adverse shocks mitigates the reduction in credit supply but at the same time increases the risk of a bank default and the cost of funds for banks. Overall, we find that under high CRs, CRs that are cyclically adjusted result in a policy improvement. By contrast, a reduction in the capital ratio after a bad shock does not help to maintain economic activity under low CRs. When large negative shocks hit an economy with poorly capitalized banks, the positive effects of a more limited tightening in credit supply are somewhat beneficial in the short run, but the negative effects of greater risk of banks default dominate in the medium/long run.

4 . Summary

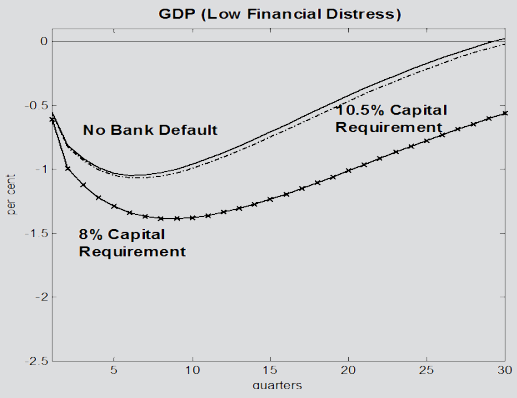
The model developed by Clerc *et al.* (2014) analyzes the effects of capital requirements on the steady state and on the transmission of shocks. A distinctive feature of the model is default risk for different types of borrowers and a clear rationale for capital regulation, which arises as a welfare improving response to excessive risk taking by banks.

Shock propagation and amplification is very large when bank risk is high and/or bank capital is low. High capital requirements eliminate the extra shock propagation coming from bank defaults.

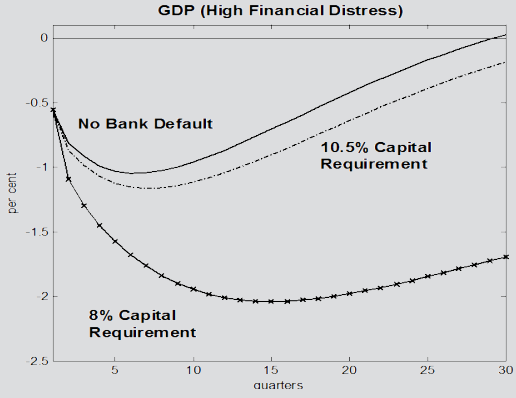
Countercyclical response is only beneficial when high capital requirements are in place.

The model can be extended to allow for the possibility of securitization and liquidity risk (*e.g.* in the form of interim funding shocks suffered by banks). These extensions may allow for the

Chart 3.1 • GDP response to depreciation shock under alternative CRs and low (left panel) and high (right panel) financial distress | In percentage points



Source: Authors' calculations.



Source: Authors' calculations.

expansion of the analysis to the regulatory treatment of securitization, liquidity regulation, and the assessment of lending of last resort policies. While the basic model belongs to the class of non-monetary models, introducing nominal rigidities and a meaningful role for monetary policy constitutes a natural third possible extension that would allow us to assess the interactions between macroprudential policy and monetary policy.

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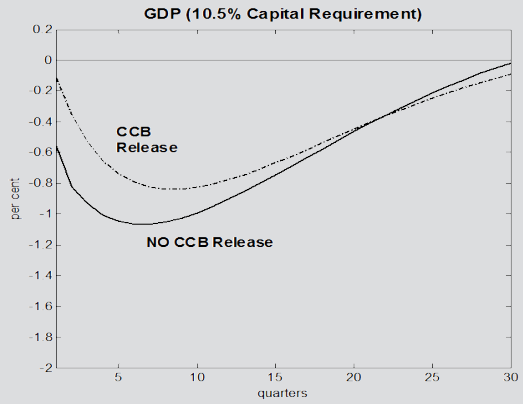
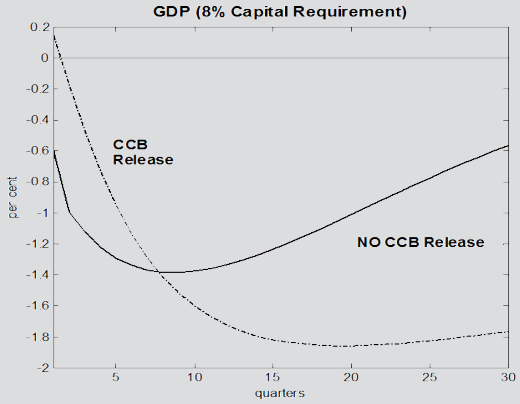
Chart 3.3.1 • GDP response to depreciation shock under constant CRs (starred line) or countercyclical adjustments of the CRs (dashed line) for low (left panel) and high (right panel) CRs



Source: Authors' calculations.



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Notes

1. This article builds upon the joint paper entitled "Capital Regulation in a Macroeconomic Model with Three Layers of Defaults". It also relates to the Banque de France, joint article "Macroprudential Capital Tools: Assessing their Rational and Effectiveness" (Financial Stability Review, 18, April 2014). The analyses, opinions and findings of this article represent the views of the authors, which are not necessarily those of the European Central Bank, the Eurosystem of Central Banks, the Banco de Portugal or any of the institutions with which we are affiliated. We thank Dominik Supera for his excellent research assistance.

2. Banque de France, Financial Stability Department.

3. Czech National Bank

4. Banco de Portugal, Economic and Research Department. Corresponding author.

5. Deutsche Bundesbank, Research Department.

6. European Central Bank, DG Research.

7. European Central Bank, DG International.

8. CEMFI.

9. Federal Reserve Board of Governors, Office of Financial Stability..

10. See http://www.ecb.europa.eu/home/html/researcher_mars_en.html.

11. The MaRS network conducted research in the following three areas: macro-financial models linking financial stability and the performance of the economy (WS1); early warning systems and systemic risk indicators (WS2); assessing contagion risks (WS3).

12. For a survey, see also the report of the Mars research network. See http://www.ecb.europa.eu/home/html/researcher mars.en.html

13. For a discussion on the importance to introduce default in macro-models, see Geanakoplos (2011) and Goodhart, Tsomocos and Shubik (2013).

14. For the mathematical formulation of the model see Clerc *et al.* (2014).

15. This modeling feature has been introduced in macro models by Kiyotaki and Moore (1997) and extended by Iacoviello (2005) to a business-cycle framework with housing investment.

Financial frictions and shock transmission: the Portuguese case[1]

Gabriela Castro[2] | Ricardo M. Félix[2] | Paulo Júlio[2] | José R. Maria[2]

ABSTRACT

This article uses the *PESSOA* model to assess the macroeconomic impact of two relevant shocks that conditioned the Portuguese economy in the recent past: the fall in external demand and the rise in sovereign debt risk premium. *PESSOA* is a general equilibrium model, calibrated to incorporate the main features of the Portuguese economy. The recession driven by the external demand shock is magnified by the prevalence of financial frictions, in particular due to the drop in investment, which does not occur in the case of the risk premium shock. Financial frictions increase the persistence of recessionary effects, especially in the external demand shock, to the extent that capital holders experience a persistent reduction of their net worth, which increases the degree of leverage, the risk levels associated with investment projects, and the costs of external financing. Results show also that the recession causes a decrease in fiscal revenues in both shocks, and thus fiscal policy must take a restrictive stance to ensure the stability of public debt in the medium and long term.

1. Introduction

Over the last decade, the Portuguese economy has been affected by several events which shaped its evolution. These events are usually termed in the literature on economic models as shocks.

This article analyses the impact of two external shocks on the Portuguese economy: the sudden contraction of global economic activity and international trade flows at the end of 2008; and the increased cost of sovereign debt from mid-2010. The analysis of these shocks is of particular importance, given their magnitude and the evidence of their impact on the Portuguese economy. Additionally, these shocks are clearly exogenous and thus independent of contemporary economic policy decisions of authorities. This allows to threat them as structural shocks – a crucial feature for the interpretation of the role of these shocks on economic developments and on the decisions of policymakers, including decisions on fiscal policy.

This article uses a general equilibrium model for a small euro-area economy – the *PESSOA* model (see Almeida *et al*., 2013) – to explore the main transmission mechanisms of the above-mentioned shocks. The model is endowed with a financial block that allows the analysis of the role of financial frictions in the transmission of shocks. The analysis therefore attaches a particular importance to the financial mechanisms in the transmission of these shocks to real variables, by taking into account the role played by the international financial crisis and the financial markets fragmentation observed in the euro area.

The next section motivates the analysis. Section 3 presents briefly the *PESSOA* model and analyses the impact of shocks to external demand and to the sovereign risk premium on the Portuguese economy according to the model. Section 4 concludes, presents the limitations of this analysis, and suggests possible topics for future research.

2. Motivation

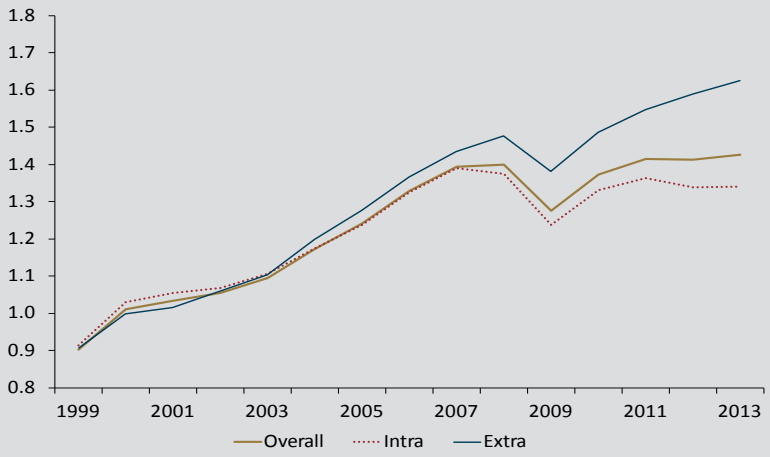
The evolution of the world economy in the 2003-2013 period was marked by a series of unanticipated events as rich and vast for economic analysis as disturbing to the smooth functioning of global economic relations. Within that period, special mention should be placed on the years following the outbreak of the international financial crisis in 2007, commonly known as the Great Recession, which constitute the most comprehensive and prolonged period of crisis since the Great Depression of the 30s of the twentieth century. The Great Recession occurred after a period of over two decades of seemingly harmonious functioning of developed economies – the Great Moderation – which was marked by relatively short and confined periods of crisis.

The onset of the Great Recession was marked by the outbreak of the international financial crisis in the United States of America (US) in mid-2007. This crisis challenged the financial system credibility, primarily in the US, and at a later stage in most developed economies. Against a background of exacerbated uncertainty, the bankruptcy of Lehman Brothers marked a period of great instability which was quickly transmitted to the real economy. The increased perception of risk by financial market participants, as well as falling confidence levels, led to a sharp decline in economic activity.

The collapse of the global economic activity led to a fall in trade flows, with strong impact in developed economies and in the main trading partners of Portugal. For a small open economy, with a strong trade exposure to euro area countries, as is the case of Portugal, the transmission of this shock was immediate, affecting exports directly and, hence, economic activity and employment levels. For the Portuguese economy, this was a shock without parallel in the history of Portugal's participation in the European project.

Chart 2.1 shows the evolution between 1999 and 2013 of an indicator that measures the external demand for Portuguese goods and services. As shown, external demand fell sharply in 2009, both in intra- and in extra-euro area markets. Despite the slight recovery, external demand from euro area countries in 2013 was still below that recorded in 2007. On the contrary, economies outside the euro area, with emphasis on emerging market economies and developing countries, experienced a rapid recovery immediately after the collapse of international trade in late 2008 and early 2009. This pattern of global economic growth is particularly unfavourable for an economy with high exposure to euro area trading partners, as is the case of the Portuguese economy.

Chart 2.1 • Foreign demand of Portuguese goods and services | In logs (1989=0)



Sources: ECB and authors' calculations.
Note: Annual data.

The economic contraction described above had a marked global nature, having affected most of the developed economies. However, the increase in risk perception by financial market participants had clearly heterogeneous impacts with regard to the reassessment of risk pricing, which reflected abruptly in the financing costs of some euro area economies, whose structural fragilities were highlighted by the recession.

Euro area economies, which abdicated from having own currencies and from defining independent monetary and exchange rate policies, have benefitted during the first ten years of participation in the euro from favourable financing conditions and from a framework of macroeconomic stability provided by the credibility of the euro. In this context, the accumulation of a set of macroeconomic imbalances resulting from the structural fagilities was not reflected in the interest rates on sovereign debt in an obvious manner over a prolonged period. The money market functioned smoothy and the monetary policy transmission was regular. This situation, perceived as given by resident agents, changed abruptly in a framework marked by a new risk perception of financial market participants associated with an increase in the materialization of credit risk. In an initial stage this involved a rapid increase in sovereign debt interest rate differentials of countries with structural fragilities (Ireland, Greece, Portugal, Cyprus, Italy and Spain) against countries with stronger economic fundamentals (notably Germany). The increase in interest rates on sovereign debt in euro-area economies with fragilities was accompanied by the emergence of financial tensions, in particular the loss of access by banks of these countries to international wholesale funding markets, which determined the transmission of sovereign risk to the private sector, with incidence on the funding conditions of non-financial corporations.

The intensification of the sovereign debt crisis throughout 2010, particularly following the request for international financial support by the Greek government, determined the loss of access to market funding by some sovereign states that experienced significant increases in debt in previous years, including Portugal. Interest rates of sovereign debt ceased to reflect solely the underlying risk of default (e.g. incorporating a premium due to the low liquidity of these securities). The loss of regular access to market financing entailed the need to resort to a financial assistance program, with the cost of public sector borrowing starting to be determined by lending rates of international institutions, particularly the International Monetary Fund (IMF) and the European Union (EU).

The evolution of interest rates implied in the public debt of Portugal and of the euro area, which reflect effective funding costs, showed a significant increase in the spread after 2010 and a close proximity in the proceeding period (see Chart 2.2). This article analyses the impact of the rising cost of public sector funding, based on the spread between these interest rates, which recorded a remarkable increase in 2010, followed by a reduction over the two subsequent years.

3. The *PESSOA* model

The *PESSOA* model is a general equilibrium model designed to incorporate the key features of an euro-area small open economy. In this context, it is assumed that domestic shocks do not impact the external environment, as in Adolfson *et al*. (2007), nor affect the monetary policy decisions of the European Central Bank (ECB). The stability of the economy in nominal terms is ensured by the assumption of perfect credibility of the inflation target, set exogenously by the ECB. The integration in the monetary union implies that the nominal exchange rate is irrevocably fixed, assuming perfect credibility. The dynamic stability of the model is ensured by the reaction of international trade flows to fluctuations in the real exchange rate.

The *PESSOA* model follows closely the Global Integrated Monetary and Fiscal Model (Kumhof, Muir, Mursula and Laxton, 2010). The model is intrinsically neo-Keynesian, whereby the functioning of labour and product markets is based on the assumption of monopolistic competition and nominal rigidities in wage and price determination. The model also includes real rigidities that allow for realistic responses of investment and imports. The model version used herein incorporates a financial sector that interacts with the rest of the economy, particularly through the decisions of those agents responsible for the acquisition of capital goods – the entrepreneurs.

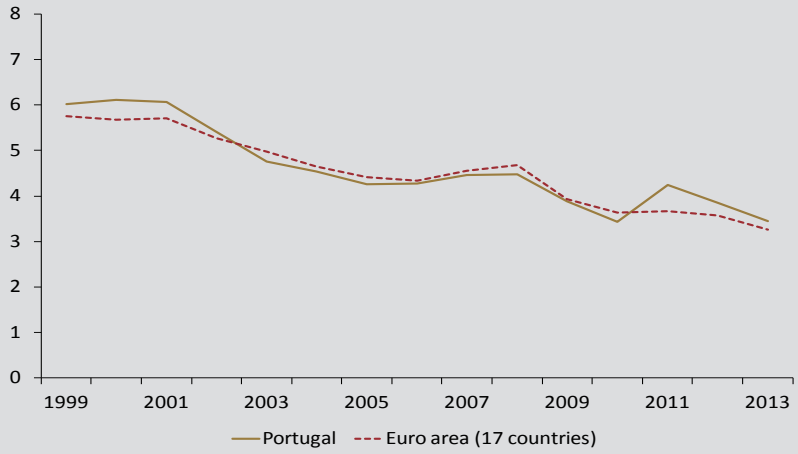
Section 3.1 outlines the *PESSOA* model. Almeida *et al*. (2011) contains an identical description, though without reference to the financial sector, while Almeida *et al*. (2013) contains a detailed description, including the derivation of all equilibrium conditions of the model. Section 3.2 presents in a stylized manner the shocks analysed in this article, namely the decline in external demand for Portuguese goods and services and the sharp rise in the sovereign risk premium (in line with the empirical evidence presented in section 2). Shocks are not anticipated by economic agents, so their occurrence is a surprise. Once the shocks occur, perfect foresight is assumed on its future path. Finally, section 3.3 presents the macroeconomic impacts of these shocks, identifying the contribution of financial constraints for their transmission and interaction with the real variables of the economy.

3.1. Presentation of the model

Figure 3.1.1 shows the *PESSOA* model in a flowchart. Economic agents operating in the non-financial sector of the economy establish among themselves a relationship involving flows of labour, intermediate goods and final goods, as well as income flows (compensation of employees, dividends, taxes, transfers from government to households).

The decisions of economic agents are conditioned by an external environment, which, as noted, remains unchanged despite domestic shocks. For sake of simplicity, it is assumed that the external environment corresponds to the remaining countries of the euro area. The relationship of the domestic economy with the foreign economy includes flows of imports and exports of goods and services as well as financial flows associated with transactions of assets/debt.

Chart 2.2 • Interest rates implied in the Portguese and Euro Area public debt | In percentage



Sources: Eurostat and authors' calculations.
Notes: Annual data. Interest rates were computed by taking into account gross consolidated public debt in euros and interest payments including swaps and FRA. Euro area data considers 17 countries.

The *PESSOA* model is a dynamic model that evolves towards a well-defined equilibrium labelled "steady state". The economy is in a stable and lasting equilibrium in the steady state, in which inflation is stabilized and economic growth depends only on technological progress, in a context where it is assumed that there is no population growth. Given an exogenous shock in a given period t, for example an unexpected fall in external demand, the economy deviates from the steady state that existed in period $t-1$ (hereinafter "initial steady state") and starts to reflect the set of decisions of economic agents in periods t, $t+1$, $t+2$,... In a general equilibrium framework, demand equals supply in all markets and in all periods; however the endogenous variables of the model will adjust in all periods, reflecting the decisions of economic agents as a result of the shock. The economy only stabilizes in the new steady state after the dissipation of the impacts of all shocks. The model's endogenous variables stabilize in levels that may or may not correspond to the initial steady state, depending on the type and nature of the shock.

The transitional equilibria always results from the optimizing behaviour of agents, which use all available information and anticipate future developments in relevant variables. In the case of temporary shocks, as discussed in this article, the final steady state coincides with the initial one, and only the transitional dynamics of the economy is affected. The characterization of the economy in the period between the onset of the shock and the stabilization around the new steady state depends crucially on the shock duration and on the adjustment conditions of the economy (degree of nominal and real rigidities, degree of market competition, prevailing financial constraints). The mechanisms that ensure the dynamic stability of the model, *i.e.*, the convergence to a well-defined steady state, are essentially based on the adjustment of prices and wages, which determine at all times the real exchange rate and in interaction of this adjustment with trade and financial flows with the rest of the euro area.

Households have finite life with random duration in *PESSOA*, facing an instant probability of death, independent of age, in line with the overlapping generation model proposed by Blanchard (1985) and Yaari (1965). Through an insurance contract, the surviving households divide among themselves, at all times, the assets of the households that pass away. The modeling setup includes a wage income profile which translates into adjusted labour-productivity earnings of each generation, assuming that younger generations are more productive than older generations (a constant productivity decay rate throughout life is considered). Households derive utility from consumption

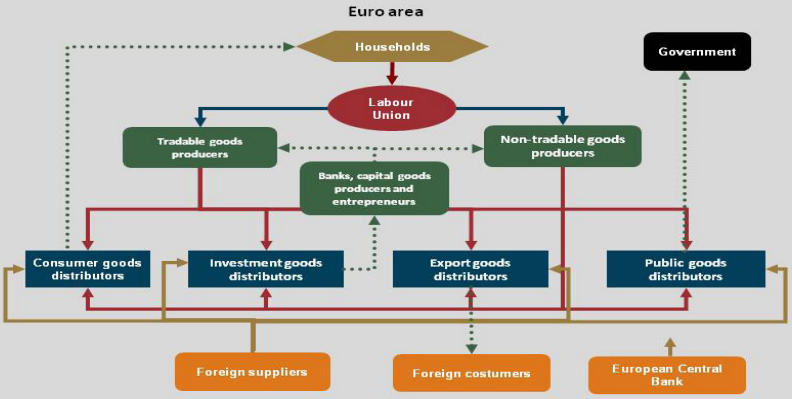


Chart 3.1.1 • The *PESSOA* model

Source: Made by the authors.

and leisure, through a utility function with constant relative risk aversion. There are two types of households in the model: the assets/liabilities holders, which perform intra- and inter-temporal optimization, smoothing consumption; and those which simply perform intratemporal optimization, in line with Galí, López-Salido and Vallés (2007). This distinction is not however significant to frame the relevant transitional equilibria analysed in this article.

"Labour unions" are agents that operate in a context of monopolistic competition in the labour market. Unions give workers bargaining power, enabling them to obtain a wage higher than their marginal rate of substitution between consumption and leisure, thus giving rise to a wage premium. The model incorporates wage rigidities in the form of adjustment costs associated with wage changes.

The non-financial sector of *PESSOA* incorporates firms producing intermediate goods (tradable and non-tradable), which use labour and capital. The production function assumes a constant elasticity of substitution between production factors. In turn, firms producing final goods use intermediate goods and imports to produce final goods demanded by the various agents in the economy (consumer goods, investment goods, goods for public consumption and export goods). Each agent in the economy demands a different type of final good.

The Government sets the public consumption level and performs transfers to households. Revenues stem primarily from tax collection. Although transfers from EU can also be considered, this article assumes that these remain unchanged. Government spending and revenues need not to be equal over time, and the Government may incur in budget deficits or surpluses. In this context, the tax collection can be deferred through the issuance of public debt, which gives rise to interest payments associated with the stock of outstanding bonds (held by households with access to asset markets). The interest rate on sovereign domestic debt i_t may differ from the interest rate that prevails elsewhere in the euro area i_t^* though a sovereign risk premium φ_t. More precisely,

$$i_t = \varphi_t \; i_t^* \tag{1}$$

It is considered in this article that tax rates on labour income (including income tax and social contributions paid by employees and firms) will be determined endogenously in order to maintain unchanged, in the steady state, the public debt-to-GDP ratio. The remaining tax rates, particularly on household consumption and on corporate income, remain exogenous and do not change.

It is assumed that all bonds issued by the Government are held by domestic households, which may, however, borrow abroad. Given that the domestic economy is sufficiently small, changes in its international investment position (IIP) have no impact on the euro-area interest rate. Contrary to models that consider infinitively-lived agents, the IIP in the long run is determined endogenously in models with finite lifetimes as *PESSOA* (Frenkel and Razin, 1996; Harrison *et al*., 2005). Besides household borrowing from abroad, IIP is determined by external transfers and by the trade balance. This article highlights the behaviour of domestic exports Y_t^X, which depends on the following demand curve,

$$Y_t^X = \alpha^{A^*} \left(\frac{P_t^X}{P^*} \right)^{-\xi^{A^*}} Y_t^{A^*} \tag{2}$$

where α^{A^*} is a parameter associated with the production technology in the rest of the euro area,

P_t^X is the price of domestic exports, P^* is the exogenous price that prevails in the rest of the euro area, and $Y_t^{A^*}$ is the external demand for domestic goods. The parameter ξ^{A^*} measures the elasticity of substitution between domestic and foreign goods. It should be noted that the (exogenous) external variables include an asterisk (*) and that α^{A^*} and P^* remain unchanged.

Finally, the financial sector includes agents that will be labelled as "banks and entrepreneurs". The modeling of such agents, which interact closely with the producers of capital goods, closely follows the approach suggested by Bernanke, Gertler and Gilchrist (1999). Banks are relatively passive financial intermediaries, whose main function is to intermediate funds between households and entrepreneurs. Households are indifferent between making deposits in banks or purchasing public debt, as the interest rate received by them is equal in both cases. Banks, in turn, charge an interest rate conditional on the state of the economy, which will be determined in all periods. It is assumed that the banking sector operates under perfect competition, so the interest rate implies ex-post zero profit in all periods. The interest rate charged by banks effectively depends on several factors, including the success of financed projects, which are subject to the uncertainty associated with each project, as well as all aggregate shocks that affect the economy's operating conditions.

Entrepreneurs are agents with insufficient net worth to finance their optimal capital levels. They are involved in risky activities, since each of them is unaware if their projects are sufficiently productive to honour the lending contract signed with the bank. If the project is sufficiently productive, the bank receives a contractually agreed share and the entrepreneur gets the remaining part. If the project is not sufficiently productive, the entrepreneur declares bankruptcy and hands over the capital to the bank. This amount will thus be insufficient to fulfil the established lending contract; in addition, the bank can only recover a share of that value. This cost, labelled the monitoring cost, has a positive and direct correlation with the level of financial frictions in the economy.

In all periods there are a number of bankruptcies in the economy, reflecting the risk associated with ongoing projects. A bank may record losses with a particular entrepreneur, but given that it assumes a fully diversified portfolio of projects, the zero profit is assured by charging an appropriate rate of interest to all projects in the portfolio that prove sufficiently productive so as to cover losses on projects that failed. This interest rate is naturally higher than the one associated with the sovereign debt, which is the rate at which the bank can borrow from households. After obtaining enough external funds, the entrepreneur purchases in each period capital from capital goods producers, immediately renting it to firms producing intermediate goods, which demand this production factor (in addition to labour).

The credit market functioning incorporates a mechanism – usually called "financial accelerator" - with implications for the propagation and amplification of shocks. The mechanism translates into an endogenous association between external finance premium and net worth. Given the need for bank loans to finance optimal levels of expenditure, entrepreneurs will have to incorporate finance premiums positively correlated with the degree of leverage, defined as the ratio between loans and net worth. *Ceteris paribus*, a fall in net worth implies an increase in leverage and in financing costs. In a context where net worth is pro-cyclical, the functioning of the credit market introduces a countercyclical external finance premium, which amplifies credit fluctuations and thus investment, spending, and production.

The modeling of a small open economy combines the necessary complexity such that the model is useful for the conduct of economic policy, with enough simplicity such that the analytical model is computationally tractable. The *PESSOA* model remains – like all economic models – a simplified representation of reality. The assumption of perfect foresight on the part of households and

firms collides, for instance, with the existence of limits in practical terms to formulating and solving complex problems, either due to the amount of information required, or to the inability to process and compute the utility of each alternative action in order to ensure the optimal choice. The modeling of the financial system, in particular the assumption of zero profits by banks, is admittedly insufficient. The *PESSOA* model is calibrated so as to reproduce the major macroeconomic data of the Portuguese economy (ratio of expenditure to GDP, negative net external position, etc.). A detailed description of the calibration of the model can be found in Almeida *et al*. (2013).

3.2. The external demand shock and the sovereign risk premium shock

Charts 3.2.1 and 3.2.2 show the external demand and the sovereign risk premium shocks, respectively. The external demand for Portuguese goods and services showed a continued decline from the fourth quarter of 2008 up to the third quarter of 2009, recovering thereafter. As can be seen in chart 3.2.1, this dynamics is well approximated by an autoregressive process (AR)

$$\ln x_t = \rho \ln x_{t-1} + \varepsilon_t \qquad (3)$$

where $\ln x_t$ stands for the logarithm of variable x_t, the parameter is a constant which determines the persistence of the AR process, and ε_t stands for the innovation in period t. In the case of the external demand shock, $x_t \equiv Y_t^{A^*}$, in line with the notation in equation (2). The calibration of the parameters of equation (3) implies $\rho = 0.8$ and $\varepsilon_t = -0.15$, which corresponds to a drop of 15 per cent in the quarter in which the innovation occurs, followed by a gradual reversion at a rate of approximately 60 per cent per year. The average reduction in $Y_t^{A^*}$ in the first four quarters is 11 per cent, which compares with an observed value of 11.6 per cent in 2009.

The sovereign risk premium, measured by the annual value of the spread of implied sovereign debt interest rates *vis-à-vis* the euro-area average, reported in chart 3.2.2, stood close to 60 basis points (bp) in 2011, declining in 2012 and 2013 to about 30 and 15 bp, respectively. *PESSOA* is designed for quarterly frequency, and thus the observed annual data must be converted. The shock analysed in this article considers an AR process, as shown in equation (3), where $\rho = 0.86$ and $\varepsilon_t = 70$. This shock corresponds to an increase of about 70 basis points in the first quarter of 2011, followed by a gradual decrease at a rate of approximately 45 per cent per year. In this case, it should be noted that $x_t \equiv \varphi_t$, in line with the notation in equation (1). The magnitude of the initial shock and the rate of decline were defined to minimize the sum of squared deviations between the estimates of the annual value of sovereign debt risk premium and the average annual projection process associated with AR process.

3.3. Macroeconomic impacts

This section assesses the impact of these shocks and analyses how financial frictions may have affected their propagation and interaction with the real variables of the economy.

3.3.1. The external demand shock

The macroeconomic impacts of the external demand shock and the role of financial frictions in their transmission are shown in chart 3.3.1.1. Simulation results allow for the conclusion that a sudden drop in external demand causes a recession. This conclusion is independent of the presence of financial frictions, although in the latter case investment is substantially hindered.

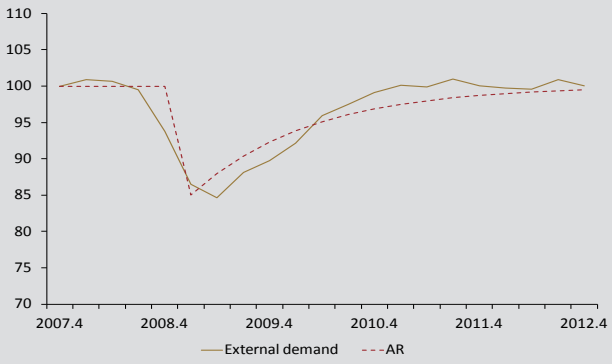
Exports, which are directly affected by the aggregate shock, exhibit a strong reduction in the first year (about 7 per cent). Financial frictions do not affect the size of this decline. The demand for domestic intermediate goods is reduced, particularly in the tradable goods sector, to the extent that exports are extremely intensive in this type of intermediate goods. This determines a contraction of factor demand, particularly labour, inducing a decline in the equilibrium wage rate.

Household consumption shrinks about 0.6 per cent in the first year. The contribution of financial frictions for this fall is virtually nil. The evolution of consumption reflects a reduction in disposable income, resulting not only from the decline in the number of hours worked and wages, but also from the increase in labour income taxes. The economic contraction triggers a decline in tax revenues, making it necessary to increase taxes in order to ensure the sustainability of public debt in the medium and long term. The volatility displayed by household consumption reflects the volatility of the real interest rate, which stems from inflation expectations, since the nominal interest rate is exogenously determined and does not change with the shock. The decline in wages leads to a decrease in production costs, affecting firms' price setting and implying a decline in inflation and thus a real exchange rate depreciation. This price competitiveness effect plays an important role both in cushioning the impact of the external demand shock on exports and in reducing the imported content of aggregate demand.

The main distinguishing factor of the external demand shock, when considering a context in which financial frictions are present, is the investment behaviour, which is reflected in the dynamics of the capital stock. Rather than increasing 0.2 per cent, investment declines by 1.1 per cent in the first year.

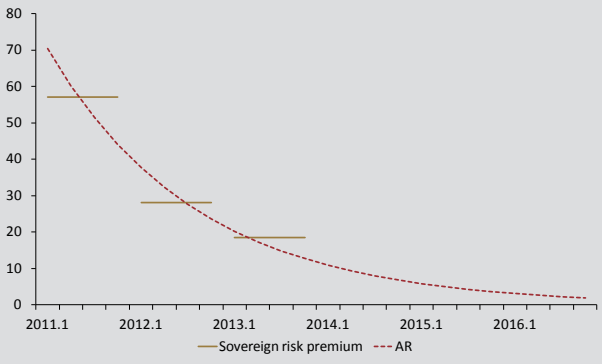
If the economy is characterized by the absence of financial frictions, it would not be in the economic agents best interest to significantly change the levels of investment due to the presence of adjustment costs. The anticipation of a recovery in exports, not only because of the temporary nature and low persistency of the fall in external demand, but also due to the real exchange rate depreciation, would result in a marginal increase in investment (the production of tradable goods is relatively capital intensive). Thus, investment has a counter-cyclical behaviour, contradicting the stylized fact that investment is a strongly pro-cyclical variable. When considering an environment with financial frictions, investment becomes clearly pro-cyclical, making the model more realistic. In this case, the increase in the real interest rate reduces the value of the firm's net worth. This

Chart 3.2.1 • External demand | Index 2007T4=100



Sources: ECB and authors' calculations.
Notes: Quarterly data. The actual figures are identical to those in Chart 2.1.

Chart 3.2.2 • Sovereign risk premium | Interest rate differential *vs.* euro area | In percentage points

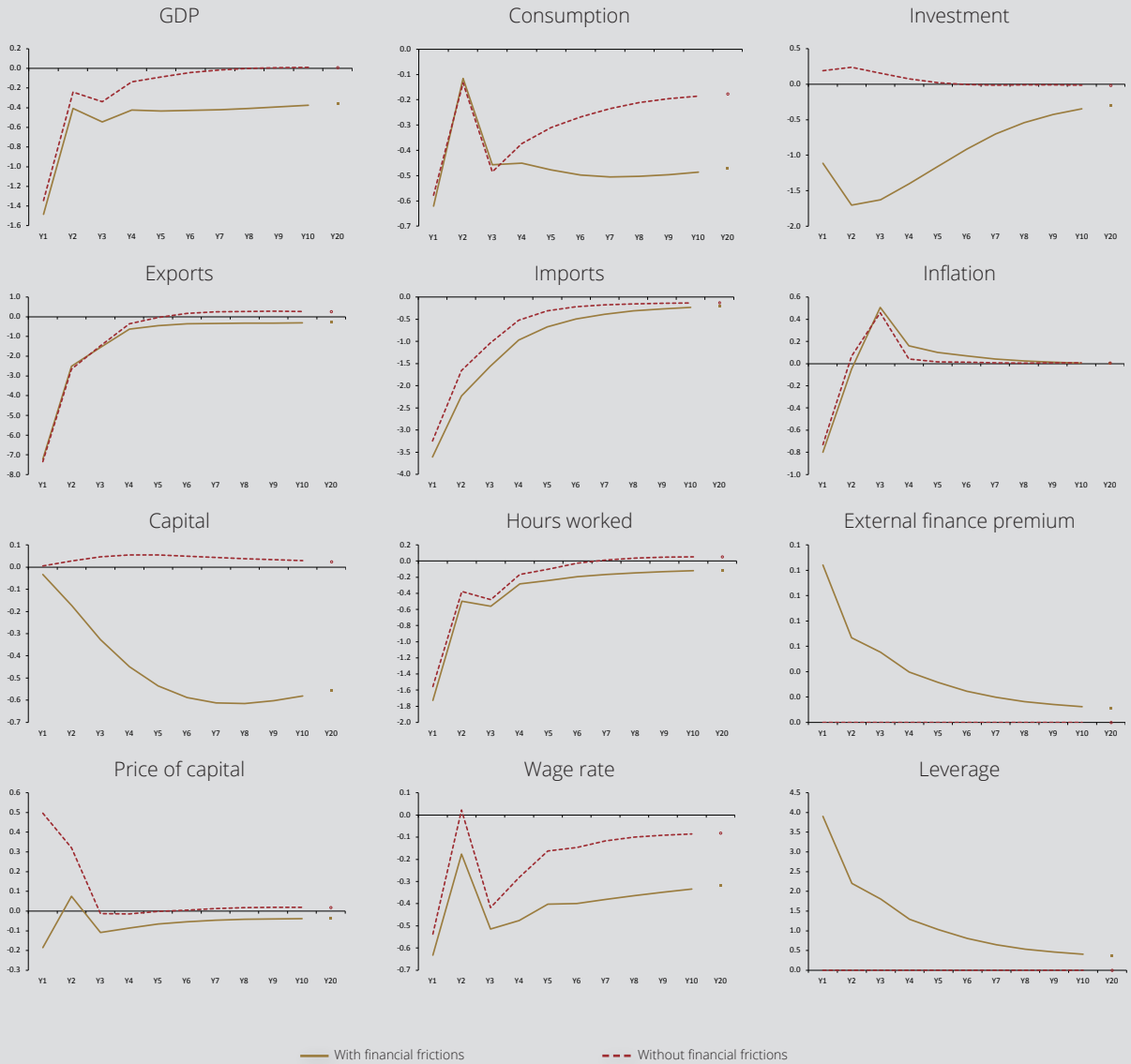


Sources: ECB and authors' calculations.
Notes: Quarterly data. The actual figures are identical to those in Chart 2.2.

adds to the reduction in the demand and the price of capital and triggers an increase in leverage, defined as the entrepreneurs borrowing to equity ratio. The deterioration of the financial situation leads to an increase in the risk premium charged by banks and places a larger fraction of firms under financial distress and facing a larger bankruptcy risk, ultimately determining a fall in investment.

The second distinguishing factor that should be emphasized in the transmission of the external demand shock is that financial frictions worsen the recession, not only in magnitude but also in terms of the persistence. GDP is reduced by 1.5 per cent in the first year, of which 0.2 percentage points are associated with those frictions. From then onwards, the economy remains constrained by the time period that firms will take to restore net worth and thus leverage and external financing costs to the levels that prevailed before the shock. While these differentials

Chart 3.3.1.1 • Macroeconomic impacts of a external demand shock | Deviations from initial steady-state



Source: Authors' calculations.
Notes: Annual figures. The lines show the first 10 years while the dots refer to a 20 years horizon. All results are expressed as percentage deviations from the steady state, except for the values obtained for inflation (calculated year on year) and leverage, which are in percentage points. Inflation is calculated based on the prices of consumer goods paid by households. Leverage is defined as the share of loans to entrepreneurs as a percentage of equity.

persist, the investment will be hindered and the economy will remain depressed as compared with the initial situation.

The deeper recession when the model incorporates financial frictions generates also the need for further increases in taxation in order to ensure a sustainable public debt path. Increased taxation exacerbates the recessive nature of the shock and has a visible impact on the evolution of household consumption. In line with the reduction in aggregate demand, imports drop 3.6 per cent with financial frictions, which creates an additional contribution of -0.4 percentage points relative to a framework without financial frictions.

3.3.2. The sovereign risk premium shock

The macroeconomic impacts of the shock on the sovereign risk premium are shown in chart 3.3.2.1. As in the previous section, this shock causes a recession, which stands at 0.6 per cent in the first year. The contribution of financial frictions for this decline is about 0.1 percentage points. The economy recovers as the shock dissipates.

The increase in domestic interest rates generates a fall in household consumption in the first year of 1.1 per cent (contribution of -0.2 percentage points associated with the presence of financial frictions). The sovereign risk premium shock induces households to postpone their consumption expenditures, not just because of a negative wealth effect, reflecting the decrease of the present discounted value of the after-tax households' income, but also due to a significant substitution effect, insofar as the return from savings – that is, the relative price of present consumption vis-à-vis future consumption – increases. The reduction in aggregate demand induces firms to reduce labour demand, yielding a reduction both in hours worked and in wages.

Investment declines by 1.2 per cent in the first year, with the contribution associated with the existence of financial frictions being nil. The persistent contraction in activity generates a reduction in the demand for capital, leading to a downward adjustment of the stock used by intermediate goods producers. *Ceteris paribus*, this process of deleveraging should lead to a reduction in the cost of bank lending to entrepreneurs, to the extent that they would not need to resort to such a high percentage of external funding to meet their optimal spending level. However, this result does not hold, as the effect is fully offset by the reduction in entrepreneurs' net worth determined by the rise in the real interest rate of the economy as well as by the reduction in the price of capital. Indeed, in the first year, leverage even increases, though only marginally.

As in the previous section, the recession generates a decline in tax revenue, and hence the tax rate on labour income has to increase in order to ensure the sustainability of public debt.

Exports are marginally affected in the short term, increasing 0.3 per cent in the first year and recording a contribution of about 0.1 percentage points associated with the presence of financial frictions. This development primarily reflects the marginal depreciation of the real exchange rate. Despite the decline in production implied by the sovereign risk premium shock, in both the tradable and non-tradable goods sectors, the positive effect on exports justifies a temporary reallocation of resources in the economy, in relative terms, towards the tradable goods sector. Imports fall sharply, in line with the imported content of aggregate demand components.

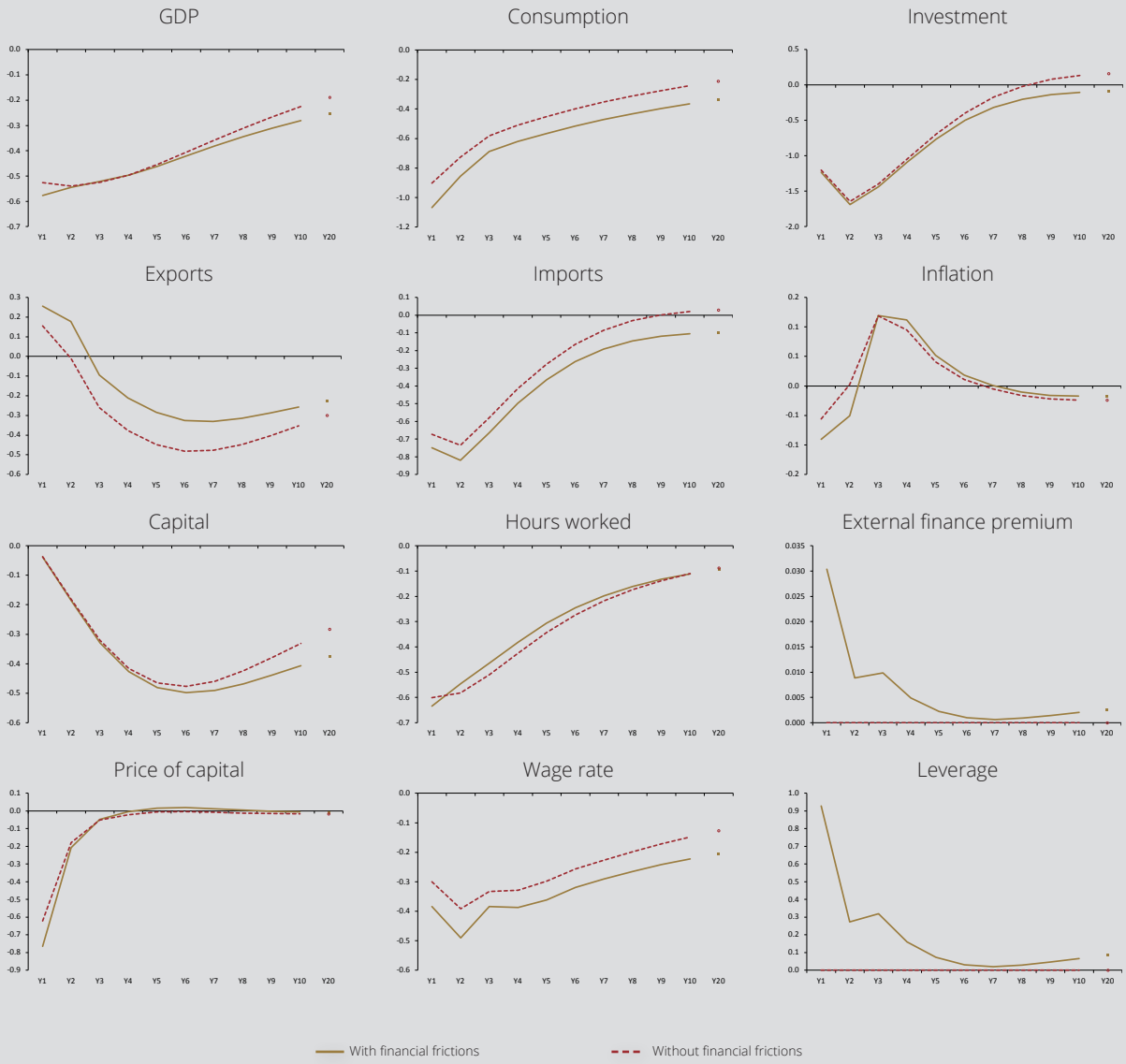
The simultaneous contraction of supply and aggregate demand generates a small effect on the prices of consumer goods. Inflation is marginally reduced, which contributes to explain the negligible impact of financial frictions in the transmission of the sovereign risk premium shock. The shock is transmitted integrally to all sectors of the economy, though there is no significant increase in leverage or an additional premium charged by banks. Since banks pay households

an interest rate identical to the interest rate of Government bonds, the increase in bank lending rates is directly passed on to the corporate sector.

4. Conclusions

This article analyses the role of the contraction of the world economy and of international trade flows recorded in late 2008 and in 2009, as well as of the increase in the risk premium of sovereign debt, on the evolution of the Portuguese economy in recent years. This analysis is conducted in a general equilibrium framework using the *PESSOA* model (Almeida *et al*., 2013), which captures a set of effects and interactions that are not considered in a consistent manner from a theoretical standpoint in reduced form models. The model incorporates a financial sector, allowing for the

Chart 3.3.2.1 • Macroeconomic impacts of a sovereign risk premium shock | Deviations from initial steady-state



Source: authors' calculations.
Notes: Annual figures. See chart 3.3.1.1 for details.

analysis of the role played by financial frictions and thus of an important set of constraints inherent to the Great Recession.

The simulations presented in this article reveal that both the collapse of international trade flows and the rise in the sovereign debt risk premium generate a significant contraction in economic activity. This reduction is more persistent the higher is the degree of financial frictions, which constitute an important mechanism in the analysis of the shocks considered.

Results support the conclusion that the amplification of shocks depends on their nature. In particular it is noted that the impact of negative demand shocks is larger the higher is the downward effect on prices. Financial frictions play an important role in the amplification of the impacts associated with the negative global economic activity shock. In case of the increase in the sovereign risk premium there is a contraction in aggregate demand, which is accompanied by a downward revaluation of the optimal level of capital stock, taking into account the change in financing conditions. Leverage levels are not significantly affected, given that the decrease in the price of capital and the increase in real interest rates reduce the value of equity. Hence financial frictions play a limited role in this case.

The analysis presented in this article is conditioned by the model used and its calibration. In particular, the interaction between real and financial variables of the model depends on the transmission mechanism considered. The inclusion of a fully-fledged financial sector, in which the banking sector plays a more active role, would enrich the model setup and will make it more realistic. This is a research topic to develop in future work.

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Notes

1. The opinions expressed in the article are those of the authors and do not necessarily coincide with those of Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the authors.

2. Banco de Portugal, Economic Research Department.

Grade retention during basic education in Portugal: determinants and impact on student achievement[1]

Manuel Coutinho Pereira[2] | Hugo Reis[2]

ABSTRACT

The percentage of students repeating a school year is not homogeneous among European countries. In Portugal grade retention is a common practice. This article examines the determinants of grade retention and analyzes its impact on student performance in Portugal, presenting at the same time some results for a set of European countries. In Portugal, individual, family and peer characteristics are important factors explaining grade retention. In particular, students with less maturity and worse economic conditions are more likely to repeat. The effects of school retention are evaluated in the framework of a treatment effects model. Academic performance at a later stage of basic education is negatively affected by repeating at an early stage, which suggests that there will be advantage in implementing alternatives to support students. The short-term effects of repeating at a later stage are positive, although small. In this case, the results do not call into question grade retention.

1. Introduction

Management of students' learning difficulties varies from one country to another. In almost all European countries, according to the legislation, it is possible for a student to repeat a grade during compulsory education, in particular at the basic level.

Grade retention consists in holding students in the same grade for an additional year rather than promoting them along with their age peers. This practice is mostly based on the principle that by repeating a school year, a student has a further opportunity to improve its skills and knowledge. Even in the cases where some remedial measures are provided when students experience problems, retention is proposed as the ultimate measure of support. This practice affects also children that seem immature compared with their age peers. The idea is to give them an opportunity to catch up with the human capital needed in the next grade. Grade retention is also defended by those who claim that education systems are more efficient with less heterogeneous peer groups, and by those who view it as a way to ensure better accountability. However having students repeating grades is costly, entailing the expense of providing an additional year of education, and the cost to society in delaying the student's entry into the labour market. In addition, opponents of grade retention emphasize the psychological effects of such policy. They highlight, in particular, the decreased self-esteem, impaired peer relationship, distancing from school and increased dropout likelihood. Therefore, and taking into account the literature on grade retention, the impact of repeating a grade on students achievement and human capital accumulation is still an open question.

Some countries, like Norway and Iceland, have opted for automatic progression from one year to the other throughout compulsory education, and provide alternative support measures to students in difficulty. In the other European countries, students who have not met the defined criteria must repeat the year. The most common criteria are deficient academic progress,

attendance record, and behaviour. The percentage of students repeating a school year is not homogeneous among European countries even for those with similar regulations. For instance, in the Scandinavian countries and Italy less than 5 percent of the students aged 15 have ever been retained at ISCED 1 or ISCED 2. In contrast, in countries like Portugal, France, Spain and Luxembourg, figures are above 30 per cent. Therefore, in Portugal grade retention is a common practice. Despite some recent decreasing trend, the official figures from the Ministry of Education show that in 2011/12 academic year the retention rate was 15.6 percent in the 3rd cycle of basic education and 11.2 and 4.4 percent in the 2nd and 1st cycles, respectively.

Our article studies the determinants of grade retention at an earlier and a later stage of basic education and its impact on academic achievement. The analysis is performed for Portugal and for a set of European countries, using the OECD's Programme for International Student Assessment (PISA) dataset. According to the International Standard Classification of Education (ISCED), we analyze separately grade retention in two different moments of basic education: ISCED 1 and ISCED 2. In Portugal, the first level corresponds to the 1st and 2nd cycles (1st to 6th grade) and the second level to the 3rd cycle (7th to 9th grade).[3] The effects of school retention are evaluated in the framework of a treatment effects model where selection is endogenous, *i.e.* correlated with performance.

An important issue when evaluating the effect of grade retention is that it is impossible to hold both the grade and age fixed when retaining a student. The PISA dataset, covering students aged 15, is better-suited for measuring the later type of effect, *i.e*. comparing student's cognitive development holding age fixed (see Cooley, *et al.*, 2011, and Schwerdt and West, 2012, for a more detailed discussion of the two approaches). This contrasts with most studies in this area which use samples of students in the same grade.

In what concerns the determinants of grade retention, individual, family and peer characteristics are important factors. In particular, for Portugal, students with less maturity and worse economic conditions are more likely to fail a grade. Socio-economic aspects, school characteristics and differences at the regional and country levels (for example, institutional factors) are important as well.

In this article, we found that school retention during ISCED 1 produces negative effects on student performance in the long-term (defined as more than three years - recall that PISA tests assess student performance at the end of, or just after, ISCED 2). From a policy perspective there seems to be scope for intervention, namely to replace, at least partially, this practice by other forms of student support, which may turn out to be less expensive. The effects of retention at ISCED 2 are positive, despite small, in the short-term (again, taking into account the timing of PISA tests). Although we are not able to address long-term effects in this case, our evidence does not contradict grade retention in more advanced levels of schooling. Finally, it should be noted that students whose socio-economic characteristics make them more likely to repeat are generally also those who gain most (or lose less) with treatment.

Our study belongs to the literature on the impact of retention on educational performance. In contrast to early contributions that did not address endogeneity or selection problems, recent papers provide some evidence of positive effects, in particular in the short-term. For example, Jacob and Lefgren (2009) and Schwerdt and West (2012) (using a regression discontinuity approach) for the US, and with different approaches, Mahjoub (2012), Elodie (2013) and Gary-Bobo, *et al.* (2014) for France. In addition, Baert, *et al.* (2013) using a structural dynamic choice model and Belgian data found some positive effects on performance in the year after retention and also some persistence. All these works essentially perform a same-grade comparison. With

the PISA dataset but using slightly different approaches than the one in this article, Diris (2012) and Garcia-Perez *et al.* (2014) found in general negative effects of retention for a set of OECD countries and Spain, respectively.

The remaining of this article is organized as follows. Section 2 presents the data and summary statistics. Section 3 describes the regression results about determinants of grade retention. Section 4 presents the model used to evaluate the impact on test scores, and section 5 discusses the findings in this regard. Section 6 concludes

2. The database and descriptive analysis

In this study we use the PISA dataset for a group of European countries[4] in 2003 and 2009, years for which there is information on whether a student repeated one or more years during basic education. The student, family and school variables in the regressions are essentially those already employed in previous studies using PISA data, such as Pereira and Reis (2012) (see table 2.3.1 in section 2 and appendix 1 for a complete list of the variables and respective means). There are a couple of additions that are worth highlighting: i) indicators of retention at both levels, ISCED 1 and ISCED 2, computed from the student questionnaire; ii) indicators of kindergarten attendance; iii) indicators of entry age in primary education and its relationship to the cut-off date regulated by law; and iv) an indicator that reflects the maturity of the student. On the basis of the PISA dataset, we also add variables that capture variations at the school level (peers) and at the regional level[5].

2.1. Retention indicator

Table 2.1.1 shows for 2003, 2009 and for the two years together, the percentage of students in the sample who repeated only at ISCED 1, only at ISCED 2, at both levels, and those who have not repeated during basic education. Columns 1 to 3 present the results for the full set of countries, columns 4 to 6 show the results for countries with data available in the two years, and the last three columns present the values for Portugal. The results for 2003 and 2009 are very similar, even when we add further countries in 2009.

The percentage of students who never repeated is around 82 percent, for the full set of countries, compared with only 70 per cent for Portugal. This difference mainly reflects the number of repeaters during ISCED 1, for which the percentage in Portugal is around 13 percent, about twice the average for the other countries. Concerning ISCED 2, Portugal also displays values nearby 13 percent, closer to the average for the other countries that is above 10 percent.

Table 2.1.1 • Grade Retention in Portugal and in a set of European countries

	Whole Sample Percentage (%)			Sample with same countries in both years Percentage (%)			Portugal Percentage (%)		
	2003	2009	Total	2003	2009	Total	2003	2009	Total
Non-repeaters	81.5	82.5	82.0	81.5	81.4	81.5	70.5	70.4	70.4
Repeaters only in ISCED 1	6.5	6.4	6.4	6.5	6.8	6.6	12.8	13.7	13.2
Repeaters only in ISCED 2	10.5	9.7	10.1	10.5	10.2	10.4	12.6	12.8	12.7
Repeaters in both ISCED 1 and 2	1.5	1.5	1.5	1.5	1.6	1.5	4.1	3.2	3.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of countries	20	25		20	20				

Source: PISA 2003 and 2009.
Note: In Portugal, ISCED 1 corresponds to the 1st and 2nd cycles together, and ISCED 2 to the 3rd cycle. For the remaining european countries, the number of grades in each level may be different (see Eurodyce, 2013).

Chart 2.1.1 provides an international comparison of the percentage of students who repeated at least once in basic education. Besides Portugal that has a rate of around 30 percent, countries like Spain, Luxembourg and France stand out with figures higher than 35 percent. In contrast, about half of the countries have percentages below 5 percent, indicating considerable heterogeneity of retention practices. These lower levels also somehow reflect the European trend to limit this practice, fostered by some international organizations such as the OECD (see, for example, OECD, 2012).

2.2. Test scores

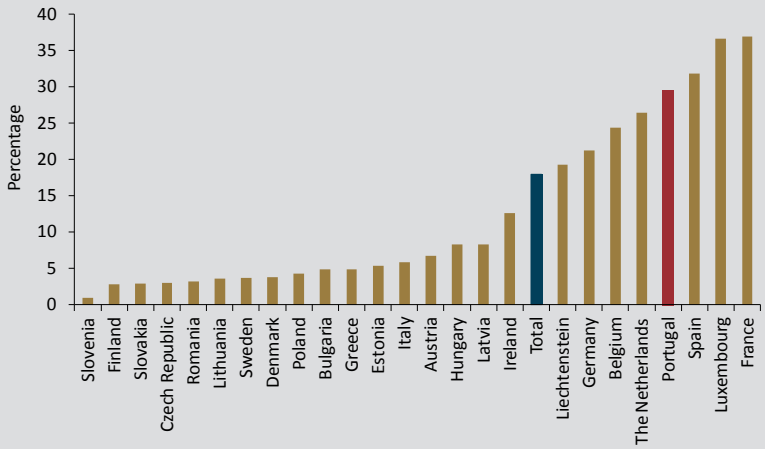
Table 2.2.1 shows the mean and standard deviation of math and reading PISA test scores by type of retention[6], comparing Portugal with the countries considered as a whole. The table shows not only a difference between repeaters and non-repeaters, but also heterogeneity within repeaters. In particular, those who were retained at ISCED 2 have higher scores than those who repeated at ISCED 1, which in turn have better outcomes than those who repeated at the two levels. Comparing Portugal with the overall mean, there are only significant differences for the students who repeated at ISCED 1 or ISCED 2 only, where Portugal has lower values. Regarding the students who never repeated and those who repeated at both levels, the mean scores are very similar to other European countries.

Table 2.2.1 • Test scores by retention levels - mean and standard deviation

	Total		Portugal	
	Mathematics	Reading	Mathematics	Reading
Non-repeaters	508.4	505.0	512.6	520.7
	(87.9)	(86.4)	(71.2)	(65.7)
Repeaters only in ISCED 1	418.0	411.2	396.6	406.4
	(81.6)	(83.6)	(60.8)	(66.8)
Repeaters only in ISCED 2	448.5	442.1	426.2	428.7
	(83.5)	(86.5)	(59.6)	(63.0)
Repeaters in both ISCED 1 and 2	378.8	373.4	372.7	371.0
	(81.1)	(86.3)	(55.4)	(64.3)
Total	497.6	493.7	481.2	488.4
	(91.5)	(91.0)	(84.1)	(82.9)

Sources: PISA 2003 e 2009.
Note: This table presents the mean of test scores by retention level. Standard deviation in brackets.

Chart 2.1.1 • Percentage of students who have repeated a year at least once in basic education



Source: PISA 2003 and 2009.

2.3. Explanatory variables

We end this section with a brief analysis of explanatory variables, in particular individual and family attributes. Table 2.3.1 presents a characterization of these variables by type of retention, comparing Portugal with the average for the countries in the sample.

Individual variables include gender, binary variables for students who attended kindergarten for only one year and more than one year, and two variables related to entry in primary education. The first one - entry age - captures the age attained in the year of entry relative to age 6 (regardless of the official entry age). For example, the variable takes on the value 0 if the student entered school in the year he was 6, and the value 1 if the student entered school in the year he was 7. The second variable - late entry - flags the students for whom it is possible to detect a difference between the actual and the regulatory entry ages, namely when there is a cut-off date during the year that was not met (for example, by a decision of the parents and/or teachers). Note that, despite the existence of such rules in many countries, for some of them, including Portugal[7], this does not show up clearly in the data. Still, for some countries in the sample, late entry may capture specific characteristics of the students that are thereby purged from the estimated impact of retention.

Individual variables include an indicator of the maturity of the student, in terms of relative age, in the spirit of Bedard and Dhuey (2006). This measure of maturity is calculated as the difference in months between the dates in which the student has completed 6 and entered school (using September of the entry year as a reference)[8] :

Maturity= 9 – birth month + 0, if the student entered school in the year that turns 6 years old (entry age = 0);

Maturity = 9 – birth month + 12, if the student entered school in the year that turns 7 years old (entry age = 1);

Maturity = 9 – birth month + 24, if the student entered school in the year that turns 8 years old (entry age = 2).

Table 2.3.1 shows that there are significant differences in some individual characteristics between repeaters and non-repeaters, such as gender and kindergarten attendance. Regarding this last attribute, the Portuguese figures are lower than for the whole sample in both groups. Table 2.3.1 also shows that Portuguese students have, on average, less maturity at entry than their European counterparts. In particular, the difference is about 5 months among those who did not repeat and about 2 months among those who repeated. This is explained by the official later entry age in some countries (age 7), and also by the loose implementation of the cut-off date rule in Portugal (as it follows from the data). Moreover, for the full set of European countries, the average maturity of non-repeaters exceeds that of repeaters. This also holds for Portugal, conditional on the entry age cohorts (this is the relevant type of analysis, by construction of the maturity indicator).

Regarding family variables, students who did not repeat have a higher percentage of more educated parents and better socio-economic conditions (measured by the books at home variable). Among repeaters, those who repeated only at ISCED 2 feature better socio-economic conditions than those who repeated at ISCED 1 only. Moreover, there is a higher percentage of single-parent families among the students who were retained, but no significant difference in this regard between the two groups of repeaters.

Besides student and family variables, we also considered peer and school characteristics, as well as covariates to capture regional variability in socio-economic conditions, and also in attitudes towards education and school retention practices. Finally, the regressions include country fixed--effects that absorb variation arising from institutional differences, particularly regarding retention, and year fixed-effects. The remaining variables used in the analysis are presented in appendix 1, including the respective means for the whole sample and Portugal.

Table 2.3.1 • Summary statistics - student and family characteristics by retention level | Mean and standard deviation

	Non-repeaters		Repeaters					
			Only in ISCED 1		Only in ISCED 2		ISCED 1 and ISCED 2	
	Total	Portugal	Total	Portugal	Total	Portugal	Total	Portugal
Individual characteristics								
Female (b)	0.52	0.56	0.44	0.48	0.41	0.44	0.37	0.37
	(0.50)	(0.50)	(0.50)	(0.50)	(0.49)	(0.50)	(0.48)	(0.48)
Kindergarten – 1 year (b)	0.18	0.18	0.19	0.22	0.14	0.20	0.17	0.19
	(0.38)	(0.38)	(0.39)	(0.42)	(0.35)	(0.40)	(0.38)	(0.39)
Kindergarten – 2 or more years (b)	0.77	0.61	0.71	0.48	0.79	0.57	0.71	0.52
	(0.42)	(0.49)	(0.45)	(0.50)	(0.41)	(0.50)	(0.45)	(0.50)
Entry age	0.52	0.06	0.35	0.23	0.27	0.12	0.12	0.08
	(0.53)	(0.29)	(0.52)	(0.49)	(0.46)	(0.38)	(0.33)	(0.27)
Late entry	0.07	-	0.09	-	0.06	-	0.02	-
	(0.26)	-	(0.31)	-	(0.26)	-	(0.13)	-
Maturity	8.7	3.4	6.4	4.8	5.7	3.7	3.3	2.6
	(6.3)	(4.5)	(6.1)	(6.6)	(5.7)	(5.2)	(4.9)	(4.5)
Family variables								
Books at home (25-200) (b)	0.52	0.53	0.44	0.38	0.50	0.47	0.42	0.34
	(0.50)	(0.50)	(0.50)	(0.48)	(0.50)	(0.50)	(0.49)	(0.47)
Books at home (>200) (b)	0.26	0.20	0.12	0.06	0.17	0.09	0.09	0.07
	(0.44)	(0.40)	(0.33)	(0.25)	(0.38)	(0.29)	(0.29)	(0.26)
Lower secondary education (b)	0.09	0.19	0.15	0.20	0.15	0.25	0.19	0.18
	(0.28)	(0.39)	(0.36)	(0.40)	(0.36)	(0.43)	(0.39)	(0.39)
Upper secondary education (b)	0.46	0.24	0.39	0.16	0.41	0.19	0.36	0.16
	(0.50)	(0.43)	(0.49)	(0.37)	(0.49)	(0.40)	(0.48)	(0.36)
Terciary education (b)	0.42	0.30	0.34	0.17	0.32	0.17	0.26	0.17
	(0.49)	(0.46)	(0.47)	(0.37)	(0.47)	(0.37)	(0.44)	(0.37)
Single-parent family (b)	0.13	0.12	0.18	0.17	0.18	0.17	0.18	0.16
	(0.34)	(0.33)	(0.38)	(0.37)	(0.38)	(0.37)	(0.39)	(0.37)
No parents at home (b)	0.01	0.02	0.02	0.05	0.02	0.03	0.04	0.05
	(0.11)	(0.14)	(0.15)	(0.21)	(0.13)	(0.16)	(0.18)	(0.22)
Immigrant (b)	0.06	0.04	0.20	0.09	0.13	0.06	0.14	0.06
	(0.24)	(0.20)	(0.40)	(0.28)	(0.34)	(0.24)	(0.35)	(0.23)
Language at home different from the test language	0.04	-	0.03	-	0.06	-	0.05	-
	(0.20)	-	(0.18)	-	(0.24)	-	(0.23)	-
Foreign language at home	0.03	0.01	0.11	0.03	0.07	0.02	0.08	0.02
	(0.18)	(0.10)	(0.31)	(0.16)	(0.25)	(0.15)	(0.27)	(0.13)
Educational resources at home	5.04	5.05	4.62	4.45	4.78	4.63	4.37	4.19
	(1.08)	(0.99)	(1.30)	(1.24)	(1.21)	(1.16)	(1.31)	(1.30)
White collar - low skill (b)	0.23	0.28	0.25	0.29	0.28	0.33	0.29	0.31
	(0.42)	(0.45)	(0.43)	(0.46)	(0.45)	(0.47)	(0.45)	(0.46)
White collar - high skill (b)	0.54	0.43	0.39	0.18	0.41	0.23	0.26	0.13
	(0.50)	(0.49)	(0.49)	(0.38)	(0.49)	(0.42)	(0.44)	(0.33)

Source: PISA 2003 and 2009.
Note: (b) stands for binary variable. Standard deviation in brackets.

In PISA there is only data on peers (mean of the family variables at the school level) and schools at the time the student takes the test. This issue becomes particularly relevant for students who repeated at ISCED 1, as the majority of students who have failed a grade at ISCED 2 most likely still attend the same school (*i.e.* they have not changed school meanwhile).

Regarding students who repeated at ISCED 1, we construct variables that proxy the characteristics of schools they were attending at the time. Accordingly, for students in PISA currently attending a school that also has ISCED 1, it was assumed that the student has remained in that school throughout. In the other cases, we calculated an average of the characteristics of schools with ISCED 1 by region and type of community where the school is located[9]. In spite of measurement error, this procedure should make up partly for the lack of information regarding schools when students were retained at an early stage of basic education, and mitigate some endogeneity.

3. Determinants of grade retention

The analysis of the determinants of retention is performed separately for students who repeated (once or more) at ISCED 1 and ISCED 2, using a probit model. Students who repeated at the two levels are excluded from both samples[10]. Moreover, in the rest of the article, we consider only 23 countries: France was excluded for not having school data and Slovenia for having less than 1 percent of repeaters.

3.1. Main results

Table 3.1.1 shows the determinants of grade retention at ISCED 1 and ISCED 2 in Portugal and for the countries in the sample as a whole. Regarding ISCED 1, the results in columns 1 and 2 show clearly that individual, family and peer factors are important in explaining retention. In general, all variables are statistically significant in the entire sample; for Portugal, however, kindergarten attendance is not significant. Note that the effects tend to be stronger for Portugal than for the set of European countries in the sample. In Portugal, the probability of repeating at ISCED 1 decreases by around 3.5 percentage points (pp) with an increase of one standard deviation (about five months) in maturity. The same probability decreases by a similar magnitude when the student is female. For the countries as a whole, the effect of maturity is also the most important one, albeit smaller, reaching about 2 pp. Another important variable in the full sample is kindergarten attendance for at least two years, which reduces the probability of repeating at ISCED 1 by around 1.4 pp.

The most important family variables are parental education and books at home (variable measuring differences in income). As with individual attributes, the effects are stronger for Portugal than for the entire sample. In particular, the probability of repeating at ISCED 1 decreases by about 4.5 pp when students have more books at home (around 1.5 pp for all countries). The same probability decreases for Portugal by more than 2 pp if the parents have higher levels of education (about 1 pp for the full sample). Another important factor is family structure. For example, for Portugal the probability of failing a grade increases by about 3.3 pp if the student belongs to a single-parent family.

Results for ISCED 2, in columns 3 and 4, show many similarities to ISCED 1, although the magnitude of the effects is different. As in the previous case, the effects for Portugal are in general stronger than those for all countries. Individual characteristics appear as particularly important. In Portugal, the probability of repeating at ISCED 2 decreases by around 3 pp with an increase

Table 3.1.1 • Grade retention determinants in two levels of basic education

	ISCED 1		ISCED 2	
	Total	**Portugal**	**Total**	**Portugal**
Individual variables				
Female [b]	-0.009	-0.034	-0.026	-0.044
	(0.001)***	(0.007)***	(0.002)***	(0.007)***
Kindergarten – 1 year [b]	-0.002	0.003	-0.004	0.016
	(0.002)	(0.011)	(0.003)	(0.012)
Kindergarten – 2 or more years [b]	-0.014	-0.008	-0.011	0.012
	(0.002)***	(0.009)	(0.003)***	(0.009)
Entry age	-0.008	-	-0.028	-0.012
	(0.002)***	-	(0.003)***	(0.019)
Late entry	0.021	0.039	0.008	-
	(0.002)***	(0.023)*	(0.004)*	-
Maturity	-0.003	-0.007	-0.002	-0.006
	(0.000)***	(0.001)***	(0.000)***	(0.001)***
Family variables				
Books at home (25-200) [b]	-0.011	-0.044	-0.013	-0.015
	(0.001)***	(0.009)***	(0.002)***	(0.008)*
Books at home (>200) [b]	-0.015	-0.046	-0.019	-0.032
	(0.001)***	(0.011)***	(0.002)***	(0.010)***
Lower secondary education [b]	0.000	-0.023	-0.002	0.002
	(0.002)	(0.009)**	(0.003)	(0.009)
Upper secondary education [b]	-0.010	-0.033	-0.009	-0.014
	(0.002)***	(0.009)***	(0.003)***	(0.009)
Terciary education [b]	-0.011	-0.023	-0.015	-0.027
	(0.002)***	(0.011)**	(0.003)***	(0.010)***
Single-parent family [b]	0.008	0.033	0.023	0.027
	(0.002)***	(0.012)***	(0.003)***	(0.012)**
No parents at home [b]	0.019	0.000	0.027	0.004
	(0.006)***	[0.027]	(0.008)***	(0.024)
Immigrant [b]	0.018	-0.063	0.014	0.015
	(0.003)***	(0.012)***	(0.004)***	(0.021)
First language not test language	-0.007	-	0.002	-
	(0.001)***	-	(0.004)	-
Foreign language at home	0.004	0.089	0.002	0.033
	(0.003)	(0.058)	(0.005)	(0.035)
Educational resources at home	-0.005	-0.017	-0.007	-0.009
	(0.000)***	(0.005)***	(0.001)***	(0.004)**
White collar - low skill [b]	-0.007	-0.015	-0.002	-0.002
	(0.001)***	(0.008)*	(0.002)	(0.008)
White collar - high skill [b]	-0.013	-0.04	-0.006	-0.022
	(0.001)***	(0.011)***	(0.002)***	(0.009)**
Peer variables				
Books at home (25-200) - peers	-0.024	-0.235	0.000	-0.280
	(0.013)*	(0.133)*	(0.011)	(0.090)***
Books at home (>200) - peers	-0.016	-0.503	0.002	-0.360
	(0.017)	(0.225)**	(0.014)	(0.133)***
Lower secondary education - peers	-0.018	0.172	0.004	0.094
	(0.022)	(0.137)	(0.021)	(0.101)

Sources: Authors' calculations.
Notes: This table shows the marginal effects from a probit model. (b) stands for binary variable. Standard deviation in brackets. Standard deviation in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3.1.1 • Grade retention determinants in two levels of basic education (continued)

	ISCED 1		ISCED 2	
	Total	**Portugal**	**Total**	**Portugal**
Peer variables (continued)				
Upper secondary education - peers	-0.064	-0.048	0.002	0.010
	(0.020)***	(0.140)	(0.017)	(0.096)
Terciary education - peers	-0.054	0.098	-0.033	0.192
	(0.021)***	(0.152)	(0.018)*	(0.104)*
Single-parent family - peers	0.057	0.615	0.044	0.261
	(0.013)***	(0.189)***	(0.014)***	(0.112)**
No parents at home - peers	0.065	0.412	0.079	0.214
	(0.033)*	(0.266)	(0.038)**	(0.199)
Immigrant - peers	0.01	0.3	0.036	-0.053
	(0.016)	(0.155)*	(0.012)***	(0.131)
Educational resources at home - peers	-0.012	-0.132	-0.010	-0.152
	(0.004)***	(0.050)***	(0.004)**	(0.035)***
White collar - low skill - peers	-0.011	0.033	0.004	0.009
	(0.014)	(0.129)	[0.013]	(0.090)
White collar - high skill - peers	-0.04	-0.271	-0.010	-0.109
	(0.014)***	(0.141)*	[0.012]	(0.091)
Other control variables	School variables	School variables	School variables	School variables
	Regional variables	Regional variables	Regional variables	Regional variables
	year fixed-effect	year fixed-effect	year fixed-effect	year fixed-effect
	country fixed-effect	-	country fixed-effect	-
Number of students	233935	8620	236666	8619
	Maturity		Maturity and retention practices	
Joint Test (F-test)	250.8	30.3	608.6	40.5
p-value	(0.00)	(0.00)	(0.00)	(0.00)

Sources: Authors' calculations.
Notes: This Table shows the marginal effects from a probit model. (b) stands for binary variable. Standard deviation in brackets. Standard deviation in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

of one standard deviation in maturity. Maturity is also the most important variable for the whole sample, but with a smaller effect of about 1.3 pp. Kindergarten attendance for at least two years is equally important, reducing the propensity to repeat at ISCED 2 by about 1 pp For the whole sample, another relevant factor is entry age: entering the education system one year later (regardless of the official entry age) decreases the probability of repeating at ISCED 2 by about 3 pp. This effect is smaller for ISCED 1 (below 1 pp). For Portugal, this variable does not show up as significant, particularly for ISCED 2, which is due to the loose implementation of the cut-off date rule (see above). Therefore, variables entry age and late entry coincide, and we cannot disentangle the effect of entering later than the date officially prescribed. The effects of family characteristics, such as parental education, number of books at home and single-parent family, are also important, especially in Portugal. All these features have a similar impact on the propensity to repeat at ISCED 2 (about 3 pp).

In addition, the joint tests for individual, family, peer, school, region and country variables, separately, suggest that all these groups of variables influence retention in both education levels analyzed. In Portugal, the effect of schools appears less evident for ISCED 1. These results show that socio-economic aspects are important but are not the only factors explaining grade retention. In particular, the results for the country-fixed effects show that institutional factors may have an important role in the observed differences between countries.

The main findings are robust to different specifications at both levels, ISCED 1 and ISCED 2, namely, interacting with country and year fixed-effects, removing regional variables, or using school fixed-effects. These results are also robust to a change in the group of countries considered by restricting it to countries with higher percentages of retention (see Pereira and Reis, 2014).

4. The treatment effects model

The effects of school retention are evaluated in the framework of a treatment effects model with endogenous selection (see *e.g.* Wooldridge, 2002, Chapter 18, or Blundell and Costa Dias, 2009).

4.1. Methodology

We assume that the performance of each student will depend on whether she/he was retained. Scores with and without treatment are random variables, respectively, S_R and S_{NR} given by

$$S_R = \mu_R + x\,\beta_R + u_R \tag{1}$$

and

$$S_{NR} = \mu_{NR} + x\,\beta_{NR} + u_{NR}. \tag{2}$$

In this general specification, the impact of the determinants observed by the analyst on performance differs depending on whether there is student retention ($x\,\beta_R \neq x\,\beta_{NR}$). In other words, each of these cases gives rise to a distinct education production function. There is observed heterogeneity in the treatment effects, as the treatment interacts with other variables in score determination. In practice, vectors β_R and β_{NR} may differ only for a subset of regressors in x.

At the same time, there are factors that the researcher does not observe, for example, the capabilities and motivation of the student, which also determine performance. Such factors are captured by the error terms in the equations above. In this model, as the error terms are also assumed to be different ($u_R \neq u_{NR}$), grade repetition is allowed to interact with unobserved factors or, equivalently, there is unobserved heterogeneity in its effects.

To complete the model, it is assumed that the mechanism underlying the selection of students to retain is:

$$T^* = x\,\boldsymbol{\pi}_1 + z\,\boldsymbol{\pi}_2 + e, \tag{3}$$

where T* is a latent variable. In general, the covariates considered in the education production functions (vector x) are also part of the selection mechanism. Vector z z includes variables that are not related to school performance (so that they do not enter equations (1) and (2)) but influence the selection of repeaters, *i.e.* the propensity to repeat. These variables function as instrumental variables, and have a key role in the estimation of treatment effects in the presence

of endogeneity. Note that in this model endogeneity is captured by the non-zero covariances between the error terms of the primary equations (1) and (2), and the error term of the selection equation (*i.e.* $\sigma(u_{R'}, e) \neq 0$ and $\sigma(u_{NR}, e) \neq 0$). Indeed, even controlling for the observed determinants of grade retention, selection for treatment remains endogenous as unobserved factors, such as the ability and motivation of the student, play an important role both in the probability of repeating and the explanation of performance.

The treatment indicator, T, is a function of T^* such that $T=1$ if and only if $T^* \geq 0$ and $T=0$ if and only if $T^*<0$. In practice, the analyst observes a realization of the variables $S_{R'}$ when the student fails a grade (*i.e.* $S_R \mid x, T=1$), and S_{NR} otherwise ($S_{NR} \mid x, T=0$). The counterfactual scores $S_R \mid x, T=0$ and $S_{NR} \mid x, T=1$ are not observed. The quantities of interest that can be obtained in this context include the average treatment effect, $ATE = E(S_R - S_{NR})$, and the average treatment effect on the treated $ATET = E(S_R - S_{NR} \mid x, T=1)$. We can also estimate what would have been the effect of treatment on those who were not treated, $ATENT = E(S_R - S_{NR} \mid x, T=0)$.

The estimation of the parameters of interest in the education production functions is carried out by the Heckman control function method (Heckman, 1978, 1979, or Vella and Verbeek, 1999 for a more recent reference), which is consistent under the hypothesis of normality of the error terms. In the process, we also get an estimate of the covariance between the errors in the outcome equations and the selection equation (see *e.g.* Pereira and Reis, 2014).

In the regressions we included the greatest range of control variables available in PISA for the years and countries considered, namely covariates related to the student and family, the current school and peers, as well as regional indicators derived from socio-economic measures and non-cognitive outcomes and year and country fixed-effects (see table 2.3.1 and appendix 1). In the regressions measuring the effect of retention at ISCED 1 we also used the variables described at the end of section 2.3 to capture the school environment that surrounded the students during those grades. Although performance is measured when PISA tests are taken, such ISCED 1 variables should be included to the extent that they determine repetition, in order to eliminate possible sources of endogeneity of the instruments in the outcome equations. However, we considered only the school regressors that proved significant as determinants of repetition and a subset of peer covariates.

The effects of student retention in Portugal are evaluated on the basis of regressions estimated for the extended sample of European countries that we have been considering. As explained in the next section, this solution allows benefiting from a more compelling instrumentation of the treatment indicator than restricting the sample to Portuguese students. However, in order to estimate a specific education production function for Portugal, we interacted all explanatory variables in the model (except the country fixed-effects) with the fixed-effect for Portugal.[11]

With regard to observed heterogeneity, the repetition indicator was interacted with the student and family regressors as well as the country fixed-effects. Furthermore, we allow a specific impact of the first two groups of covariates in the Portuguese case. The regressions are weighted by the student weights in the PISA database.

With the estimates of the different parameters in hand, it is possible to use the theoretical expressions of the treatment effects to estimate them as a function of the variables in x and, in particular, for subgroups of interest within the student population. The average effects of grade

retention for the whole or a subgroup of Portuguese students (namely, those who repeated and those who did not) are obtained as averages over the respective subsamples. One can also calculate the corresponding estimates for all countries underlying the estimation of the model. The standard deviations of the estimates are calculated by bootstrap.

4.2. Motivation for the instrumental variables

The endogeneity in this treatment effects model stems from a probable correlation between grade failure and non-observable individual attributes, so that the latter may be reflected on the measured effect of grade failure. Therefore the indicator of repetition at ISCED 1 was instrumented by a maturity index, in the vein of Angrist and Krueger (1991) and, more recently, Bedard and Dhuey (2006) (see section 2.3 for the details about the construction of this variable), and the indicator of repetition at ISCED 2 by the same maturity indicator and a variable that seeks to capture different regional retention practices.

It is straightforward to argue that maturity affects the probability of grade retention, particularly at ISCED 1, since older children, with more maturity, are likely to perform better. In addition, teachers may be reluctant to hold back older children due to negative stigma effects. Indeed, in the previous section, the indicator of maturity emerges as an important determinant of repetition. However, the main question is whether a measure of maturity is related to unobserved individual attributes, after controlling for all the observable ones (namely, individual, family, peer, school and regional) and country fixed-effects. We assume that the additional variation within each country, conditional on all those variables, is generated by exogenous shocks (*e.g.* an unpredictable event positively or negatively affecting the student). In this case, the individual unobservable attributes will not be related to maturity.

As an alternative approach to retention at ISCED 2, which is closer to the moment the PISA tests are taken, we use an additional variable that captures cross-country differences in grade retention practices. For this purpose, we take the average level of regional retention[12], controlling at the same time for socioeconomic characteristics and attitudes towards education in those regions. Our hypothesis is that after controlling for these variables as well as school characteristics and country fixed-effects, the variation in retention across regions will mainly capture differences in retention practices. In some countries, for instance, the Netherlands, the regulation of grade retention is not centralized, but partly defined at the regional level. If our instrument captures such differences, it is possible to argue that it affects the likelihood of repetition. Again, the question is whether the instrument is related to unobservable determinants of test scores at a later point in time. It is assumed that the regional repetition level affects individual performance only through the repetition indicator or; in other words, the unobservable determinants of test scores do not vary in response to changes in retention practices.

Despite being strong, these assumptions are tenable given the detailed information we have, respectively, by student and region (see Pereira and Reis, 2014, for further discussion about the validity of the instruments). The results for determinants of grade repetition and significance of the instruments presented in table 3.1.1 show that in our main specifications the instruments (maturity for ISCED 1 and maturity plus average retention for ISCED 2) are important explanatory factors of the likelihood of repetition. Furthermore, the main findings in the article are robust to using the instruments separately.

To the extent that our model includes country fixed-effects, the use of the abovementioned instruments is essentially based on variability within countries as a source of exogenous variation.[13] With regard to retention practices, given that the Portuguese education system is very centralized,

such exogenous variation (notably, regional or between schools) will tend to be lower than in other countries in the sample. Concerning maturity at the beginning of compulsory education, the variability in the distribution throughout the year of the time the required age is reached may be larger in countries with higher educational decentralization, as the regulations in this area tend to be vague and admit numerous exceptions.[14] Therefore the instrumentation of repetition indicator benefits from estimating a multi-country regression.

5. Empirical results

This section presents the estimates of the average treatment effects (ATE) for the Portuguese students in PISA, as well as for repeaters (ATET) and non-repeaters (ATENT), obtained by the Heckman control function method. We consider grade failure at ISCED 1 and ISCED 2, and scores in reading and math, as a measure of performance. We present, in addition, the treatment effects estimated by ordinary least squares.[15] Naturally, in the presence of endogeneity and interaction of grade failure with unobservables, this estimator is biased. Nevertheless, a comparison of the least squares estimates with estimates taking into account selection for treatment and unobserved heterogeneity provides an additional cross-checking of the findings.

5.1. Impact of student retention on test scores

The estimates in table 5.1.1 differ substantially depending on whether we consider grade failure at an initial stage of basic education or later on. We estimate a negative and statistically significant effect of retention during ISCED 1 on the performance of Portuguese students, both for those who were treated (ATET), and for those who were not, if they had been (ATENT). Contrary to what might be expected, the impact of treatment is (slightly) more negative among the first of these groups, although the difference is not statistically significant. In relative terms, in the case of reading, the estimates in table 5.1.1 correspond to about -19 and -14 percent of the average score, respectively, for repeaters and non-repeaters. In contrast, for retention at ISCED 2, the findings are clearly differentiated depending on the group considered. We estimate a positive and statistically significant effect on the performance of repeaters, although of a small magnitude (about 4

Table 5.1.1 • Average impact of grade retention during basic education in Portugal

		ISCED 1				ISCED 2			
		Reading		Mathematics		Reading		Mathematics	
Heckman control function	ATE	-74.3	(6.2)***	-83.4	(6.0)***	-15.7	(4.9)***	-21.4	(4.7)***
	ATET	-76.5	(6.5)***	-87.9	(5.9)***	15.7	(5.3)***	14.0	(5.1)***
	ATENT	-73.9	(6.6)***	-82.6	(6.5)***	-21.4	(5.3)***	-27.8	(5.1)***
	$\sigma(u_R, e)$	-7.1	(3.6)**	-8.0	(3.6)**	-27.2	(2.9)***	-24.2	(2.7)***
	$\sigma(u_{NR}, e)$	1.1	(4.0)	3.9	(3.7)	-53.3	(3.1)***	-53.0	(2.9)***
Ordinary least squares	ATE	-83.0	(2.7)***	-92.2	(2.4)***	-72.8	(2.2)***	-74.2	(2.2)***
	ATET	-76.1	(2.3)***	-83.6	(2.2)***	-68.5	(2.2)***	-69.3	(2.2)***
	ATENT	-84.3	(2.9)***	-93.8	(2.6)***	-73.5	(2.2)***	-75.1	(2.3)***

Source: Authors' calculations.
Note: The treatment effects are obtained as described in section 4.1; the table presents averages for the Portuguese students. The parameters σ(uR,e) and σ(uNR,e) are estimated commonly for all countries. Standard deviations obtained by bootstrap in parentheses. * Significant at 10%; ** Significant at 5%; and *** significant at 1%.

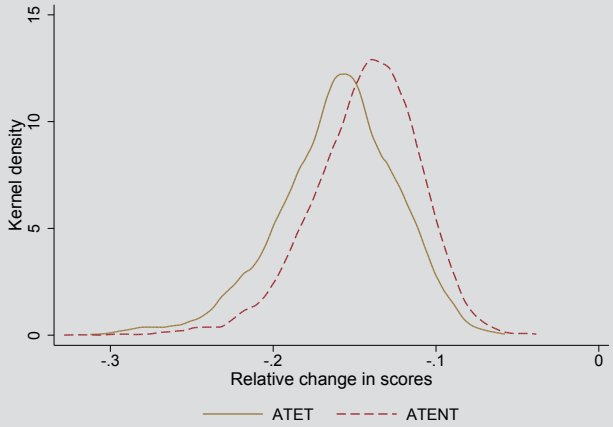
percent of the respective average score for reading). For non-repeaters, we still estimate a negative impact if the treatment had occurred, but a less important one (about -4 percent of the average group score for reading). Evidence on the basis of math and reading scores is very similar.

The evidence presented in table 5.1.1 is complemented with charts 5.1A and 5.1B that show the distribution by the student population of treatment gains in terms of reading performance, for repeaters and non-repeaters (the corresponding charts for math give similar indications). Note that when measuring the treatment gains for a given student it is preferable to use the relative variation in scores than the absolute. To this end, we take as a reference the situation in the absence of retention (which may be observed or counterfactual, depending on the group of students at issue). Therefore in the case of a student i who was held back, we take the ratio to the score excluding the estimated gains from treatment, *i.e.* $ATET_i \ / \ (S_i - ATET_i)$, where S_i is the observed score. In the case of a student who did not fail the grade, the gain is given by $ATENT_i \ / \ S_i$.

Chart 5.1A shows that the distribution of the effects of grade failure at ISCED 1 for the treated is slightly displaced to the left relative to the distribution of the potential effects on the untreated. Thus, the findings in this respect presented in table 5.1.1 for the mean hold in fact for the entire distribution. Furthermore, it is estimated that the impact of repetition at ISCED 1 is negative over the whole distribution for both groups of students. Regarding retention at ISCED 2, chart 5.1B indicates clear differences between the distributions of effective treatment gains for repeaters and potential gains for non-repeaters. While for the latter group there are losses virtually throughout the entire distribution, it is estimated that most repeaters reap benefits from treatment.

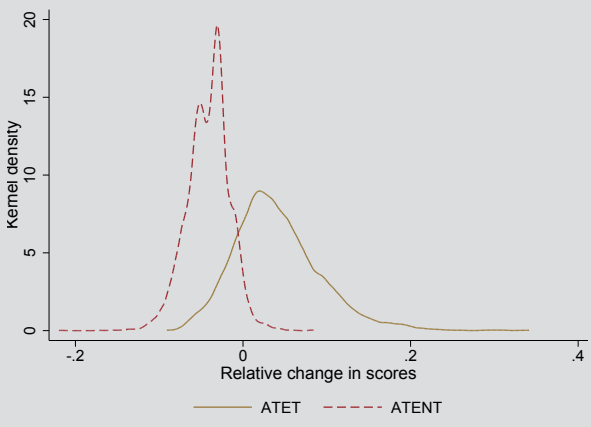
Pereira and Reis (2014) show that these findings are robust to changes in the instruments[16], despite some sensitivity in the size of estimated of treatment effects.

Chart 5.1 A • Distribution of the effects of grade retention at ISCED 1 for repeaters (ATET) and non-repeating (ATENT) in Portugal, scores in reading



Source: Authors' calculations.
Note: Distribution of the ratio $ATET_i/(S_i\text{-}ATET_i)$ for repeaters, and the ratio $ATENT_i/S_i$ for non-repeaters, where S_i is the observed score and $ATET_i$ and $ATENT_i$ the effect of the treatment on student *i*.

Chart 5.1 B • Distribution of the effects of grade retention at ISCED 2 for repeaters (ATET) and non-repeating (ATENT) in Portugal, scores in reading



Source: Authors' calculations.
Note: Distribution of the ratio $ATET_i/(S_i\text{-}ATET_i)$ for repeaters, and the ratio $ATENT_i/S_i$ for non-repeaters, where S_i is the observed score and $ATET_i$ and $ATENT_i$ the effect of the treatment on student *i*.

5.2. Interpretation of results

As mentioned above, the treatment effects in this article are estimated from a sample of students with approximately the same age and attending different grades. Retained students attend a lower degree than they would without retention. This tends to impact negatively on estimates of treatment effects reflecting differences in curricula (adding to other potential impacts such as through instruction time, teacher quality, or even educational trajectories). It is not possible to isolate a specific effect of grade retention via the academic degree on performance in PISA, but its magnitude should be substantial.[17]

The estimates presented in table 5.1.1 indicate, firstly, a very negative effect of retention at ISCED 1 on performance in PISA. As the PISA tests are taken around the end of ISCED 2, this is a long--term effect (say, between 4 and 9 years after grade failure). Such result contradicts the common perception that grade failure at an early stage of the educational career may be beneficial (or, at least, relatively less harmful), to the extent that it gives the child an opportunity to catch up with the necessary maturity levels[18] (for instance, Tomchin and Impara, 1992, for the United States). Note that the empirical evidence tends to contradict this perception, with several studies finding negative effects of early retention on long-term performance (Baenen, 1988, Pagani *et al.*, 2001, among others). The results in this article are thus generally in line with such literature, but the evidence presented in table 5.1.1 provides yet other elements of interest in this regard.

The least squares estimate of the impact of grade failure at ISCED 1 has a similar magnitude as the estimates correcting for the endogeneity of treatment. In fact, the mean treatment effect estimated by the Heckman control function is only slightly lower (in absolute terms) than the strongly negative least squares estimate, both for reading and math. The respective confidence intervals intersect. In the case of retention during ISCED 2, by the contrary, the correction of endogeneity brings about a much less negative mean treatment effect. Consistently, the covariances between the error terms in outcome equations and selection equation for ISCED 1 regressions, are negative but on the brink of non-significance (parameter $\sigma(u_R, e)$) or not significant at all (parameter $\sigma(u_{NR}, e)$). Again this in contrast to the corresponding estimates for retention at ISCED 2, which are negative[19] and highly significant, as expected in the presence of endogeneity. Remember that these parameters capture the co-movement between the unobservable factors in the primary and selection equations. While such results apply to the countries in the sample as a whole and not specifically to Portugal, it should be noted that the unobservable factors should be uncorrelated with country-related aspects (captured by the inclusion of respective fixed-effects).

Results suggest a low degree of endogeneity in the selection of students for retention during ISCED 1. In other words, unobservable factors that determine the performance of students at a later stage of the educational career seem not to play an important role in the selection of students for retention at an early stage of it. The fact that the actual losses of repeaters (ATET) are slightly higher than the potential losses of non-repeaters (ATENT) also indicates a failure in selection for treatment. Note that this phenomenon is not related to observable characteristics of students. With regard to those, it is shown in section 5.3 that the students who benefit most from treatment are generally those more likely to be chosen, in accordance with the evidence in section 3.

In conclusion, the findings in this article indicate that early retention - a practice particularly prevalent in Portugal (see Table 2.1.1) - seems to be detrimental to educational performance in the long run. Thus, there may be an advantage in replacing to some extent this practice for alternative support programs. In Portugal, an example of this type of actions is the program «Mais Sucesso Escolar» whose goal is to support projects to prevent and combat school failure in basic education.

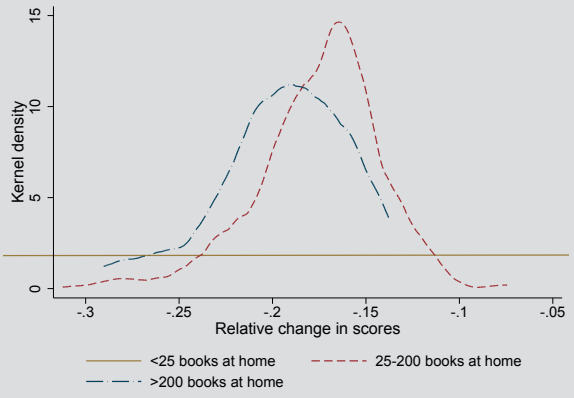
Furthermore, the results suggest that the mechanism of selection could not effectively scrutinize at an early stage of school life which children would benefit from treatment in the long-term. Two sorts of reasons may explain this last result. On the one hand, some unfavorable characteristics of younger students, notably, immaturity, may be overcome in later stages, and cease to play an important role for performance. The data nonetheless exclude that this process is a consequence of treatment, *i.e.* grade failure at ISCED 1 could have led students to change personality traits with a negative impact on performance. Indeed, if this had happened, repeaters should reap more benefits (less losses) from treatment than non-repeaters, which is not the case. On the other hand, the selection of repeaters at ISCED 1 is based on less information and entails more subjective judgment by the participants in the process (notably, teachers and parents) than at a later stage. Recall, for example, that at the early grades of ISCED 1 such a decision is primarily based on the assessment of a single teacher.

With regard to grade failure during ISCED 2, the estimates in table 5.1.1 indicate a small positive effect on performance in Portugal. Our results are in line with recent studies such as Gary-Bobo *et al.* (2014) for France and Baert, *et al.* (2013) for Belgium. Older literature as Hagborg, *et al.* (1991) tended to find negative effects of repetition, particularly at a later stage. Given that PISA tests are taken around the end of ISCED 2, in this case grade retention precedes the tests by around 1 to 3 years. Therefore one cannot rule out that the measured positive effects of grade failure are limited to the years immediately after treatment. There are several studies concluding that performance gains from retention are confined to the short-term (*e.g.* Mantzicopoulos *et al.*, 1992, and Roderick and Nagaoka, 2005). PISA assesses the use of school knowledge from a practical standpoint, not as formal testing. This suggests the possibility of persistence in treatment gains, but one cannot draw firm conclusions on this point.

5.3. Effects of retention by characteristics of repeaters

In this section we present some evidence on the effects of grade retention on treated students conditional on their observable characteristics. We consider socio-economic background of students, gender and living with parents. Only the findings for reading scores are discussed, as math scores give very similar indications.

Chart 5.3.1 A • Distribution of the effects of grade retention at ISCED 1 by the socioeconomic background of repeaters, scores in reading



Source: Authors' calculations.
Note: Distribution of the ratio $ATET_i/(S_i\text{-}ATET_i)$, where S_i is the observed score and $ATET_i$ the effect of the treatment on student i (repeater), for the categories of the variable books at home.

Chart 5.3.1 B • Distribution of the effects of grade retention at ISCED 2 by the socioeconomic background of repeaters, scores in reading

Source: Authors' calculations.
Note: Distribution of the ratio $ATET_i/(S_i\text{-}ATET_i)$, where S_i is the observed score and $ATET_i$ the effect of the treatment on student i (repeater), for the categories of the variable books at home.

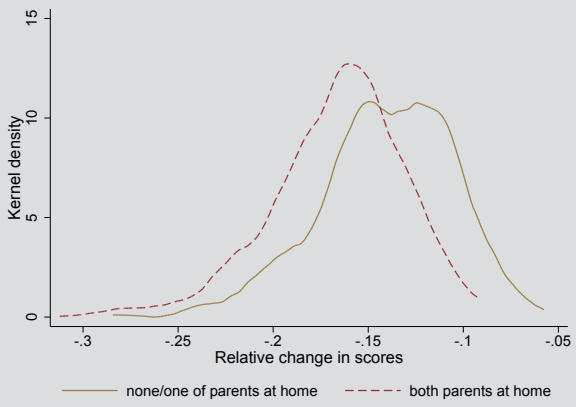
The socio-economic background is measured by the number of books at home (an indicator commonly used in this context) considering three cohorts. Charts 5.3.1A and 5.3.1B show that the gains (losses) of repetition are larger (smaller) for students from disadvantaged families for both levels of education considered. For ISCED 2, the treatment produces gains of 0.3, 3.2 and 5.6 percent, on average, in the scores of treated students, from the highest cohort to the lowest. The difference between the outer cohorts is statistically significant. Regarding retention at ISCED 1, the corresponding figures are -19.4, -17.5 and -14.7 percent; in this case, negative treatment effects throughout the distribution are estimated even for the most disadvantaged students. Recall that in section 3 we showed that students from disadvantaged families were more likely to be selected for retention; it turns out that such students also benefit most (or lose least) with treatment.

With regard to gender, the change in scores of female students subjected to treatment is more positive than that of male students (not shown). The treatment gains are, respectively, 6.0 and 2.5 percent, on average, for retention at ISCED 2 (-14.6 and -17.4 percent at ISCED 1). The differences between such estimates are, however, not statistically significant. Although male students tend to benefit less (or lose more) with treatment once chosen, the probability of being so is relatively higher (see section 3).

Finally we consider differentiated effects of grade repetition depending on the situation of repeaters in terms of living with their parents (Charts 5.3.2A and 5.3.2B). Scores of those who do not live with both parents vary more positively with treatment (this is clearer for ISCED 1 than for ISCED 2). Treatment brings about changes of -14.0 and 5.5 percent in the scores of repeaters, respectively, at ISCED 1 and ISCED 2 (-16.6 and 3.7 percent for those who live with both parents).

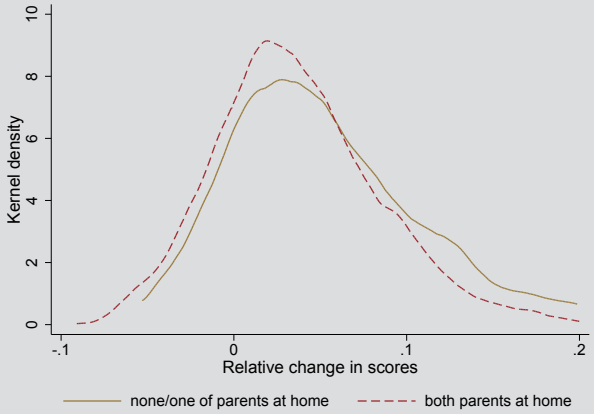
In general, the variation in the effects of repetition as a function of the analyzed characteristics goes in the same direction, whether repetition occurs at ISCED 1 or 2. Moreover, with regard to family variables, selection tends to encompass those who benefit more (or lose less) with treatment. Thus, as noted, the slightly more negative estimate for ATET vis-a-vis ATENT obtained for ISCED 1 (Table 5.1.1 and Chart 5.1A) seems to reflect the interaction with unobservable characteristics.

Chart 5.3.2 A • Distribution of the effects of grade retention at ISCED 1 by the situation of repeaters in terms of living with parents, reading scores



Source: Authors' calculations.
Note: Distribution of the ratio $ATET_i/(S_i\text{-}ATET_i)$, where S_i is the observed score and $ATET_i$ the effect of the treatment on student *i* (repeater), for the categories of the variable living with parents.

Chart 5.3.2 B • Distribution of the effects of grade retention at ISCED 2 by the situation of repeaters in terms of living with parents, reading scores



Source: Authors' calculations.
Note: Distribution of the ratio $ATET_i/(S_i\text{-}ATET_i)$, where S_i is the observed score and $ATET_i$ the effect of the treatment on student *i* (repeater), for the categories of the variable living with parents.

5.4. Comparison with the estimates for a set of European countries

We now make a comparison between the effects of grade failure in Portugal and in the group of European countries that were the basis for estimations. Table 5.4.1 shows the average treatment effects for the entire sample.[20]

In general, the results for the set the European countries considered are broadly consistent with those obtained for Portugal. On the one hand, grade repetition at ISCED 1 has very negative effects for those submited to treatment, in contrast to the positive effects of repetition at ISCED 2. Moreover, the difference between the ATET and ATENT for ISCED 1 is statistically not significant (the estimate of the second parameter being less negative than the estimate of the first one). The magnitude of treatment benefits for repeaters at ISCED 2 in table 5.4.1 is, however, higher than previously estimated for Portugal. More generally, Pereira and Reis (2014) show that country fixed-effects interact strongly with the indicator of repetition. This may be explained, among other factors, by the differences among policies of support to repeaters implemented in the different education systems, an issue discussed in more detail in that study.

Table 5.4.1 • Average impact of grade retention during basic education in a set of European countries

		ISCED 1				ISCED 2			
		Reading		Mathematics		Reading		Mathematics	
Heckman	ATE	-59.9	(8.8)***	-64.4	(8.9)***	4.1	(6.4)	-6.9	(6.0)
control	ATET	-63.7	(7.2)***	-76.5	(6.7)***	49.0	(5.6)***	42.0	(5.2)***
function	ATENT	-60.1	(8.5)***	-65.0	(8.6)***	7.8	(6.0)	-2.8	(5.6)

Source: Authors' calculations.
Note: The treatment effects are obtained as described in section 4.1; the table presents averages for all students in the sample. Standard deviations obtained by bootstrap in parentheses.
* Significant at 10%; ** Significant at 5%; and *** significant at 1%.

6. Conclusions

This article studies the determinants of grade retention during basic education and analyzes its effects on student performance in Portugal compared to Europe, using data from OECD PISA 2003 and 2009. The main conclusions are as follows.

- The results point to the importance of individual characteristics, family and peers as determinants of grade retention. In particular, students with less maturity and worse economic conditions are more likely to repeat in Portugal.

- Despite the importance of socio-economic aspects, there are other factors that help explain grade failure. The results suggest the importance of school characteristics, regional differences and differences at the country level (*e.g.* institutional features).

- The long-term effects of repetition at ISCED 1 on student performance in Portugal are negative, which suggests that there will be advantage in replacing this practice, at least partially, for alternative ways of supporting students who have learning difficulties in the early stages of school life.

- Students who are most likely to be retained during ISCED 1 on the basis of their observable

characteristics (*e.g.* socio-economic factors) tend to be less penalized with treatment. In contrast, at this early stage of schooling, there seems to be difficulties in identifying the students whose unobservable characteristics would enable them to achieve gains in performance over the long-term.

- The effects of short-term repetition at ISCED 2 in Portugal are positive albeit small. Therefore, despite the uncertainty about the long-term effects, our results do not call into question the practice of retention for higher levels of schooling. In addition, there is an alignment between selection for treatment and treatment benefits, both in regard to observable and unobservable characteristics of students.

- The results for the set of European countries considered in the sample are broadly consistent with those for Portugal, but there is a more positive effect of student retention at ISCED 2 in the first case.

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Notes

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2. Banco de Portugal, Economic Research Department.

3. The number of grades in each level is similar but not necessarily the same across countries. For more details, see Eurydice (2013).

4. These countries are: Austria, Germany, Belgium, Denmark, a Slovakia, Spain, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Liechtenstein, Luxembourg, the Netherlands, Poland, Portugal, the Czech Republic, and Sweden, for which there is information available for 2003 and 2009. In 2009 there are also data for Bulgaria, Slovenia, Estonia, Lithuania and Romania.

5. Using means at the level of the PISA stratification variable that has in most cases a regional component. For countries where this is not the case, we use means at the level of the school location variable (village, small town, town, city and large city).

6. In this article we use the mean of the five plausible values for each discipline. Note that in the estimations the variance is generally calculated by bootstrap.

7. Despite some exceptions, in Portugal the cut-off date is September 15 of the year the student turns out 6 years old.

8. In most countries the school years starts in September.

9. We are assuming the existence of low mobility of students across schools and regions, which should be reasonable for most countries as we are considering basic education levels only.

10.The study of the impact of grade retention on performance for this group of students would require a slightly different methodological approach than the one presented in section 4, notably multiple treatment effects.

11.Thus one is just imposing a common influence of the instruments on the propensity to repeat in Portugal and the other countries in the sample.

12.For the calculation of this variable, we took averages at the level of the PISA stratification variable (which in most cases has a regional component) and the school location indicator.

13. More accurately, in the case of maturity (measured in months) as the model includes, in addition to the country fixed-effects, the entry age in compulsory education (in years), the source of exogenous variation is the variability of maturity within country and entry age cohorts.

14. For example, for Germany, Kluve and Fertig (2005) write *«Regulations determining maturity, and hence enrolment and deferment decisions, are somewhat vague: in some cases parental application is sufficient, in some cases approval by the school and/or a public health officer is required, and sometimes decisions are based on a test. This leads to the fact that there is possible variation in enrolment practices over time and across federal states, and even between neighboring schools.»*

15.Note that even for this estimator *ATET* and *ATENT* differ due to the existence of interactions of grade retention with various covariates.

16.For example, the consideration of retention practices in the regressions for ISCED 1, or the maturity indicator, separately, for ISCED 2.

17.It is possible to get an idea of such magnitude by running regressions for repeaters and non-repeaters of scores on the academic degree and covariates included in the education production function (but excluding entry age which is precisely meant to capture, along with grade failure, the impact of academic degree). It is estimated that attending the degree immediately above can bring gains of around 40 points for repeaters (ISCED 1 and ISCED 2) and 30 points for non-repeaters (reading scores).

18.This perception by teachers about beneficial effects of retention typically covers the kindergarten and early primary grades.

19.The negative sign of these covariances stems from the fact that important unobservable factors explaining performance (say, ability and motivation of the student) also play a role in the selection equation, but with the opposite effect.

20.The differences to the estimates presented in Pereira and Reis (2014) are justified by the fact that the latter are based on a model without interactions for Portugal.

Appendix 1 - Summary Statistics - peer, school and regional characteristics (mean)

	ISCED 1		ISCED 2	
	Total	Portugal	Total	Portugal
Peer variables				
Books at home (25-200) - peers	0.52	0.49	0.52	0.49
Books at home (>200) - peers	0.25	0.16	0.24	0.16
Lower secondary education - peers	0.09	0.20	0.09	0.20
Upper secondary education - peers	0.45	0.22	0.46	0.22
Terciary education - peers	0.41	0.26	0.40	0.26
Single-parent family - peers	0.14	0.14	0.14	0.14
No parents at home - peers	0.01	0.03	0.01	0.03
Immigrant - peers	0.07	0.05	0.07	0.05
Educational resources at home - peers	5.00	4.86	4.99	4.87
White collar - low skill - peers	0.23	0.29	0.24	0.29
White collar - high skill - peers	0.53	0.36	0.52	0.36
School variables				
located town 15000- 100000 inh. (b)	0.40	0.43	0.40	0.43
located town > 100000 inh. (b)	0.28	0.21	0.29	0.21
Percentage of girls	24.54	24.12	25.37	24.76
Grade amplitude (max-min grade)	7.53	6.28	5.19	5.16
Class size	22	21	23	22
Student/teacher ratio	12.60	9.49	12.98	9.83
Percentage of computers with web	0.82	0.82	0.86	0.77
School educational resources	0.00	0.00	0.00	-0.11
Teacher participation	0.21	-0.33	0.10	-0.43
Teacher shortage	-0.06	-0.53	-0.11	-0.65
School Size	540	808	630	983
Private school (b)	0.23	0.20	0.15	0.10
Ability grouping between classes (b)	0.64	0.62	0.61	0.52
Admission criteria: residence (b)	0.40	0.48	0.37	0.38
Admission criteria: academic record (b)	0.18	0.02	0.22	0.01
Admission criteria: feeder schools (b)	0.14	0.02	0.18	0.01
Admission criteria: Religious philosophy	0.14	0.21	0.10	0.14
School responsibility: resource allocation	2.92	2.37	2.68	2.01
School responsibility: curriculum and assessment	3.08	2.32	2.94	1.99
Student absenteeism (b)	0.09	0.08	0.10	0.12
Students with disruptive behaviour (b)	0.07	0.07	0.06	0.07
Students skipping classes (b)	0.06	0.06	0.06	0.09
Students being bullied (b)	0.02	0.00	0.01	0.00
Math regulat lessons	3.31	3.85	3.19	3.79

Source: PISA 2003 and2009.
Note: (b) stands for binary variable.

Appendix 1 - Summary Statistics - peer, school and regional characteristics (mean)

	Total	Portugal
Regional characteristics		
Books at home (25-200) - region	0.52	0.49
Books at home (>200) - region	0.24	0.16
Lower secondary education - region	0.10	0.20
Upper secondary education - region	0.46	0.22
Terciary education - region	0.40	0.26
Single-parent family - region	0.14	0.14
No parents at home - region	0.01	0.03
Immigrant - region	0.07	0.05
First language not test language - region	0.04	-
Foreign language at home - region	0.04	0.01
Educational resources at home - region	4.98	4.86
White collar - low skill - region	0.23	0.29
White collar - high skill - region	0.52	0.35
Attitude towards school - region	-0.04	0.31
Relation with other students - region	-0.09	0.31
Retention practices	0.09	0.19

Source: PISA 2003 and 2009.
Note: (b) stands for binary variable.

Forecasting Portuguese GDP with factor models[1]

Francisco Dias[2] | Maximiano Pinheiro[3] | António Rua[2]

ABSTRACT

In this article, we assess the relative performance of factor models to forecast GDP growth in Portugal. A large dataset is compiled for the Portuguese economy and its usefulness for nowcasting and short-term forecasting is investigated. Since, in practice, one has to cope with different publication lags and unbalanced data, we also address the real-time performance of such models.

1. Introduction

With the widespread development of the statistical systems, the information set available to policymakers has become progressively larger. Naturally, this poses methodological challenges in terms of how to take on board all the available data, which can involve hundreds of series.

For forecasting purposes, the use of factor models to forecast macroeconomic variables in a data rich environment has become increasingly popular in the literature and among practitioners at central banks and international institutions. See, for example, Stock and Watson (1998, 2002a, 2002b) and Giannone *et al.* (2008) for the United States, Marcellino *et al.* (2003) and Angelini *et al.* (2011) for the euro area, Artis *et al.* (2005) for the UK, Schumacher (2007, 2010, 2011) and Schumacher and Breitung (2008) for Germany, Barhoumi *et al.* (2010) for France, de Winter (2011) and den Reijer (2013) for the Netherlands, and for a cross-country study encompassing several European countries see Rünstler *et al.* (2009).

Factor models allow circumventing the curse of dimensionality when dealing with large datasets by reducing the dimension of the number of series to a manageable scale, which is particularly useful in the case of forecasting. In fact, these models allow one to summarize the information contained in large databases in a set of a handful of unobserved common factors that drive a sizeable fraction of the overall comovement amongst the whole set of variables in the dataset. However, since it ignores entirely the information content other than the one conveyed by this small set of factors, it may potentially disregard data that can be useful for the variable to be forecasted or the forecast horizon under consideration.

Dias, Pinheiro and Rua (2010) suggest an alternative procedure to overcome this shortfall. In particular, a tailor made targeted diffusion index (TDI) dependent on the variable to be forecasted and the forecast horizon is proposed. This index is simply a weighted average of all the factors of the dataset that take into account both the explanatory power of each factor for the variable to be forecasted and the relative importance of the factor in capturing the total variation of the series. For the US case, such an approach outperformed the standard factor model in forecasting several macroeconomic variables.

Herein, we focus on the Portuguese case which was one of the hardest hit economies as from the latest economic and financial crisis. In particular, we assess the performance of several alternative factor models to forecast GDP growth using a large dataset compiled for Portugal, which encompasses 126 monthly series as from 1995.

By considering a relatively long out-of-sample period, from 2002 up to 2013, we can assess the relative performance of the different models during the pre-crisis period and during the latest years where pronounced GDP downturns and upswings were observed. This can be particularly useful to assess the robustness of the forecasting performance of factor models in periods of significant economic stress.

Since forecasting in real-time typically involves missing observations for some of the variables due to different release lags, we also address how to overcome this issue and evaluate the corresponding pseudo real-time forecasting performance.

The article is organised as follows. In section 2, an introductory overview of the factor models considered in subsequent analysis is provided. In section 3, we describe the dataset for Portugal whereas in section 4 the estimated common factors are discussed. In section 5, we assess the out-of-sample forecasting performance with balanced data. In section 6, the issue of how to deal with unbalanced data is addressed whereas in section 7 the pseudo real-time performance is evaluated. Finally, section 8 concludes.

2. Factor models

Formally, the static factor model assumes that each and every variable in the data set can be specified as a combination of two terms: one component driven by a small set of latent unobserved static factors common to all variables and an idiosyncratic component specific to each variable, that is

$$X_t = \Lambda F_t + e_t$$

where X_t is the N-dimensional vector time series in the panel for period t, Λ is an (Nxr) matrix of factor loadings, F_t is the vector of r unobserved common factors and e_t is the N-dimensional vector of idiosyncratic terms. The unobserved factors can be estimated relying on the principal components technique which is shown to provide a consistent estimator of the factor space under fairly general conditions.

Dynamic factor models, on the other hand, were originally developed by Geweke (1977), Sargent and Sims (1977), Geweke and Singleton (1981) and Watson and Engle (1983) and applied in the context of a limited number of variables. This type of model has been extended to handle the information conveyed by large data sets. The dynamic factor model has an equivalent static factor model representation, where the r-dimensional static factors comprise both current and lagged values of the q dynamic factors. When the number of static and dynamic factors are the same, that is, r = q, there is no difference between the static and dynamic forms (see Stock and Watson (2005)). Moreover, as pointed out by Bai and Ng (2007), not much is expected to be gained from the distinction between the static factors and the dynamic factors for forecasting purposes.

Typically, the first few top-ranked principal components capture a sizeable share of the comovent amongst the series in the dataset. Once the number of factors is determined, the variable to be forecasted y is projected on the set of the r estimated factors and possibly on lags of the dependent variable. This results in the following forecasting model

$$y_{t+h} = \beta_0 + \sum_{i=1}^{r} \beta_i \hat{F}_{t,i} + \sum_{j=0}^{p} \delta_j y_{t-j} + v_{t+h}$$

where h refers to the forecast horizon, y_{t-j} are the autoregressive components of the regression and v_{t+h} denotes the forecast error. Such an approach corresponds to the so-called diffusion index (DI) model proposed by Stock and Watson (1998, 2002a, 2002b).

In practice, the above discussed factor model requires a priori the determination of the number of factors and the space spanned by those factors relies on the principal components method. In fact, the factors reflect the top-ranked principal components, that is, the ones that encompass the largest share of the common comovement in the dataset. All other lower-ranked factors are entirely disregarded independently of their possible informational content for forecasting the variable of interest. This can result in an important shortcoming for the forecasting purposes as such an approach does not take into account neither the specific variable to be forecasted nor the forecast horizon. This shortfall was circumvented in Dias, Pinheiro and Rua (2010), where the authors propose a targeted diffusion index (TDI), which reconciles both the spirit of the Stock and Watson approach and the targeting principle discussed by Bai and Ng (2008). Basically, the suggested procedure considers in the forecasting model a synthetic regressor which is computed as a linear combination of all the factors of the dataset, that is

$$y_{t+h} = \beta_0 + \beta_1 F^{\circ}_{(h)t} + \sum_{j=0}^{p} \delta_j y_{t-j} + v_{t+h}$$

$$F^{\circ}_{(h)t} = \sum_{n=1}^{N} \left(\frac{\omega_{(h)n}}{\sum_{i=1}^{N} \omega_{(h)i}} \right) \hat{F}_{(h)t,n}$$

$$\omega_{(h)n} = \left(\frac{1}{T-h} \sum_{t=1}^{T-h} \hat{F}_{(h)t,n} y_{t+h} \right) \left(\frac{\varphi_{(h)n}}{\varphi_{(h)1}} \right)$$

The first equation is the same as in the case of the DI approach but where the top-ranked principal components, *i.e.*, the common factors, are replaced by the synthetic composite indicator. This targeted diffusion index is the convex linear combination of all the factors derived from the database, where the weights attached to each factor take into account both the relative size of the of the overall variation captured by each factor $\left(\frac{\varphi_{(h)n}}{\varphi_{(h)1}} \right)$ and its correlation with the variable of interest at the relevant forecast horizon $\left(\frac{1}{T-h} \sum_{t=1}^{T-h} \hat{F}_{(h)t,n} y_{t+h} \right)$. The weights attached to each factor are naturally dependent not only on the relative importance of the factor but also on the specific series to be forecasted and corresponding forecast horizon. This modelling strategy avoids discarding potentially relevant information contained in the dataset and it is designed to obtain a better match between the available data and the variable to be forecasted. As shown in Dias, Pinheiro and Rua (2010), this approach proved to be quite promising *vis-à-vis* the diffusion index model, improving considerably the forecast performance for several US macroeconomic variables.

3. Dataset

The monthly dataset compiled for the Portuguese economy comprises 126 series and it includes both hard and soft data. It covers business and consumers surveys (43 series), retail sales (4 series), industrial production (7 series), turnover in industry and services (20 series), employment, hours worked and wage indices in industry and services (24 series), tourism nights spent

in Portugal (3 series), car sales (3 series), cement sales, vacancies and registered unemployment (5 series), energy consumption (3 series), goods exports and imports (10 series), real effective exchange rate, Portuguese stock market index and ATM/POS series (see the Appendix for a detailed list of series and corresponding source).

Although most series are provided on a seasonally adjusted basis, for those variables that are not, but which present a seasonal pattern, a seasonal adjustment was conducted resorting to X12-ARIMA. The sample period runs from the beginning of 1995 up to the end of 2013 (T=228 monthly observations). Since for some variables the series start later than 1995, we resort to the Expectation-Maximization (EM) algorithm suggested by Stock and Watson (2002a) to balance the dataset at the beginning of the sample period.

Regarding GDP, the series in real terms is available from the Portuguese National Statistics Office (INE) as from the first quarter of 1995 up to the fourth quarter of 2013 on a seasonally adjusted basis.

With the exception of survey data, all series are taken in logarithms. The series are then differenced to obtain stationarity. For GDP we took the first-difference of the quarterly series, which corresponds to the quarter-on-quarter growth rate. For the monthly series we compute a 3-month difference, that is, the change in one month as against three months earlier.[4]

Additionally, for the estimation of the common factors, we use outlier-adjusted series, as in Stock and Watson (2005). The outlier adjustment corresponds to replacing observations of the transformed series with absolute deviations exceeding six times the interquartile range by the median value of the preceding five observations.

4. Common factors

In the case of the diffusion index model approach one has to determine the number of factors to consider for the forecasting purposes. Based on the IC_2 criterion suggested by Bai and Ng (2002), we find the number of static factors to be four. As a whole these four factors explain 41 per cent of the total variation in the monthly dataset over the entire sample with the first factor accounting for 21 per cent, the second 9 per cent, the third 6 per cent and the fourth 5 per cent. In the case of the United States and using the same criterion, Bai and Ng (2007) show that the common factors (which were determined to be seven) explain as a whole 46 per cent of the variation in the dataset compiled by Stock and Watson (2005) which comprises 132 monthly series.[5]

As is Stock and Watson (2002a), to characterize the factors we present in chart 4.1 the R^2 of the regressions of the 126 individual series on each of the four factors over the entire sample period. We find that the first factor is related with industrial and services activity and external trade and some labour market series namely hours worked in industry. The second factor reflects to a large extent business and consumer confidence while the third factor is related with labour market developments namely employment. Finally, the fourth factor seems to be spread out meaning that is not representative of any particular type of series.

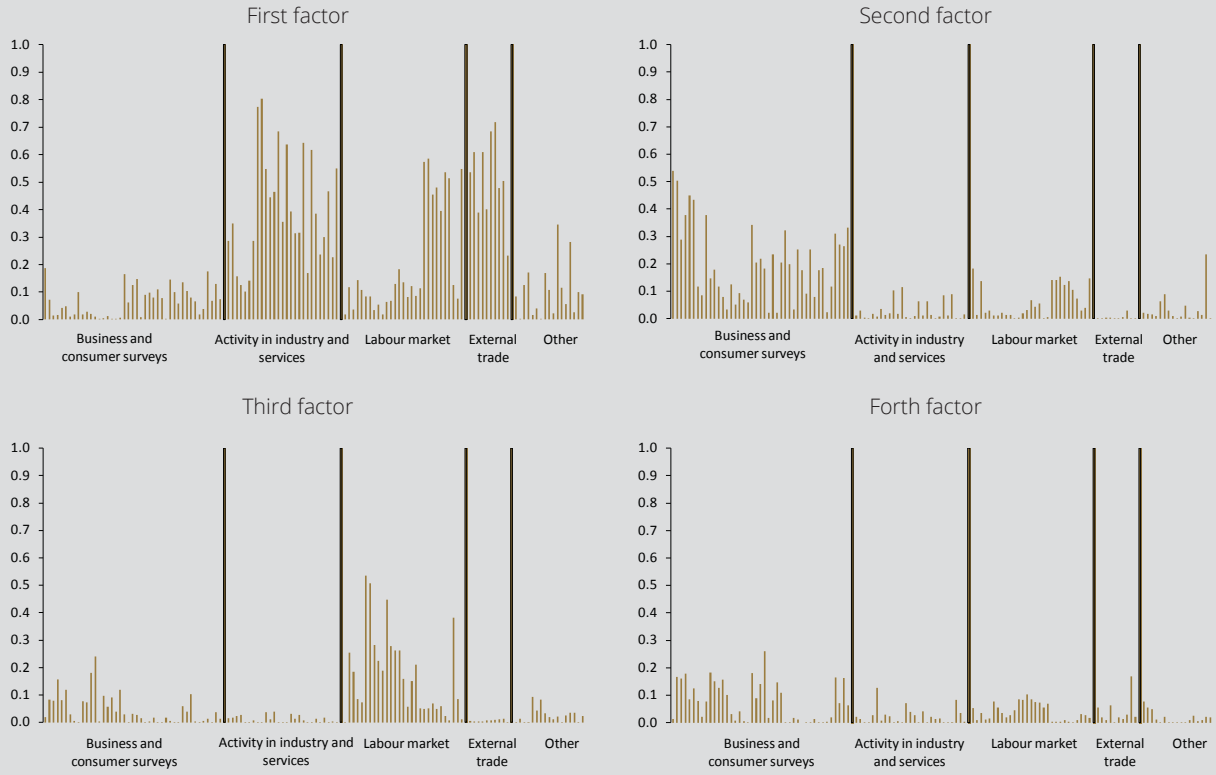
Given the number of static factors, one can determine the number of primitive or dynamic factors, that is, the factors that are dynamically distinct. In this respect, Bai and Ng (2007) propose two criteria, q_3 and q_4, to estimate the number of dynamic factors with the former having better properties for samples with small N or T. In our case, the first criterion points to the presence of four dynamic factors whereas the second suggests the existence of three. This is in line with the results of Bai and Ng (2007) who found, for the United States, the number of dynamic factors to

be the same or close to the number of static factors when the number of static factors is relatively small.

To assess the robustness of the above results to the sample period, we conduct the following exercise. Starting with the sample period up to the end of 2001, we compute the above criteria. Then, we expand the sample period by one month and compute again the criteria. This is done in each and every month until we reach the end of 2013, that is, the full sample. The resulting number of factors is presented in chart 4.2. Regarding the number of static factors, the criterion always points to the existence of four static factors. Concerning the number of dynamic factors, q_3 suggests almost always the presence of four dynamic factors whereas the results based on q_4 are more unstable changing basically between three and four dynamic factors. Overall, the above evidence reinforces the finding of four static factors which essentially coincide with the number of dynamic factors.

A similar recursive exercise has been conducted to assess the stability of the degree of the communality over time. In chart 4.3, we plot the variation in the dataset explained by the space spanned by the set of common factors as a whole as well as for each factor individually. Until the end of 2008, the results suggest a slightly increase in the case of the first factor whereas the other factors present a very mild downward trend. However, in late 2008 and early 2009, there is a sizeable increase in the communality. This is mainly evident the case of the first two factors. In fact, with the Great recession there was a significant increase in the comovement in the series which resulted in a larger variance captured by these two factors. Thereafter, there seems to be a slight overall reversal.

Chart 4.1 • R^2 between the individual series and the factors



Source: Authors' calculations.

5. Out-of-sample forecasting exercise

In this section, we present results for an out-of-sample forecasting exercise to assess the relative performance of the above mentioned models to forecast Portuguese real GDP growth.

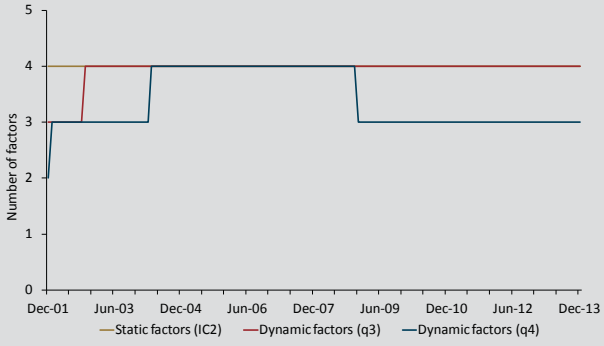
The out-of-sample forecast evaluation period runs from the first quarter of 2002 up to the fourth quarter of 2013, which corresponds to two thirds of the sample period. On the one hand, such a long out-of sample period allows for a better assessment of the relative forecasting performance of the models. On the other hand, it provides room for a sub-sample analysis which can be particularly useful given the economic features of the Portuguese economy over the last decade. In particular, we split the out-of-sample period in two sub-samples namely from 2002 Q1 up to 2007 Q4 and from 2008 Q1 up to 2013 Q4. The latter covers the period in which Portugal has been under stress with pronounced economic activity changes while the former sub-sample captures the pre-crisis period. Such an analysis will enable us to assess if the forecasting performance during a more stable period differs from the one recorded during a clearly more challenging period.

We focus on the nowcasting performance of the models (denoting this forecast horizon as h=0) as well as on forecasting up to 4-quarters ahead (h=1,...,4). In particular, the nowcast exercise involves forecasting GDP growth for a given quarter assuming that all the observations for the monthly series are available up to the end of that quarter. This corresponds to the so-called balanced data case.

As is usual in this type of exercises, we consider as a benchmark a univariate autoregressive model for GDP with the lag order determined by standard BIC criteria in each round of the recursive exercise. We have also considered for both the diffusion index and TDI models the corresponding models augmented with GDP lags. However, augmenting the regression with lags of the dependent variable does not improve on GDP forecasting performance. Hence, to save space, we present only the results for the factor models without GDP lags in the regression.

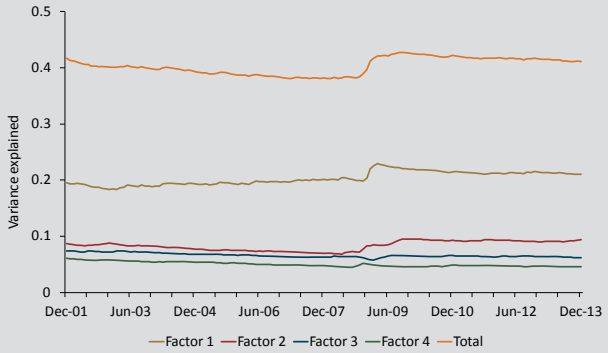
The results in terms of the Mean Squared Error (MSE) and the relative MSE *vis-à-vis* the benchmark model are presented in Table 5.1. For the forecast evaluation period as a whole, the TDI model outperforms the other models for all the forecast horizons considered. However, one should note that factor models do not seem to improve substantially on the univariate

Chart 4.2 • Number of static and dynamic factors



Source: Authors' calculations.

Chart 4.3 • Variation in the dataset explained by the common factors



Source: Authors' calculations.

autoregressive model for more distant forecast horizons. Giannone *et al*. (2008) for the United States and Runstler *et al.* (2009) for several European countries also found that the forecasting gains of using factor-augmented models disappear when the forecast horizon increases. In particular, the forecasting gains are noteworthy for nowcasting and forecasting one-period ahead, to a lesser extent for two-quarters ahead and relatively negligible for higher horizons. To assess the statistical significance of the gains in terms of GDP forecast accuracy of the factor models relative to the benchmark we computed the Diebold and Mariano (1995) test. The test results are also presented in Table 5.1 and basically support the previous finding. *Vis-à-vis* the DI approach, the TDI model presents a gain of more than 20 per cent for the shorter horizons.

To assess the robustness of the forecasting performance of the models over time we conducted a sub-sample analysis. One can see that all the models for all forecast horizons present a higher MSE in the second part of the out-of-sample period than in the first sub-sample. This results support the a priori that that the second sub-sample is a much more challenging period. In terms of the relative performance of the models, the previous findings remain unchanged for both sub-samples. In addition, one should mention that the gains of the TDI approach against the DI model for shorter horizons are less striking for the second sub-sample period.

We also computed the Mean Absolute Error as an alternative to the MSE. The results are presented in Table 5.2. One can see that all the main conclusions are robust to the forecast error measure considered.

6. Jagged edge data

As mentioned above, the exercise conducted in the previous section assumes that all the series are available up to the end of the quarter. In a real-time context, due to different release lags, one is often confronted with incomplete data for several series when the forecasting exercise is performed. This results in an unbalanced dataset at the end of the sample, the so called jagged edge

Table 5.1 • MSE and relative MSE for GDP forecasts

	Mean Squared Error					Relative Mean Squared Error				
Forecast horizon	**h = 0**	**h = 1**	**h = 2**	**h = 3**	**h = 4**	**h = 0**	**h = 1**	**h = 2**	**h = 3**	**h = 4**
Out-of-sample period: 2002Q1-2013Q4										
Autoregressive model	0.0099	0.0109	0.0116	0.0108	0.0107	1.00	1.00	1.00	1.00	1.00
DI model	0.0042	0.0089	0.0105	0.0109	0.0118	0.43 ***	0.82	0.90	1.02	1.10
TDI model	**0.0033**	**0.0071**	**0.0095**	**0.0097**	**0.0104**	0.33 ***	0.65 ***	0.82	0.90	0.98
Out-of-sample period: 2002Q1-2007Q4										
Autoregressive model	0.0090	0.0081	0.0096	0.0083	0.0084	1.00	1.00	1.00	1.00	1.00
DI model	0.0042	0.0076	0.0072	0.0095	0.0090	0.47 **	0.93	0.75	1.15	1.06
TDI model	**0.0025**	**0.0058**	**0.0064**	**0.0063**	**0.0070**	0.28 **	0.71 *	0.66	0.76	0.82
Out-of-sample period: 2008Q1-2013Q4										
Autoregressive model	0.0108	0.0137	0.0136	0.0132	**0.0129**	1.00	1.00	1.00	1.00	1.00
DI model	0.0043	0.0103	0.0137	**0.0123**	0.0146	0.40 *	0.75	1.00	0.93	1.13
TDI model	**0.0040**	**0.0085**	**0.0126**	0.0130	0.0139	0.37 **	0.62 **	0.92	0.98	1.08

Source: Authors' calculations.
Notes: Bold format denotes the best performing model for each forecast horizon. Asterisks *,**,*** denote rejection of the null hypothesis of equal forecast accuracy at 10%, 5% and 1% significance level, respectively.

data. To avoid discarding the most recent information for forecasting purposes, one has to fill in the missing data. Suppose that one is interested in updating the GDP forecast every month and that the forecasting exercise is conducted around mid-month. In chart 6.1, we provide a stylized description of the information set available at each point in time.

Chart 6.1 should be read in the following way. In the middle of the second month of the quarter, say mid-February, a subset of the series – N_1 series – are available up to January whereas for the remaining series there is no available information for any of the months of the first quarter. In mid-March, the former subset is now available up to February while the other series are available up to January. In April, only the latter series are not available up to the end of the first quarter. For the Portuguese case, taking into account the corresponding release calendar, the set of series more timely represent around 45 per cent of the total number of series in the monthly dataset.

To take on board the latest available information and to cope with the incomplete data, one has to fill in the missing observations. Hence, we assess the relative performance of the previously discussed models also to forecast the monthly series.[6] As highlighted in chart 6.1, we have to consider forecasts up to 3-months ahead. Based on the MSE criterion, we determine the number of series for which each model performs best (chart 6.2). For the entire out-of-sample period the univariate autoregressive model seems to perform best for most series and such evidence seems to be more marked for longer horizons. Qualitatively similar results are obtained for both sub-samples.

Furthermore, based on the distribution of the relative MSE of the several models *vis-à-vis* the autoregressive model (see chart 6.3), one can conclude that even when the autoregressive model does not outperform the other models, the losses are relatively small. In particular, for the series where the relative MSE is less than one, the losses are, on average, smaller than 4 per cent for all horizons (and around 5 per cent *vis-à-vis* the best performing model). In contrast, the gains of the autoregressive model against the remaining models are, on average, above 14 per cent for the one-month ahead forecasts, more than 12 per cent for two-months ahead and close to 8 per cent for the three-months ahead horizon. In summary, the parsimonious univariate autoregressive

Table 5.2 • MAE and relative MAE for GDP forecasts

	Mean Absolute Error					Relative Mean Absolute Error				
Forecast horizon	**h = 0**	**h = 1**	**h = 2**	**h = 3**	**h = 4**	**h = 0**	**h = 1**	**h = 2**	**h = 3**	**h = 4**
Out-of-sample period: 2002Q1-2013Q4										
Autoregressive model	0.80	0.87	0.91	0.85	0.84	1.00	1.00	1.00	1.00	1.00
DI model	0.54	0.75	0.80	0.83	0.89	0.67 ***	0.86 *	0.88	0.97	1.05
TDI model	**0.48**	**0.71**	**0.76**	**0.78**	**0.84**	0.60 ***	0.81 ***	0.84	0.91	0.99
Out-of-sample period: 2002Q1-2007Q4										
Autoregressive model	0.78	0.77	0.83	0.77	0.78	1.00	1.00	1.00	1.00	1.00
DI model	0.51	0.70	0.66	0.79	0.78	0.65 ***	0.91	0.80	1.03	0.99
TDI model	**0.43**	**0.64**	**0.65**	**0.66**	**0.67**	0.55 ***	0.82 *	0.78	0.85	0.86
Out-of-sample period: 2008Q1-2013Q4										
Autoregressive model	0.81	0.97	0.98	0.93	**0.90**	1.00	1.00	1.00	1.00	1.00
DI model	0.57	0.80	0.93	**0.86**	1.00	0.70 *	0.83	0.95	0.92	1.11
TDI model	**0.52**	**0.77**	**0.88**	0.90	1.00	0.65 *	0.80 *	0.90	0.96	1.11

Source: Authors' calculations.
Notes: A bold format denotes the best performing model for each forecast horizon. Asterisks *,**,*** denote rejection of the null hypothesis of equal forecast accuracy at 10%, 5% and 1% significance level, respectively.

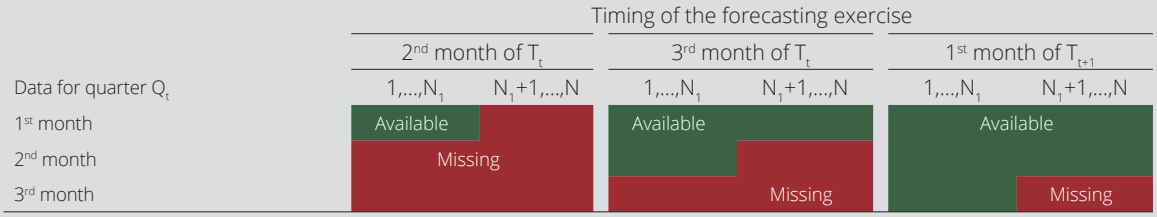
model seems to be a suitable choice for balancing the dataset whenever required. This is also in line with the results of Runstler *et al.* (2009) who found the univariate autoregressive model to work best for coping with jagged edge data when forecasting with the above factor models.

7. Pseudo real-time forecasting exercise

Drawing on the autoregressive model to fill in the missing monthly data whenever required, we now assess how the forecasting performance of the TDI approach deteriorates *vis-à-vis* the balanced data case addressed in section 5.[7] As expected, the jagged edge data issue is much more relevant for the nowcasting purposes than for longer horizons. Since for all the horizons other than the nowcast the impact is marginal, we only present the results for the nowcasting case. We assess both the MSE and the MAE for the TDI model for each of the timings discussed in the previous section.[8] Moreover, we also display the results for the balanced data case (see section 5), which corresponds to nowcasting GDP growth for quarter t in the 2nd month of quarter $t+1$. For instance, in mid-May all the monthly information is available concerning the 1st quarter of the year.

From chart 7.1, one can see that less information implies a worsening of the forecasting performance, whatever the forecast measure considered. This seems particularly striking in the worst case scenario considered, with the MSE being twice as large as the balanced data case. Moreover, as the available information for quarter t in the 2nd month of that quarter is quite scarce, the nowcasting performance is not much different from forecasting one-quarter ahead. When considering the sub-samples, one can conclude that the deterioration in absolute terms is more

Chart 6.1 • Stylized calendar and data availability



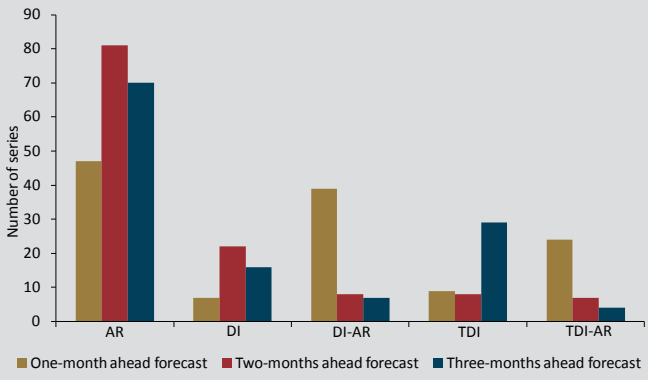


Chart 6.2 • Best performing model for the monthly series

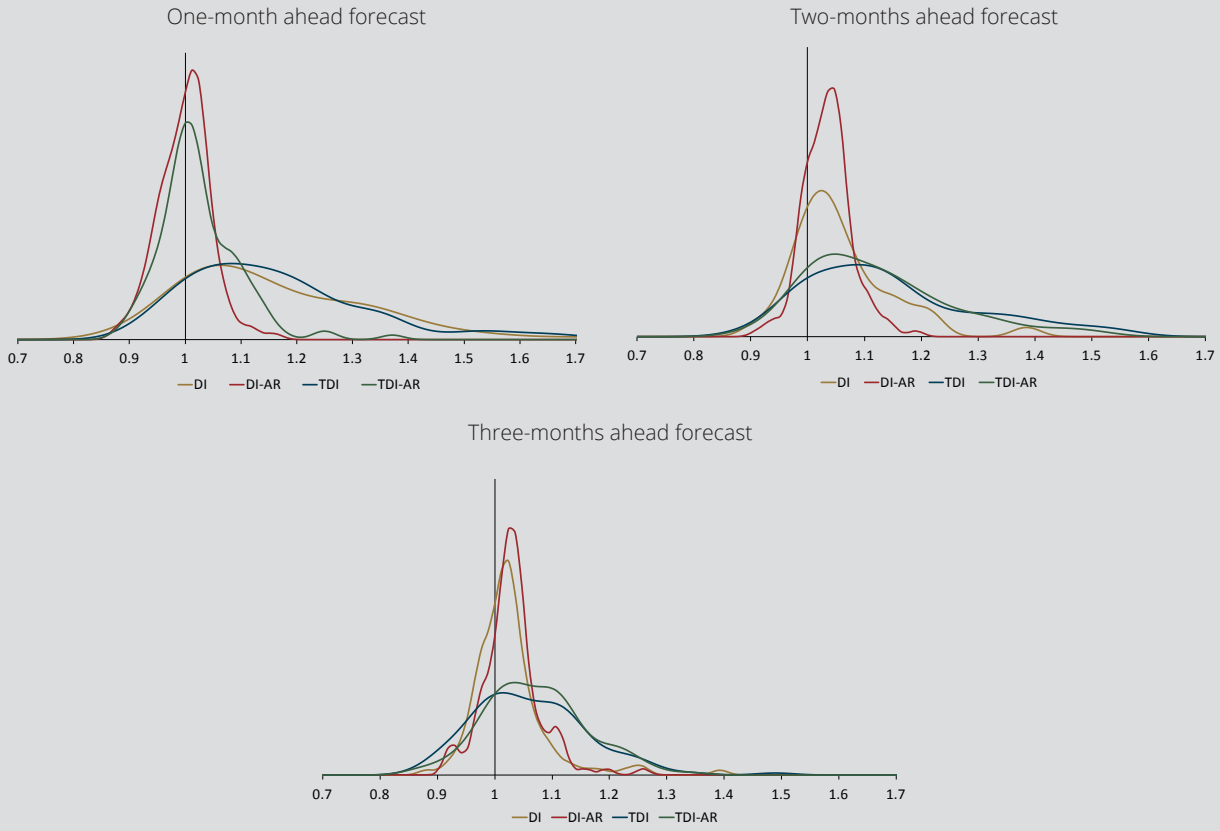
Source: Authors' calculations.

marked in the second half of the out-of-sample period. In fact, in a sample period with pronounced changes the availability of information becomes even more important to assess ongoing developments.

8. Conclusions

In this article, we assessed the relative performance of several factor models to forecast GDP growth using a large monthly dataset compiled for the Portuguese economy. We find that factor models outperform significantly the univariate autoregressive model for nowcasting and one--quarter ahead forecasting while for longer forecast horizons the gains are substantially reduced. Among the factor models, the TDI approach developed by Dias, Pinheiro and Rua (2010) clearly improves on the diffusion index model.

Chart 6.3 • Distribution of relative MSE for the monthly series

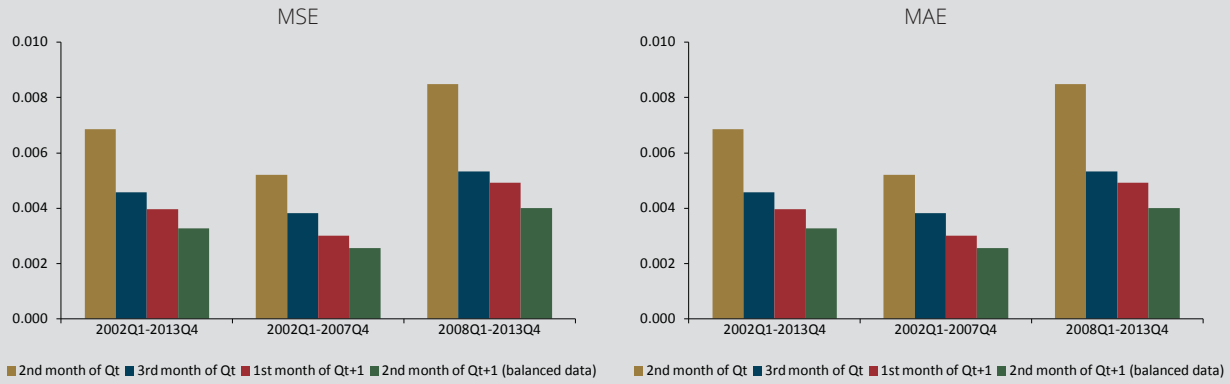


Source: Authors' calculations.

To gain further insights on the relative performance of the models, we considered a relatively long out-of-sample period namely from the first quarter of 2002 up to the fourth quarter of 2013. By splitting it in two, we could assess the forecasting performance over a pre-crisis period and as from the latest economic and financial crisis onwards. Although the forecast errors are larger in the latter period, the main findings in terms of the relative performance still hold in such a challenging period.

Since in real-time one has to deal with jagged-edge data so to take on board the latest available information, we also investigated the forecasting performance of the same models to fill in the missing data for the monthly series. Overall, the parsimonious autoregressive model seems to perform fairly well *vis-à-vis* the other models. Having established this, we assessed the impact of coping with jagged-edge data on the forecasting performance of the TDI approach. As expected, less available information leads to larger forecast errors.

Chart 7.1 • MSE and MAE for GDP nowcasting with jagged edge data



Source: Authors' calculations.

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Notes

1. The opinions expressed in the article are those of the authors and do not necessarily coincide with those of Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the authors.

2. Banco de Portugal, Economic Research Department.

3. Banco de Portugal, Advisor to the Board.

4. We also assessed the forecasting performance with alternative transformations of the monthly data, namely month-on-month and year-on-year changes. We find that forecasting quarter-on-quarter GDP growth with the 3-month difference transformation outperforms the variant with the month-on--month transformation (see also Runstler *et al*. (2009)) and that forecasting the year-on-year growth does not improve on the results.

5. For comparison, the first four common static factors explain around 35 per cent of the variation in that US dataset.

6. For a more precise modelling of the dynamics, we focus on the month-on-month changes of the monthly series.

7. As is standard in the literature, this is called a pseudo real-time exercise since data revisions are not taken into account.

8. Concerning the case addressed in the last column of chart 6.1, we also assessed the forecasting performance when the EM algorithm suggested by Stock and Watson (2002a) is used to balance the dataset as well as its extension proposed by Pinheiro, Rua and Dias (2013). We find the former to perform worse whereas the latter delivers similar results *vis-à-vis* the AR case.

Appendix

Series	Source
Economic Sentiment Indicator	European Commission
Consumer Confidence Indicator	European Commission - Consumers survey
Financial situation over last 12 months	European Commission - Consumers survey
Financial situation over next 12 months	European Commission - Consumers survey
General economic situation over last 12 months	European Commission - Consumers survey
General economic situation over next 12 months	European Commission - Consumers survey
Major purchases at present	European Commission - Consumers survey
Major purchases over next 12 months	European Commission - Consumers survey
Unemployment expectations over next 12 months	European Commission - Consumers survey
Savings at present	European Commission - Consumers survey
Savings over next 12 months	European Commission - Consumers survey
Price trends over last 12 months	European Commission - Consumers survey
Price trends over next 12 months	European Commission - Consumers survey
Statement on financial situation of household	European Commission - Consumers survey
Construction Confidence Indicator	European Commission - Construction survey
Building activity development over the past 3 months	European Commission - Construction survey
Assessment of order books	European Commission - Construction survey
Employment expectations over the next 3 months	European Commission - Construction survey
Prices expectations over the next 3 months	European Commission - Construction survey
Industrial Confidence Indicator	European Commission - Manufacturing survey
Production trend observed in recent months	European Commission - Manufacturing survey
Assessment of order-book levels	European Commission - Manufacturing survey
Assessment of export order-book levels	European Commission - Manufacturing survey
Assessment of stocks of finished products	European Commission - Manufacturing survey
Production expectations for the months ahead	European Commission - Manufacturing survey
Selling price expectations for the months ahead	European Commission - Manufacturing survey
Employment expectations for the months ahead	European Commission - Manufacturing survey
Retail trade Confidence Indicator	European Commission - Retail trade survey
Business activity over recent months	European Commission - Retail trade survey
Assessment of stocks	European Commission - Retail trade survey
Expected business activity	European Commission - Retail trade survey
Orders placed with suppliers	European Commission - Retail trade survey
Employment expectations	European Commission - Retail trade survey
Services confidence indicator	European Commission - Services survey
Business situation development over the past 3 months	European Commission - Services survey
Evolution of the demand over the past 3 months	European Commission - Services survey
Expectation of the demand over the next 3 months	European Commission - Services survey
Evolution of the employment over the past 3 months	European Commission - Services survey
Expectations of the employment over the next 3 months	European Commission - Services survey
Economic Sentiment Indicator - Germany	European Commission
Economic Sentiment Indicator - Spain	European Commission
Economic Sentiment Indicator - France	European Commission
Economic Sentiment Indicator - UK	European Commission
Industrial Production Index - Total	Instituto Nacional de Estatística
Industrial Production Index - Manufacturing	Instituto Nacional de Estatística

Industrial Production Index - Consumer goods	Instituto Nacional de Estatística
Industrial Production Index - Consumer goods non-durable	Instituto Nacional de Estatística
Industrial Production Index - Consumer goods durable	Instituto Nacional de Estatística
Industrial Production Index - Investment goods	Instituto Nacional de Estatística
Industrial Production Index - Intermediate goods	Instituto Nacional de Estatística
Industrial turnover index - Total	Instituto Nacional de Estatística
Industrial turnover index - Manufacturing	Instituto Nacional de Estatística
Industrial turnover index - Consumer goods	Instituto Nacional de Estatística
Industrial turnover index - Consumer goods durable	Instituto Nacional de Estatística
Industrial turnover index - Consumer goods non-durable	Instituto Nacional de Estatística
Industrial turnover index - Intermediate goods	Instituto Nacional de Estatística
Industrial turnover index - Investment goods	Instituto Nacional de Estatística
Industrial turnover index - Domestic market - Total	Instituto Nacional de Estatística
Industrial turnover index - Domestic market - Consumer goods	Instituto Nacional de Estatística
Industrial turnover index - Domestic market - Consumer goods durable	Instituto Nacional de Estatística
Industrial turnover index - Domestic market - Consumer goods non-durable	Instituto Nacional de Estatística
Industrial turnover index - Domestic market - Intermediate goods	Instituto Nacional de Estatística
Industrial turnover index - Domestic market - Investment goods	Instituto Nacional de Estatística
Industrial turnover index - External market - Total	Instituto Nacional de Estatística
Industrial turnover index - External market - Consumer goods	Instituto Nacional de Estatística
Industrial turnover index - External market - Consumer goods durable	Instituto Nacional de Estatística
Industrial turnover index - External market - Consumer goods non-durable	Instituto Nacional de Estatística
Industrial turnover index - External market - Intermediate goods	Instituto Nacional de Estatística
Industrial turnover index - External market - Investment goods	Instituto Nacional de Estatística
Services turnover index - Total	Instituto Nacional de Estatística
Vacancies	Instituto de Emprego e Formação Profissional
Unemployment	Instituto de Emprego e Formação Profissional
New applications for employment by the unemployed	Instituto de Emprego e Formação Profissional
New job vacancies	Instituto de Emprego e Formação Profissional
New occupied jobs	Instituto de Emprego e Formação Profissional
Industrial employment index - Total	Instituto Nacional de Estatística
Industrial employment index - Manufacturing	Instituto Nacional de Estatística
Industrial employment index - Consumer goods	Instituto Nacional de Estatística
Industrial employment index - Consumer goods durables	Instituto Nacional de Estatística
Industrial employment index - Consumer goods non-durables	Instituto Nacional de Estatística
Industrial employment index - Intermediate goods	Instituto Nacional de Estatística
Industrial employment index - Investment goods	Instituto Nacional de Estatística
Industrial wages index - Total	Instituto Nacional de Estatística
Industrial wages index - Manufacturing	Instituto Nacional de Estatística
Industrial wages index - Consumer goods	Instituto Nacional de Estatística
Industrial wages index - Consumer goods durables	Instituto Nacional de Estatística
Industrial wages index - Consumer goods non-durables	Instituto Nacional de Estatística
Industrial wages index - Intermediate goods	Instituto Nacional de Estatística
Industrial wages index - Investment goods	Instituto Nacional de Estatística
Hours worked index - Total industry	Instituto Nacional de Estatística
Hours worked index - Manufacturing	Instituto Nacional de Estatística
Hours worked index - Consumer goods	Instituto Nacional de Estatística
Hours worked index - Consumer goods durables	Instituto Nacional de Estatística
Hours worked index - Consumer goods non-durables	Instituto Nacional de Estatística
Hours worked index - Intermediate goods	Instituto Nacional de Estatística

Hours worked index - Investment goods	Instituto Nacional de Estatística
Services employment index - Total	Instituto Nacional de Estatística
Services wages index - Total	Instituto Nacional de Estatística
Hours worked index - Total services	Instituto Nacional de Estatística
Merchandise imports - Total	Instituto Nacional de Estatística
Merchandise imports - Total exc. Fuels	Instituto Nacional de Estatística
Merchandise imports - Consumer goods	Instituto Nacional de Estatística
Merchandise imports - Intermediate goods	Instituto Nacional de Estatística
Merchandise imports - Investment goods	Instituto Nacional de Estatística
Merchandise exports - Total	Instituto Nacional de Estatística
Merchandise exports - Total exc. Fuels	Instituto Nacional de Estatística
Merchandise exports - Consumer goods	Instituto Nacional de Estatística
Merchandise exports - Intermediate goods	Instituto Nacional de Estatística
Merchandise exports - Investment goods	Instituto Nacional de Estatística
Retail trade turnover index - Total	Instituto Nacional de Estatística
Retail trade turnover index - Food	Instituto Nacional de Estatística
Retail trade turnover index - Non-Durable Non-Food	Instituto Nacional de Estatística
Retail trade turnover index - Durable goods	Instituto Nacional de Estatística
Tourism - Number of nights spent in Portugal	Instituto Nacional de Estatística
Tourism - Number of nights spent in Portugal by residents	Instituto Nacional de Estatística
Tourism - Number of nights spent in Portugal by non-residents	Instituto Nacional de Estatística
Light passenger vehicle sales	ACAP - Associação Automóvel de Portugal
Light commercial vehicle sales	ACAP - Associação Automóvel de Portugal
Heavy commercial vehicle sales	ACAP - Associação Automóvel de Portugal
Cement sales	CIMPOR, SECIL
Consumption of electricity	Rede Eléctrica Nacional
Consumption of gasoline	Direção Geral de Energia
Consumption of diesel	Direção Geral de Energia
Real effective exchange rate index	Banco de Portugal
PSI-20	Euronext Lisboa
ATM/POS	Banco de Portugal

SERIES

Quarterly series for the portuguese economy: 1977-2013

Annual series on household wealth: 1980-2013

QUARTERLY SERIES FOR THE PORTUGUESE ECONOMY: 1977-2013

As has been the case since 2004, this section contains updated quarterly long series for the Portuguese economy. The update released in this Bulletin presents the same breakdown as in previous series and includes quarterly figures for 2013 for the first time.[1]

Data now released incorporate the series of quarterly national accounts, as well as quarterly national accounts for institutional sectors published by Statistics Portugal (*Instituto Nacional de Estatística* – INE) in March 2014, closely following the methodological procedures adopted in the Economic Bulletin – Summer 2011.

As regards the main expenditure components, data released for the period from 1995 onwards are consistent with quarterly data from INE both at current prices and in volume (chain-linked volume using 2006 as benchmark).

In turn, series on disposable income for the period starting in the first quarter of 1999 differ from figures published by INE in the quarterly national accounts for institutional sectors, given that they are seasonally adjusted in cases where a seasonal pattern is discernible (while figures published by INE are unadjusted). As a rule, the X12-ARIMA procedure was used for seasonal adjustment purposes. Series with an unstable seasonal pattern (making it difficult to use the X12-ARIMA procedure) were adjusted by breaking down data on annual figures published by INE into quarterly figures using the corresponding quarterly indicator on the basis of a four-quarter moving average.

Regarding the period not covered by current INE publications (prior to 1995 for expenditure components and to 1999 for disposable income components) as well as labour market data, the methodology underlying the construction of these series did not undergo significant changes compared to those detailed in the article "Quarterly series for the Portuguese economy: 1977-2003" published in the June 2004 issue of the Economic Bulletin. Basically, the procedure consists in previously backdating annual figures in the quarterly national accounts on the basis of rates of change in the Long Series published by Banco de Portugal, which are then broken down into quarterly figures using related indicators where possible and in compliance with the methodology detailed in the article mentioned above.

Note

1. Quarterly series for the period 1977-2013 are only presented in electronic format on Banco de Portugal's website.

ANNUAL SERIES ON HOUSEHOLD WEALTH: 1980-2013

This section releases annual series on household wealth for the period 1980-2013, corresponding to an update of estimates published in the Economic Bulletin – Summer 2013. These wealth estimates include the financial component (assets and liabilities) and housing (the main component of non-financial wealth).[1] The underlying concepts and methodology are identical to those described in Cardoso, Farinha and Lameira (2008).[2]

As the previous estimates, the financial series (assets and liabilities) presented here are consistent with the financial national accounts published by Banco de Portugal (see Box 5.1 "Updating of household wealth estimates: 1980-2010" in the 2010 Annual Report of Banco de Portugal on the procedure used to backdate series due to the revision of financial accounts occurred in 2009).

The methodology used to calculate housing wealth is based on a method normally used to calculate capital stock estimates – the perpetual inventory method. This method consists of, first, successively accumulating fixed capital investment (in this case, in housing), and then, postulating reasonable hypotheses for its service life and depreciation method. The resultant series on housing wealth was adjusted, taking the new estimate derived from the Household Finance Survey (*Inquérito à Situação Financeira das Famílias* – ISFF), as benchmark for 2010. Therefore, survey data provide a one-off estimate for the reference year, while the remaining years are calculated in compliance with rates of change implicit in the series updated with the usual methodology, based on long series of Housing GFCF.

Notes

1. The series are only available in electronic format on Banco de Portugal's website.

2. Cardoso, F., Farinha, L. and Lameira, R. (2008), "Household wealth in Portugal: revised series", Banco de Portugal, *Occasional Paper 1*.