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PROJECTIONS FOR THE PORTUGUESE ECONOMY: 2010-2012(*)

1. INTRODUCTION

The projections for the Portuguese economy point to a contraction of GDP in 2011 and a limited growth in 2012. These developments in economic activity will be marked by the reinforcement of the adjustment process of the macroeconomic imbalances accumulated over more than a decade. The current projections encompass a slight decline in households' and firms' borrowing requirements and imply, in particular, a significant fiscal consolidation, against the background of a substantial fall in domestic demand. This projection exercise assumes that the use of funds by the Eurosystem will remain significant until the end of the projection horizon, against persisting difficulties in access by Portuguese banks to wholesale funding markets.

Within this adjustment framework, economic developments worldwide and, in particular, the sustained recovery of international trade flows will be critical for the recovery of economic activity in Portugal. However, it is crucial that Portuguese firms producing tradable goods and services are able to channel their production to products and markets with higher growth potential, in order to minimize the impact of domestic demand adjustments on the development of economic activity, and thus contribute to reduce the external account imbalance.

The current projections for the Portuguese economy point to a contraction of GDP of 1.3 per cent in 2011, followed by a 0.6 per cent growth in 2012 (Table 1.1). This profile of economic activity developments reflects, on the one hand, a decline in domestic demand over the projection horizon,

Table 1.1

PROJECTIONS OF BANCO DE PORTUGAL: 2010-2012
Rate of change, per cent

	Weights 2009	EB Winter 2010			EB Autumn 2010	
		2010(p)	2011(p)	2012(p)	2010(p)	2011(p)
Gross Domestic Product	100.0	1.3	-1.3	0.6	1.2	0.0
Private Consumption	66.6	1.8	-2.7	-0.5	1.8	-0.8
Public Consumption	21.3	3.2	-4.6	-1.0	1.5	-1.0
Gross Fixed Capital Fromation	19.5	-5.0	-6.8	-0.4	-4.2	-3.2
Domestic Demand	107.7	0.5	-3.6	-0.5	0.4	-1.2
Exports	28.0	9.0	5.9	6.1	7.9	4.5
Imports	35.6	5.0	-1.9	2.4	4.2	0.4
Contribution to GDP growth (p.p.)						
Net exports		0.7	2.5	1.1	0.7	1.2
Domestic Demand		0.6	-3.9	-0.6	0.5	-1.2
of which: Changes in Inventories		-0.3	0.2	0.0	-0.2	0.1
Current and Capital Account (% GDP)		-8.8	-7.1	-7.0	-9.2	-8.2
Trade balance (% GDP)		-6.4	-3.9	-2.9	-6.5	-5.1
Harmonized Index of Consumer Prices		1.4	2.7	1.4	1.4	1.8

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

(*) This article is based on data available up to mid-December 2010.

particularly sharp in 2011, and, on the other hand, continued significant growth in exports, albeit at a slower pace than projected for 2010, in line with developments in international trade flows. This growth pattern will contribute to reduce the external borrowing requirements of the Portuguese economy, which will nonetheless remain high.

Inflation is projected to increase to 2.7 per cent in 2011 (1.4 per cent in 2010), and to decline to 1.4 per cent in 2012. This profile is largely influenced by the increases in indirect taxation in mid-2010 and early 2011. Their effects on consumer price growth is projected to exceed 1 percentage point in 2011 (0.3 percentage points in 2010). In this context, consumer prices, excluding the effects of the rises in indirect taxation, will evolve in line with wage costs and import prices. No substantial changes are envisaged in profit margins, after the compressions observed in the recent past.

The risks surrounding the current projections for economic activity are clearly on the downside. In terms of the international framework, it is hard to gauge the underlying robustness of global economic recovery. The need for additional consolidation measures to meet the demanding fiscal targets for 2011 and 2012 also imply non-negligible downside risks for economic activity. Moreover, these projections assume the maintenance of a significant liquidity support by the Eurosystem to the national banking system, which is essential to ensure a gradual and orderly adjustment of households' and firm's balance sheets.

In comparison with data published in the Autumn 2010 issue of the *Economic Bulletin*, GDP growth was revised upwards in 2010 and involves a significant downwards revision in 2011 (Table 1.1). The revision in 2010 was due to higher-than-anticipated growth of exports and public consumption. Change in domestic demand remains virtually unchanged, in spite of some differences in its composition. GDP revision in 2011 is essentially motivated by the revaluation of the outlook for domestic demand, which has been revised significantly downwards, and is broadly based across all its components. This revision is mainly determined by the effects of the fiscal consolidation measures, in the framework of the State Budget for 2011. These measures, which had not been considered in the previous projections, will condition the development of household disposable income and, as a result, the outlook for demand. Moreover, the current projections include tighter credit conditions for the private sector over the projection horizon, which also contributes to curtail the development of domestic demand. As regards inflation, the projections include an upward revision of consumer prices in 2011. This mainly reflects the effects of the increase in the VAT standard rate from 21 to 23 per cent, which is partially offset by more moderate wage growth than anticipated in the Autumn issue, against a background of more adverse conditions in the labour market.

2. CONJUNCTURAL DATA AND ASSUMPTIONS

The current projections are based on data available on the recent developments in the Portuguese economy, and on a set of assumptions for the 2011-2012 period.

These projections include data compiled in the Quarterly National Accounts by *Instituto Nacional de Estatística – INE* (Statistics Portugal) for the third quarter of 2010, as well as conjunctural economic indicators available for the fourth quarter. Worthy of note within the external framework of the economy is the projection of external demand growth for Portuguese goods and services,[1] which is expected to remain buoyant, even though short of the estimate for 2010 and of the average growth rate observed in the period prior to the outbreak of the international economic and financial crisis. As regards the domestic framework, the projections are conditioned by the inclusion of the measures approved within the context of public finances, in particular in the State Budget for 2011.

(1) Assumptions for external demand were based on the projections published by the European Central Bank in the December 2010 issue of the Monthly Bulletin.

Favourable GDP developments in 2010, with a clear showdown in domestic demand at the end of the year

The current projections point to 1.3 per cent growth of economic activity in 2010 (Table 1.1), which include a marked deceleration at the end of the year. According to the Quarterly National Accounts of *INE*, GDP growth in the first three quarters of 2010 posted a year-on-year change of 1.5 per cent. This reflects, on the one hand, marked export growth – as a result of the significant increase in external demand - and, on the other hand, the strong dynamics of private consumption. These developments in overall demand led to non-negligible growth of imports, in year-on-year terms, reflecting mainly the effects of import-intensive consumption spending growth.

Recent conjunctural data point to a significant slowdown of economic activity, in year-on-year terms, at the end of the year. This profile includes a deceleration in all domestic demand components (excluding changes in inventories), especially in private consumption. This development reflects most likely, in particular, a revision of the expectations of economic agents, in the wake of the measures announced for the State Budget for 2011, as well as the continued deterioration in labour market conditions. Private consumption decelerated at the end of 2010, notwithstanding the anticipation of purchases of motor vehicles associated with the fiscal changes that entered into force in January 2011. Exports of goods and services continued to grow significantly, though at a slower pace than in the previous quarter, in line with external demand developments.

Decelerating external demand and rising interest rates over the projection horizon

Following the strong growth in 2010, projections for the international framework point to a slowdown in external demand for Portuguese goods and services in 2011, followed by some recovery in 2012 (Table 2.1). Growth of external demand will nonetheless remain significant.

Turning to the financing conditions for the economy over the next two years, it is assumed that the Eurosystem will continue to support liquidity to the national banking system up to the end of the projection horizon. The assumptions with regard to interest rates, exchange rates and oil prices are based on financial market information available up to mid-December 2010. The assumption for short-term interest rates is based on expectations regarding the developments of the three-month EURIBOR implicit in futures contracts. This information points to a continued gradual increase in short-term interest rates in the interbank money market over the projection horizon. Nevertheless, this upward trend, which had already been observed in 2010, implies that money market interest rates will remain at average levels below those observed during the period prior to the outbreak of the international economic and financial crisis.

As regards long-term interest rates on Portuguese sovereign debt, the technical assumptions – maintenance of the interest rate differential *vis-à-vis* Germany over the projection horizon – imply a gradual increase in the course of 2011 and 2012. The evolution of Portuguese sovereign debt risk premia has been conditioned, *inter alia*, by doubts regarding the sustainability of public finances, in a context of persistent structural fragilities of the Portuguese economy. This fact will continue to constrain conditions of access by the national banking system to international wholesale debt markets, with gradual and probably swifter transmission effects to corporate and household financing conditions than in the recent past.

The technical assumptions for exchange rates, which consider that these will remain unchanged at the levels observed in mid-December, imply a depreciation of the euro in effective terms in 2011. According to data available in futures markets, oil prices are expected to rise gradually over the projection horizon reaching average values close to USD 90 (approximately €69) in 2011 and 2012.

Table 2.1

ASSUMPTIONS UNDERLYING THE PROJECTION EXERCISE

		EB Winter 2010			EB Autumn 2010	
		2010	2011	2012	2010	2011
External demand	arc	8.6	5.1	5.9	6.9	4.6
Interest rate						
Short term	%	0.8	1.3	1.9	0.8	1.1
Long term	%	5.3	6.2	6.6	5.2	5.9
EUR exchange rate						
EUR effective	arc	-6.3	-1.8	0.0	-7.1	-2.4
EUR-USD	aav	1.32	1.32	1.32	1.30	1.28
Oil price						
in USD	aav	79.6	89.9	90.4	77.4	80.8
in EUR	aav	60.1	68.3	68.6	59.5	63.3

Sources: Bloomberg, ECB, Thomson Reuters and Banco de Portugal calculations.
Notes: *arc* - annual rate of change; *%* - per cent; *aav* - annual average value. An increase in the exchange rate represents an appreciation.

This reflects, *inter alia*, the recovery in global economic activity and the ensuing increase in demand for raw materials.

Growth prospects for the Portuguese economy will be significantly affected in the short term by the fiscal consolidation process

Turning to developments in public finances aggregates, and according to the rules followed in the Eurosystem projection exercises, fiscal policy measures are considered only when they have already been approved in legal terms, or are highly likely to pass the legislative process, and have been specified in sufficient detail. In the absence of detailed enough information on the expenditure items that are mostly determined by discretionary decisions and not necessarily fixed by law (for instance, subsidies, purchases of goods and services and investment) the Eurosystem projection exercise are based on a most likely norm.

As regards measures on the revenue side, with effects as of July 2010, reference should be made to the 1 percentage point increase in all VAT rates, the increase in personal income tax, as a result of the rise in the tax rates applicable to the different income brackets and final withholding tax rate, and the introduction of a 2.5 percentage points surcharge in corporate income tax applicable to firms with taxable profit exceeding €2 million. Moreover, according to the State Budget for 2011, the following are worthy of mention: the rise in the VAT standard rate from 21 to 23 per cent, the 1 percentage point increase in the contribution of public sector employees to the *Caixa Geral de Aposentações – CGA* (public employees' pension system), the introduction of a levy on the financial sector and the transfer of banking sector employees to the general social security system.

On the expenditure side, the main measures considered were: the 5 per cent cut in overall costs with total gross payments to public sector employees, the freeze in hiring and promotions and progressions, the reduction in expenditure with non-contributory social benefits and unemployment benefits, and the freeze in pensions. Cuts were also considered in public investment (partly due to the reduction in transfers to regional and local governments), in intermediate consumption, in health expenditure and in transfers to the State corporate sector.

Public consumption and public investment are expected to decrease in real terms in 2011 and 2012. The contraction in public consumption reflects, in addition to the reduction in the aforementioned

expenditure in goods and services, the reduction in the number of public employees, according to public finances assumptions for both years.

3. SUPPLY, DEMAND AND EXTERNAL ACCOUNTS

Against the background of a significant contraction in economic activity in 2011 and a weak growth in 2012, the current projections incorporate a persistent large output gap over the projection horizon. The current projections include a contraction of 1.3 per cent in GDP in 2011 and a growth of 0.6 per cent in 2012 (1.3 per cent in 2010). According to the midpoints of the projection ranges, published by the ECB in the December 2010 issue of the *Monthly Bulletin*, GDP growth in the euro area is expected to be substantially higher, standing at 1.4 and 1.7 per cent in 2011 and 2012 respectively (1.7 per cent in 2010).

Contraction of economic activity in the non-tradable goods and services sectors and dynamic growth in export-oriented sectors

At the sectoral level, growth is expected to be concentrated in the tradable goods and services sectors – manufacturing and more export-oriented services sector –, against a background where worldwide economic growth will be the driving force of global demand. Activity in the construction and non-tradable services sectors is likely to be conditioned by the significant contraction in demand.

In the labour market, employment is projected to decrease by 1.0 and 0.2 per cent in 2011 and 2012 respectively (after a reduction of 1.3 per cent in 2010), basically reflecting contemporaneous and lagged effects stemming from developments in overall economic activity. In this projection, public sector employment is expected to decrease substantially, in line with the assumptions for public finances variables. Accordingly, labour input will continue to post a negative contribution to GDP growth over the projection horizon, which is expected to be particularly meaningful in 2011. The contribution of the capital stock to GDP growth is projected to be marginally negative in both years, following the decline in investment. Finally, total factor productivity is expected to have a -0.5 per cent contribution to GDP growth in 2011 and a 1.3 per cent in 2012.[2] These developments in total factor productivity will reflect less intensive use of production factors in 2011, against a background of declining employment, followed by more intensive use in 2012.

In the context of the global economic and financial crisis, coupled with the subsequent adjustment process of the Portuguese economy, the evaluation of potential output growth is subject to a larger degree of uncertainty than usual. Furthermore, this assessment is highly sensitive to the assumptions and methodologies used in its calculation. In the current projection, in which economic activity is expected to contract once again in 2011, the estimates point to a small positive growth rate in potential output over the projection horizon (Chart 3.1).[3]

Economic developments over the projection horizon marked by a strong contraction in domestic demand, particularly intensive in 2011, and buoyant external demand

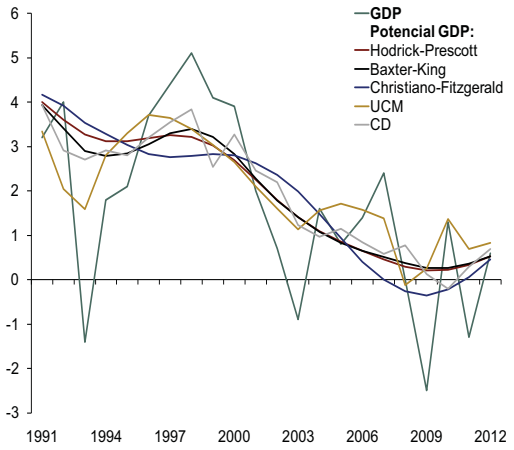
The projection for economic activity in the 2011-2012 period is characterized by a strong reduction

(2) This accounting exercise of contributions to growth is carried out on the basis of a Cobb-Douglas production function. For a more detailed discussion of this methodology, see Almeida, V. and R. Félix (2006), "Computing potential output and the output gap for the Portuguese economy", Banco de Portugal, *Economic Bulletin* – Autumn 2006.

(3) The unobserved component methodology (UCM) is presented in Centeno, Novo and J. Maria (2009), "Unemployment: A supply, demand, and institutions approach", in "The Portuguese Economy in the Context of Economic, Financial and Monetary Integration", Economics and Research Department, Banco de Portugal.

Chart 3.1

POTENTIAL GDP GROWTH
Per cent



Sources: *INE* and Banco de Portugal.
Notes: UCM - stands for unobserved component methodology; CD stands for the methodology based on a Cobb-Douglas production function.

in domestic demand – constrained by the fiscal consolidation measures and tighter financing conditions – and continued buoyant exports, albeit presenting some slowdown *versus* 2010 (Charts 3.2 and 3.3). As a result, domestic demand is expected to post a clear negative contribution to GDP growth over the projection horizon, particularly in 2011, reflecting one of the features of the adjustment process of the imbalances of the Portuguese economy.

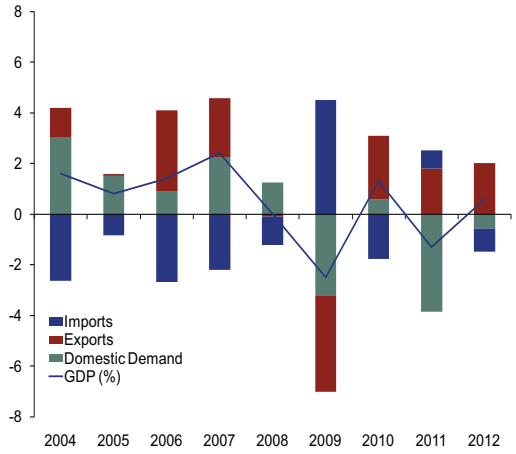
The current projections include a sharp reduction in private consumption in 2011 (2.7 per cent), followed by a smaller drop in 2012 (0.5 per cent). The evolution in this expenditure item is expected to be principally marked by the fiscal consolidation measures considered, namely the reduction in public sector nominal wages and a further increase in income taxes. These measures are expected to deteriorate prospects for disposable income developments, amid the continuation of particularly adverse conditions in the labour market, most notably the large increase in unemployment. Furthermore, the prevalence of tighter credit conditions, which are expected to become progressively more active over the projection horizon, and the constraints stemming from the solvency conditions from the households' budget constraints are also expected to affect consumption growth in 2011 and 2012.

The fiscal consolidation measures and their immediate impact on the macroeconomic environment are expected to affect the evolution of real disposable income of households, for which a reduction of 2.4 per cent is projected for 2011, followed by an increase of 1.4 per cent in 2012 (Chart 3.4). The decline in real disposable income in 2011 is associated with the reduction in the wage bill, in particular in the public sector, arising from both the adjustment in nominal wages and a drop in employment. The wage bill is also expected to contract in the private sector, as a result of moderate wage developments in a context of declining employment. Furthermore, the assumptions for public finances imply a deceleration in public transfers to households and an increase in income taxes.

Spending on durable goods is projected to be specially affected during the contraction phase of economic activity, presenting as usual a more pronounced pro-cyclical profile. The current projection points to decreases of 21.7 and 3.7 per cent in 2011 and 2012 respectively. The decline projected for 2011 reflects *inter alia* the effect of the anticipated spending on durable goods at the end of 2010,

Chart 3.2

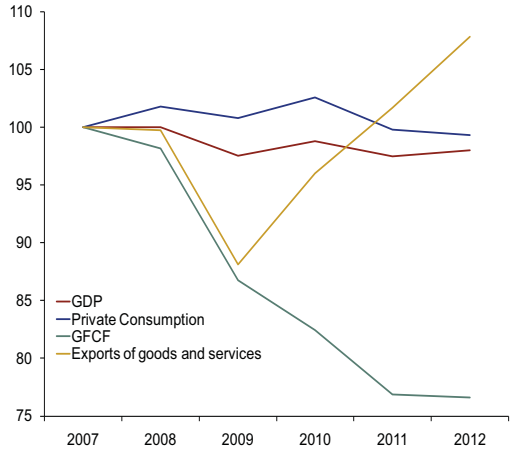
BREADKDOWN OF GDP GROWTH
Contribution to the rate of change



Sources: *INE* and Banco de Portugal.

Chart 3.3

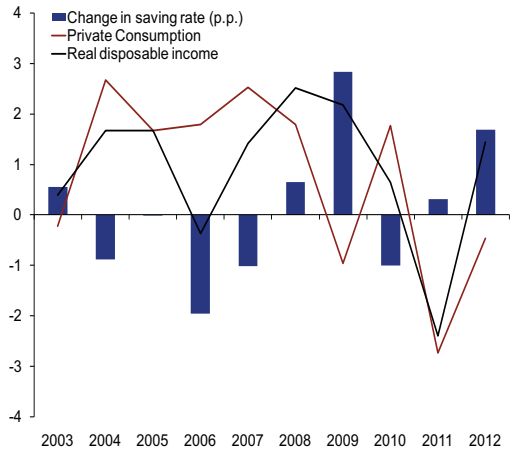
GDP AND EXPENDITURE COMPONENTS
Index (2007=100)



Sources: *INE* and Banco de Portugal.

Chart 3.4

PRIVATE CONSUMPTION, REAL DISPOSABLE INCOME AND SAVING RATE
Annual rate of change



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

due to the 2 p.p. rise in the standard VAT rate in January 2011. The evolution of consumption on non-durable goods is expected to be smoother, presenting a significantly more moderate negative growth rate over the two years of the projection horizon.

Gross fixed capital formation (GFCF) is projected to fall sharply in 2011 (6.8 per cent), followed by a milder contraction in 2012 (0.4 per cent). This pattern is extensive to all investment components, both public and private. Developments in private GFCF are projected to reflect mainly the worsening outlook for domestic demand and households' future income, against a background of tighter credit conditions. The steep downward trend in corporate investment observed since 2007, which is practically similar to that of total GFCF (Chart 3.3), is expected to continue to contribute to restrain potential future growth of the Portuguese economy.

As for GFCF by institutional sector, households' investment in housing is expected to shrink strongly by 11.5 per cent in 2011 and by 2.9 per cent in 2012. Corporate investment on the other hand is projected to decline around 5.0 per cent in 2011 and to post a positive change of 1.1 per cent in 2012, mirroring the moderate recovery of private sector output at the end of the projection horizon.

In the current projection exports are the only demand component which will continue buoyant, and are projected to grow around 6.0 per cent in both 2011 and 2012 (9.0 per cent in 2010). This profile is in line with developments in external demand, in a context where no significant changes are expected in external competitiveness of the Portuguese economy.

Imports of goods and services are projected to recede by 1.9 per cent in 2011, followed by a growth of 2.4 per cent in 2012, which compare with an increase of 5.0 per cent in 2010. These developments are mainly determined by the profile of domestic demand, in particular of the components with higher import content – durable goods consumption and corporate investment. The degree of import penetration is expected to increase marginally on average over the period 2011-2012 (in contrast with the estimated increase of 2 p.p. in 2010), though some reduction is expected in 2011, as is usually the case in years of contraction in economic activity.

Reduction in external financing requirements over the projection horizon, remaining nonetheless at high levels, portraying in particular the gradual deterioration in the income account

Against the background of a marked fall in domestic demand, coupled with a significant expansion in external demand, the external financing requirements of the Portuguese economy, as measured by the combined current and capital account balance as a percentage of GDP, are likely to decline over the projection horizon from an estimated value of 8.8 per cent of GDP in 2010 to around 7.0 per cent in 2011 and 2012, remaining however at high levels. This dominant feature of the Portuguese economy over the past decade portrays the continuous imbalance between the levels of domestic savings and investment (Chart 3.5).

The projected reduction in external financing requirements results mainly from the combination of a substantial decrease in the goods and services deficit, partially offset by the deterioration in the income account (Chart 3.6), since the balance of the other items as a whole is projected to remain virtually unchanged as a percentage of GDP over the projection horizon.

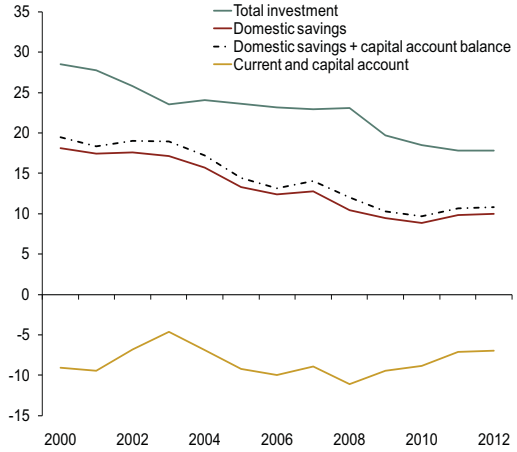
The goods and services deficit is projected to decrease considerably from 6.4 per cent of GDP in 2010 to 3.9 and 2.9 per cent in 2011 and 2012 respectively (Chart 3.6). Besides the significant increase in exports, the decline in domestic demand plays an important role in this improvement. Excluding energy, the trade balance is likely to improve from a deficit of 3.2 per cent of GDP in 2010 to a small surplus of 0.8 per cent in 2012, an unprecedented feature in the last 15 years. Owing to the high energy dependence and intensity of the Portuguese economy, the energy account deficit is expected to remain above 3 per cent of GDP over the projection horizon.[4]

Mention should also be made to the continuous increase in the income account deficit, as a result of the gradual deterioration of the international investment position, following the historically high combined current and capital account deficits over the past decade. In addition, the current background of high risk premia for Portuguese sovereign debt implies an increase in external debt service. Thus, the current projection includes a widening of the income account deficit from 4.5 per cent of GDP in 2010 to 5.4 per cent in 2011 and 6.3 per cent in 2012.

(4) For more detailed information on energy dependence and intensity in Portugal, see "Box 4.4 *Structure of energy production and consumption in Portugal*", Banco de Portugal, *Annual Report* 2009.

Chart 3.5

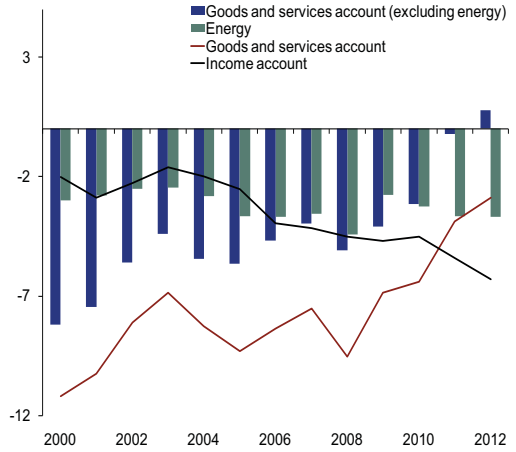
CURRENT AND CAPITAL ACCOUNT
As a percentage of GDP



Sources: *INE* and Banco de Portugal.

Chart 3.6

TRADE AND INCOME ACCOUNT
As a percentage of GDP



Sources: *INE* and Banco de Portugal.

Finally, in line with the assumptions for the profile of European Union transfers, the current projection foresees that the combined capital and current transfers account surplus for 2011 and 2012 will remain unchainged at the level estimated for 2010.

4. PRICES AND WAGES

According to the current projections, consumer prices, as measured by the Harmonised Index of Consumer Prices (HICP), are expected to increase, on average, by 2.7 per cent in 2011, followed by a slowdown in 2012 (1.4 per cent), to a level similar to that in 2010. The projection for inflation in 2011 reflects, *inter alia*, the increases in indirect taxes, a first increase of 1 percentage point, in all VAT rates, which entered into force on 1 July 2010 and a second increase in the standard VAT rate from 21 to 23 per cent as from January 2011. Under the assumption that these increases will be fully passed on to final consumer prices, the impact on inflation is estimated to be 0.3 and 1.1 percentage points in 2010 and 2011 respectively. Discounting this effect, inflation is projected to increase as from 2010, remaining however low over the projection horizon. In the euro area, the midpoints of the projection ranges for the HICP, published by the ECB in the December 2010 issue of the *Monthly Bulletin*, stand at 1.8 and 1.5 per cent in 2011 and 2012 respectively (1.6 per cent in 2010).

Moderate wage growth over the projection horizon coupled with a temporary upsurge in inflation in 2011, mainly as a result of the increases in indirect taxes

Wage developments in the private sector, one of the main determinants of internal pressures on consumer prices, should be conditioned by the continuous deterioration in labour market conditions – decrease in net employment and a rise in the unemployment rate to historically high levels. On the other hand, the 5 per cent wage cuts on average in the public sector in 2011 are expected to have some spill-over effects on collective wage agreements in the private sector. Against this background, the current projections include subdued unit labour cost growth in the private sector. Unit labour costs are expected to increase around 1 per cent, in nominal terms, over the 2011-2012 period, following a slight drop estimated for 2010 (0.3 per cent). This result portrays the combination of moderate wage growth and marginally positive average changes in labour productivity within this

sector. In turn, the acceleration in non-energy import prices, in annual average terms, should also contribute to the rising profile of the HICP over the projection horizon. Finally, no significant changes are expected in profit margins, following the reduction witnessed in the recent past.

The energy price component of the HICP is expected to slowdown over the projection horizon, from 9.5 per cent in 2010 to 7.2 per cent in 2011 and 1.7 per cent in 2012. Besides the VAT increase effects, these projections reflect expected developments in energy raw material prices, in particular oil prices, according to available information in futures markets, which portrays mainly the gradual pickup in global economic activity and, consequently, in world demand for energy goods.

5. UNCERTAINTY AND RISKS

The projections for 2011 and 2012 presented in Table 1.1 refer to the most likely values, based on the set of assumptions presented in section 2. The non-materialisation of the assumptions underlying the current projection, as well as the possibility that idiosyncratic factors may directly affect the macroeconomic environment, put in evidence the importance of the quantitative risk and uncertainty assessment presented in this section.[5]

Significant downside risks to economic activity over the projection horizon

As regards the assumptions underpinning external environment variables, the main risk factor relates to how strongly external demand for Portuguese goods and services will grow. Indeed, in the current juncture considerable uncertainty surrounds the sustainability of the world demand recovery. This raises issues about the unwinding of monetary and fiscal stimuli, against a background of sovereign debt market tensions in the euro area. In turn, the possible need for additional fiscal consolidation measures in several euro area countries that are major destination markets for Portuguese goods and services may result in sluggish economic activity in those countries. The combination of these factors will tend to lead to lower world growth and, consequently, weaker external demand for Portuguese goods and services; therefore, a 60 per cent probability of lower-than-projected external demand growth in both 2011 and 2012 was considered (Table 5.1). At the domestic level, one should highlight the need for a better specification of the fiscal consolidation measures, notably in the context of the 2011 State Budget, as well as additional measures that may prove necessary to meet the deficit targets for 2011 and 2012.

Moreover, it was also considered that adjustments in private consumption and investment may be larger than projected. Underlying this risk, and in addition to the above-mentioned factor associated with public finances, is the possibility that credit standards may also be significantly tighter than assumed in the current projection, particularly in the context of a reduction in the leveraging degree of the banking system. Against this background, the potential decrease in domestic demand dynamics and a possible further deterioration in labour market conditions increase the probability for corporate and residential investment to underperform the current projections. In the assessment of risks to inflation, and within the scope of public finances, the possibility of further increases in administered prices was considered, with a view to reducing transfers to the state business sector and/or increasing state revenues. Finally, lower wage growth in 2012 was also considered, against a background of worse-than-projected labour market conditions.

The results of this quantitative assessment of risks point to roughly 60 per cent and 63 per cent probabilities for lower-than-projected GDP growth in 2011 and 2012 respectively (Table 5.2 and Chart

(5) The methodology used in this section is based on the article published in Pinheiro, M. and P. Esteves (2008), "On the Uncertainty and Risks of Macroeconomic Forecasts: Combining judgements with sample and model information", Banco de Portugal, *Working Paper* 21.

5.1), which puts in evidence the high asymmetry in the distribution of GDP figures around the most likely value. This distribution implies a very low probability (of around 5 per cent) for GDP to record positive changes in 2011, increasing to around 55 per cent in 2012. As regards inflation, the assessment points towards more balanced risks in 2011, and a slight predominance of downside risks in 2012 (Table 5.2 and Chart 5.2).

Chart 5.1

GROSS DOMESTIC PRODUCT
Rate of change, per cent

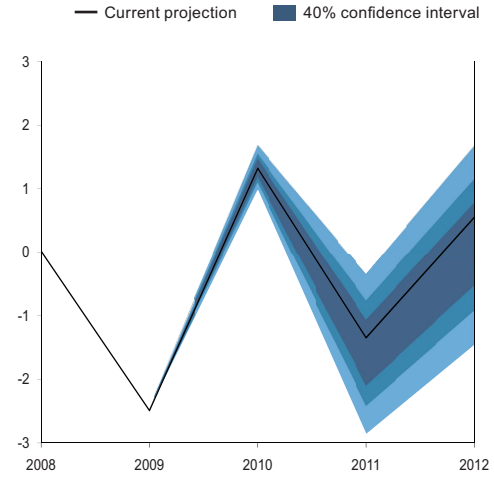
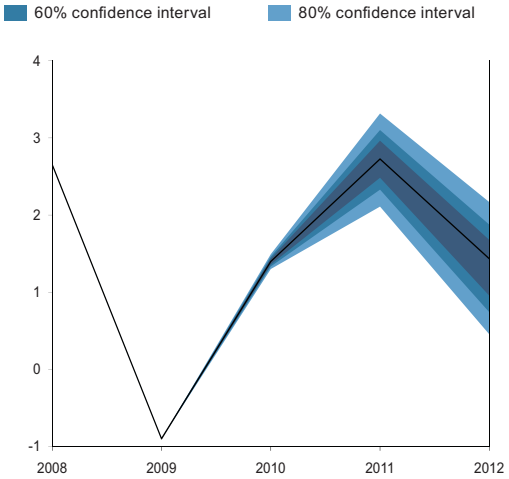


Chart 5.2

HARMONIZED INDEX OF CONSUMER PRICES
Rate of change, per cent



Sources: *INE* and Banco de Portugal.

Table 5.1

RISK FACTORS PROBABILITIES
Per cent

	2011	2012
Conditioning variables		
Domestic Demand	60	60
Public Consumption	55	60
Endogenous variables		
Private Consumption	55	60
GFCF	55	60
Wages	50	55

Source: Banco de Portugal.

Table 5.2

PROBABILITY OF AN OUTTURN BELOW THE PROJECTIONS
Per cent

	Weights (%) 2009	2011	2012
Gross Domestic Product	100.0	60	63
Private Consumption	66.6	59	64
GFCF	19.5	58	63
Exports	28.0	58	60
Imports	35.6	59	64
HICP		50	54

Source: Banco de Portugal.

6. CONCLUSIONS

These projections for the Portuguese economy point to a contraction of economic activity in Portugal in 2011 and a slight recovery in 2012. These developments reflect the impact on economic activity of the start of the adjustment of a series of imbalances which have accumulated for over more a decade. In addition, the current projection shows strong downward risks for economic activity, stemming from both a possible weaker recovery of the world economy, and the need for stronger adjustment of the balance sheets of public and private economic agents. The materialization of such risks would imply an even more marked contraction of economic activity than currently projected.

As mentioned, the projections point to a gradual adjustment of the Portuguese economy's macroeconomic imbalances, particularly as regards the reduction of net external borrowing requirements. This adjustment is envisaged as a necessary condition to ensure that the Portuguese economy resumes a sustained growth trend. Within this framework, full compliance with the fiscal consolidation targets set by the Portuguese government, and, in particular, the maintenance of a sustained downward trend of general government structural borrowing requirements play a key role in ensuring a decline in financing costs. In the current environment, Eurosystem temporary measures to enhance liquidity have been essential to prevent a greater impact on the non-financial sector of the difficulties of access of Portuguese banks to international wholesale financing markets. In addition, it is also very important that households and corporate sector balance sheets are adjusted for the purpose of an increase in saving.

In addition to a containment of domestic demand, the adjustment of the imbalances should also have an underlying comprehensive and consistent programme targeted at eliminating the main structural fragilities of the Portuguese economy. These policy measures should aim at increasing efficiency in resource allocation, leading to a rise in potential output.

Sustained fiscal consolidation cannot but rely on a substantial change in the set of rules associated with the fiscal process. These undoubtedly include preparing credible budgets on a binding multi-annual basis, as well as full commitment at all levels of general government to the objectives assumed. These fiscal procedures should set nominal limits to public expenditure in several areas, namely central government and pension expenditures, in line with the best international practices. Strict implementation of this type of rules renders the redefinition of priorities important, insofar as it promotes reallocation of expenditure, catalysing a wider discussion on the State's role in the economy.

In addition, the implementation of labour market reforms, which induce a greater efficiency in the matching of workers to available jobs, is crucial to reduce segmentation in the labour market and structural unemployment. Similarly, it is critical that the educational system be capable of improving labour force skills and, in liaison with the corporate sector and the professional training system, in promoting the increase in labour factor productivity and allowing for the setting-up of export-oriented investment projects with innovative technologies, as well as the dissemination of such technologies.

Finally, it is of key importance that changes are introduced in the institutional framework where corporate activity is carried out, in order to improve the allocation of domestic resources and to attract innovative projects. A crucial component of this framework concerns increased competition in a number of markets, in particular in non-tradable goods and services, both through the elimination of barriers to entry, and an empowerment of regulators so as to ensure effective implementation of the existing legislation.

The fall in potential growth in Portugal was associated, *inter alia*, with a reduction of the investment rate and of its quality as observed over the past few years. Paving the way for a return to high investment rates, which in a context of tighter external financing conditions requires an increase in domestic saving, relies crucially on the pursuit of structural reforms. In this context, the quality of future economic growth can be measured through the rise in the productive potential of the economy and will crucially depend on an increase in the quality and profitability of investment.

This text was based on data available up to mid-December 2010.

ARTICLES

EDUCATIONAL ATTAINMENT AND EQUALITY OF OPPORTUNITY IN PORTUGAL AND IN EUROPE: THE ROLE OF SCHOOL VERSUS PARENTAL INFLUENCE*

*Manuel Coutinho Pereira***

1. INTRODUCTION

Economics of education is rooted in economic theories studying human capital. One of its branches is concerned with understanding what happens in schools, i.e. the way performance interacts with a multitude of factors such as the characteristics and family background of students, school resources and institutional features of the educational systems. This relates to several research agendas, beginning with the effective use of resources. Education accounts for a large share of government expenditure in almost all countries. People care about whether spending additional money will improve educational outcomes, or whether a given outcome can be attained by spending less. Research has suggested that pure resource policies may not be very effective, unless they are accompanied by changes in incentives. In this context, it is important to consider institutional features, e.g. school autonomy, among the determinants of performance. Another related research agenda arises from the stylized fact that family background plays a key role in achievement, repeatedly confirmed by research since the publication of the well-known Coleman report (Coleman, 1966). A high degree of dependence of outcomes on socioeconomic background is, however, an undesirable feature of educational systems, for in this case schooling does not contribute to attenuating social inequality. However, policy interventions can only work if the underlying mechanisms are well understood. For instance, socioeconomic status needs not determine achievement directly; it may determine instead which schools students select into, and inequality may be mostly between schools.

The objective of this study is to gather insight about such issues for Portugal and several European Union countries, on the basis of the data made available by the OECD Programme for International Student Assessment (PISA) of 2006. PISA comprises cross-country tests of educational achievement, assessing students' literacy in mathematics, science and reading at the end of their compulsory education. The tests assess students' capacity to use the acquired knowledge in situations that occur in the real world, rather than the learning of specific curricula. PISA is an ongoing survey that has been administered in three-year cycles; to date, surveys were conducted in 2000, 2003, 2006 and 2009. This study uses data from the last cycle available at the time of writing which is 2006.[1] Besides the OECD countries, an increasing number of partner countries have participated in the Programme (in 2006, this extended to 57 countries).

* The initial research leading to this article was joint work with Sara Moreira. The author thanks Nuno Alves, Mário Centeno, Jorge Correia da Cunha, Ana Cristina Leal and José Ferreira Machado for their comments. The opinions expressed in the article are those of the author and do not necessarily coincide with those of Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the author.

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(1) The results of PISA 2009 became available after the completion of this study.

International student achievement surveys such as PISA are important tools for countries to monitor the quality of their educational systems, to the extent that they make available data whose collection process and definition are comparable across countries. PISA outcomes have been exhaustively debated by the national media and the different players in the educational process in several of the participating countries (see Fuchs and Woessmann, 2007). At the same time, such surveys have become a key input to empirical analysis in economics of education (Hanushek and Woessmann, 2010). The PISA dataset includes, in addition to test scores, a great deal of information about the students and their socio-economic background and school characteristics and resources. An obvious advantage of this type of data *vis-à-vis* national datasets is the possibility of assessing the importance of an estimated impact by comparing it with the same estimate for other countries. For example, the coefficients of family background measures in country regressions explaining test scores can be seen as indicators of equality of opportunities. Moreover for some variables, as those relating to the institutional design of educational systems, within-country variation is typically small or absent. Cross-country datasets are needed to enable researchers to identify the influence of such variables.

This study estimates education production functions, regressing student performance measured by test scores on a wide set of explanatory variables. These comprise at the student level, for example, gender, grade, age, parents' education and occupations, immigration background, and indicators of wealth and educational resources at home. At the school level the covariates include the student/teacher ratio, class size, measures of teacher shortages, school size and location, public/private status and indicators of autonomy. Separate education production functions are estimated for test scores in mathematics and reading. In order to guarantee a higher socioeconomic and cultural homogeneity throughout the countries considered and minimize the importance of omitted factors, we have confined our attention to the OECD participants in the Program that are members of the European Union (with the exception of France owing to a total absence of school data).

As convenient for the analysis, this study focuses on either the full set of countries or groups of them. For instance, education production functions are estimated for Portugal and the sets of three countries with the best- and worst-performing students, respectively. This makes it possible to assess to what extent differences in achievement (as far as the model can explain it) have to do with differences in the contribution of specific covariates i.e. the coefficients of the production function. Such an approach differs from other studies (e.g. Woessmann, 2003) that estimate a single education production function for all countries as a whole, in order to exploit the cross-country variability in the explanatory variables. With this sort of regressions, one can also assess whether, after controlling for a wide set of covariates, the initial differences in relative performance across countries remain. For instance, one can investigate to what extent the low educational level of the population in Portugal can explain the gap to the average of scores of Portuguese students, given that parents' education is a determinant of achievement. The study ends with an analysis of the variance of scores and the role social inequality plays in it. In this context, given that students are grouped within schools, it is important to ascertain whether performance variability is a between-school or

within-school phenomenon. The study starts with a descriptive digression through the PISA 2006 database.

2. THE PISA 2006 DATABASE AND SOME DESCRIPTIVE RESULTS

PISA tests are taken by a representative sample of the population of students around the age of 15[2] who attend schools in a given country and are in the 7th or higher grades. In general the design of the survey takes the form of two-stage stratified sampling, where schools are drawn randomly in a first stage and students within them in a second one. For instance, for Portugal 173 schools were selected at the first stage and 40 students (or all eligible students, when less than 40) were subsequently randomly selected in each of those schools. The bulk of PISA data other than test scores comes from two questionnaires, respectively filled out by students and by schools. The 2006 database encompasses 5 109 students in Portugal and 131 598 students in the set of countries under consideration.

Students included in the PISA sample are not equally representative in terms of the population, and the database is provided with final student weights that reflect sampling probabilities and other factors such as non-response. Point estimates of descriptive statistics or model parameters for the population have to be drawn weighting student observations accordingly. Test scores in PISA are reported in the form of five plausible values for each subject - mathematics, reading and science - which correspond to random draws from the estimated distribution of student's abilities (see OECD, 2009, Chapter 6). Population statistics, including model parameters, are generally obtained by averaging over the corresponding statistics computed separately for each plausible value. Their variance comes from two sources: the sampling variance and the so-called imputation variance which reflects the measurement error in the tests (OECD, 2009, Chapter 8).

We firstly present the mean of mathematics and reading scores (Charts 1A and 1B) for the set of countries considered which includes Austria, Belgium, the Czech Republic, Denmark, Finland, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Poland, Portugal, Slovakia, Spain, Sweden, and the United Kingdom. Note that test scores are standardized to have a mean of 500 and a standard deviation of 100 across OECD countries. Portuguese students ranked 16th in mathematics and 14th in reading among these 18 countries in PISA 2006. This poor outcome does not differ overly from previous surveys.[3]

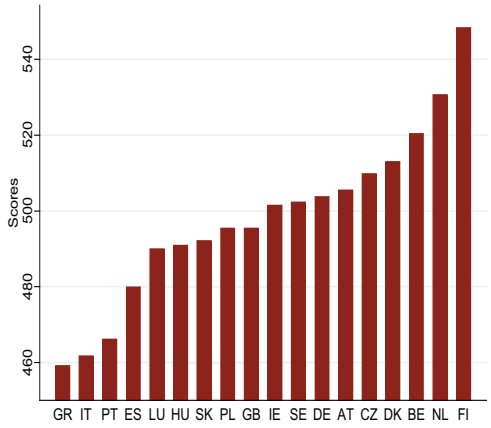
In order to benchmark the results for Portugal against those in other countries, we selected (weighting equally the rankings for the two subjects considered) two groups with the three best- and worst-performing countries. The first group includes Belgium, Finland and the Netherlands, and the second Greece, Italy and Spain. Portugal's achievement levels are very similar to the ones in this second set of countries, with which it also shares certain socio-economic and cultural traits. The

(2) More precisely, students are between 15 years and 3 months and 16 years and 3 months old. As explained below, such small age differences have an impact on performance because, combined with the student grade, they may capture a grade repetition effect.

(3) In PISA 2009 the position of the Portuguese students improved markedly, in particular for reading in which the average score is not significantly different from the OECD average in statistical terms. Portugal occupies, respectively, the 11th and 15th position in reading and mathematics within the same group of 18 countries in the last PISA.

Chart 1A

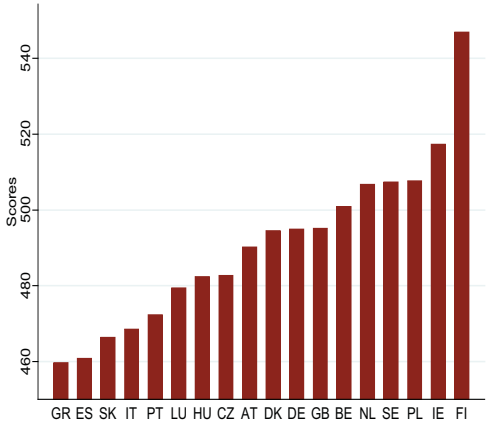
PERFORMANCE IN MATHEMATICS BY COUNTRY
Mean score



Source: Author's calculations on the basis of the PISA 2006 database.
Note: Average of the weighted averages for each plausible value.

Chart 1B

PERFORMANCE IN READING BY COUNTRY
Mean score



Source: Author's calculations on the basis of the PISA 2006 database.
Note: See previous chart.

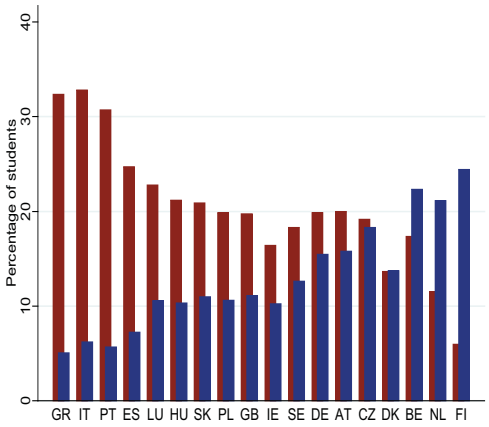
distributions of test scores (not shown) almost coincide for Portugal and the low performers. The distributions for the top performers are comparatively shifted to the right, but the dispersion is comparable. For instance, the inter-quartile range divided by the mean is 0.27 for mathematics scores in Portugal and the low-performing countries, and 0.25 for the high performers; for reading scores, these figures are between 0.26 and 0.28. The range of scores in PISA is divided into 6 successive proficiency levels which are associated with the increased difficulty of the tasks the students must perform. Charts 2A and 2B present the proportion of students, respectively, at level 1 and below and at level 5 and above, with the countries ordered in accordance with the mean score. As the mean score increases, the proportion of students at lower proficiency levels tends to go down and at higher levels to go up. However, some countries such as Austria, Belgium, the Czech Republic and Germany, have a great proportion of students at low proficiency levels for the country's average performance, indicating a higher dispersion of scores (we shall return to this issue in section 4).

Table 1 shows the characteristics of the student population, their families and schools for Portugal, breaking down further between public and private schools, and in the benchmark groups. These are the variables included in the education production functions to be estimated in the next section. In countries in which the compulsory school starting age is at six, students are mostly distributed between the 9th and the 10th grade (reflecting the specific rules regarding the birth date). This is the case of Portugal and all countries in the two groups except Finland, where school starts at seven and almost all students are in the 9th grade.[4] A reasonably high number of Portuguese students - around 20 per cent - are still in grades 7th or 8th due to higher repeating rates.

(4) More generally, in the full set of countries considered, the school starting age ranges from four or five in the United Kingdom to seven in Denmark, Finland, Poland and Sweden.

Chart 2A

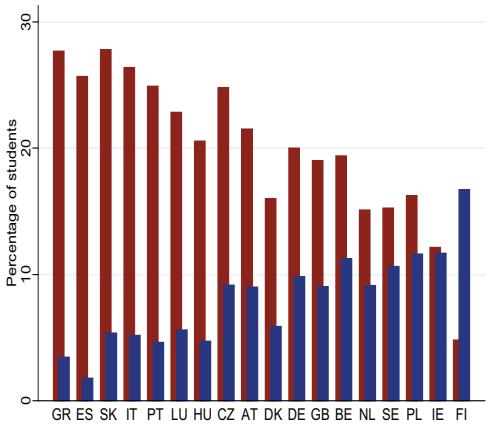
PROFICIENCY IN MATHEMATICS BY COUNTRY
Students at level 1 and below (in red) and at level 5 and above (in blue)



Source: Author's calculations on the basis of the PISA 2006 database.
Note: Average of percentages for each plausible value.

Chart 2B

PROFICIENCY IN READING BY COUNTRY
Students at level 1 and below (in red) and at level 5 and above (in blue)



Source: Author's calculations on the basis of the PISA 2006 database.
Note: See previous chart.

Concerning family background, the gap between Portugal and the best performers is particularly large in the case of parents' education and occupations. For instance, in Portugal around 25 percent of students have at least one parent in a white-collar/high-skilled occupation, and about 20 percent have at least one parent with a tertiary education level. These percentages are close to 60 per cent for the countries where students perform best. Furthermore, less than 5 percent of students in these countries indicated that the highest education level of their parents was primary education, against almost 40 per cent of Portuguese students. The same type of gap occurs, albeit to a lesser extent, *vis-à-vis* the low performing countries. The wealth indicator (computed from answers on household possessions of durable goods) has a higher average figure for the high-performing countries, as one would expect from the fact that they are richer. In contrast, the indicator for educational resources at home has a similar level throughout countries. The proportion of immigrant students is slightly higher in the best-performing countries than in Portugal and the worst-performing group (about 10 percent against 5 percent). For Portugal, students attending private schools come from advantaged households, as shown by the wealth indicator and particularly the upper cohorts of parents' education and occupations.

We now proceed to school variables. The share of private schools differs substantially between the best-performing countries (more than 50 percent),[5] and Portugal and worst performers (around 10 percent). Schools in Portugal are bigger, located in comparatively smaller towns and have a higher proportion of repeaters than those in both benchmark groups. Among the resource indicators, it is particularly striking the very low student/teacher ratio in Portuguese public schools. Portuguese schools have comparatively less autonomy of resource management and definition of curricula

(5) Note that most of these schools have private management but public financing.

Table 1

EXPLANATORY VARIABLES (MEANS) [a]

	Portugal			Low-performing countries [b]	High-performing countries [b]
	Total	Public	Private		
Student characteristics					
7th grade	6.6	6.9	3.9	0.2	0.2
8th grade	13.1	13.5	9.9	3.7	5.3
9th grade	29.5	29.7	27.6	21.0	47.5
10th grade	50.9	50.0	58.6	72.4	46.5
11th grade				2.8	0.5
age (years)	15.7	15.7	15.7	15.8	15.8
female	51.7	52.1	48.3	50.0	48.8
Family background					
wealth (index) ⊂ [-2.1,2.3][c]	-0.17	-0.20	0.11	-0.14	0.45
educational resourc. home (ind.) ⊂ [0,7]	6.2	6.2	6.4	6.1	6.2
books at home < 25	38.9	40.0	29.2	24.7	28.0
books at home 25-200	45.6	45.6	46.3	53.2	48.3
books at home > 200	15.5	14.5	24.5	22.1	23.7
native	94.1	93.7	97.4	94.6	89.7
second-generation immigrant	3.5	3.8	1.3	4.6	4.0
first-generation immigrant	2.4	2.5	1.2	0.8	6.3
test language at home	97.7	97.6	98.1	85.9	90.9
other national language at home	-	-	-	11.2	4.0
foreign language at home	2.3	2.4	1.9	2.9	5.1
parents' highest occuppat. level					
blue collar/low skilled	12.6	13.2	7.6	11.8	7.1
blue collar/high skilled	24.2	24.9	18.7	19.0	9.4
white collar/low skilled	36.3	36.6	33.4	23.7	22.4
white collar/high skilled	26.9	25.4	40.3	45.5	61.2
parents' highest education level					
primary or less	38.6	39.2	33.5	7.9	3.6
lower secondary	15.3	15.4	14.8	22.3	5.4
upper secondary	23.5	24.0	19.6	38.5	32.3
tertiary	22.5	21.5	32.1	31.2	58.6
School characteristics					
school size (1000 students)	0.957	0.922	1.268	0.694	0.824
proportion of girls	50.9	51.0	49.7	49.7	48.9
located in town with less 15 000 people	42.5	40.8	57.9	24.9	25.6
located in town with 15 000-100 000 people	35.9	38.2	15.1	42.0	51.0
located in city with more 100 000 people	21.6	21.0	27.1	33.1	23.4
grade amplitude (max-min grade)	5.1	4.7	8.3	4.9	4.8
proportion of repeaters	14.6	15.3	7.2	10.5	4.7
school faces competition[d]	72.9	71.9	81.7	78.4	84.4
autonomy resources (ind.) ⊂ [-1.1,2.0]	-1.0	-1.1	-0.8	-0.6	0.1
autonomy curric./assessm. (ind.) ⊂ [-1.4,1.3]	-0.5	-0.5	-0.3	0.1	0.4
school faces parental pressure[e]	7.1	4.9	26.5	16.1	7.4
public school	91.1			84.4	44.2
private school	8.9			15.6	55.8
School resources					
class size (students)	24.0	23.7	26.3	27.0	22.3
student/teacher ratio	8.9	8.4	13.3	10.4	12.9
proportion web-connected computers	80.2	79.7	84.5	84.9	89.1
computer/student ratio	0.07	0.07	0.06	0.11	0.15
regular lessons mathematics (hours)	3.5	3.5	3.8	3.5	3.2
regular lessons language (hours)	3.2	3.2	3.4	3.9	3.1
school faces lack of math. teachers	1.3	0.6	7.7	10.5	21.1
school faces lack of language teachers	0.0	0.0	0.0	9.2	13.5
Computer familiarity					
self-conf. internet tasks (ind.) ⊂ [-2.9,0.8]	-0.2	-0.2	-0.2	-0.4	0.4
time spent intern./entert. (ind.) ⊂ [-2.1,3.2]	0.2	0.2	0.1	-0.1	0.2

Source: Author's calculations on the basis of the PISA 2006 database.

Notes: **(a)** Weighted averages; figures as a percentage of totals unless otherwise stated (more details about the definition of variables are given in Appendix 1). **(b)** The low-performing countries include Greece, Italy and Spain; the high-performing countries include Belgium, Finland and the Netherlands. **(c)** The intervals show the percentiles 1. and 99. of the indicator. **(d)** School reports that there is at least one other school in the same area competing for its students. **(e)** School reports that there is pressure from a majority of parents to achieve higher academic standards.

and assessment practices, particularly in comparison to the best-performing countries. Curiously, schools in the two benchmark groups of countries report a shortage of qualified teachers, in contrast to their Portuguese counterparts. Note that there is no measure of teacher experience in the PISA 2006 database, so this could not be included in the education production function.[6]

3. THE EDUCATION PRODUCTION FUNCTION

3.1. Specification and possible sources of biases

The relationship between educational attainment and its determinants is typically studied by means of an education production function - see, for instance, Hanushek (1979) and Todd and Wolphin (2003) for detailed discussions about the specification and estimation of these functions. They can be generically specified as

$$Score_{ij} = b_0 + b_1 St_{ij} + b_2 Fm_{ij} + b_3 Sc_j + b_4 Re_j + e_{ij},$$

where i indexes the student and j the school. $Score$ is the outcome of the test, St is a vector of student characteristics, Fm includes family background measures, Sc comprises various school features and Re includes variables associated with school resources. The determinants of student performance we consider in this study are listed in Table 1.[7] The main problem affecting the estimation of education production functions is the endogeneity of some covariates, often arising from their correlation with unobservables, notably cognitive abilities of students. Although ideally measures of such abilities should be added to the equation above, this is almost never the case as they are hard to come by. Actually, one of the variables we consider - the indicator measuring self-confidence in internet tasks (under computer familiarity in Table 1) - is of particular interest in this respect because it can be seen as an indicator of student abilities,[8] although it may also reflect family possessions and/or school resources to the extent that these condition students' internet access. A second problem relates to the fact that the PISA database is cross-sectional, allowing the estimation of models in levels but not of value-added specifications that require panel data.

Student grade captures the exposure to more or less advanced curricula and, combined with student age, also a grade repetition effect (see the next section). Note that grade repetition does not appear in our regression. This variable would reflect past performance which is related to current performance. As a result student grade is itself partly endogenous to current performance. Therefore, one may expect an overestimation of its (positive) effect on attainment *vis-à-vis* a regression controlling also for the number of years the student has repeated.

(6) The database includes the share of teachers with tertiary education, but this variable shows reduced variability (the median is close to 90 percent). As it was, in addition, fully missing for some countries, it was not taken on board in the regressions.

(7) There are no missing values for the test scores; in contrast, most of the explanatory variables in the production have a small amount of missings. In order to avoid a great loss of information, we imputed these missing values prior to estimation, similarly to previous researchers (e.g. Fuchs and Woessmann, 2007). The details are given in Appendix 2.

(8) Note that this variable measures competence in tasks only loosely related to the use of computers as learning tools (see Appendix 1). Otherwise its explanatory power would be of less interest. Another variable available in the PISA database which measures self-confidence in general computer tasks (not used) appears more likely to suffer from this problem.

The explanatory variables relating to family background can be considered largely exogenous to educational achievement[9] and, at the same time, should make a steady contribution to the knowledge acquired by the student over the years, adequately captured by a level-type modelling. Most of schools' basic characteristics such as location and size, and institutional features such as autonomy, can also be deemed exogenous in the production function. Parental pressure, however, may not fulfil this and, besides the influence exerted on schools to improve standards, capture the selection of better schools by parents who are more concerned with their children's education. This may lead to an overestimation of the variable's expected positive impact on performance. Given that we control extensively for family and immigration background, even if students from favoured households select preferentially into private schools, this should not cause a bias in the measurement of the private-school effect.

The variables measuring the use of resources by schools, e.g. class size and hours of regular lessons, are clearly less suitable for the specification in levels we use. In effect, such variables will usually change from one year to the other, and the current level of knowledge will also depend on the values they assumed in the past. With PISA data this shortcoming cannot be overcome. The volume of resources may itself respond to student performance: for instance, students with poor attainment may have supplementary classes.[10] Nevertheless, given the resource covariates we consider and their definition in terms of school averages (except for the hours of regular lessons), this is unlikely to be an issue for our estimates.

When estimating education production functions using data from more than one country, one has to reckon with country-specific effects that have an impact on school outcomes, e.g. social attitudes towards education. In the production functions estimated for the two benchmark groups, such effects are accommodated by the inclusion of binary variables at the country level.

3.2. Determinants of attainment in Portugal and in the benchmark countries

Student characteristics

Table 2 presents the estimates of the education production functions for Portugal and the two groups of countries where students had, respectively, the worst (Greece, Italy and Spain) and the best (Belgium, Finland and the Netherlands) scores. We start with the impact of student characteristics. In Portugal there is a positive effect on performance of the student grade, clearly significant (the same holds for the groups of high- and low-performing countries). A comparison with the coefficients of the other binary variables in the regression shows that its magnitude is very large. For the Portuguese PISA 2006 students, grade and age interact in the following way. Among all students of a given age, those in the top grade, which can be the 10th or the 9th depending on the date of birth,[11] never

(9) Assuming that ability is not correlated across generations; otherwise abler students could be associated with advantaged families.

(10) An example of a resource variable in the PISA database strongly affected by this sort of endogeneity is out-of-school-time lessons. We experimented with it in the production function, but the positive effect it may have on performance is completely offset by the selection of the low-performing students it entails.

(11) According to the rules governing the start of compulsory education, the students who never repeated and were six years old by 15 September 1996 are in the 10th grade, those who became six only after 31 December are in the 9th grade, and those who became six in-between are in either of those grades, depending on a decision of parents.

Table 2 (to be continued)

EDUCATION PRODUCTION FUNCTION, ESTIMATES[a]

	Portugal		Low-performing countries [b]		High-performing countries [b]	
	Mathematics	**Reading**	**Mathematics**	**Reading**	**Mathematics**	**Reading**
Student characteristics						
grade (7th)[c]						
8th	39.4	53.2	12.1	54.4	51.4/73.0	90.2/67.7[d]
	3.5	*4.1*	*12.6*	*18.0*	*7.7/12.6*	*14.8/19.0*
9th	83.1	95.7	58.8	93.5	86.0/124.6	132.1/111.8
	3.8	4.4	13.0	17.2	*6.7/13.1*	*15.5/18.3*
10th	144.1	158.7	115.2	144.1	142.2/-	186.1/-
	2.9	*3.7*	*13.1*	*17.5*	*6.7/-*	*15.6/-*
11th	-	-	119.7	150.3	202.6/ -	245.2/ -
			13.8	18.7	10.3/ -	15.7/-
age	-17.1	-23.4	5.5	0.5	-17.1	-18.8
	2.1	*2.6*	*1.2*	*1.6*	*1.4*	*1.6*
female gender (male)	-26.9	20.9	-26.8	18.7	-24.3	16.9
	1.6	*1.4*	*0.8*	*1.0*	*1.0*	*1.1*
Family background						
wealth	-3.5	0.3	-4.2	-7.9	-2.0	-3.8
	1.3	*1.1*	*0.5*	*0.8*	*0.7*	*0.9*
educat. resources at home	2.2	2.0	8.5	8.7	7.8	8.0
	0.7	*1.0*	*0.4*	*0.4*	*0.5*	*0.6*
books at home (less than 25)						
between 25 and 200	19.6	15.4	21.8	23.2	22.2	21.4
	1.5	*1.6*	*1.0*	*0.9*	*1.0*	*1.1*
more than 200	35.4	22.8	46.2	39.9	49.0	42.7
	2.1	*2.6*	*1.2*	*1.2*	*1.1*	*1.4*
immigration background (native)						
second generation immigrant	-17.4	-14.5	-7.1	-4.6	-24.0	-9.6
	3.3	*6.5*	*2.0*	*2.1*	*2.9*	*3.1*
first generation immigrant	-15.1	-9.8	-15.9	8.8	-27.7	-18.5
	6.6	*5.6*	*4.0*	*5.0*	*1.9*	*3.4*
language at home (test language)						
other national language	-	-	-0.8	-3.2	26.3	28.1
			1.3	1.6	2.0	2.2
foreign language	23.8	-10.1	12.2	-9.6	-1.2	-18.3
	5.2	*4.9*	*3.4*	*3.2*	*3.1*	*2.9*
hig. occup. parents (bl. col./low skil.)						
blue collar/high skilled	1.2	2.6	4.0	0.4	4.5	7.2
	2.8	*3.1*	*1.4*	*1.5*	*2.3*	*2.6*
white collar/low skilled	2.3	10.0	7.4	7.8	10.5	14.6
	2.8	*3.2*	*1.1*	*1.3*	*1.7*	*2.3*
white collar/high skilled	18.1	23.7	12.6	11.9	21.3	26.5
	2.7	2.9	1.2	1.5	2.2	2.5
highest educ. parents (primary or less)						
lower secondary	-0.4	3.6	13.5	17.8	13.2	16.3
	2.3	*2.6*	*1.8*	*2.1*	*5.2*	*3.7*
upper secondary	2.4	3.0	17.6	25.2	10.2	18.6
	1.3	*2.7*	*1.8*	*1.9*	*3.9*	*2.8*
tertiary	0.3	5.8	15.2	20.0	10.5	19.2
	2.6	*2.9*	*1.7*	*1.6*	*3.9*	*2.9*

Table 2 (continued)

EDUCATION PRODUCTION FUNCTION, ESTIMATES[(a)]

	Portugal		Low-performing countries [(b)]		High-performing countries [(b)]	
	Mathematics	**Reading**	**Mathematics**	**Reading**	**Mathematics**	**Reading**
School characteristics						
school size	4.2	8.5	-2.6	-1.9	24.7	20.0
	3.1	*2.9*	*2.2*	*2.6*	*3.5*	*4.1*
proportion of girls	88.9	98.5	-5.0	34.3	34.7	52.7
	23.2	*25.2*	*4.7*	*5.7*	*5.5*	*6.8*
located in (town < 15 000 people)						
town 15 000 - 100 000 people	1.5	-3.7	3.1	6.2	-3.1	-1.2
	2.6	*2.7*	*2.1*	*2.7*	*2.5*	*3.3*
city > 100 000 people	6.4	10.9	11.7	14.5	-6.5	1.0
	2.9	*3.1*	*2.1*	*2.5*	*3.2*	*3.7*
grade amplitude	0.0	1.3	2.1	1.0	1.3	1.3
	0.6	*0.7*	*0.6*	*0.6*	*0.3*	*0.4*
proportion of repeaters	-26.2	-9.8	-60.0	-107.8	-75.0	-120.6
	11.6	*14.0*	*14.3*	*13.9*	*17.1*	*23.1*
school faces competition (no)	6.8	1.3	-0.1	3.7	0.5	4.3
	2.3	*2.2*	*2.0*	*2.3*	*3.4*	*4.5*
autonomy resource allocation	-8.9	44.5	1.1	2.1	3.4	3.1
	12.1	*13.6*	*1.4*	*2.0*	*1.5*	*2.0*
autonomy curriculum/assessment	-2.7	-7.6	-2.5	-1.6	-1.6	-2.8
	1.5	*1.5*	*0.9*	*1.1*	*1.2*	*1.6*
school faces parental pressure (no)	6.0	9.4	14.8	15.0	11.5	12.9
	3.5	*4.9*	*2.4*	*2.2*	*3.4*	*3.0*
private school (public)	13.4	-12.3	-35.2	-24.9	7.4	6.2
	4.7	*6.4*	*4.7*	*4.2*	*2.1*	*2.0*
School resources						
class size	0.5	0.3	-0.3	-0.1	1.5	1.8
	0.3	*0.3*	*0.1*	*0.1*	*0.4*	*0.5*
student/teacher ratio	0.1	-0.4	3.7	2.8	4.4	4.6
	0.5	*0.6*	*0.4*	*0.3*	*0.5*	*0.8*
prop. web-connected computers	-0.5	11.5	17.2	13.1	15.5	3.1
	4.0	*5.3*	*2.9*	*4.1*	*5.2*	*5.5*
computer/student ratio	23.9	17.9	13.6	-10.6	26.3	-2.2
	29.4	*29.5*	*7.4*	*9.8*	*10.2*	*12.5*
hours of lessons language/math.	6.8	5.4	9.0	7.4	9.4	3.5
	0.3	*0.5*	*0.3*	*0.2*	*0.2*	*0.3*
shortage teachers lang./math. (no)	-	-	3.5	11.5	-12.0	-19.1
			2.9	*3.2*	*2.4*	*3.5*
Computer familiarity						
self-confidence in internet tasks	10.3	16.2	14.8	18.2	13.1	17.5
	1.1	*0.9*	*0.4*	*0.5*	*0.7*	*1.0*
time spent on internet/entertainment	-5.2	-8.1	-12.6	-14.3	-7.2	-9.2
	0.9	*0.9*	*0.4*	*0.6*	*0.5*	*0.6*
coefficient of determination	0.56	0.56	0.36	0.34	0.48	0.45
observations in the sample	4981	4981	45660	45660	18319	18319

Source: Author's calculations.

Notas: (a) Average of the coefficients estimated by weighted least squares regressions of the five plausible values in mathematics and reading, respectively, on the covariates listed in the table and country dummies (not shown); standard errors shown in italics. The variance depends on the sampling variance, calculated in accordance with the Fay's variant of the balanced repeated replication method, and the imputation variance. **(b)** The low-performing countries include Greece, Italy and Spain; the high-performing countries include Belgium, Finland and the Netherlands. **(c)** Ommitted category in parenthesis, for binary variables. **(d)** The grade effect is estimated separately for Finland (figures on the right) where the school starting age is at 7, and in the other high-performing countries (figures on the left), where it is at 6.

repeated a year, those one grade below repeated once, and so on (this holds true for all students except those born between 15 September and 31 December whose parents could and did postpone school entry by one year). Therefore, as stated, the variable captures not only the impact of the student's current curricula, but also an effect associated with grade repetition.

The explanatory power of age, with grade held fixed, has to do with the students born between 15 September and 31 December: an increasing number of such students, as the birth dates approach the end of the year, waited a further year to enter school. Thus, as age goes down within that group and each grade, except the 10th, the proportion of children entering school at the age of 6 goes up and that of students who repeated once (9th grade) or one additional year (grades below) goes down, and thus the negative relationship with attainment. Gender has a clear influence on scores, with boys performing better in mathematics and girls in reading. The effect is precisely estimated and, as one would expect, similar across countries.

Family background

Our education production function includes several measures relating to the socioeconomic background of students, and results confirm that they have a strong impact on attainment. The contribution of the books at home variable stands out, which does not come as a surprise as it is very often the best single predictor of educational performance in similar regressions (Hanushek and Woessmann, 2010). Naturally, it is not the number of books at home *per se* that is causally associated with achievement, but this variable captures very well a home environment propitious to learning. The measured impacts in Portugal are lower than those for the two groups of benchmark countries, particularly in the upper category (more than 200 books). In all of the three regressions, as one moves up in the breakdown of parental occupations, a positive influence on performance emerges, particularly marked for white-collar/high-skilled jobs. As far as the formal education of parents is concerned, its contribution is barely or not significant for Portugal, in contrast with the strong impact in the two benchmark groups. Among family background covariates, academic qualifications may be specifically associated with parents' monitoring of school tasks of their children. The results may signal less capability or readiness by Portuguese parents to do so.

A second set of covariates in this group relates to nationality and language spoken at home. Immigrant status generally entails a disadvantage in terms of attainment, which is largest for the countries where students perform best. In the case of Portugal, the second-generation immigrant students fare worse than their first-generation counterparts in terms of point estimates (although the difference is statistically not significant at the usual levels). This implies that the negative impact of the status seems not to attenuate as students and their families have lived longer in the country. It is interesting to note that once the immigration status is controlled for, to speak a foreign language at home has a positive and significant impact on mathematics scores in Portugal (for reading scores this is still negative). Such result may reflect a very strong commitment to school of certain groups among the population of immigrant students, surpassing that of native students.

The contribution of educational resources at home to the performance of Portuguese students is positive and significant, but falls short of that in the two benchmark groups. The coefficient of the wealth indicator is either non-significant or even significantly negative, basically indicating that it has no impact of its own, once many other aspects of the socio-economic status of students are taken into account.

The impacts of family background variables can be interpreted in another dimension which relates to educational equity - an issue explored in more detail in section 4. The relationship between a summary measure of socioeconomic status (for instance, the number of books at home) and an achievement variable - sometimes called the slope of the *socioeconomic gradient* - is often used as an indicator of educational opportunity. A steeper socioeconomic gradient implies more unequal school outcomes for children from households of different statuses, holding the rest constant. In the education production function for Portugal, the coefficients of the variables measuring several aspects of family background suggest a weaker impact on achievement, in particular in comparison to the countries with the best performance. Two factors may account for this. The first is a more passive parental attitude toward education, featuring less involvement by parents in the school lives of their children. The second is an educational system that tends to offset more the unequal situation of children from different social classes.

School characteristics

We consider a multitude of school characteristics in our education production function. The point estimates of the influence of school size are positive for Portugal, albeit only significant in the case of reading tests. This indicates the existence of economies of scale, in line with the findings in Pereira and Moreira (2007). In the benchmark groups, the same sort of evidence is confined to high-performing countries. In contrast, school location for Portugal appears less important than in that study, since only the upper category - location in a city over 100 000 people - makes a significant (positive) difference to performance. Such results must be accounted for by the much larger set of controls used here. A higher proportion of repeaters produces the expected negative impact on performance, while a higher proportion of girls contributes to a school atmosphere conducive to favourable outcomes.

From a theoretical perspective, the effect of school autonomy on attainment is ambiguous. On the one hand, it can be positive because decision-makers at the school level tend to have better information. However, autonomy can also be used by local decision-makers to pursue their own aims, which may not coincide with an improvement of students' achievement levels (Hanushek and Woessman, 2010). In the empirical literature, it has been found that the room for manoeuvre in budget allocations (given the overall amount) including teacher hiring and rewarding, and in choosing textbooks and teaching methods, tends to enhance performance. In contrast, autonomy of schools over the budget size and autonomy of teachers over the curriculum to be covered in class appear negatively linked to performance, possibly because these lend themselves more to opportunistic behaviour. The regressions in this study are a less-than-ideal environment for analysing these

effects, since they do not fully exploit cross-country variation that precisely helps to pinpoint them. Nevertheless, our point estimates generally fit with this sort of evidence. Autonomy in resource allocation makes a positive contribution to achievement (in Portugal this occurs for reading scores only) and autonomy of curriculum and assessment a negative one, although not always significant. Note that, in the Portuguese case, there is virtually no autonomy of teacher allocation and rewarding for public schools and so the first of the two indicators is close to the overall minimum throughout; it is private schools that lend some variability to it.

Parental pressure has a positive impact on performance although, as mentioned above, this may also reflect the effect of better schools being chosen by more attentive and informed parents, in addition to the pressure they may bring to bear upon schools. The coefficient of the private school indicator is negative, but on the brink of non-significance for reading, and positive and significant for mathematics. In the latter case, the impact measured in the mean of the dependent variable is around 3 percent. Pereira and Moreira (2007) - who used the average scores in the 12th grade national examinations for all subjects, 2003/04 and 2004/05 - estimated the private-school effect at 7 to 8 percent. We get a lower effect for mathematics (and an effect of the opposite sign for reading). Apart from the different dataset, this result can be explained by the absence of family controls in the aforementioned study, leading to an upward bias in the coefficient. While it is possible that the inclusion of such controls approximately empties the explanatory content of the private-school indicator, these results should not be considered as definitive. Given that private schools are a small part (about 10 percent) of the population of relevant students, there is the possibility of biases caused by the sampling process. A comparison between the averages of scores in private and public schools in the PISA 2006 database and those in the 9th grade national examinations (academic year 2006/07), indicates that this may be the case.[12]

School resources

Traditional measures of school resources such as average class size and student/teacher ratio do not enter significantly into the Portuguese education production function. In the two benchmark groups of countries, the coefficient of the student/teacher ratio has a counter-intuitive positive sign and is statistically significant (this also holds true for class size in high-performing countries). Hanushek (1986) surveys the findings in many studies over the contribution of resource variables and concludes that this is often not significant and, in some cases, opposite-than-expected effects are found. This fits in with the well known result that such variables have a much weaker (if any) influence on attainment than those relating to family background. The amount of regular lessons stands in contrast with this sort of evidence, featuring a clear positive and statistically significant impact on performance, in all of the three regressions. If interventions at the level of resources are to be carried out, this appears to be the only variable where they can be effective.

(12) In PISA 2006, the average scores in private schools are, respectively, 5.5 percent higher in mathematics and 3.2 percent in reading. The corresponding figures in the 9th grade national examinations, 2006/07, in mathematics and portuguese are 22.6 and 7.8 percent (Jornal Público, 2007).

Computer familiarity

We argued above that the variable internet skills could be a measure of student abilities. The fact that its impact is positive and significant, and not very different across countries, speaks in favour of such an interpretation. In contrast, the time spent in entertainment and internet browsing is negatively related to performance.

3.3. Differences in country performance with parental characteristics remaining constant

Rankings of countries constructed on the basis of PISA test scores, as presented in Charts 1A and 1B, obviously do not control for the factors determining test scores. At the same time, determinants such as the education level and the occupational structure of the population, which the student background variables capture, come from the past and are largely unaffected by current education policies. A question arising in this context is how rankings would change should the distribution of parental characteristics across countries be held constant. This is particularly pertinent for Portugal that has one of the lowest endowments among the European Union countries in terms of the education level of its population. In order to investigate the issue, we estimate an education production function for the full set of countries, including the family background measures as covariates (Table 1) plus country-specific binary variables.[13] The coefficients of the latter variables can be interpreted as the mean scores holding constant parental characteristics, and compared with the unconditional means presented in Charts 1A and 1B. Such an exercise is not without caveats, because our model is only an approximation of reality. In practice if the level of certain covariates, say, in a low-performing country, changed to the level prevailing in a high performer, the actual change in achievement would differ from that implied by the model. The results are set out in Charts 3A and 3B, in terms of each country's gap in comparison to the best performer, i.e. Finland.

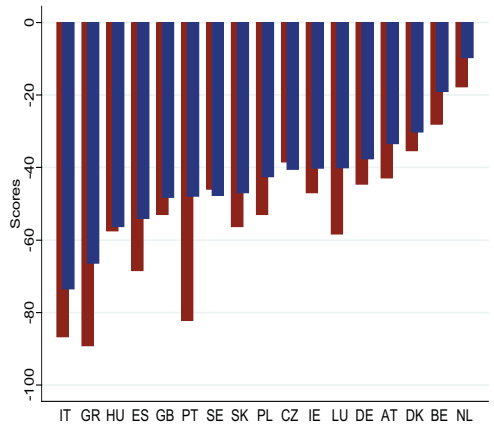
Portugal is the country in which the gap to the best performer narrows most when the conditional mean of scores, instead of the unconditional mean, is considered. This confirms a strong negative impact of the composition of parental characteristics on attainment. The narrowing of the gap is more pronounced than in some of the other low-performing countries such as Spain and Italy which, as shown in Table 1, have a more favourable situation in terms of that composition than Portugal. Charts 3A and 3B indicate a less gloomy situation for Portugal in terms of school outcomes than Charts 1A and 1B. In mathematics, although still in the bottom half of the ranking, Portugal is close to the group of countries with middling levels of achievement. In reading, the change is more marked, with the Portuguese students rising to the upper half of the countries in terms of performance.

(13) The other regressors, such as school characteristics and resource variables, are not included because we do not want to control for them. The student background variables will capture the effect of these omitted regressors to the extent that there is correlation between both. However, this should be reasonably low (except possibly for the public or private status of schools) and cause a small distortion.

Chart 3A

MATHEMATICS PERFORMANCE BY COUNTRY, DIFFERENCE TO FINLAND

Unconditional mean (in red) and mean holding family background constant (in blue)



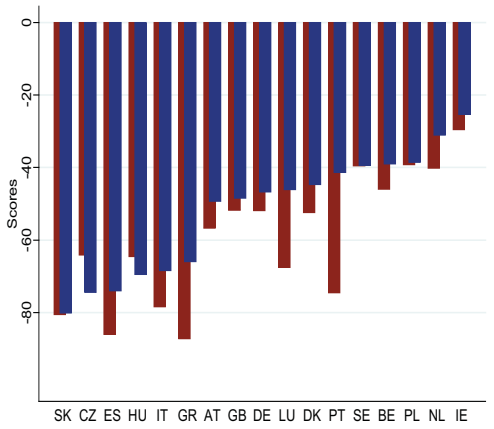
Source: Author's calculations.

Note: Based on weighted least squares regressions of mathematics scores on country-specific constants (unconditional mean) and on these constants plus all socioeconomic covariates (mean holding family background constant). The chart shows the difference between the coefficients for each country and Finland.

Chart 3B

READING PERFORMANCE BY COUNTRY, DIFFERENCE TO FINLAND

Unconditional mean (in red) and mean holding family background constant (in blue)



Source: Author's calculations.

Note: Same as the previous chart but for reading scores.

4. SOME ASPECTS OF VARIABILITY IN STUDENT PERFORMANCE

We now consider variability in student performance or academic inequality, complementing the preceding results which were mainly aimed at explaining the respective level. Analyses usually place much emphasis on social inequality as a source of academic inequality. This is justified by the importance of the socioeconomic status of parents for the educational performance of their children. In addition, the regressors in this group usually have higher variance than, notably, those related to school resources (particularly in the context of analyses within countries or involving countries with similar levels of development). At the same time, academic inequality feeds back on social inequality, as the education level of older generations is the single most important factor behind the current distribution of workers by occupations and earning levels. In fact, one of the main objectives of educational systems is to progressively attenuate such inequalities, by ensuring that the distribution of children's skills at the end of the period of education is less unequal than that of their parents. There are other important sources of variability in educational outcomes, such as students' cognitive skills and the quality of teaching.

Students are assigned to schools, and dispersion in student achievement may materialize to some extent through the existence of schools that differ substantially as far as that achievement is concerned. It is thus important to look, besides the overall variability in student performance, at the proportion evaluated between and within schools. If the between-school component is large *vis-à-vis* the within-school component, then students with lower achievement levels concentrate in some schools and students with higher levels in others. Such phenomenon may occur for a number of re-

asons, for example, schools may have a socioeconomic intake that covers students predominantly coming from either advantaged or disadvantaged households. When there is a great asymmetry in living standards across regions in a country, given that the mobility of students is limited, the social composition of schools located in poorer regions will differ markedly from their counterparts in richer areas. The same holds for asymmetries across neighbourhoods within large towns, particularly in the absence of catchment areas (which oblige students to attend their local school), as parents tend to enrol their children in schools attended by their peers.

A mechanism introducing differentiation in achievement between schools is early tracking of students as it exists in the educational systems of some of the countries we consider (Brunello and Checchi, 2007). Early tracking is the allocation of students to schools offering specific curricula, for instance, general *vs* vocational, at an early stage (say, between 10 and 12 years of age). This allocation can be made on the basis of criteria such as formal tests and teachers' recommendation or self-selection. Formal testing brings about sorting of students in accordance with their socioeconomic background and individual capabilities, as these are important determinants of scores in the placement tests. Sorting in accordance with the background may occur even in the case of self-selection, as parents with blue-collar jobs may find it more natural to enrol their children in schools offering vocational curricula, and parents with white-collar jobs in schools offering university-oriented curricula.

As a first exercise, we consider the association between the variance decomposition of mathematics scores and a family background measure, the index of economic, social and cultural status (ESCS index). This index, available in the PISA database, summarizes several dimensions of family background (see Appendix 1 for details about its construction), except for immigration status. The decomposition of the variance for each of the two variables is obtained from the estimation of multilevel models without explanatory variables, including school-specific random intercepts[14] (see Goldstein, 2010). Chart 4A depicts the scatter plot of total variance of mathematics scores and the ESCS index (both normalized to have the means equal to 100) and Chart 4B the respective between-school shares. In countries in which these shares are larger, schools differ more substantially as regards student achievement and social composition.

We start by looking at the dispersion of mathematics scores. There is no obvious relationship across countries between attainment (Chart 1A), on the one hand, and variability of scores and its decomposition in these charts, on the other. The best performer - Finland - has both the lowest overall variance and between-school share; however, Belgium, also on the top of the performance ranking, has the highest variance and one of the highest between-school shares (the Netherlands, another top performer, has the highest). Low levels of attainment are as well compatible with rather different situations in terms of score variability, as illustrated by the cases of Italy and Spain. These conclusions generally hold for the dispersion of reading scores as well (not shown), which is greater than

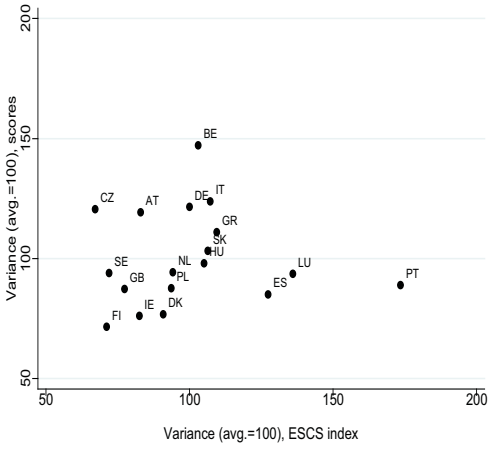
(14) This model explains the dependent variable as the sum of these intercepts (equal to a fixed grand mean plus each school's random deviation from it) and a student-level residual variable. The estimations were performed using the program GLLAMM (Rabe-Hesketh et al., 2004) that runs within STATA. Weighting was made in accordance with the first of the two schemes proposed by Pfeffermann et al. (2008). In the case of mathematics scores, the first plausible value was taken.

that of mathematics scores in most countries.

As far as the dispersion of the ESCS index is concerned, Portugal stands as an outlier with a figure of almost 75 percent over the cross-country average (Chart 4A). However, this dispersion is «passed on» to test scores to a much lesser degree than in other countries (a fact that also holds, to a certain extent, for Luxembourg and Spain). Such a finding must be accounted for by the smaller impact of family background variables on achievement in the education production function for Portugal (Table 2).[15] As a result the overall score variance for Portugal is a bit below the average, and the same applies to the share attributable to between schools (around 35 percent against an average of slightly more than 40 percent). A group of countries including Austria, Belgium, the Czech Republic, Germany and Italy seem to be in the opposite situation to Portugal, in that they have more variance of scores than implied by the ESCS index. All of these countries, except Italy, have early tracking of students (the other countries in the group sharing this institutional feature are Hungary, the Netherlands and Slovakia). Various studies - e.g. Hanushek and Woessman (2006) - have associated this feature with an increase in the variance of school outcomes.[16] The impact of early tracking is, as expected, more evident in the share of between-school variance (Chart 4B), as it implies a sorting of students in accordance with family background and, in some cases, cognitive abilities. Other factors may add to such differentiation between schools as, for instance, teacher sorting - better teachers may prefer to teach better students - and divergent curricula. The large overall variance of scores in comparison to the ESCS index in some of these countries may be also explained by a higher

Chart 4A

VARIANCE OF MATHEMATICS SCORES AND THE ESCS INDEX



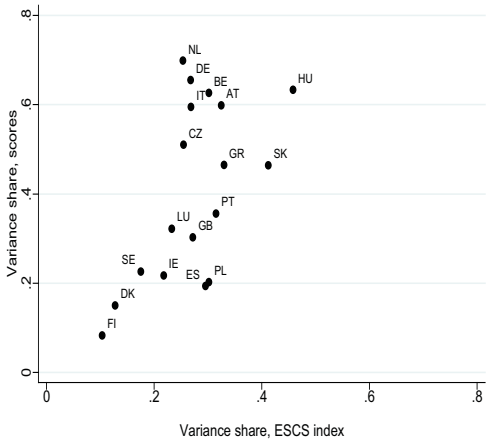
Source: Author's calculations.

Note: Based on the estimation of multilevel models for each one of the variables, including school-specific random parameters, whose variance accounts for the between-school component, and the student-level disturbance, whose variance accounts for the within-school component.

Chart 4B

VARIANCE OF MATHEMATICS SCORES AND THE ESCS INDEX

Between-school shares



Source: Author's calculations.

Note: See previous chart.

(15) In general, the contribution of a given regressor to the explained variance of the dependent variable results from the respective variance and regression coefficient.

(16) The influence on the level of outcomes is a more controversial issue, on which no firm evidence has been established.

proportion of immigrant students, a dimension not captured by the index.

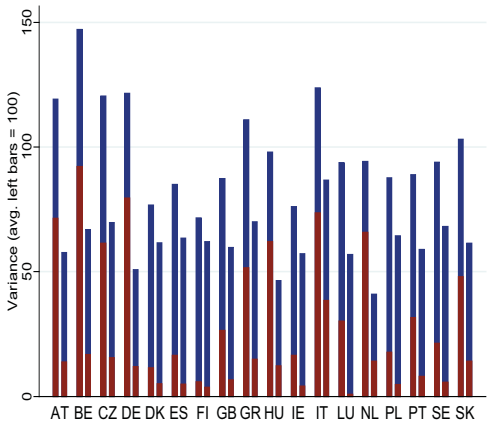
We conclude this section by estimating a multilevel model which includes the full set of family covariates as predictors of performance variability, both at the student level and, as school averages, at the school level.[17] These latter regressors capture the externalities for the school as a whole associated with its socioeconomic composition. The overall variance and its decomposition in this model are presented in Chart 5, where we also present the corresponding quantities in the model without covariates (measured in the y-axis of Charts 4A and 4B above) in order to facilitate the comparison of results. The lower part of each bar in red shows the between-school component of variance. All quantities are normalized by the cross-country average variance in the model without covariates, so that the sizes of the bars can be compared.

Socioeconomic covariates explain an important share of score variability. Therefore, the variance estimated in the second model is smaller than in the first one. In addition, the reduction in the between-school component clearly exceeds that in the within-school component, particularly in countries with school tracking. The amount of between-school variance that remains is, nevertheless, slightly larger for this set of countries than for the others, except for Italy and Greece, which presumably reflects the other aspects of differentiation between schools brought about by early tracking. Note that Italy and, to a lesser extent, Greece are special cases in that student achievement differs between schools more substantially than may be explained by social inequality. The between-school

Chart 5

MATHEMATICS SCORE VARIANCE, TOTAL AND BETWEEN-SCHOOLS

Model without covariates (left bars) and controlling for the family background (right bars)



Source: Author's calculations.

Note: Based on the estimation of multilevel models, respectively, without covariates (same model as in the note to Chart 4A), and including the socioeconomic covariates both as school averages and student variables (centred around the school averages). The variance captured by this last model is that unexplained by the covariates.

(17) The coefficients of all the covariates (i.e. the slopes) are modelled as constant parameters, while the intercepts continue to be random and school-specific.

variability of scores in Portugal is comparable to that of countries without early tracking (with the two exceptions just mentioned) and, within this group, higher than, for instance, in the Northern European countries as well as in Spain.

The evidence presented shows that the influence of social inequality, in the countries where it is largest, is mostlly felt through school composition effects and between-school differentiation in performance. The variance remaining after social inequality is controlled for, which as seen is mostly evaluated within schools, should be mainly accounted for by unobservables. These may include, for instance, student abilities and the quality and effectiveness of teaching (for instance, organization of classes and methods used by teachers). The covariates in the education production regressions estimated in section 3 that have been now omitted should only account for a fraction of the remaining variance, as they are mostly at the school level. This reading is also suggested by the sizeable portion of score variability that remains unexplained in those regressions, as shown by the relatively low value of the coefficients of determination in Table 2. Carneiro (2006) concludes similarly that covariates analogous to the ones we include in the production functions fail to explain a considerable amount of score variance in PISA 2003 for Portugal.

5. CONCLUSIONS

This study presents an analysis of the level and variability of educational performance in Portugal and European Union countries using the PISA 2006 database. The main conclusions are as follows:

• Portuguese students consistently come in the lower half of the performance ranking in the group of countries considered, both in mathematics and reading. These results are partly brought about by a disadvantaged situation in terms of household background, namely as far as parental education and occupations are concerned.

• In the education production function for Portugal, similarly to those in both groups of reference countries, the socioeconomic covariates are the main determinants of achievement, with a much less important contribution by resource variables (except for the hours of regular lessons).

• Socioeconomic covariates make, however, a weaker contribution to performance in Portugal than particularly in the high-performing countries. This is probably explained by less involvement on the side of parents in their children's education, and the role of the educational system in smoothing the performance of children of unequal social backgrounds.

• Some variables in the education production function for Portugal, namely, school location and private or public status are found to have a weaker impact than in previous studies, once one controls extensively for the family background.

• There is no obvious relationship between the level and dispersion of performance across countries, with both high and low levels being compatible with very different degrees of dispersion.

• Social inequality is shown to be an important source of variability in performance, particularly in

countries whose educational systems have early tracking of students. This latter feature also brings about important differentiation in performance between schools due to peer effects and sorting of students in accordance with abilities.

• Portugal has a higher level of dispersion in the socioeconomic covariates but, given the flatter socioeconomic gradient, this is relatively less passed on to test scores, whose variance is close to the cross-country average.

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APPENDIX 1

Definition of some explanatory variables

Wealth (PISA database). Index computed on the basis of student answers on household possession of durable goods such as television, cars or cellular phones.

Educational resources at home (computed by the author). Index calculated by adding up binary variables on household possession of the following items: a study desk, a quiet place to study, a computer for schoolwork, educational software, own calculator, books to help with schoolwork and a dictionary.

Immigration background (PISA database). Binary variables for: native students - born in the country as well as at least one of the parents; second-generation immigrant students - born in the country but the parents born outside; first-generation immigrant students - born outside the country.

Grade amplitude (computed by the author). Calculated as the difference between the maximum and the minimum grades at each school.

School competition (PISA database). Binary variable for schools that report that there is at least one other school in the same area competing for its students.

Autonomy of resource allocation (PISA database). Index computed on the basis of school answers about who has responsibility for resource management e.g. teacher hiring, firing and rewarding, and formulation of the school budget.

Autonomy of curriculum and assessment (PISA database). Index computed on the basis of school answers about who has responsibility for student assessment policies, curricula, and textbooks used.

Parental pressure (delivered in the PISA database). Binary variable for schools that reported constant pressure from many parents regarding academic standards.

Self-confidence in internet tasks (PISA database). Index computed on the basis of student answers about how well they perform tasks such as chatting online, downloading files or music from the internet, and sending emails.

Time spent on the internet and entertainment (PISA database). Index computed on the basis of student answers about how often they use computers for tasks such as browsing the internet, playing games, downloading music, sending emails and chatting online.

Economic, social and cultural status (ESCS) index (PISA database). Index summarizing the information about household possessions of durable goods, household possessions of cultural goods, educational resources at home, number of books at home, highest parental education and the highest parental occupation.

APPENDIX 2

Data imputation

Data imputation was carried out using predicted regression imputation (see Kalton and Kasprzyk, 1982). The variables with missing values were regressed on a set of «fundamental» variables comprising grade, age, gender, school location and country (these regressions were run over the full set of countries). The observations for which at least one of these fundamental variables had no values were disregarded. It is worth noting that the student variables in this group had very few or no missings. The inclusion of school location allows to eliminate from the sample schools that had filled out the respective questionnaire very sparsely, with most variables - including location - missing.

In the imputation procedure, it was distinguished between student and school variables. The former were imputed by estimating regressions, at the level of the student, by weighted least squares in the case of continuous variables and weighted (ordered) probit regression in the case of ordinal and binary variables. When the variable to impute was continuous, predicted values were filled in for the missing data, when the variable was ordinal or binary, the predicted category was filled in. The school variables were imputed estimating regressions at the level of the school, with the student variables entering as school averages, by the unweighted versions of the same methods.

Only a small proportion of values need to be imputed for each variable: on average, 2 percent of the used sample. The maximum level of imputation was 7 percent. A comparison of the descriptive statistics before and after imputation shows very minor changes. Nevertheless, without the imputation procedure, considering the regressions in section 3, around 34 percent of the observations would have been lost.

HOUSEHOLD SAVING IN PORTUGAL: MICRO AND MACROECONOMIC EVIDENCE*

*Nuno Alves***

*Fátima Cardoso***

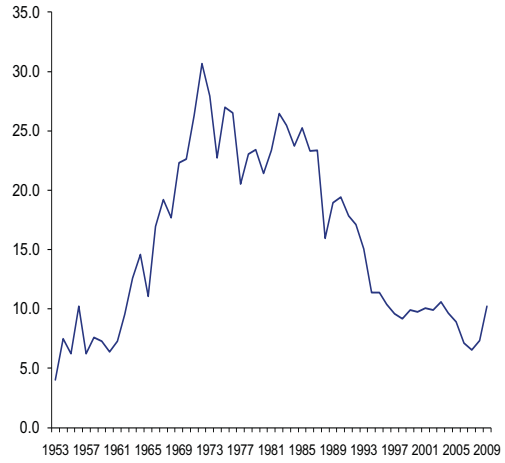
1. INTRODUCTION

The evolution of the household saving rate has attracted a growing interest in the debate on the Portuguese economy. This interest is based on the persistence of various macroeconomic imbalances, in particular the high external borrowing requirements of the economy. Additionally, it is well known that the households saving rate declined sharply in the convergence period to the euro area and stood afterwards at relatively low levels in the European context, amounting to about 10 percent of disposable income in 2009 (Charts 1 and 2). However, despite the importance of the evolution of household savings in Portugal - as well as those of the other institutional sectors - the applied literature in this area is still rather scarce.

Chart 1

HOUSEHOLD SAVING RATE IN PORTUGAL

As a percentage of disposable income



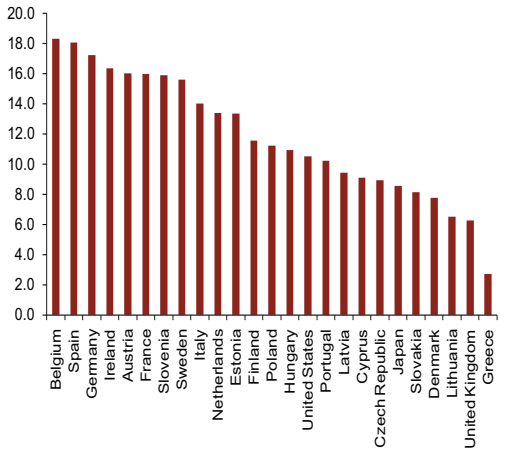
Sources: *INE* and Banco de Portugal.

Notes: Before 1995, the data are based on the long series of Banco de Portugal; after 1995 they are base on INE's national accounts. Savings are not adjusted by the participation of households in pension funds.

Chart 2

HOUSEHOLD SAVING RATE: INTERNATIONAL COMPARISON - 2009

As a percentage of disposable income



Source: AMECO.

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** Banco de Portugal, Economics and Research Departament.

This article aims to contribute to the debate on the evolution of the household saving rate in Portugal. One novelty of the paper is the joint presentation of micro and macroeconomic evidence. These two dimensions are clearly complementary, given that individual decisions are not always consistent with the aggregate effects at the level of the economy as a whole. A good example of these composition effects is the "paradox of thrift," popularized by Keynes (where individual families decide to increase savings but, given the contractionary impact of these decisions on demand and disposable income, aggregate saving ends up declining). Thus, we will analyse both the saving decisions of households at a microeconomic level and the evolution of the saving rate at an aggregate level.

A thorough analysis of the saving behaviour of households implies a combination of a wide range of interrelated decisions with an inter-temporal nature. Thus, it is not surprising that the study of saving requires the combination of economic fields such as economic growth, labour supply, government policy or consumption decisions. This complexity – in a theoretical framework that additionally requires the inclusion of issues such as uncertainty and risk – justifies some restraint on the theoretical interpretation of the empirical results presented in this paper and represents an open opportunity for future research.

The paper is structured as follows. In Section 2 the saving decisions of households in Portugal is characterized, based on a cross-section sample for 2005/06. In Section 3, the evolution of the aggregate household saving rate is modelled for the period 1985-2009, based on time series regressions. Section 4 presents the main conclusions.

2. WHO SAVES IN PORTUGAL?

The analysis of the saving decisions of households[1] at a micro level is typically absent from studies on the saving rate in Portugal. This section aims to fill this gap, by characterizing the heterogeneity prevailing in the household saving behaviour in Portugal. This characterization is potentially important not only to interpret developments observed at the macro level but also in defining policies aiming to influence the saving decisions of households (see Kotlikoff, 1989). This section begins by presenting the data used in the analysis (subsection 2.1). Next, it explores some evidence on the distribution of saving in Portugal and on the evolution of saving over the life cycle of agents (subsections 2.2 and 2.3). Finally, it presents a multivariate analysis of the factors associated with the saving decisions at a microeconomic level (subsection 2.4).

2.1. Description of data and conceptual issues

The analysis is based on the latest Household Expenditure Survey (IDEF), conducted by the National Statistics Institute (INE) in 2005/06.[2] 10403 households participated in this survey. The saving of each household was defined as the difference between total income and total expenditure.[3] These

(1) In this section we will refer to households in a strict sense, while in section 3 this concept will include non-profit institutions serving households. Throughout the article, we will only report data on gross savings (and the gross saving rate).

(2) For a detailed presentation of the survey and its design see INE (2008).

(3) The survey data do not allow identifying the income generated by each household member. In addition, it should be noted that expenditures refer to the main year of the survey (2006) while the income aggregates concern the previous year (2005). Thus the computation of savings includes, on average, a slightly downward bias, which should not significantly affect the reported results.

variables include non-monetary components, namely owner-occupied housing, self-consumption, wages paid in goods and other non-monetary transfers. Income includes social transfers and is net of taxes and contributions to social security regimes. The surveys also provide household weights that allow extrapolating the results to the whole population (INE, 2008). These weights were used in all computations.

Studies on saving at a microeconomic level are inevitably confronted with the quality of data used. In the case of IDEF, the saving rate is considerably higher than the one calculated in the National Accounts by INE. This feature is consistent with numerous international studies (see for example Moreno-Badía, 2006). In fact, the average (weighted) saving rate in the IDEF 2005/06 amounts to about 20 percent, while the official saving rate stood at 8.9 per cent in 2005 and 7.1 percent in 2006. This discrepancy requires two observations. First, it is known that both income and expenditure are calculated with significant measurement errors in household surveys. Typically, both income and expenditure are under-reported. These errors are transmitted directly to the estimates of savings. However, it should be noted that the microeconomic evidence reported below will not be significantly affected by these measurement errors if they do not differ systematically among the various population segments. Second, there are significant methodological differences between the official national accounts statistics and the saving computations based on the IDEF. A relevant example relates to the interest payments, which are not available in IDEF. According to the national accounts, these payments amounted to about 6 percent of disposable income in 2005 and to about 7 percent in 2006.

2.2. Some facts on the distribution of saving in Portugal

Chart 3 characterizes the distribution of saving and the saving rate of households in Portugal, according respectively to the deciles of saving, income and wealth.[4] The figure highlights some important features of the distribution of household saving in Portugal. Firstly, there is a high inequality in the distribution of saving. Over 90 percent of total saving is generated by only 20 percent of households (the decile of households with higher levels of saving accounts for approximately two thirds of total saving). In turn, there are many households who report negative levels of saving. In fact, the first three deciles of the distribution of saving display negative average saving rates. It is interesting to compare this result with the answers to the *Inquérito à Literacia Financeira da População Portuguesa* ("Survey on Financial Literacy of the Portuguese Population", (Banco de Portugal, 2010)), in which about half of the respondents reported no savings.

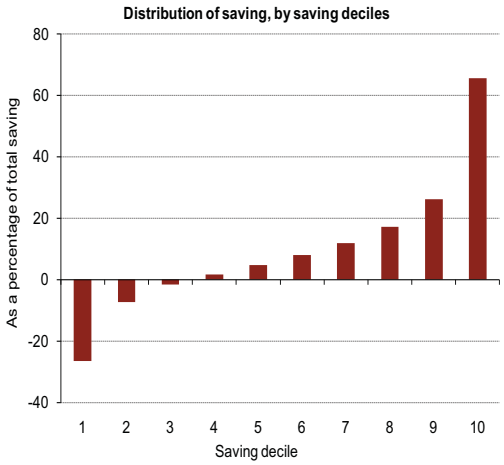
Secondly, the figure allows concluding that the majority of savings is undertaken by households with higher levels of income or wealth (net or gross). In terms of distribution by income deciles, one can conclude that the two deciles of the population with the highest incomes account for about 70 percent of total saving (this value may be biased upwards due to the presence of measurement error).

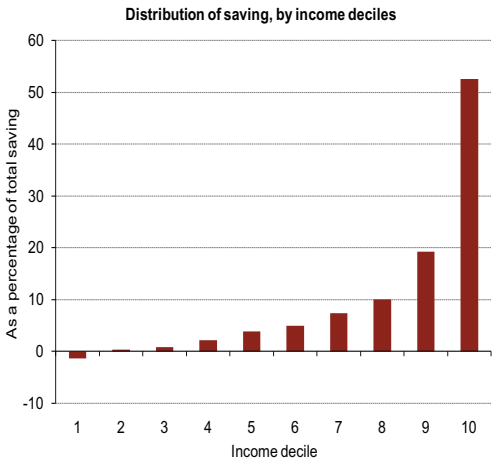
(4) The measure of net wealth was computed using the latest Survey on Households Wealth (*Inquérito à Riqueza e Património das Famílias* (IPEF)), conducted by INE and Banco de Portugal in the latest quarter of 2006 and in the first quarter of 2007. The sample of households in the IPEF is a subsample of the IDEF 2005/06, being composed of around 8500 households. For a detailed presentation of the characteristics of the IPEF, see Farinha (2008).

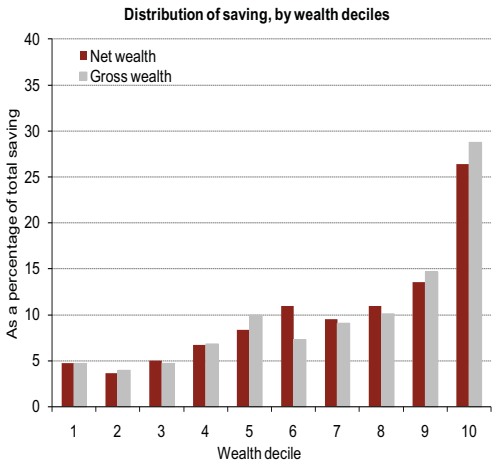
Chart 3

DISTRIBUTION OF SAVING AND SAVING RATE

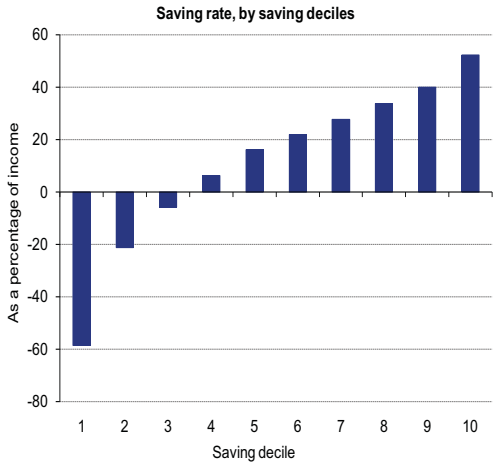
Saving

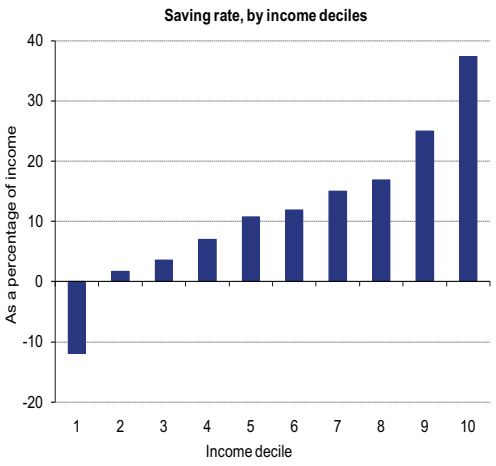


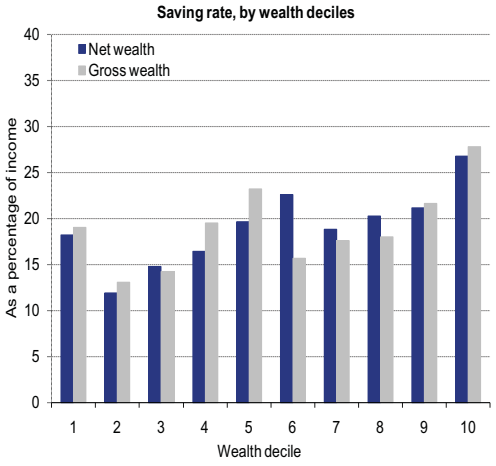




Saving rate







Source: IDEF 2005/06.

In the case of the wealth distribution, the asymmetry in the distribution of savings is lower, with the two deciles with highest wealth representing about 40 percent of total savings.

Thirdly, it is interesting to note that the conclusions in terms of saving match those obtained with the saving rate. In particular, the saving rate is increasing in household income and wealth. The fact that the saving rate increases with wealth is contrary to models where saving is simply proportional to permanent income. This result is in line with the one obtained by Dynan *et al.* (2004) for the United States. Note, however, that the dispersion of the saving rate is clearly higher among the various income distribution deciles compared to the wealth distribution deciles.

2.3. The behaviour of the saving rate over the life cycle

The theory that structures the analysis of the behaviour of saving rate is the life-cycle theory, originally proposed by Modigliani and Brumberg (1954). This conceptual framework formed the basis for many subsequent developments, in particular the introduction of uncertainty, liquidity constraints and intergenerational transfers (Attanasio and Weber, 2010). In general terms, the theory suggests that individuals smooth consumption decisions throughout life and in face of unanticipated and temporary shocks affecting current and future income. Thus, individuals tend to save less when their incomes are lower - including the beginning of active life, periods of unemployment or after the retirement age - and when their spending needs are higher - especially in the case of child-birth or the purchase of durable goods (Blundell, 2010).

Unfortunately, information from the IDEF, given its cross-sectional nature - focusing on a single moment in time - does not allow testing the validity of the life cycle theory for the Portuguese case. The problem with observing only microeconomic data for a specific year is that the saving decisions of individuals in different age groups result from the sequence of shocks faced in the past, from expectations regarding future income in each moment of time, and from the respective preferences, which may not be comparable across generations. One cannot therefore assess the validity of the theory by simply observing the equilibrium behaviour at a given point in time. In fact, the test of the theory would ideally require panel data, in which households were followed over a relatively long time. Alternatively, the analysis could be developed based on a sequence of surveys of a cross-sectional nature, but sufficiently representative to allow the construction of synthetic cohorts at different points in time (see Browning and Crossley, 2001).[5]

Nevertheless, it is interesting - from a descriptive point of view - to observe the patterns of income, expenditure and saving for households in Portugal, according to the age groups of the respective representatives.[6] This evidence is reported in Chart 4a. The figure shows that household income follows a hump-shaped profile over the age gradient, with the highest levels being registered for the age group between 45 and 54 years. Particularly notable is the decline in yields observed in the retirement age. The household expenditure largely follows the same pattern of income, although

(5) The combination of the previous surveys on household expenditures (for 1994/95 and 2000) with the IDEF 2005/06 could constitute a starting point for this analysis, but is beyond the aim of this article.

(6) In the IDEF, the household's representative is typically the male partner and usually displays the highest education level.

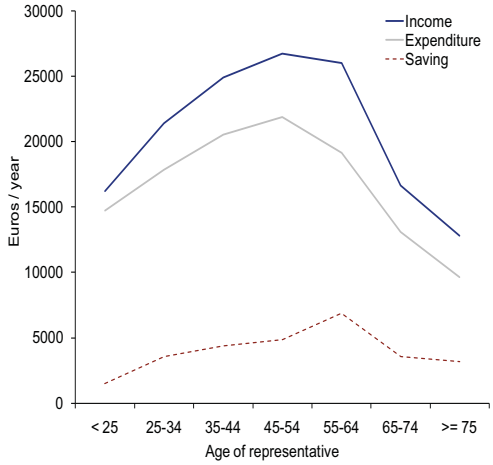
slightly flattened. Thus, saving increases until the age group 55-64 years and decrease thereafter, though remaining permanently at positive levels.

Although not allowing a direct assessment of the saving behaviour of individuals throughout their life cycle, the figure reveals two elements which are usually presented as contradictory to the life cycle theory. The first element refers to the fall in spending observed in older households, which contradicts the smoothed profile predicted by the theory. The literature states that this behaviour is associated with expenditures that are no longer held at retirement (prominent examples being the expenditure on transportation to work and the expenditure in restaurants), and with the fact that individuals tend not save enough for retirement, which requires - at that time – a permanent downward revision of consumption levels (Browning and Crossley, 2001). The fact that the saving rate remains positive until the end of the life cycle is usually justified on grounds of precaution - for example related to the possibility of occurrence of unexpected medical expenses - or the desire to leave inheritances to descendants.[7]

The second element apparently in conflict with the life cycle theory derives from the strong co-movement between consumption and income across age groups. This seems to contradict the ability of individuals to smoothen their expenditure levels, as predicted by theory. However, as pointed out by several authors, this evidence should be qualified with the changes in household composition observed during the life cycle (Attanasio and Weber, 2010). In fact, the hump-shaped profile of expenditure disappears when we re-scale income and expenditure with the OECD modified equivalence scale - which attributes a weight of 1.0 to the first adult in the household, 0.5 to other adults and 0.3 to each child (see Chart 4b).

Chart 4 a

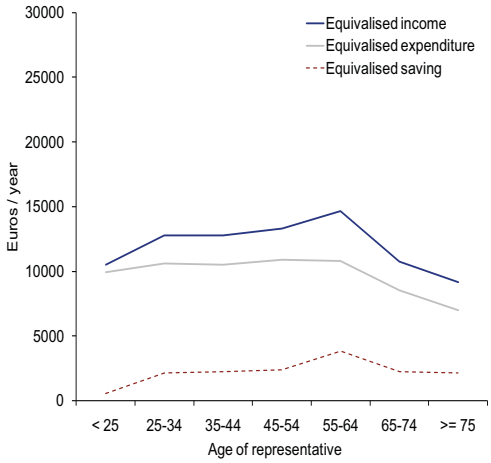
INCOME, EXPENDITURE AND SAVING OF HOUSEHOLDS



Source: IDEF 2005/06.

Chart 4 b

INCOME, EXPENDITURE AND SAVING OF HOUSEHOLDS (EQUIVALISED)



Source: IDEF 2005/06.

(7) According to Jappelli e Modigliani (2003), saving during retirement is actually negative, if correctly measured. In particular, the transfers to pension funds should be accounted for as savings in the moment of the transfer. In this context, pensions at retirement should be understood as a decline in previously cumulated wealth and not as current income.

Thus, globally, the data in the IDEF 2005/06 emerge as consistent with several important dimensions of the life cycle theory.

2.4. Some multivariate evidence

To further understand the factors associated with the households' saving decisions in Portugal several regressions were estimated aiming to exploit the wealth of microeconomic information contained in the IDEF 2005/06. In order to analyse the information on the households in the highest percentiles of the distribution of savings several quantile regressions were estimated. In these regressions, the explained variable is the household level of saving - or the saving rate - and the explanatory variables include geographical data (region of the household and urban/rural breakdown), characteristics of the representative (age, working condition, education level and ownership of housing) and characteristics of the household (household size, number of members working beside the representative, existence of a spouse in the household).

Table 1 presents the regression results for the mean and for the percentiles 50 and 90. The estimated coefficients measure the impact of each variable on the mean or the percentiles of the (conditional) distribution of saving (or saving rate). The comparison between the least squares regressions and the quantile regressions highlights the importance of the higher percentiles in determining the mean results.[8]

We will now highlight some of the main results shown in Table 1, in order of presentation of the variables. The first set of variables assesses the impact of the representative's age. The results show that household saving increases over the life cycle, peaking before the age of retirement. This is visible in both the mean and the two percentiles. Thus, the non-conditional profiles presented in charts 4a and 4b are robust to the conditional estimation on a large number of additional variables.

Concerning the role of education, the results show that there is a monotonic positive relationship between the level of education and saving in Portugal. This relationship is particularly marked in the higher percentiles of the distribution of saving. This conclusion is directly related to the high returns to education in Portugal, which determine a strong relationship between educational attainment and income generated at the household level (see Alves *et al.*, 2010).

The following variables measure the impact of the employment status of the representative on the level of saving (and on the saving rate). This impact is one of the most robust and consistent across regressions. In particular, households in which the representative was unemployed displayed significantly lower levels of saving relative to those in which the representative worked. In terms of the saving level, the impact is not significantly different along the upper half of the distribution of saving. In turn, the negative relationship between unemployment and the saving rate is not significantly different from zero for the higher percentiles of the respective distribution. With regard to households in which the representative was retired, the level of savings did not differ significantly from the one

(8) It should be noted that the coefficients for the lowest percentiles of the savings distribution have typically the same signs as those for the highest percentiles, but are in general non-significant.

Table 1

OLS ESTIMATES AND QUANTILE REGRESSIONS (50TH AND 90TH PERCENTILES)
Dependent variable: saving (euros/year) and saving rate (in percentage)

	Saving			Saving rate		
Mean and percentiles 50 and 90	**Mean**	**p(50)**	**p(90)**	**Mean**	**p(50)**	**p(90)**
Age of representative (relative to age group between 25 and 34 years)						
Less than 25	-863.9	52.2	2528.2	-14.433	-6.119	-6.697
	(1461.4)	(818.8)	(1889.7)	(5.201)	(7.218)	(5.036)
35-44	1393.0	836.0	1212.0	0.363	0.616	-1.608
	(488.4)	(284.6)	(686.3)	(1.738)	(2.497)	(1.837)
45-54	2695.4	1084.4	4039.1	-3.408	-0.922	0.855
	(513.2)	(285.3)	(698.5)	(1.826)	(2.504)	(1.815)
55-64	5808.3	1835.5	8042.9	-0.448	2.720	6.195
	(558.5)	(309.7)	(800.2)	(1.988)	(2.715)	(2.004)
65-74	4983.4	2001.3	5985.9	2.713	6.139	5.655
	(695.4)	(367.5)	(1034.0)	(2.475)	(3.226)	(2.371)
Equal or over 75	5450.1	2146.3	5552.7	8.301	10.567	6.505
	(757.2)	(394.3)	(1080.5)	(2.695)	(3.464)	(2.486)
Education of representative (relative to 0 completed years of education)						
4 years of education	-265.2	64.9	1342.4	-4.029	-3.572	-4.980
	(448.6)	(212.8)	(578.1)	(1.597)	(1.869)	(1.437)
6 years of education	973.6	772.2	3623.9	-3.617	-1.994	-4.797
	(569.0)	(284.1)	(768.9)	(2.025)	(2.495)	(1.877)
9 years of education	1483.0	1194.7	5040.1	-5.550	-0.521	-2.287
	(578.9)	(290.2)	(783.6)	(2.060)	(2.549)	(1.905)
12 years of education	4339.3	2912.5	8764.9	0.681	2.903	-1.575
	(609.5)	(314.7)	(835.3)	(2.169)	(2.764)	(2.062)
≥ 15 years of education	12182.9	8844.7	25374.0	9.573	9.241	5.245
	(592.0)	(306.7)	(815.1)	(2.107)	(2.693)	(2.060)
Employment statuts of representative (relative to working representative)						
Unemployed	-2870.6	-1949.5	-2492.1	-5.780	-7.573	-0.433
	(563.6)	(307.7)	(738.2)	(2.006)	(2.702)	(1.871)
Retired	-568.7	384.8	-639.6	2.765	1.444	0.182
	(479.4)	(236.9)	(703.3)	(1.706)	(2.076)	(1.537)
Other non-worker	-1561.9	-1350.7	-315.3	-8.980	-7.038	0.204
	(598.4)	(304.9)	(782.0)	(2.130)	(2.673)	(1.976)
Nº members working (besides representative)	2132.6	2565.0	2965.5	8.327	8.812	3.246
	(219.6)	(115.1)	(280.5)	(0.782)	(1.008)	(0.714)
Household size	-103.7	-282.9	930.2	-2.731	-3.136	-0.410
	(146.8)	(76.8)	(186.4)	(0.522)	(0.676)	(0.475)
Family with spouse/companion	1899.9	969.4	988.5	3.091	4.331	-0.582
	(337.9)	(174.1)	(452.1)	(1.202)	(1.532)	(1.140)
Owner-occupied housing	1226.5	1291.1	2134.1	8.918	5.360	1.220
	(303.6)	(161.2)	(395.8)	(1.081)	(1.413)	(1.011)
Constant	-5808.3	-2076.5	-4124.5	3.353	10.788	49.650
	(795.8)	(415.8)	(1179.1)	(2.832)	(3.650)	(2.766)
Number of observations	10403	10403	10403	10403	10403	10403
Pseudo R2	0.127	0.076	0.254	0.042	0.031	0.031

Source: IDEF 2005/06.
Notes: Standard errors in parenthesis. Observations were weighted with sample weights.

registered in households where the representative worked. This result is probably linked to the fact that, according to the tax and social security system rules in 2005/06, the entry into retirement did not involve a sizeable reduction in the individuals' net income. Finally, the presence of an additional working member in the household significantly increases the household saving level and rate.

Table 1 then presents the coefficients on some characteristics of the household.[9] Interestingly, the size of the household does not significantly affect either the level (except on the right tail of the distribution) or the saving rate. Thus, we conclude that the determination of household saving arises not so much through size but through the ability to generate income, which is mainly associated with the educational level and the degree of participation in the labour market. Interestingly, the presence of a spouse in the household significantly influences household saving, even controlling the impact of all other explanatory variables. This effect is particularly relevant for the lower percentiles of the saving distribution. This result should be related not only to insurance mechanisms existing within households but also to the existence of economies of scale which may not be properly captured in the analysis.[10]

Finally, the fact that households own the dwelling they live in is associated with a higher level of saving, more significantly for the highest percentiles of the saving distribution. This fact is probably associated with the role of wealth in the analysis. In fact, an alternative specification - for the subsample contained in the IPEF (the Household Survey on Wealth) - including the level of wealth (either gross or net) as an additional explanatory variable suggests that households with higher wealth have higher levels of saving. Note, however, that this relationship may reflect some endogeneity, given that households with higher saving rates throughout their life cycle tend to accumulate higher levels of wealth, everything else equal.

The evidence presented in this section may be important not only for a microeconomic characterization of saving decisions, but also in identifying the segments of the population most affected by policies aiming to condition those decisions. However, extrapolating decisions at the individual level to the macroeconomic level is particularly complex. The relationship between unemployment and savings is a good example of this difficulty. In fact, the microeconomic evidence suggests incontrovertibly that an unemployment spell tends to decrease the household saving rate. However, the shocks that determine the increase in unemployment - for example a surge in uncertainty at an aggregate level - may generate an increase in saving at a macroeconomic level. This complexity justifies the segmentation typically found in literature between micro and macro approaches. In this article, this segmentation will be unavoidable, also given the fact that the microeconomic evidence focuses on a single year, while the macroeconomic evidence presented in the following section refers to the period since Portugal joined the European Community.

(9) The regressions also included regional dummies. In this context, it should be mentioned that the regions with the highest levels of saving – after controlling for all the remaining variables – are the Azores and Madeira. The regions with the lowest saving levels are the North and Centre.

(10) This notwithstanding, it should be noted that, even re-scaling the level of saving with the OECD modified equivalence scale, all the above results would still hold.

3. MODELLING THE SAVING RATE BEHAVIOUR IN THE PERIOD 1985-2009

In the previous section we identified a set of stylized facts about the distribution of saving in Portugal, according to the characteristics of households included in the IDEF and the IPEF. However, the cross-section nature of those databases does not allow assessing the main factors underlying the behaviour of saving rate over time in Portugal. In this section we explore the intertemporal nature among the saving rate and a set of macroeconomic aggregates. This relationship will be quantified through an error correction mechanism model, in order to identify a set of empirical regularities on the saving rate behaviour. We start by briefly describing the type of relationship usually expected between the saving rate and a set of variables that potentially explain its behaviour (subsection 3.1). Then, we present the results of the estimation of an inter-temporal model for the Portuguese economy (subsection 3.2).

The estimation of an equation for the saving rate in Portugal faces the challenge of ensuring both a long sample period and the absence of substantial regime changes. In this context, the relationship was estimated using annual data for the period of integration of Portugal in the European Community. In fact, in the mid-80s, the financial liberalization started in Portugal, with increased competition across financial markets, associated with greater innovation and a wider access of households to new financial products (see DEE, 2009). The liberalization in the financial sector and the higher nominal stability translated into a broader access to credit by households, implying a reduction of liquidity constraints for some agents (see Castro, 2006). The transition to a liberalized financial system is bound to have changed the drivers of households saving decisions. This regime change thus justifies the exclusion in the estimation of the period before the integration in EEC.

3.1. Factors explaining the saving rate developments

Given the extent and variety of factors identified in literature as potentially being associated to the saving rate evolution, the assessment of variables to include in the long and short term relations usually arises from a study of the respective empirical properties. The variables that were more robust in explaining the saving rate in Portugal were the nominal interest rate (or, alternatively, the inflation rate), the government fiscal balance, the real GDP rate of growth and total wealth as a percentage of disposable income. The theoretical and empirical literature identifies several transmission channels among these variables and the saving rate, which we summarize before presenting the estimation results for the Portuguese case.

Inflation

Inflation is an important factor for the evolution of the saving rate, with a generally positive association emerging between these two variables. This stylised fact has been shown in a robust and consistent way in studies that assess saving developments in different countries and in different sampling periods. There are essentially two channels to explain that relationship. On the one hand, periods of high inflation generally reflect greater uncertainty, which tend to increase savings for pre-

cautionary reasons. On the other hand, higher inflation tends to erode the value of financial wealth of households, which promotes an increase in households saving in order to compensate for this effect (see Berry *et al.*, 2009). Likewise, on the side of liabilities (loans) the existence of high inflation forces households to pay a higher debt service, which is a forced saving, also suggesting a relationship in the same direction.

The relation between the inflation rate and the saving rate in Portugal is clearly shown in Chart 5. Given that inflation is a relevant phenomenon when analysing trends in the saving rate (especially in the long run), some authors calculate a saving rate adjusted for inflation, in which saving is adjusted for the effect of erosion in households wealth. As shown in Chart 6, the adjusted saving rate is rather more stable than the unadjusted rate since the early 90s.

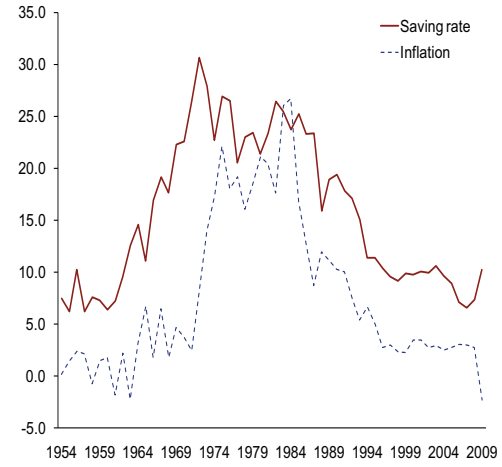
Real interest rate

A rise in the real interest rate increases the opportunity cost of current over future consumption, encouraging households to postpone consumption expenditures, thus increasing the saving rate (substitution effect). However, the effect of increasing future income associated with higher earnings from accumulated savings can lead to an increase in current consumption (income effect). The sign of the relation between the saving rate and the real interest rate will depend on the relative importance of these effects of opposite sign, which are particularly dependent on the net financial position of households. Empirically, the results in the literature point to an ambiguous and/or not significant relationship between the real interest rate and the saving rate.

In the empirical application to Portugal we use a nominal interest rate, which comprises the joint

Chart 5

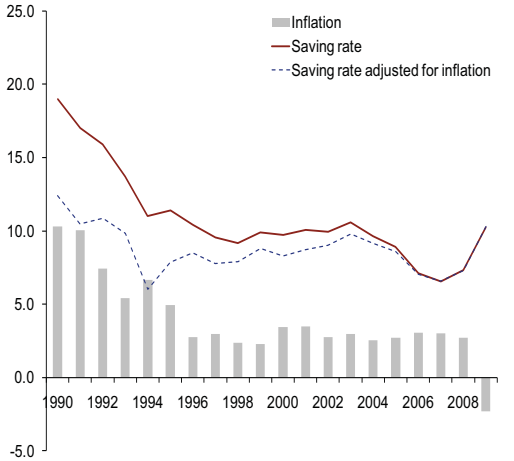
SAVING RATE AND INFLATION



Sources: *INE* and Banco de Portugal.

Chart 6

SAVING RATE ADJUSTED FOR INFLATION



Sources: *INE* and Banco de Portugal.

Notes: Saving rate not adjusted for the participation of households in pension funds. The saving rate adjusted and not adjusted for inflation is shown as a percentage of the respective disposable income. Inflation is defined as the annual rate of change of the private consumption deflator.

effect of the real interest rate and the inflation rate. According to the arguments above, the expected sign of the relationship between the nominal interest rate and inflation is positive. Moreover, the nominal interest rate may capture the evolution of credit access conditions. For example, a decline in the nominal interest rate – or an increase in financial intermediation – decreases the number of households with liquidity constraints and allows more smoothing in consumption decisions which, in turn, decreases the aggregate saving for precautionary reasons.

Fiscal policy

The households' decisions on saving and consumption are influenced by other economic agents' decisions, in particular, those of government. Economic theory suggests a negative relation between fiscal balances and the saving rate. Thus, a decrease in the fiscal balance, namely when associated with a reduction of taxes or spending with households (social security subsidies, expenditure in health and education,...) is likely to translate in an increase in the saving rate. On the one hand, there tends to be some substitution between public and private expenditure. On the other hand, if the imbalance of public accounts increase significantly, households are likely to increase, albeit partially, their savings, anticipating the possible need for future tax increases (an extreme version of this argument corresponds to the Ricardian equivalence theorem). It is worth mentioning that the degree of substitution between household´s saving and public saving should depend additionally on the fraction of households with liquidity constraints.

GDP growth rate

The existence of a positive relation between the saving rate and economic growth has been widely documented in empirical terms.[11] According to lifecycle/ permanent income theory, households tend to smooth consumption as a function of their permanent income, that is, the income they expect to receive throughout their lifetime. Thus, unexpected and temporary fluctuations in their disposable income are likely to be reflected in saving fluctuations with the same direction. This argument points to a pro-cyclical behaviour of the saving rate. Additionally, even if households have the perception that their permanent income has changed, the adjustment in consumption occurs somehow gradually – given the importance of habits in consumption decisions – so that the relationship between income and saving is expected to be positive also in this case. Carrol *et al.* (2000) present a theoretical model, with habit formation, consistent with a positive relationship between GDP growth and the saving rate.

Wealth

Being wealth a potential source of present or future purchasing power, significant increases in its value and not seen as temporary by households (in particular resulting from price valuations in assets) may be seen by households as equivalent to increases in their permanent income, with a posi-

(11) Typically, the debate in literature focuses on the causality direction between saving and economic growth and usually concludes on the existence of causality channels in both directions.

tive impact in consumption levels (and negative in savings). On the other hand, losses in the value of wealth resulting from the devaluation of their assets can induce households to increase savings in order to replace their wealth levels. Therefore, significant variations in wealth are expected to be reflected in opposite direction variations in the saving rate. In this section, we use the concept of net worth (net wealth), that is, total wealth minus debt. It should be noticed that the relation between debt and saving is ambiguous, depending namely on the type of indebtedness, the degree of liquidity constraints and the moment in the life cycle in which the debt is generated.

Other explanatory factors

The literature identifies a large set of additional variables which may influence the saving rate, such as the age structure of households, the share of working-age population or the degree of uncertainty in the economy.[12] These variables were not included in the estimation either due to implausible results – for example, the share of individuals with more than 65 years is able to capture, to a large extent, the evolution of the saving rate in the last 25 years, due to a strong negative correlation between the two variables – or non-significant results – such as in the case of volatility in stock market indices, which aimed to proxy the level of uncertainty.

3.2. Results of the model estimation

The long term equation estimated for the saving rate has the following form:

$$SvRate_t = \propto_0 + \propto_1 Interest_t + \propto_2 BGov_t + \propto_3 GDPvrc_t + \varepsilon_t \quad (1)$$

where $SvRate$ is the household saving rate (as a percentage of disposable income), Interest is a representative interest rate of deposits (measured in terms of annual average),[13] $BGov$ is the government fiscal balance excluding temporary measures (as a percentage of GDP) and $GDPvrc$ is the volume rate of change of GDP. All these variables are integrated of order 1 in the sample period. Equation (1) configures a cointegration relationship. In fact, according to Johansen tests, the null hypothesis of no cointegration is rejected, even taking into account the critical values adjusted for small samples.[14]

In turn, the short term dynamics of the variation of the saving rate, resulting from a "general-to-specific" approach, has the following form:

$$\Delta SvRate_t = \beta_0 + \beta_1 \Delta SvRate_{t-1} + \gamma_1 \Delta BGov_t + \gamma_2 \Delta GDPvrc_t + \gamma_3 \Delta Wealth_t + \theta Dummy94 - \tau ECM_{t-1} + u_t \quad (2)$$

(12) Another factor which may have some impact in saving is the evolution of emigrants/immigrants remittances, as they influence directly the households´ disposable income. Assuming that at least part of the emigrants´ remittances is not translated in expenditures of resident households, increases in those remittances will imply increases in savings. Equivalently, an increase in immigrants' remittances is likely to contribute to a decrease in saving in Portugal. It should be referred that the share of net remittances of emigrants in household disposable income has gradually decreased between 1995 and 2009, which may have contributed ceteris paribus to a decrease in saving rate.

(13) The results of estimation would be very similar if we had considered a reference rate in banking markets (Euribor), due to the strong association between the two rates.

(14) The unit root and cointegration tests are available upon request from the authors.

where Δ represents the first difference of the respective variable, $Wealth$ is the value of total net worth of households (measured as the value of financial assets and housing minus debt) as a percentage of disposable income, $Dummy94$ is a dummy variable that takes the value 1 in 1994[15] and ECM is the error correction mechanism, that is, the vector of residuals from equation (1).

The equations were estimated for the period 1985 to 2009. The results of the estimation are shown in Table 2.[16] The variables are statistical significant and have the expected signs, in line with estimated relations in empirical studies for other countries.[17] It is also worth stressing that these parameters are stable over time, which was confirmed by a recursive estimation of parameters (available upon request).

There are five main ideas that can be highlighted from Table 2. First, the nominal interest rate has a positive relationship with the saving rate in the long term. An increase of 1 percentage point in the nominal interest rate is associated with an increase in 0.6 percentage points in the saving rate in long term. Note that, as noted above, the nominal interest rate captures not only the combination of income and substitution effects but also the impact of inflation rate developments. Additionally, it also reflects the impact of the regime transition to the euro area, during which liquidity constraints and nominal uncertainty significantly decreased. Therefore, special caution is needed in using this model to simulate the impact of a change in interest rate on the saving rate, since the model tens to overestimate this impact.

Table 2

ESTIMATION RESULTS
Savings rate as a percentage of disposable income

Explanatory variable	Coefficient	*t*-ratio
Long-term equation (dependent variable: SvRate)		
Constant	2.88	1.99
Nominal interest rate	0.59	5.94
Fiscal balance (% GDP)	-0.87	-3.08
GDP - rate of change in volume	0.64	3.20
Short-term dynamics (dependent variable: Δ SvRate)		
Constant	-0.55	-2.92
Lagged dependent variable	-0.35	-3.43
Fiscal balance (first differences)	-0.75	-7.18
GDP - rate of change in volume (first differences)	0.41	4.01
Net total wealth/ disposable income (first differences)	-0.06	-4.10
Error Correction Mechanism (lagged)	-0.48	-4.07
dummy (1994=1)	-3.80	-4.07
Standard deviation of residuals	0.82	
Standard deviation of dependent variable	2.02	
R2	0.88	
AR 1-2 test	0.26	
	(0.77)	

(15) It should be mentioned that the reported results are robust to the presence of this dummy variable, which aims to eliminate a strong forecasting error of the model for 1994.

(16) Alternative specifications were also tested, in which the long-term relationship was defined between the saving rate and the nominal interest rate or between the saving rate and inflation. It is worth noting that the properties of these alternative long-term relationships as well as the corresponding specifications of the short-term dynamics do not show significant differences *vis-à-vis* the results reported in Table 1.

(17) Hüfner and Koste (2010) present an overview of empirical studies, including a list of the main determinants and the corresponding signs. The GDP (or income), the budget balance, and the interest rate present signs similar to those reported in table 1, in almost all the studies listed.

Second, Portuguese household saving decisions are influenced by the situation of public finances, with a significantly negative sign, both in the long and short term equations. According to the regression in levels, an increase of 1 percentage point in government balance (as a percentage of GDP) is associated with an increase of 0.9 percentage points in the long term household saving rate, in line with the results reported by Ferrucci and Mirales (2007). These results suggest the existence of a substitution between public expenditure (saving) and household expenditure (saving) over the long term.[18] This fact should be particularly relevant for households with liquidity constraints. Over the short term, a negative and significant coefficient between the change of the saving rate and the change of public balances also emerges.

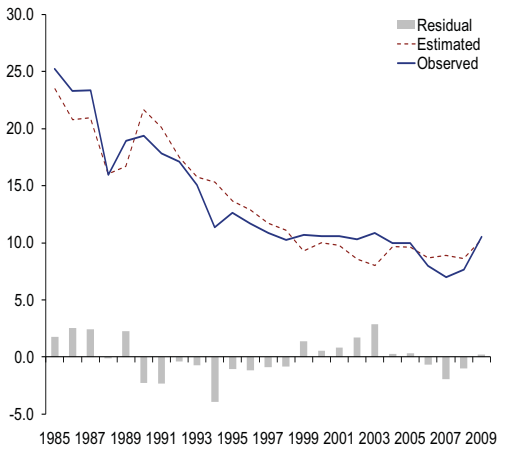
Third, the data also seem to support the existence of a positive relation between the saving rate and GDP dynamics, both in the long and short term (the long term coefficient, on GDP growth, is 0.6, and the short term coefficient, on GDP acceleration, 0.4).

Fourth, the results also suggest a negative short-term relationship between the saving rate and total net wealth (as a percentage of disposable income), confirming that fluctuations in levels of wealth tend to affect consumption in the same direction, as suggested by Castro (2007) and Farinha (2009). These results are robust to the use of the aggregate total wealth, given the similarity of temporal profile of the two variables (see Appendix). Finally, the coefficient associated to the error correction mechanism, estimated at -0.5, indicates that about half of the deviations of the saving rate from its long run determinants observed in a given year is adjusted in the following year.

Chart 7 presents the series of observed values for the saving rate and the estimated ones according to the long term equation (1), while Chart 8 presents the observed values for the variation of the saving rate and the estimated values according to the short term dynamics equation (2). The estimated

Chart 7

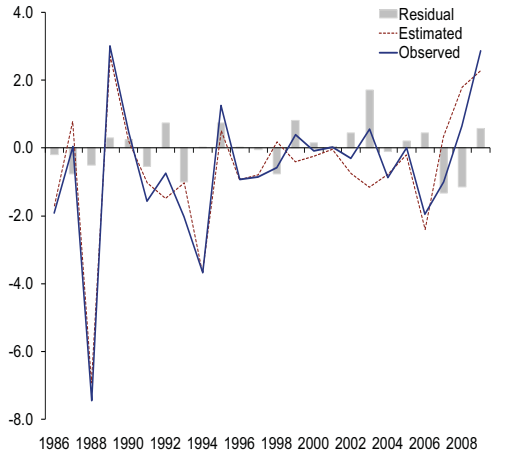
SAVING RATE - OBSERVED AND ESTIMATED



Sources: *INE* and Banco de Portugal.

Chart 8

CHANGES IN SAVING RATE - OBSERVED AND ESTIMATED



Sources: *INE* and Banco de Portugal.

(18) Over the long run, this fact mitigates the impact of a reduction in the public deficit on the external deficit (as a percentage of GDP).

model shows a remarkable performance, capturing quite well the sign and magnitude of changes in household saving rate in Portugal over the last 25 years. This reinforces its potential usefulness in the interpretation of the main factors behind the developments of the saving rate in Portugal.

The downward trend in the saving rate observed since the mid 80s, and specially in the 90s, appears to be strongly associated with the process of disinflation and decline in nominal interest rates, namely in the context of nominal convergence to the euro. Simultaneously, a significant increase in household net wealth was observed over the 90s, despite the substantial increase in indebtedness (see Cardoso *et al.*, 2008). This also contributed to sustain higher levels of consumption and promote a decline in the saving rate. Note that, throughout the 90s, the saving rate is below the values implied by the long-run relation in most years.

After the introduction of the euro, the nominal interest rate stood at historically low levels. During this period, the evolution of household wealth (as a percentage of disposable income) interrupted the strong upward trend observed in the 90s, presenting a relative stabilization. In some years, the change in wealth was actually negative, partially reflecting significant declines in asset prices in financial markets, which affected the saving decisions of households with higher levels of wealth. This interruption of the contribution of the interest rate and household wealth to the reduction in the saving ratio, combined with a negative effect stemming from income developments, translated in a relative stability in the saving rate for the period 2000-2003. More recently, in 2006 and 2007, the saving rate decreased significantly, with a significant contribution from the fiscal consolidation process. In these years, the saving rate stood below what would be expected based on the long-term relationship (as well as on the short-term relation). This may be related to the ongoing process of financial innovation seen in this period - in a context of very favourable international financial conditions - in which households had access to new financial instruments and new modalities of financing that allowed accommodating an increase in indebtedness without a significant increase in the respective debt service.

The increase in the saving rate in 2009 seems to reflect, on the one hand, an adjustment from the minima observed in 2007 and 2008 and, on the other hand, the significant worsening of the public deficit. Note in particular that the public transfers to households increased strongly in 2009, contributing to stem the slowdown in disposable income, in a context of an unanticipated fall of prices. Additionally, the growing awareness on the fiscal situation and the uncertainty surrounding the measures necessary to correct the excessive fiscal deficit should also have contributed to an increase in savings for precautionary reasons.[19]

Finally, there are several factors not included in the model that may tend to gain prominence in the near future. In particular, given the current national economic and financial situation - with the coexistence of an active constraint to external financing and the need for a simultaneous deleveraging of the public and private sectors - a tightening in credit can hamper consumption smoothing by an

(19) As mentioned above, the model does not include a variable that explicitly captures the evolution of uncertainty, since the available proxies - such as measures of volatility in financial markets (which only imperfectly capture the relevant uncertainty for household´s consumption and saving decisions) - were not significant. The non-incorporation of the direct impact of uncertainty may partially explain the underestimation by the model of the level and change in the saving rate in 2009.

increasing number of households thus changing the statistical properties of the saving rate identified above. The uncertainty associated with the adjustment process of the economy also tends to promote an increase in saving for precautionary reasons.

4. CONCLUSIONS

This article aimed to contribute to the understanding of the household saving decisions in Portugal. One of the main novelties of the analysis was the joint inclusion of micro and macroeconomic evidence. This evidence, of a segmented but complementary nature, allows having a comprehensive view on the individual and aggregate saving decisions in Portugal.

The main conclusions from the analysis were as follows.

1. There is high inequality in the distribution of saving, with a small percentage of households accounting for most of the saving generated in Portugal. These households are those with higher levels of income and wealth. Additionally, there is a significant fraction of households that report negative levels of saving. The saving rate is increasing in household income and, albeit less markedly, in wealth.

2. The microeconomic evidence suggests that there is a strong co-movement between expenditure and income throughout the life cycle, with a marked decrease of these aggregates at the retirement age. This co-movement is significantly attenuated when changes in the households' composition are taken into account. In turn, saving increases monotonically until the age group between 55-64 years and decreases thereafter, though it remains permanently at positive levels. This evolution is broadly reconcilable with the predictions of the life cycle theory.

3. The determination of saving at a microeconomic level is strongly associated with the income-generating capacity of households, which is a function of the educational level of spouses and the respective level of participation in the labour market. In fact, a multivariate analysis of the determinants of savings in Portugal uncovers a positive relationship between the level of education and saving, as well as between the level of saving and the number of household members working. These relationships are particularly marked in the higher percentiles of the distribution of saving, i.e., the segments that contribute most to saving in Portugal.

4. The household saving rate is relatively low in Portugal, compared to other European Union countries. The saving rate displayed a sharp downward trend in the convergence period to the euro and remained relatively stable over the last decade, with the exception of the period between 2005 and 2009, where a hump-shaped behaviour was recorded.

5. This evolution of the household saving rate is captured quite well by an error correction mechanism model estimated for the period 1985-2009. In this model, the saving rate is positively related in the long-run with the nominal interest rate and GDP growth, and negatively with the budget balance. In the short-run, the change in the saving rate is determined by the fluctuations of the latter two variables, by the deviations *vis-à-vis* the long-run relation, and (with negative sign) by fluctuations in the

value of household wealth.

6. Future developments in the saving rate will be influenced inter alia by the behaviour of the explanatory factors described above. However, the current economic and financial situation and prospects of significant structural changes in dimensions such as the financing conditions of economic agents and the conduct of fiscal policy may be reflected in structural breaks of the estimated relationships. Their use in projecting the future evolution of saving rates must be thus undertaken with due caution.

Understanding the factors that determine the evolution of household saving is an economic field where open questions still abound. This gap is partly related to the fact that micro and macroeconomic evidence are not directly combinable. This article attests to this conclusion. Moreover, the factors that help explaining the evolution of saving over time and differences in saving rates across countries have a markedly multidisciplinary nature - including cultural, demographic and psychological issues. The integration of these fields of knowledge is a vast and complex research agenda which should be pursued in the future.

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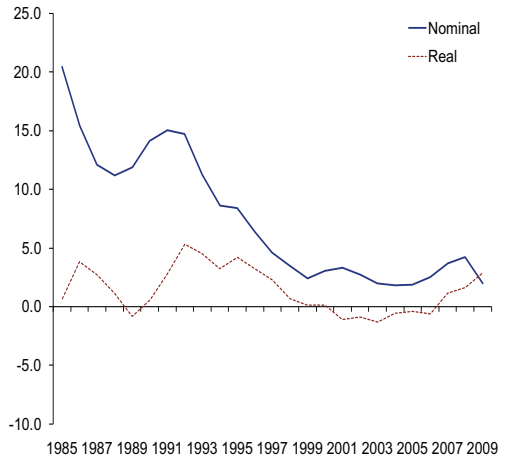
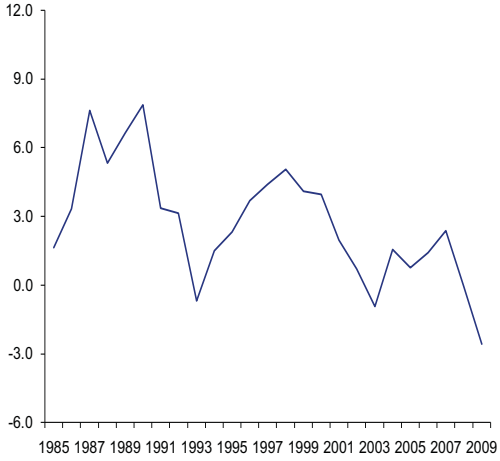
APPENDIX

Observed variables

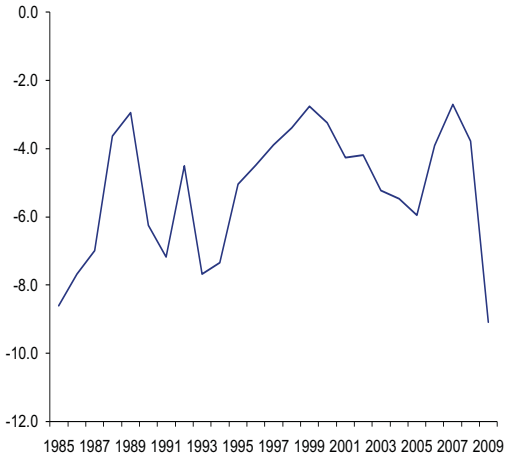
INTEREST RATE



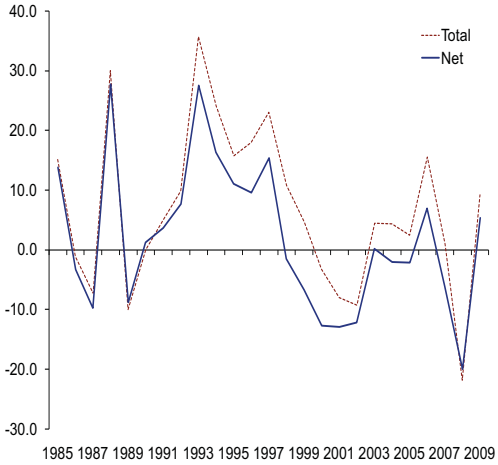
GDP
Rate of change in volume



FISCAL BALANCE (AS A PERCENTAGE OF GDP)
Excluding temporary measures



CHANGE IN WEALTH
As a percentage of disposable income



Sources: *INE* and Banco de Portugal.

UNDERSTANDING PRICE-REVIEWING STRATEGIES USING FIRM-LEVEL DATA*

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*Carlos Robalo Marques****

*Fernando Martins****

1. INTRODUCTION

In recent years, a substantial amount of theoretical and empirical research, devoted to improving the microeconomic foundations of macroeconomic behaviour, has made clear that a thorough understanding of the extent and causes of the sluggish adjustment of nominal prices is crucial to the design and conduct of monetary policy.

In this regard, an important conclusion that emerges from the literature is that firms differ from each other with respect to their price-reviewing or price-setting strategies, and that the different strategies are all widespread in the economy.[1] A second important conclusion is that the effects of monetary policy may depend crucially on the underlying mechanism of firms' price adjustment, namely on whether firms follow state-dependent or time-dependent price-setting rules.[2] Understanding the factors that lie behind firms' choice of different price-reviewing strategies is thus an issue of paramount importance.

This article adds to this strand of the literature by studying the determinants of the choice of the price-reviewing strategies followed by firms. On the theoretical front, there is now a significant literature that directly addresses this issue, but a corresponding empirical contribution is virtually nonexistent.

Using the information from a firm-level survey, this article investigates the main reasons that lead firms to select time-dependent, state-dependent or a combination of both price-reviewing practices, which we shall denote by time- and state-dependent price-reviewing strategy.[3] Specifically, we explore the information available on firms' pricing decisions using a multinomial probit model to study

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(1) For instance, Fabiani *et al.* (2006) find that in the Euro Area about 34 percent of the firms follow time-dependent rules, 20 percent follow state-dependent rules and the remaining 46 percent follow a combination of both, i.e., follow time-dependent rules under normal circumstances, but change to state-dependent price-reviewing rules upon the occurrence of specific events.

(2) In general prices tend to react faster to monetary policy shocks in state-dependent frameworks as compared to time-dependent models leading to less persistent effect on real output in the former models. See, among many others, Sheshinski and Weiss (1977), Chaplin and Spulber (1987), Dotsey *et al.* (1999), Bonomo and Carvalho (2004), Dotsey and King 2005, Burstein and Hellwig (2007), Midrigan (2007), Golosov and Lucas (2007), Bils *et al.* 2009 and Woodford (2009).

(3) When the timing of a firm's price-reviewing (or price-setting) strategy does not depend on the current or expected state of the economy, either because it is assumed to be exogenous or conditional on some underlying fixed parameters, it is said the the firm follows a time-dependent strategy. In contrast, a state-dependent firm is one in which the timing of the price-reviewing (or price-setting) rule varies according to current or expected economic conditions.

the link between their price-reviewing strategies and a number of their characteristics. The identification of such characteristics will allow us to anticipate changes in firms' behaviour, i.e., changes from time- to state-dependent and vice-versa, as a reaction to changes in economic conditions and therefore to anticipate changes in monetary policy transmission. In addition, our exercise will also allow us to answer several interesting questions, from which the following are just some examples: How do the lags of price reaction to shocks and the frequency of price changes vary between time- and state-dependent firms? How important are menu and/or information costs for the choice between time- and state-dependent price-reviewing rules? Does the type of price-reviewing strategy vary with the size of the firms? Does the cost structure matter for the firm's strategy? How does uncertainty affect firms' choice? Are firms more likely to be state-dependent when they operate in more competitive environments?

A potential disadvantage of using survey data for this type of investigation is that, in our case, these are reported, not actual data, and thus, it is impossible to know how accurate the answers provided in the survey are. However, in this particular case, this is likely to be the single available approach for the purpose at hand as there does not seem to be a valid alternative to identify the price-reviewing strategies at the firm level.[4]

In this article we document that the type of price-reviewing strategy followed by firms has important consequences for the frequency of price changes and the speed of price reaction to shocks. In particular, firms that follow state-dependent price-reviewing rules change their prices more frequently and react more quickly to demand and cost shocks than firms following time-dependent strategies.

We also find that the type of price-reviewing strategy varies significantly with those firm characteristics used to measure the importance of information costs, the variability of the optimal price and the sensitivity of profits to sub-optimal prices. Menu costs, i.e. costs of changing prices (such as the cost of printing and distributing new price lists), do not seem to play a significant role in explaining the different price-reviewing strategies. In particular, we document that smaller firms, firms for which changes in prices of raw materials are important factors for pricing decisions or that operate in competitive environments are more likely to follow state-dependent price-reviewing rules. In turn, larger firms, firms for which information costs or changes in wages are important factors for pricing decisions, or that operate in the services sector are more likely to follow time- or time- and state-dependent price-reviewing strategies. Interestingly, we also find that the time- and state-dependent rule is closer to the time-, than to the state-dependent price-reviewing strategy. Yet, the two price-reviewing strategies are very distinct. In fact, for many regressors, the magnitude of the impact on the likelihood of the two categories is different and, moreover, the probability of a firm choosing between one of the two strategies sometimes goes in the opposite direction as, for instance, in the case of a firm for which changes in the competitors' prices are important for pricing decisions.

The rest of the article is organised as follows. Section 2 presents the theoretical background which

(4) In particular, quantitative data on the frequency of price changes or the duration of price spells does not allow addressing the issue. On the one hand, these data do not distinguish between price changes and price reviews, the latter being the variable of interest in this article. On the other hand, time--dependent rules as implied by the models with information costs, are not distinguishable, in practice, from state-dependent rules, as the frequency of price changes or of price reviews depends on the underlying relevant parameters that may change over time (see ch.8).

underlies the estimated model. section 3 describes the dataset used in the article and presents some preliminary results. section 4 presents the estimated model and discusses the main results. section 5 contains some concluding remarks, and finally an Appendix provides an explanation of how the different variables were constructed.

2. THEORETICAL BACKGROUND

The process of charging an optimal price by firms may be thought of as usually involving price-reviewing and price-setting as two distinct activities. Price reviewing may be defined as the activity of assessing whether the firm's current price is appropriate or not, and in general precedes the price-setting decision which involves adjusting the price to the optimal level. In practice, a price review may or may not be followed by a price adjustment, so that if the two activities entail different types of costs it may be the case that the firm follows distinct price-reviewing and price-setting strategies.[5]

This section briefly reviews the literature on firms' price-reviewing strategies and discusses the implications for those strategies stemming from changes in the relevant parameters.

We start by summarizing the implications for the firms' price-reviewing strategies of the models suggested see Caballero (1989) and Alvarez *et al.* (2010), which assume that firms do not have access to costless information about current economic conditions.

In order to make the presentation easier let us start by assuming that i) the efficiency loss of the firm (out-of-equilibrium cost) may be captured by a quadratic function, $\mathrm{L}= \theta\ [\mathrm{p(t)\text{-}p^{*}(t)}]^2$, where θ measures the sensitivity of profits to deviations of the actual price, $p(t)$, from the optimal price, $p^{*}(t)$; and ii) the optimal price follows a random walk with Gaussian innovations with variance σ^2 per unit of time.[6] If we further assume that the firm has to pay a fixed information cost, ρ, in order to review its price, it may be shown (see) that it is optimal for the firm to follow a time-dependent price-reviewing strategy, where the optimal price-reviewing interval is given by:

$$\tau = \sqrt{\frac{2\rho}{\theta\sigma^2}} \qquad (1)$$

According to equation (1), the optimal length for price-reviewing is increasing on the information costs and decreasing on the parameters measuring efficiency loss from sub-optimal prices and the variability of the underlying optimal price.

In the model suggested in Caballero (1989) there are no menu costs, so that every price review implies a price change. In a recent contribution, Alvarez *et al.* (2010) generalise Caballeros's model by assuming that the firm has to pay an information cost to review the price and a menu cost if it decides to change the price. In this model, price reviews and price changes are separate activities:

(5) Survey data indicate that firms review their prices infrequently, and that not all price reviews yield a price adjustment. For instance, for the Euro Area, Fabiani *et al.* (2007) document that the frequency of price reviews is generally higher than the frequency of price changes. The surveys show that in most Euro Area countries the modal number of price reviews lies in the range from one to four times a year, but most firms actually change their prices only once a year. In the case of Portugal, these figures are 2 and 1, respectively.

(6) Note that θ depends on the parameters of the demand and costs functions and that, in particular, θ is increasing with the elasticity of demand faced by the firm. The variance σ^2 may be seen as measuring the volatility of demand and cost functions.

a firm may assess the adequacy of its current price, i.e., conduct a price review, and decide not adjust if the current price is inside the inaction band (stemming from the presence of menu costs). The timing of each price review is predetermined as it is decided on the previous revision date. Nevertheless the process of price reviewing is also state-dependent, because the optimal time between price reviews is a function of the expected price gap (i.e., the difference between the actual and the optimal price) at the time of price-reviewing.[7]

In contrast to Caballero (1989) and Alvarez *et al.* (2010) there are models where firms are assumed to have access to partial information at no cost, as in the contributions by Woodford (2009) and Bonomo *et al.* (2010).

Woodford (2009) developed a model with information costs where the assumptions about information availability have important implications for the strategy of price reviews. In this model it is assumed that: *i*) the firm obtains full information about the economy's state at the moment when it decides to pay the information costs and review the price; *ii*) partial information about current conditions is available between the occasions when the fixed information cost is paid, which allow firms to decide whether or not to review prices; and *iii*) the memory of the firm (information on the time at which the firm last reviewed its price) is as costly as information about current conditions external to the firm. Under these circumstances, it is shown that the optimal timing of price reviews follows a state-dependent rule. However, when the information cost is sufficiently large, the dependence of the optimal hazard (that indicates the probability of a price review) on the current state is attenuated, so that in the limit when the information cost becomes unboundedly large, the resulting model approaches one with a constant hazard rate as assumed in Calvo (1983). If, instead, memory is costless, the optimal hazard also depends on the number of periods since the last price review. If, memory is costless and the information costs are unboundedly large, the model becomes one in which prices are reviewed at deterministic intervals as in Caballero (1989).

In the model suggested in Woodford (2009) there are no menu costs dissociated from information costs, so that every price review implies a price change, as in Caballero's model. More recently, Bonomo *et al.* (2010) developed a model that allows for dissociated menu and information costs and assumes a continuous flow of partial information which may be factored into pricing decisions at no cost, together with some information that is only incorporated infrequently due, for instance, to gathering and processing costs. Nevertheless, the price-reviewing process emerges as having both time- and state-dependent components, as in Woodford (2009)'s memory costless case.

In summary, according to the models surveyed above, we may aggregate the different price-reviewing strategies into three categories: time-dependent (as in Caballero (1989)), state-dependent (as in Woodford (2009)) and time- and state-dependent (as in Alvarez *et al.* (2010) and Bonomo *et al.* (2010)).

(7) In a similar approach Abel *et al.* (2009) address consumption portfolio problems under the assumption of separate observation (information) and adjustment (transaction) costs. Interestingly, the authors show that for sufficiently small fixed transaction costs the two processes of "observation" and "transaction dates" will eventually converge to pure time-dependent rules. Intuitively, when the fixed transaction costs are not too large compared to the observation costs, the agent will find it optimal to synchronize observation and transaction dates, in order to avoid "wasting" observation costs without using the new information to undertake a transaction.

We have seen that in some of the models surveyed above changes in the importance of menu and information costs may alter the nature of the price-reviewing strategy. In particular, in the context of the time-and state-dependent model suggested in Alvarez *et al.* (2010) and Abel *et al.* (2009) a decrease in the importance of menu costs makes the model converge towards a time-dependent rule. The intuition is that a decrease in menu costs makes the width of the inaction band to converge to zero, making the source of the state-dependent component in the price-reviewing strategy to vanish. In turn, an increase in information or observation costs makes the state-dependent model in Woodford (2009) to converge to a pure time-dependent rule with a constant hazard rate as assumed in Calvo (1983)or, in the absence of memory costs, one in which prices are reviewed at predetermined intervals as in Caballero (1989). The intuition is similar: an increase in the information costs attenuates the dependence of the optimal hazard on the current state, making the optimal time between two consecutive price reviews to converge towards a pure time-dependent rule as information costs become unboundedly large.

The impact on the optimal price-reviewing strategy of changes in the variability of the optimal price (σ^2) and the sensitivity of firm's profits to sub-optimal prices (θ) may be discussed in a context of a model in which firms have access to partial information about current conditions, as in Woodford (2009). In this model, an increase in θ or in σ^2 may be thought of as bringing about both a decrease in the information costs (an increase in the uncertainty about the price gap or on the costs associated to a given price gap makes information more valuable, reducing its relative cost) and an increase in the relative cost of firm's memory (the higher is σ^2 or θ the less valuable the memory will be). Thus, an increase in θ or in σ^2, to the extent that it decreases the information costs on the current conditions and increases the memory costs of the firm, may be expected to increase the probability of a firm following state-dependent price-reviewing strategies as opposed to time-dependent or time- and state-dependent rules.

In this article, we will look into the factors that may explain why firms follow state-dependent, time-dependent or time- and state-dependent price-reviewing strategies. For that purpose, in section 4 we will consider an econometric model that relies on the theoretical approaches presented in this section, whose relevant factors, in face of the discussion above, include the menu costs, the information costs, the variability of the optimal price and the sensitivity of firm's profits to sub-optimal prices. Overall, in our estimated model, we expect high menu-costs, small information costs, large variability of the optimal price and high sensitivity of profits to sub-optimal prices, *ceteris paribus,* to increase the likelihood of state-dependent price-reviewing. Similarly, low menu costs, high information costs, small variability of the optimal price and low sensitivity of profits to sub-optimal prices, are expected to increase the likelihood of time-dependent price-reviewing strategies.

3. THE DATA

3.1. Data sources

The data used in this study come from a survey about price setting practices carried out by the Banco de Portugal.[8] In this survey, firms were asked about their price-reviewing strategies through the following question:

The price in your company is reviewed (without necessarily being changed):

1) *at a well-defined frequency (annually, quarterly,..),*

2) *generally at a defined frequency, but sometimes also in reaction to market conditions (change in the price of raw materials or in demand conditions) or*

3) *without any defined frequency, being reviewed in reaction to market conditions (changes in price of raw materials or in demand conditions).*

The responses to this question, the dependent variable in our model, are interpreted as reproducing time-dependent, time- and state-dependent, and state-dependent price-reviewing practices by Portuguese firms, respectively.

Besides the question on price-reviewing practices, the survey also contains information on a large number of firms' characteristics. These include information on the size and sector of the firm, destinations of sales (wholesalers *vs*. retailers, private *vs*. public sector), number of competitors, importance of changes in different factors for price adjustments (price of raw materials, wage costs, demand), and reasons for postponing price changes (the risk that competitors do not follow, existence of implicit or written contracts, cost of changing prices, costs of collecting information, absence of significant changes in variable costs, preference for maintaining prices at psychological thresholds, etc...).

In total, for estimation purposes, we have detailed information on 906 firms from different areas of economic activity. More specifically, our sample includes firms with 20 or more employees, from which almost 90 percent belong to Manufacturing (NACE - classification of economic activities - 15 to 37) and the remaining to Services (NACE 60 to 64, 80 and 85 - Transport, Storage and Communication, Education and Healthcare). Sectors such as agriculture, construction, or wholesale and retail trade are not included.

3.2. Preliminary data analysis

As above-mentioned, the type of price-reviewing strategy by Portuguese firms is our variable of interest. Table 1 summarises some useful information on this variable by displaying the distribution of the observed price-reviewing strategies in our sample, as well as comparable figures for other

(8) Further details on this survey may be found in Martins (2010).

Table 1

PRICE-REVIEWING STRATEGIES - INTERNATIONAL EVIDENCE
Share of firms, per cent

	PT	ES	DE	NL	BE	IT	AT
Time-dependent	32	33	26	36	26	40	41
Time- and state-dependent	25	28	55	18	40	46	32
State-dependent	43	39	19	46	34	14	27

Source: Fabiani *et al.* (2007).
Note: PT-Portugal, ES-Spain, DE-Germany, NL-Netherlands, BE-Belgium, IT-Italy and AT-Austria.

European countries taken from Fabiani *et al.* (2007).[9]

Table 1 reveals that in Portugal 32 percent of the firms in the sample follow time-dependent rules, while 43 percent follow state-dependent rules, and the remaining 25 percent follow time- and state-dependent price-reviewing strategies, i.e., generally review prices at a defined frequency, but sometimes also in reaction to market conditions. From Table 1, we can also see that figures for Portugal do not differ significantly from the general picture obtained from several European countries. Even though the distribution of the price-reviewing strategies varies somewhat across countries, we notice that the three alternative price-reviewing strategies are equally important, as none emerges as clearly dominating the others. For instance, from Table 1 we see that the proportion of time-dependent firms is above 25 percent in all countries, and that the importance of time- and state-dependent strategy varies between 18 percent (NL) and 55 percent (DE).

Table 2 considers the breakdown by sector and firm size of the different price-reviewing strategies. The table suggests the existence of strong heterogeneity in these two dimensions. Indeed, the share of firms following time-dependent rules is higher in services than in manufacturing, and tends to increase with the size of the firms.

As in similar studies, the survey data also contains information on the frequency of price changes and the speed of price reaction to shocks. Table 3 reports the average frequency of price changes as reported by the firms in the sample. From the table it can be seen that on average, time-, time- and state- and state-dependent firms have different frequency of price changes. In particular, state-dependent firms emerge as adjusting prices more frequently than firms following time-dependent price-reviewing strategies. Indeed, 17 percent of firms following state-dependent rules change their

Table 2

PRICE-REVIEWING STRATEGIES - SECTORAL AND SIZE BREAKDOWN
Share of firms, per cent

		Sectors		Size	
	Total	Manufacturing	Services	Small	Large
Time-dependent	32	30	47	30	41
Time- and state-dependent	25	25	25	22	35
State-dependent	43	45	28	48	24

Source: Survey on price setting behaviour.
Note: Small and large firms are firms with up to 250 employees and more than 250 employees, respectively.

(9) Figures for Portugal in Table 1 do not strictly coincide with those reported in Fabiani *et al.* (2007) due to differences in the samples used.

Table 3

FREQUENCY OF PRICE ADJUSTMENT
Share of firms, per cent

Frequency of price adjustment	Time- dependent	Time- and state-dependent	State-dependent
1 - Once per month or more	3	5	8
2 - Once per quarter	5	9	9
3 - Twice a year	16	14	17
4 - Once a year	61	57	40
5 - Less than once a year	16	15	26

Source: Survey on price setting behaviour.

prices at least once in a quarter, while 8 percent do it at least once in a month. On the other hand, only 8 percent of firms following time-dependent rules change their prices at least once in a quarter. The frequency of price changes for time- and state-dependent firms seems to be somewhere in between that of time- and state-dependent firms. The analysis based on visual inspection of Table 3 is corroborated by a formal non-parametric χ^2 homogeneity test, which rejects the null hypothesis of equal frequency of price changes across the three types of firms.[10]

Table 4 reports the lags or price reaction to significant positive cost and demand shocks.[11] Simple visual inspection of the table suggests that the speed of price adjustment to shocks varies according to the type of price-reviewing strategy. In particular, in both cases, time-dependent firms seem to be slower to adjust than firms following state-dependent price-reviewing strategies. Indeed, 26 percent of firms with state-dependent price-reviewing rules adjust their prices in the first month after a positive cost shock, while 58 percent do it in the first three months. The corresponding figures for time-dependent firms are 14 and 38 percent, respectively. The results for firms with time- and state-

Table 4

SPEED OF PRICE RESPONSE TO POSITIVE DEMAND AND COST SHOCKS
Share of firms in each category

Price adjustment lag	Time-dependent	Time- and state -dependent	State-dependent
Positive cost shocks:			
1 - Less than one week	3	6	6
2 - From one week to one month	11	16	20
3 - From 1 month to 3 months	24	28	32
4 - From 3 to 6 months	19	21	18
5 - From 6 months to one year	33	24	18
6 - More than one year	10	5	7
Positive demand shocks:			
1 - Less than one week	3	4	4
2 - From one week to one month	7	11	15
3 - From 1 month to 3 months	17	18	23
4 - From 3 to 6 months	13	21	13
5 - From 6 months to one year	22	21	14
6 - More than one year	38	26	31

Source: Survey on price setting behaviour.

(10) The outcome of the test is $\chi^2(8) = 42.4$, so that the null hypothesis is rejected at 1 percent level.

(11) This information was explored by Dias *et al.* (2010) to investigate the firms' characteristics that explain why some firms react to shocks faster than others.

dependent rules suggest that the speed of price adjustment is somewhere in between that of time- and state-dependent firms. Once again, the analysis based on visual inspection is corroborated by formal non-parametric χ^2 homogeneity tests, which clearly reject the null hypothesis of identical adjustment lags across the three types of firms.[12]

Overall, Tables 3 and 4 show that whether firms follow time-, time- and state-, or state-dependent price-reviewing strategies has important consequences for the frequency of price changes and the speed of price reaction to shocks. This, in turn, may be expected to have important consequences for monetary policy, as its effects would depend on the distribution of firms in terms of their price-reviewing strategies. Thus, anything that changes this distribution will affect the speed with which prices react to monetary policy shocks. In particular, one may expect the effects of monetary policy to depend on the firm size distribution or the importance of the services sector in the economy (see Table 2). Countries with a higher share of larger firms and/or with a larger services sector may be expected to display a larger proportion of time-dependent firms and thus to be stickier than otherwise identical countries. But, the factors that may change the effects of monetary policy include monetary policy itself: changes in monetary policy rules aimed at stabilizing the economy, to the extent that they alter the proportion of firms in each category, will change the frequency of price changes and the speed of price reaction to monetary policy shocks.[13]

4. AN ECONOMETRIC MODEL FOR THE PRICE-REVIEWING STRATEGIES

In order to gauge the impact of the different covariates on the type of price-reviewing strategy, we estimate a multinomial probit model, where the dependent variable, $y_{i,j}$, $j=1, 2, 3$ indicates one of the three response categories: time-, time- and state- , or state-dependent price-reviewing strategy.

The choice of the set of regressors used in the empirical model was based on the literature on price-reviewing strategies summarized in section 2. As discussed there, the relevant factors determining the type of pricing policy may be divided into four categories: menu costs, information costs, variability of the optimal price and the sensitivity of profits to sub-optimal prices. As direct quantitative data is not available, we use proxies as the regressors for each one of the four categories. The different regressors are described in the Appendix together with some summary statistics.

Table 5 presents the average marginal effects of each of the covariates on the probability of a firm following either a time-, a time- and state- or a state-dependent price-reviewing strategy, computed from the estimated parameters of the multinomial probit model.[14]

(12) For the positive cost and demand shocks the results of the tests are $\chi^2(10)=34.26$ and $\chi^2(10)=32.25$, respectively, so that the null hypothesis is rejected at 1 percent level for the two tests. The results for negative cost and demand shocks, as regards the price adjustment lags for the three type of price-reviewing strategies, including the χ^2 homogeneity tests, are qualitatively similar.

(13) For instance, by reducing inflation uncertainty it is likely that monetary policy will reduce the variability of firms' optimal price, which, according to the discussion in section 2, is likely to increase the probability of firms following time- or time- and state-dependent rules.

(14) Figures in Table 5 refer to the output of an independent multinomial probit. We note that by construction the average marginal effects for each regressor in Table 5 add up to zero. As a robustness check, we also estimated a multinomial probit allowing for the possibility of correlated errors. However, the estimates for the average marginal effects were virtually unchanged.

Tabela 5

MULTINOMIAL PROBIT
Average marginal effects

Regressors	Time-Dependent	Time- and State--Dependent	State-Dependent
Menu costs	0.0136	-0.0213	0.0077
	(-0.0345)	(-0.0337)	(-0.0366)
Information costs	0.0270	0.0612*	(-0.0882)**
	(0.0352)	(0.0340)	(0.0370)
Variability of the optimal price:			
Changes in prices of raw materials	-0.1905***	0.0451	0.1455**
	(0.0669)	(0.0550)	(0.0608)
Changes in wages	0.0868**	-0.0127	-0.0741*
	(0.0398)	(0.0402)	(0.0456)
Changes in demand	-0.0200	0.0230	0.0030
	(0.0393)	(0.0376)	(0.0423)
Efficiency loss:			
Number of competitors	-0.0818**	0.0023	0.0841**
	(0.0370)	(0.0337)	(0.0380)
Changes in competitors' prices	-0.1439***	0.0841**	0.0598
	(0.0398)	(0.0332)	(0.0401)
Services	0.1398**	0.0087	-0.1485***
	(0.0552)	(0.0486)	(0.0510)
Intermediate goods	-0.1019***	-0.0268	0.1287***
	(0.0315)	(0.0304)	(0.0349)
Size	0.0962**	0.1272***	-0.2234***
	(0.0410)	(0.0397)	(0.0384)
Number of observations: 906			

Source: Survey on price setting behaviour.
Note: Robust standard errors are in parenthesis; ***,**,* denote significance at 1, 5 and -5pt 10 percent level, respectively.

Menu costs

According to the theoretical models surveyed in section 2, we may expect high menu costs to increase the likelihood of state-dependent price-reviewing. However, in our estimated model, menu costs do not emerge as a relevant factor to discriminate among the three alternative price-reviewing strategies. This of course, may stem from the type of regressor we use. In our model, menu-costs are measured by a dummy variable that is equal to one if the firm considers that such costs are important or very important to explain the existence of price rigidity and is zero otherwise. But, it may be the case that two firms, with a very different degree of price stickiness attach the same degree of importance to menu costs. Under such circumstances, our measure of menu costs would be unable to discriminate among firms with different price-reviewing strategies. Of course, it may also be the case that in most firms menu costs do not play an important role for the decision on the type of price-reviewing strategy, if they are very small when compared to information costs (see , Ball and Mankiw (1994) Zbaracki *et al.* (2004) and Woodford (2003, 2009)).

Information costs

According to the theoretical models, we may expect high information costs to increase the likelihood of time-dependent or of time- and state dependent price-reviewing strategies, as opposed to state-dependent rules. From Table 5 we see that firms for which information costs are important,

are less likely to follow state-dependent price-reviewing strategies. In particular, for a firm for which information costs are important or very important, the probability of following a state-dependent price-reviewing strategy is 8.8 percentage points (pp) lower than the probability for an otherwise identical firm. The results for this covariate are in line with theoretical predictions, but they lack some statistical strength.

Variability of the optimal price

This category includes a group of variables deemed to affect directly or indirectly the variability of the optimal price of the firm: "changes in the prices of raw materials", "changes in wages" and "changes in demand". These covariates measure the importance of changes in the prices of raw materials, in wages and in demand for the firm's decision of a price change.

Estimates presented in Table 5 show that firms where the prices of raw materials are considered important or very important for price changes are more likely to follow a state-dependent rather than a time-dependent price-reviewing strategy. In fact, the probability of such firms following a time-dependent price-reviewing strategy is about 19 pp lower than the probability for an otherwise identical firm. In contrast, firms that consider changes in wages as important or very important for price changes are more likely to follow time-dependent price reviewing rules, compared to state-dependent ones. In both cases the results accord with intuition: in general, the price of raw materials is highly volatile, which will increase the variability of the optimal price and thus, may be expected to increase the likelihood of state-dependent behaviour; in turn, we may expect changes in wages to occur at well-defined frequencies (once a year, usually) and thus, their importance for price changes to be negatively correlated with the uncertainty surrounding the optimal price. Interestingly, the larger importance of changes in demand for the decision of a price change does not seem to have a bearing on the type of price-reviewing strategy followed by Portuguese firms.

Efficiency loss

This category includes a group of variables expected to be related to the determinants of the sensitivity of firm's profits to deviations from the optimal price: "number of competitors", "price competitiveness", "changes in competitor's prices", "services", "intermediate goods" and "size".

The number of competitors, which is used to measure the degree of competition faced by firms, may be expected to have a significant impact on the choice of a price-reviewing strategy, because it is known that the more competitive a sector is, the more sensitive profits are to sub-optimal prices (Gopinath Itskhoki (2010)). Thus, *ceteris paribus*, firms operating in more competitive environments may be expected to prefer state-dependent practices. Our estimates show that this is indeed the case. From Table 5, we see that, for a firm operating in a more competitive environment, the probability of following a time-dependent price-reviewing rule is about 8 pp lower than the probability for and otherwise identical firm.

As regards the regressor "changes in competitors' prices", we notice that a firm for which such

changes are important or very important for pricing decisions is less likely to follow a time-dependent rule and more likely to follow a time- and state-dependent rule, but the likelihood of following a state-dependent rule is not affected. This is a very interesting finding, which may be explained in a context of strategic complementarities (see, for instance, Bonomo e Carvalho (2004)). In such a context, a firm should not be expected to follow a simple time-dependent rule, as such rule does not accommodate the possibility of a firm reacting to changes in the firms' relevant environment. In contrast, by being time- and state-dependent the firm has the possibility of generally reviewing its prices at well defined frequencies, but sometimes also in reaction to market conditions, namely changes in competitors' prices.

As earlier results suggested (see Table 2 in section 3), from Table 5 we find that firms that operate in the services sector are more likely to follow time-dependent price-reviewing strategies than firms that operate in the manufacturing sector. In fact, the covariate "services" shows up with a very large impact with estimated positive marginal effects on time-dependent behaviour of around 14 pp. The type of price-reviewing strategy also varies according to the type of market for the product and the firm size. Firms that sell their products to other firms (intermediate goods) are more likely to follow state-dependent rules than firms whose products are mainly for final demand (whose main destinations are wholesalers, retailers or consumers). In contrast, larger firms tend to prefer time- or time- and state-dependent rules in detriment of state-dependent strategies. According to our estimates, the probability of a large firm following a state-dependent price-reviewing rule is about 22 pp lower than the probability for a comparable small firm. This outcome was to be expected given the preliminary findings in section 3.

The results for the covariates "services", "intermediate goods" and "size" may reflect the fact that services, final goods and goods produced by large firms are typically goods on which the firm has a higher degree of price setting power (either through product differentiation or through a larger market share) than in the case of manufacturing, intermediate goods or goods produced by small firms, and thus face a less elastic demand, which makes profits less sensitive to non-optimal pricing.

Overall, the results in Table 5 show that the time- and state-dependent strategy is somewhat closer to the time- than to the state-dependent strategy, in the sense that changes in regressors that bring about significant changes in one of the two strategies, usually also bring about changes of the same sign in the likelihood of the other (even though in some cases not statistically different from zero). However, the results also show that time- and time- and state-dependent behaviour must be seen as two distinct choices. Indeed, for many regressors the magnitude of the impact on the two categories is different and, moreover, the probability of a firm choosing between one of the two strategies sometimes may go in the opposite direction as, for instance, in the case of a firm for which changes in competitors' prices are important or very important for pricing decisions.

5. CONCLUSIONS

This article uses firm-level data to look into the factors that may explain why firms follow time-, state-, or time- and state-dependent price-reviewing strategies.

In line with the evidence found in other countries, Portuguese firms are strongly heterogeneous as regards their price-reviewing strategies. In our sample, 32 percent of the firms follow time-dependent, 43 percent state-dependent and the remaining 25 percent time- and state-dependent price reviewing strategies. Importantly, the frequency of price changes and the speed of price reaction to shocks of time-dependent firms is significantly lower than that of state-dependent firms, while firms that are both time- and state-dependent rank in between.

By estimating a multinomial probit model, we find that the type of price-reviewing strategy varies significantly with those firm characteristics that measure the importance of information costs, the variability of the optimal price and the sensitivity of profits to sub-optimal prices. In particular, we document that an increase in the information costs tend to decrease the likelihood of a firm following a state-dependent price-reviewing strategy. Factors that contribute positively to the variability of the optimal price or that increase the cost of deviations from the optimal price decrease the probability of a firm following time- and/or time- and state-dependent price-reviewing rules, as opposed to state-dependent rules. Menu costs do not emerge as playing an important role.

We also find that the time- and state-dependent price-reviewing strategy is somewhat closer to the time-, than to the state-dependent strategy. Yet, the distinction between the first two strategies is still relevant. Indeed, the probability of a firm choosing between time- and time- and state-dependent behaviour sometimes goes in the opposite direction as, for instance, in the case of firm for which changes in competitors' prices are important for pricing decisions.

The fact that the proportion of time- and state-dependent firms depends on the state of the economy has important consequences for monetary policy. Monetary policy aimed at stabilizing the economy (by reducing inflation uncertainty) might increase the proportion of time-dependent firms, which, in turn, to the extent that such firms display lower frequency of price reviews and of price changes, would tend to increase the real effects of monetary policy. A simple implication of these results is that DSGE models should be improved in order to account for the heterogeneity and endogeneity of firms' price-reviewing or price-setting strategies. Otherwise, the implications of changes in monetary policy rules generated by these models might be very misleading.

APPENDIX

In this appendix, we describe the covariates used in the multinomial probit model whose results are presented in section 4, and provide the corresponding summary statistics. All the covariates used in the model are dummy variables. The details are as follows:

Menu costs -- Equal to one if the menu costs implied by price changes are ranked as an important or a very important factor to postpone price changes.

Information costs -- Equal to one if the costs involved in collecting the relevant information for price decisions are ranked as an important or a very important factor to postpone price changes.

Changes in prices of raw materials -- Equal to one if they are considered as important or very important for the firm's decision of a price increase or a price decrease.

Changes in wages -- Equal to one if they are ranked as important or very important for the firm's decision of a price increase or price decrease.

Changes in demand -- Equal to one if they are ranked as important or very important for the firm's decision of a price increase or price decrease.

Number of competitors -- Equal to one if the number of firm's competitors is greater than or equal to 5.

Changes in competitors' price -- Equal to one if they are important or very important for the firm's decision of a price increase or price decrease.

Intermediate goods -- Equal to one if "other companies" is the main destination of sales (as opposed to wholesalers, retailers, Government, consumers).

Size -- Equal to one if the number of employees is larger than 250.

Services -- Equal to one if the firm operates in the Services sector.

Table A1 summarizes the relative importance in the sample of the covariates defined above. The entries in the table record the share of firms in each category. For instance, from the table we see that around 93 percent of the firms consider that changes in prices of raw materials are important or very important for price decisions on either price increases or price decreases, and that the distribution of such firms does not change with firms' size, but varies across sectors, being relatively more frequent in manufacturing than in services. In contrast, only about 30 percent of the firms produce intermediate goods, i.e., sell their main product to other companies (as opposed to wholesalers, retailers or the Government) and are relatively more frequent in the services sector.

Table A1

MAIN CHARACTERISTICS OF THE SAMPLE
Share of firms in each category, per cent

	Total	Sectors		Firms' size	
		Manufacturing	Services	Small	Large
Menu costs	57.1	57	57.3	57.9	53.5
Information costs	40.6	41.2	34.8	41.6	36.5
Changes in prices of raw materials	93.4	95.7	71.9	93.8	93.4
Changes in wages	84.8	84.9	83.1	86.3	78.2
Changes in demand	77.7	77.5	79.8	78	76.5
Number of competitors	75.7	75.6	76.4	79.9	57.6
Changes in competitors' prices	74.6	74.3	77.5	73.9	77.6
Intermediate goods	29.9	28.9	39.3	30.8	25.9
Size (large firms)	18.8	17.9	27	-	-
Services	9.8	-	-	8.8	14.1

Source: Survey on price setting behaviour.

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ON THE CYCLICAL SENSITIVITY OF REAL WAGES*

*Pedro Portugal***

*Anabela Carneiro****

*Paulo Guimarães*****

"O que está na pessoa se deve estimar: tudo o mais é da fortuna"

"Quem muito estima cousas pequenas, nunca faz nenhuma grande"

D. Francisco de Portugal, 1º Conde de Vimioso

Real wage flexibility in Portugal

The Portuguese labour market has, for many decades, been conspicuous on account of its low, strongly counter-cyclical, unemployment rates. Based on widespread evidence of the very low mobility level of labour, researchers have naturally pointed to real wage flexibility as being the main reason for this result. Over the course of this period, there has been an accumulation of convincing research, suggesting a strong cyclical sensitivity of aggregate wages to the unemployment rate.[1] Reference should be made to the following cautionary note, set out in the box "*Real wage flexibility in Portugal*", in the 1998 report of the Banco de Portugal.

"It should be borne in mind that the configuration influencing the institutional framework governing the Portuguese labour market over the course of the last decade, was contemporaneous with relatively high price growth. The recent change in the monetary system, associated with a regime of low inflation may be the cause of significant and unpredictable changes in the parameters defining the determination of wages in Portugal, i.e. the conditions governing real wage flexibility may not be necessarily guaranteed in the future, under the Portuguese economy's new framework."

In a similar vein, the following concern was expressed in the box entitled "*Nominal and Real Wage Rigidity: A Microeconomic Approach*" in the 2004 report of the Banco de Portugal:

"*Strong nominal wage rigidity may, in a low inflation regime, seriously constrain corporate behaviour and lead firms, when confronted with the need to react to negative shocks (which could, for example, be triggered by an intensification of market product competition, to prefer to adjust employment*

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(1) See Luz and Pinheiro (1993), Gaspar and Luz (1997), Dias, Esteves and Félix (2004), Marques (2009) and Martins, Marques and Portugal (2009).

rather than wages, thus increasing unemployment."

With historically high unemployment levels, a fresh look should be taken at the relationship between wages and the unemployment rate. An important dimension of wage flexibility is real wage cyclicality and how real wages react to changes in economic activity. Employment adjustments over the aggregate labour demand curve trigger a counter-cyclical reaction of real wages. Alternatively, the inter-temporal substitution of labour by leisure over the dynamic labour supply curve will generate real wage cyclicality in tandem with the economic cycle.

Heterogeneity of workers, firms and jobs

A characterisation of the behaviour of real wages may, however, be partly obfuscated by changes in the composition of the workforce over the course the cycle. The use of aggregate wage indicators irremediably confounds the effect of changes in wage dispersion, distribution of hours worked and composition of the labour force. An additional implication of the use of aggregate data is the implicit assumption that the relationship between real wages and the economic cycle is the same for all workers, establishments, industries or professions.

The bias introduced by a greater tendency towards retaining skilled workers in recessionary periods (and the hiring of unskilled workers in periods of expansion) has been well documented in the literature. In the absence of any control for worker heterogeneity, this generates an illusion of wage counter-cyclicality. The change in the sectoral composition of employment over the economic cycle, comprising the creation and destruction of firms may also spuriously influence the wage cyclicality measurements. In turn, the emergence of well paid jobs during an expansion and the change to low paid jobs in the downward stage of the economic cycle will tend to artificially amplify the indication of wage cyclicality *vis-à-vis* the economic cycle (Gertler and Trigari, 2009).

This article aims to reassess the real wage cyclicality in Portugal, taking into consideration the heterogeneity of workers, jobs and pay policies.[2] The study requires access to longitudinal databases with an unusually high level of information content and the use of estimation techniques particularly suited to the presence of various types of observed and unobserved heterogeneity. To this end, we made use of the individual records of the Quadros de Pessoal from 1986 to 2007.

The treatment of heterogeneity firstly involved a distinction between newly hired workers and existing workers within a firm, with a view to the consideration of the difference, emphasised by economic theory, in the wages of newly hired employees and those of other workers. Secondly, the analysis was organised in such a way as to permit the conditional inference of the observation of individual characteristics (namely, gender, age and workers' academic qualifications). Lastly, the estimation technique used enabled to control for worker characteristics, which are unknown, but constant over the estimation period. This included motivation, discipline, creativeness or leadership skills for workers, corporate competence, organisational structure, market dominance or product specialisation

(2) The idea of considering simultaneously firm and job fixed effects in the estimation derived from various insightful discussions with Mark Gertler and Antonella Trigari.

for firms and task complexity, complementarity with sophisticated equipment, etc. for jobs. In sum, a set of fixed effects per worker, firm and job, i.e. a collection of dummy variables for each of the effects was included in the regression model. An algorithm guaranteeing the exact solution to the ordinary least squares estimation involving a linear regression model with various high-dimensional fixed effects was specially developed by Carneiro, Guimarães and Portugal (2010). To the best of the authors' knowledge, an estimation with three types of high-dimensional fixed effects has never before been presented.[3]

An econometric model with three high-dimensional fixed effects

The basic specification of the regression equation is set out below:

$$lnw_{ijft} = \lambda_i + \gamma_f + \theta_j + x_{it}\beta + \alpha t + \delta t^2 + \varphi ingresso_{jft} + \xi_s ciclo_t + \xi_h ciclo_t * ingresso_{jft} + u_{ijft}$$

in which w_{ijft} is the monthly inflation-adjusted wage of an individual i, in a job j of the firm f, in the period t. λ_i represents a worker fixed effect, γ_f a firm fixed effect and θ_j a job fixed effect.[4] x is a vector of time-varying individual observable characteristics, such as age (and its square) and education. t and t^2 define a quadratic time trend and the variable $ciclo$ corresponds to the economic cycle indicator. As we are particularly interested in comparing the real wage cyclicality of workers who stay with a firm for consecutive years and newly hired workers, a dummy variable indicating the presence of a newly hired worker (tenure less than 12 months) and an interaction term between the latter and the cycle indicator was also included in the model. The parameters of interest are ξ_s and ξ_h. When the unemployment rate is used as the economic cycle indicator, ξ_s measures the semi-elasticity of real wages in relation to the unemployment rate for workers who stay with a firm for two consecutive years, and ξ_h the increase in the same semi-elasticity associated with newly hired workers.

It is easy, albeit time-consuming, to estimate a regression model with high-dimensional fixed effects

As our database consists of a panel of annual observations with multiple observations per worker and firm, it is possible to isolate the effect of these observed and unobserved characteristics of workers, firms and jobs which remain constant over time. This can be achieved through the introduction of fixed or random effects, although the fixed effects option is preferable as it does not impose any restriction on the correlation between observed and unobserved effects.

The introduction of a fixed effect in a linear regression model is relatively simple. For example, the introduction of a fixed effect per firm consists on the introduction of a firm-specific dummy variable. If there is a very large number of firms, as in the case under consideration, the application of the least squares estimator formula requires a large scale matrix inversion which makes it impractical. Fortunately, there is a simple solution to the least squares problem that does require the introduction

(3) Readers who are less than "enchanted" by the "magic" of the estimation of this type of model may, at no great risk, abstain from reading the next two sections. All such readers need to do is conceive that it is possible to estimate a model with 6,171,261 dummies identifying each worker, 520,147 dummies identifying each firm and 108,035 dummies identifying each professional category.

(4) Jobs are identified on the basis of a worker's professional category as defined in the collective wage bargaining agreement.

of dummy variables in the regression. This is known as the "within-groups" estimator and derives from the direct application of the Frish-Waugh-Lovell regression theorem. In practical terms, the within transformation consists in subtracting the average of each group (in this case firms) to the original variables of the model.

The issue becomes more complicated when it involves two or more high dimensional fixed effects. This is the situation we are dealing with in which the aim is to control simultaneously for fixed effects in 520,147 firms, 6,171,261 workers and 108,035 jobs. In this case, even if the estimation of one of the fixed effects using the within-groups estimator is avoided, it would still be impractical to estimate a model including dummy variables for the other fixed effects. In a prominent work, Abowd *et al* (1999) dealt with the problem of the estimation of a linear regression model which includes two high dimensional fixed effects and suggested several approximated solutions for the least square estimates. This was followed up by Abowd *et al* (2002) who suggested an iterative algorithm which provided the exact solution to this problem.

In practice, the implementation of this latter method, when applied to very large databases, has been problematical. There is also no obvious way of extending the method to more than two high dimensional fixed effects. In light of such problems, a cyclical algorithm leading to the exact solution of a linear regression model with two or more high-dimensional fixed effects was developed. The algorithm, although simple and slow, has the advantage of requiring relatively little in terms of computational resources. In the Appendix we present a detailed description of the algorithm.

Wage bargaining in Portugal

Private sector workers' wages, in Portugal, are subject to two levels of restriction. The first, simply defines the guaranteed minimum wage which establishes a wage floor for most workers. The second level is defined on the basis of collective bargaining between employers' associations and the unions which stipulates the minimum wage for each professional category.

The wage agreement comprising the central, albeit not unique, element of the negotiations, may derive from sectoral (the mostly common) firm or multi-firm agreements. Notwithstanding the fact that the agreement is only legally binding upon the parties involved in the negotiations, i.e. workers who are union members and firms which are affiliated with employers' associations, the Ministry of Labour and Social Solidarity (MTSS) systematically uses extension mechanisms to broaden the coverage of the collective wage bargaining agreement to all firms and workers in the sector.

Firms often have advantage in paying their workers more than the amounts agreed in the collective bargaining. The main motivation of firms in paying wages higher than those set out in the agreements is to retain workers who, having been involved in selection and training processes, demonstrate that they are well suited for their respective jobs.

Cyclical sensitivity of real wages

The cyclical sensitivity of real wages may be condensed in the reaction of wages to the unemployment rate. The first line of Table 1 shows the semi-elasticity of real wages to the unemployment rate, when only exercising control over the observed heterogeneity across individuals.[5] Accordingly, a one percentage point increase in the unemployment rate corresponds to a 1.685 per cent decrease in the real wages of workers who stay with a firm for consecutive years and a reduction of 2.319 (1.685+0.634) per cent in the real wages of newly hired workers.[6]

This evolution could evidently derive both from a change in the composition of employment and a modification in the reaction of wages, when the workforce over the period in question is homogenous. The consideration of the effects associated with the unobserved characteristics of workers shows that a significant part of the loss of cyclical sensitivity of real wages is effectively associated with changes in the composition of employment. The fact that a comparison between the first and second lines of Table 1 shows that the recomposition of the workforce over the course of the economic cycle generates a counter-cyclical bias is consistent with the well documented fact that in times of recession firms tend to retain their most highly skilled workers.

In contrast, the sectoral recomposition of employment deriving from the creation and destruction of firms over the economic cycle, tends to generate a pro-cyclical bias (line three of Table 1).

Lastly, also controlling for the heterogeneity of jobs, considerably increases wage cyclicality *vis-à-*

Table 1

REAL WAGE CYCLICALITY (N =30 906 573)

Cyclical variable	OLS	
	Stayers	**New-hires**
Unemployment rate	-1.685	-0.634
	(0.336)	(0.317)
	Worker Fixed Effect	
	Stayers	**New-hires**
Unemployment rate	-1.883	-0.814
	(0.384)	(0.222)
	Worker and Firm Fixed Effect	
	Stayers	**New-hires**
Unemployment rate	-1.683	-0.503
	(0.320)	(0.162)
	Worker, Firm and Job Fixed Effect	
	Stayers	**New-hires**
Unemployment rate	-2.094	-0.594
	(0.384)	(0.147)

Source: *Quadros do Pessoal* (1986-2007).
Note: Robust standard errors in parenthesis.

(5) The dependent variable is defined as the monthly inflation-adjusted wage, excluding overtime. The regressions include, as independent variables, in addition to cyclical variables, a quadratic trend, the indication of the presence of a newly hired worker (with less than 12 months in the job), as well as gender, age (and its square) and a worker's academic qualifications.

(6) The conventional standard error estimates associated with the estimator of the coefficient of the variable which measures the economic cycle will tend to be dramatically undervalued, as this variable contains only temporal variation. The problem is expeditiously resolved through the calculation of a clustered-robust standard error.

vis the unemployment rate. A one percentage point increase in the unemployment rate induces a 2.094 per cent reduction in the real wages of a worker who stays with a firm for two consecutive years and a 2.688 per cent reduction in the case of a newly hired worker. This result appears to suggest that the unobserved component of the recomposition of jobs follows a cyclical trajectory similar to the unobserved component of the recomposition of the workforce, reinforcing the idea of a more pronounced trend towards the maintenance of better paid jobs in recessionary periods with the most poorly paid jobs being filled in periods of expansion.

In short, the estimates set out in Table 1 are generally indicative of wage flexibility over the period 1986-2007, particularly in the case of newly hired workers.

Wage agreements and wage cushions

In Cardoso and Portugal (2005), the wage cushion is defined as being the log difference between the observed real basic monthly wage and the real monthly wage agreed in the wage bargaining negotiations for the respective professional category. Curiously, it has been noted that the greater real wage cyclicality of newly hired workers has been decisively affected by the cyclicality of the wage cushion. The wages agreed in wage bargaining negotiations are highly sensitive to the evolution of the unemployment rate both in the case of workers who stay with a firm or newly hired workers, although, in the latter case firm-specific contractual dispositions also play an important role in explaining the behaviour of real wages over the cycle (Table 2).

A revealing breakdown of the unemployment rate[7]

A particularly illustrative way of characterising the evolution of the unemployment rate is to decompose this indicator into the probability of finding and the probability of losing a job (Charts 1 and 2).[8] The behaviour of these indicators is, once again, indicative of the well known sclerosis of the Portuguese labour market, translating into a low intensity of flows between unemployment and employment and between employment and unemployment (Blanchard and Portugal, 2001; Varejão and Portugal, 2007). The average probability of the value of finding a job (19.5 per cent) is less than half of the estimate of the US economy's 46 per cent (Shimer, 2005). In turn, the average value of the probability of losing a job, at 1.4 per cent, is less than half of the estimate of 3.5 per cent for the US economy.

In this context, it is of interest to note that in the Portuguese labour market it is the duration of unemployment (inverse to the probability of finding a job) which is the most decisive factor in the evolution of the unemployment rate (Torres, 2009).

(7) We are grateful for Olivier Blanchard's suggestion on how to decompose the unemployment rate.

(8) The calculation of these probabilities complies with Shimer's formulation (2005) which has minimum information requirements (Torres, 2009). In the case of the probability of losing a job, the expression is the ratio between the number of short term unemployed (less than three month), u^s_{t+1} , and the volume of employment, e_t : $\frac{u^s_{t+1}}{e_t}$. In the case of the probability of finding a job the equations is as follows: $\frac{u_t - u_{t+1} - u^s_{t+1}}{u_t}$, in which u_t is the unemployment pool for quarter t. The unemployment series was harmonized to permit the use of the definition of unemployment in a restricted sense over the whole of the period.

Table 2

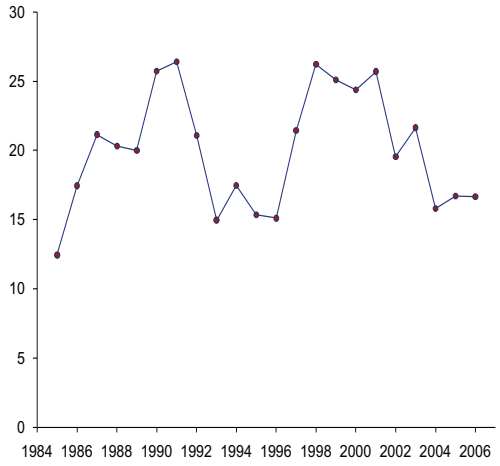
REAL WAGE CYCLICALITY BY WAGE DEFINITION (N =30 906 573)

Cyclical variable	Worker, firm and job fixed effect	
	Bargained Wage	
	Stayers	**New-hire**
Unemployment rate	-1.981	-0.055
	(0.410)	(0.054)
	Wage Cushion	
	Stayers	**New-hire**
Unemployment rate	-0.113	-0.539
	(0.184)	(0.122)
	Monthly Wage	
	Stayers	**New-hire**
Unemployment rate	-2.094	-0.594
	(0.384)	(0.147)
	Hourly Wage	
	Stayers	**New-hire**
Unemployment rate	-2.197	-0.482
	(0.597)	(0.157)

Source: *Quadros do Pessoal* (1986-2007).
Note: Robust standard errors in parenthesis.

Chart 1

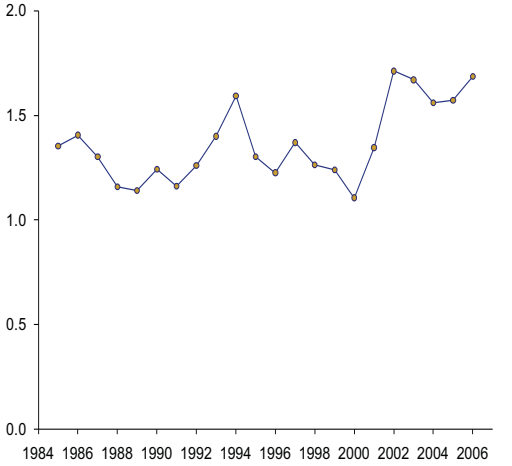
JOB FINDING PROBABILITY



Sources: *INE* and Sónia Torres calculations.

Chart 2

JOB SEPARATION PROBABILITY



Sources: *INE* and Sónia Torres calculations.

Real wages, in general, react both to the change in the probability of finding a job and to the change in the probability of losing a job. Accordingly, a one percentage point increase in the probability of finding a job will correspond to a 0.51 per cent increase in the real wages of workers who start a new job (line two of Table 3). As opposed to the above, a one percentage point increase in the probability of losing a job will correspond to a 9.5 per cent decrease in the real wages of workers who start a new job (line three of Table 3). However, when the bands between the changes of the two probabilities are considered, the magnitude of the effect of the aggregate indicators on wages is similar.[9]

Table 3

REAL WAGE CYCLICALITY BY CYCLICAL VARIABLE (N =30 906 573)

Cyclical variable	Worker, firm and job fixed effect	
	Stayers	New-hires
Unemployment Rate	-2.094	-0.594
	(0.384)	(0.147)
Job Separation Probability	0.418	0.088
	(0.075)	(0.026)
Job Finding Probability	-10.3	0.8
	(4.2)	(1.2)

Source: *Quadros do Pessoal* (1986-2007).
Note: Robust standard errors in parenthesis.

The recent fall in wage cyclicality

Lastly a re-examination of this issue of the real wage cyclicality, in light of the new institutional framework imposed by euro membership in 1999, is of interest.

To analyse the impact of the change in the monetary system in Portugal on the relationship between real wages and the unemployment rate, the base model was estimated to include a binary variable identifying the period 1999-2007.

The estimates presented in the first panel of Table 4 show evidence of strong wage flexibility for the period 1986-1998, particularly for newly hired workers. There is, however, a clear indication of a significant decrease in the real wage cyclicality since 1999. Semi-elasticity, in the post-membership period was 1.808 percentage points lower for stayers and 2.468 (1.808+0.660) percentage points lower for newly hired workers.

However, admitting that there is a certain time lag in the transmission of the effect of the change in the monetary system to the labour market, and, in particular to wage bargaining, then the indication of the drop in wage cyclicality is even more expressive. For workers who stay with a firm for two consecutive years the effect associated with the unemployment rate for the period 2002-2007 is virtually nil, whereas for newly hired workers the semi-elasticity of wages to the unemployment rate

(9) These results are consistent with those achieved by Addison, Machado and Portugal (2010) who show that reservation wages diminish with the length of unemployment and with Carneiro and Portugal (2008) who establish a negative relationship between wages and the probability of separation through dismissal.

Table 4

THE FALL IN THE REAL WAGE CYCLICALITY (N = 30 906 573)

Cyclical variable	Worker, firm and job fixed effect			
	Stayers		New-hires	
	Coefficient	Change in coefficient	Coefficient	Change in coefficient
	1986-1998	1999-2007	1986-1998	1999-2007
Unemployment Rate	-2.612 (0.709)	1 808 (1.213)	-0.990 (0.175)	0.66 (0.215)
	1986-2000	2001-2007	1986-2000	2001-2007
Unemployment Rate	-2.460 (0.560)	2.462 (1.213)	-0.955 (0.117)	0.612 (0.165)

Source: *Quadros do Pessoal* (1986-2007).
Note: Robust standard errors in parenthesis.

is minus 0.343 per cent. It is, to a certain extent, hardly reassuring to know that these results do not derive from changes in the composition of workers, firms or professional categories, as these results are obtained by controlling for the composition effects.

With due proviso for the care to be taken over the interpretation of these results, owing to the uncertainty of the timeline associated with the measurement of the economic cycle, claim may naturally be made to the loss of real wage sensitivity as one of the mechanisms responsible, inter alia, for the Portuguese economy's current macroeconomic imbalances (Blanchard, 2007).

On the inadequate architecture of the wage formation system in Portugal

In the debate over the Portuguese economy the essentiality of the link between unemployment and wage behaviour is mysteriously ignored. In the interpretation of these authors, the continued increase in the duration of unemployment, in conjunction with the drop in the sensitivity of real wages to conditions in the Portuguese labour market, reflects mirrors an evolution of bargained wages that are out of sync with feasible wages.[10]

The indication of the decrease in real wage cyclicality may be associated with the inadequacy of mechanisms for determining wages in low inflation regimes. The use of across-the-board procedures to ensure that agreements are extended to cover the whole of the sector tend to exacerbate the already strong nominal wage rigidity.

In turn, the growing generosity of the unemployment benefit system, particularly as regards the potential duration has undoubtedly facilitated the tolerability of unemployment status, in favour of persistently higher and less sensitive reservation wages and therefore higher unemployment.

In the Portuguese economy's current institutional framework, the successive increases in labour costs in the form of increases in minimum wages, impacting particularly on the marginal adjustment fringes of the Portuguese labour market, may lead to an undesirable fall in the arrival rate of job offers and, accordingly, a higher rate of unemployment.

(10) See Blanchard and Portugal (2001).

The current architecture of the wage formation system no longer appears capable of guaranteeing necessary real wage flexibility. In this context, and as in the case of other European countries, consideration of the introduction of decentralised wage bargaining mechanisms allowing firms to opt in or opt out of sectoral wage agreements appears to be an effective route to promote wage flexibility.

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APPENDIX

To understand how the algorithm operates we begin by defining a linear regression model in matrix form including a fixed dimensional effect n,

$$Y = X\beta + D1\alpha + \varepsilon$$

Here X is a matrix with a dimension $M \times k$ containing the observed explanatory variables, $D1$ is a matrix with a dimension $M \times n$ containing the n dummy variables relative to the fixed effect and α and β are the vectors with the model's regression coefficients. Knowledge of the least squares solution for α would enable us to calculate the vector $D1\alpha$ (with the dimension $M \times 1$), adding it as an explanatory variable to a linear regression between Y and X. This strategy would enable the least square estimates of β to be obtained. On the other hand, knowledge of the least squares solution for β, would easily enable us to obtain the least squares estimates for α.

In this case, the least square estimates for α would be the group averages of the elements of the vector $u=Y-X\beta$. This means that the model may be estimated using an algorithm which alternates between the estimation of α and β. A possible strategy for implementing the algorithm would be the following sequence of iterations:

1) Obtain the initial values for β by regressing Y on X;

2) Calculate the residuals u using the last estimate of β;

3) Estimate α calculating the averages per group of elements of u;

4) Estimate β by regressing Y on X and including an additional variable, $D1\alpha$, calculated as the last estimate of α;

5) Return to step 2 and iterate until obtaining convergence;

It should be noted that this algorithm only requires the estimation of regressions with $k+1$ explanatory variables and the calculation of averages per group of regression residuals.

Although it works, this strategy is inefficient because, as we have already discussed, estimates β could be calculated by running of the transformed Y on the transformed and X variables. Let us now consider a situation in which there are two fixed high dimensional effects. The situation can be represented, as set out below,

$$Y=X\beta+D1\alpha+D2\gamma+\varepsilon$$

in which $D2$ is a matrix with a dimension $M \times p$ containing p columns indicating membership to the second group and γ is a vector of parameters.

In this case, the above proposed algorithm may be easily modified to accommodate this new situation. Now, we only need to alternate between the solution of β, α and γ. Accordingly, to estimate β we implement the regression from Y on X, including two additional variables containing the values of α and γ for each observation. At each step, we obtain estimates for α calculating the group averages of the residuals $u=Y-X\beta-D2\gamma$ with the estimates of γ being similarly obtained. This means that we

can obtain the exact least squares solution without the need to invert a high dimensional matrix. The implementation of the algorithm requires the calculation of various regressions with $k+2$ explanatory variables and averages per group of estimation residuals.

If we wish to include a third fixed effect in the regression, we can implement the above described regressions using the within-groups estimator to avoid the direct estimation of third effect coefficients, i.e. the only requirement is that we subtract the average calculated for the groups comprising the third fixed effect from all of the variables entering into the regressions of the above described algorithm.

A noted disadvantage of this method is the slow convergence rate of the cyclical algorithms. However, it is possible to accelerate the algorithm by retaining the estimates of α (or γ) produced in the last iterations and using them to adjust the convergence trajectory of the estimates of the fixed effect coefficients.

The standard error estimates associated with the estimation of β may also be obtained avoiding the inversion of a high dimensional matrix. The standard error estimates can be calculated through the application of the Frisch-Waugh-Lovell regression theorem. The strategy consists of firstly expurgating the three fixed effects (using the above described algorithm) of the Y and each of the X variables and then running regression between the transformed Y and X variables. This regression, in addition to producing the correct estimates for β, also produces the correct estimates of the standard errors (whether or not robust) provided that the degrees of freedom associated with the estimate of the variance of the perturbation term are correct. For more details see Guimarães and Portugal (2010).

CHRONOLOGY OF MAJOR FINANCIAL MEASURES

January to December 2010

2010

January

• 4 January (Circular-Letter No 1/2010/DET, Banco de Portugal, Issue and Treasury Department)	Informs that, within the scope of application of Decree-Law No 195/2007 of 15 May, regarding contracts on the euro banknote recycling activity, the cash-in-transit companies ESEGUR, S.A., PROSEGUR, Lda., LOOMIS, S.A. and GRUPO 8, Lda., shall maintain in 2010 the conditions under which they are authorised to carry on such activity. In 2009, they concluded with success the process of full adjustment to the above legal system.
• 5 January (Decree-Law No 2/2010, Official Gazette No 2, Series I Ministry of Finance and Public Administration)	Approves the reprivatisation process of the whole capital stock of BPN (Banco Português de Negócios), SA.
• 5 January (Decree-Law No 3/2010, Official Gazette No 2, Series I, Ministry of Finance and Public Administration)	Establishes that the collection of any charges for payment services and cash operations in ATMs shall be prohibited.
• 7 January (Instruction No 1/2010, Official Gazette No 16, Series II, Part C, Ministry of Public Administration, Portuguese Treasury and Government Debt Agency)	Approves the conditions of issue of Treasury bills and the market operator status.
• 14 January (Instruction of Banco de Portugal No 01/2010 BNBP 2/2010)	Establishes the procedures to be followed when retaining counterfeit/suspect banknotes and coins. Revokes Instruction No 9/2009, published in the Official Bulletin No 8/2009 of 17 August 2009.
• 15 January (Instruction of Banco de Portugal No 27/2009 BNBP 1/2010)	Determines, without prejudice to other regulations, which Instructions shall be applicable to payment institutions.
• 15 January (Instruction of Banco de Portugal No 28/2009 BNBP 1/2010)	Amends a number of Instructions, so that they may apply to payment institutions, i.e. the new type of payment service providers.
• 15 January (Instruction of Banco de Portugal No 29/2009 BNBP 1/2010)	Determines which accounting data shall be reported to Banco de Portugal by payment institutions which carry out any business other than the provision of payment services.
• 26 January (Notice of Banco de Portugal No 1/2010, Official Gazette No 27, Series II, Part E)	Lays down the information to be released in the statement on the remuneration policy of management and auditing board members of institutions subject to the supervision of Banco de Portugal. This Notice shall enter into force on the day following its publication and shall apply to financial years started on 1 January 2010 or thereafter.

February

- 1 February (Circular Letter No 2/10/DSBDR, Banco de Portugal, Banking Supervision Department)

  Lays down the recommendations applicable to the remuneration policy of management and auditing board members of institutions subject to the supervision of Banco de Portugal as well as of the respective staff earning variable remuneration and carrying on their activities at auditing level or any other level that may have a material impact on the institution's risk profile. This is aimed at bringing compensation mechanisms closer into line with prudent and appropriate risk control and management.

- 4 February (Decision No 5166/2010, Ministry of Finance and Public Administration. Minister's Office, Official Gazette No 57; Series II, Part C)

  Approves the new Chart of Accounts of Banco de Portugal, pursuant to Article 63(1) of the Organic Law of Banco de Portugal (Law No 5/98 of 31 January).

- 22 February (Instruction of Banco de Portugal No 4/2010, BNBP 3/2010)

  Amends Instruction No 10/2007, published in the Official Bulletin No 5/2007 of 15 May 2007, relating to external rating agencies.

March

- 4 March (Instruction of Banco de Portugal No 7/2010, BNBP 3/2010)

  Publishes the maximum rates in credit agreements for consumers within the scope of Decree-Law No 133/2009 of 2 June, applicable in the second quarter of 2010.

- 10 March (Instruction of Banco de Portugal No 8/2010, BNBP 4/2010)

  Determines that credit institutions shall send to Banco de Portugal information on deposit and credit agreements, in line with the attached Table, for the analysis and evaluation of the number of customers' complaints.

- 15 March (Instruction of Banco de Portugal No 5/2010, BNBP 3/2010)

  Amends Instruction No 33/2007, published in the Official Bulletin No 1 of 15 January 2008, which regulates the operation of the TARGET2 national system.

- 15 March (Instruction of Banco de Portugal No 6/2010, BNBP 3/2010)

  Amends Instruction No 24/2009, published in the Official Bulletin No 11 of 16 November 2009, which regulates the granting of intraday credit and the contingency liquidity facility.

- 30 March (Notice of Banco de Portugal No 2/2010, Official Gazette No 74, Series II, Part E)

  Establishes the minimum reporting requirements to be met by credit institutions having their head office or a branch in the national territory, when negotiating or signing housing loans or linked credit agreements or during the life of the agreement. The present Notice enters into force on 1 November 2010, and shall apply to loans to be agreed after that date.

April

- 5 April (Instruction of Banco de Portugal No 9/2010, BNBP 4/2010)

  Introduces changes in Instruction No 1/99 of 15 January 1999, which laid down the general rules governing the Intervention Operations Market. Revokes Circular Letter No 6/2009/DMR of 26 February 2009.

• 6 April (Notice of Banco de Portugal No 3/2010, Official Gazette No 74, Series II, Part E)	Defines the new contribution system for the Mutual Agricultural Credit Guarantee Fund by the Central Agricultural Credit Bank and Mutual Agricultural Credit Banks belonging to the Integrated System of Mutual Agricultural Credit (Portuguese acronym: SICAM), bringing it closer to the system applicable to the institutions participating in the Deposit Guarantee Fund. It sets at 0.10% the base contributory rate in 2010.
• 16 April (Instruction of Banco de Portugal No 10/2010, BNBP 5/2010)	Establishes the reporting requirements to be met by credit institutions *vis-à-vis* their customers when negotiating or signing housing loans or linked credit agreements or during the life of the agreement.
• 22 April (Instruction No 5/2010, Official Gazette No 86 – Series II, Part C, Ministry of Finance and Public Administration. Portuguese Treasury and Government Debt Management Agency)	Approves the conditions for the issue of Treasury Bills (TB) and the market operators' statutes. The present Instruction enters into force on 1 May 2010.
• 22 April (Resolution No 17/2010 of the Presidency of the Council of Ministers, Official Gazette No 111, Series II, Presidency of the Council of Ministers. Council of Ministers)	Appoints, pursuant to Article 27 of the Organic Law of Banco de Portugal, approved by Law No 5/98 of 31 January, Mr. Carlos da Silva Costa as Governor of Banco de Portugal, with effect from 7 June 2010.
• 23 April (Decree No 7/2010, Official Gazette No 79 – Series I, Ministry of Foreign Affairs)	Approves the Economic Cooperation Agreement between the Portuguese Republic and the Democratic Republic of São Tomé and Príncipe with a view to strengthening the macroeconomic and financial stability of São Tomé and Príncipe, signed in São Tomé on 28 July 2009. For that purpose, it creates the Economic Cooperation Agreement Commission (Portuguese acronym: COMACE), within which a Macroeconomic Monitoring Unit is forecast to be created.

May

• 10 May (Executive Order No 260/2010, Official Gazette No 90 – Series I, Ministry of Finance and Public Administration)	Approves, under Article 5(1) of the Regime Excepcional de Regularização Tributária de Elementos Patrimoniais (Extraordinary scheme for the tax adjustment of financial assets), approved by Article 131 of Law No 3-B/2010 of 28 April, the respective model of declaration and filling-in instructions. Banco de Portugal shall be responsible for retaining such documents in the archives for a period of 10 years.
• 17 May (Instruction of Banco de Portugal No 11/2010, BNBP 5/2010)	Revokes Instruction No 49/96, published in the BNBP 1/96 of 17 June, which enabled Mutual Agricultural Credit Banks to open housing savings accounts under certain conditions.
• 17 May (Instruction of Banco de Portugal No 12/2010, BNBP No 5/2010)	Regulates statistical data reporting to Banco de Portugal. Revokes Instruction No 19/2002, published in the Official Bulletin No 8 of 16 August 2002.

• 18 May (Law No 8-A/2010, Official Gazette No 96, Series I, Assembly of the Republic)	Approves a system enabling the Government to lend funds and carry out other lending operations to euro area Member States and to grant personal State guarantees to operations intended to finance these States, within the scope of an initiative to strengthen financial stability.
• 20 May (Resolution No 40/2010 of the Council of Ministers, Official Gazette No 112, Series I, Presidency of the Council of Ministers)	Creates a new public debt instrument denominated Treasury Certificate. Its aim is to promote long-term savings by citizens and to boost the government debt market. This Resolution enters into force on 1 July 2010.
• 26 May (Decree-Law No 52/2010, Official Gazette No 102, Series I, Ministry of Finance and Public Administration)	Approves procedural rules and evaluation criteria for the prudential assessment of acquisitions and increase of holdings in the financial sector, transposing into national legislation Directive No 2007/44/EC of the European Parliament and of the Council of 5 September. The present Decree-Law enters into force on the day following its publication.
• 28 May (Information No 7, OJ C 138, Luxembourg)	Extract from the decision on the opening of winding-up proceedings concerning the Banco Privado Português, S.A. under Article 9 of Directive 2001/24/EC of the European Parliament and of the Council on the reorganisation and winding up of credit institutions. Publication provided for in Article 13 of that Directive and in Article 21 of Decree-Law No 199/2006 of 25 October. Withdrawal of authorisation of Banco Privado Português, S.A., is effective as of 12 p.m. on 16 April 2010.

June

• 09 June (Instruction of Banco de Portugal No 14/2010, BNBP 7/2010)	Amends Clause 3 (3) of the Standard Contract regarding participation in the BPnet system, annexed to Instruction No 30/2002, published in the Official Bulletin No 10 of 15 October 2002.
• 9 June (Circular Letter No 13/10/DSBDR, Banco de Portugal, Banking Supervision Department)	Provides clarification on Instruction No 13/2009, due to doubts and errors detected in the filling-in of the annexed forms. It also informs that the service "Data collection/Prudential reporting in the BPnet System Supervision Area" is available, which is a new information collection application envisaged in the above Instruction.
• 11 June (Council Resolution No 40/2010, Official Gazette No 112 Series I, Presidency of the Council of Ministers)	Creates a new public debt instrument, the so-called Treasury Certificates.
• 11 June (Circular Letter No 13/2010/DET, Banco de Portugal, Issue and Treasury Department)	Informs on the implementation of procedures between Banco de Portugal and credit institutions within the scope of the *Regime Excepcional de Regularização Tributária* (extraordinary scheme for tax adjustment), approved by Article 131 of Law No 3-B/2010 of 28 April, and governed by Executive Order No 260/2010 of 10 May. It includes in annex a list of operational procedures to be adopted upon reception of the tax adjustment declaration and the corresponding payment.
• 15 June (Instruction of Banco de Portugal No 13/2010, BNBP 6/2010)	Amends Annex V (Pricing and penalties) of Instruction No 3/2009, published in the Official Bulletin No 2/2009 of 16 February 2009, which regulates the Interbank Clearing System (Portuguese acronym: SICOI).

- 16 June (Circular Letter No 17/2010/DET, Banco de Portugal, Issue and Treasury Department)

  Releases a new version of the "recycling of euro banknotes and coins" form (annexed to Instruction No 14/2009 of 15 October), to be adopted by 1 October 2010.

- 16 June (Circular Letter No 18/2010/DET, Banco de Portugal, Issue and Treasury Department)

  Requests that credit institutions and professional cash handlers intending to access information on euro banknotes and coins and their counterfeits give identifying details on potential users. This will serve to accredit them with the Banco de Portugal National Counterfeit Centre for access to data on counterfeiting.

- 18 June (Decree-Law No 71/2010, Official Gazette No 117, Series I, Ministry of Finance and Public Administration)

  Lays down the legal regimes governing undertakings for collective investment in transferable securities under a corporate form and real estate funds under a corporate form. Hence, this Decree-Law allows for the establishment of collective investment undertakings (UCITS) and real estate funds (REF) under a corporate form, naming them *sociedades de investimento mobiliário* and *sociedades de investimento imobiliário* respectively.

- 22 June (Instruction of Banco de Portugal No 15/2010, BNBP 7/2010)

  Releases for the third quarter of 2010 the maximum rates to be applied to consumer credit agreements, signed within the scope of Decree-Law No 133/2009 of 2 June.

- 30 June (Circular Letter No 16/10/DSBDR, Banco de Portugal, Banking Supervision Department)

  Underlines the importance for institutions intending to adopt the Advanced Measurement Approach (AMA) to adequately comply with the guidelines of the Committee of European Banking Supervisors (CEBS) included in the guidance paper on operational risk mitigation techniques, released by Banco de Portugal.

- 30 June (Circular Letter No 17/10/DSBDR, Banco de Portugal, Banking Supervision Department)

  Provides clarification on the prudential treatment of the repurchase of eligible instruments for the calculation of own funds.

July

- 15 July (Instruction of Banco de Portugal No 16/2010, BNBP No 8/2010)

  Amends Instruction No 10/2007, published in the Official Bulletin No 5/2007 of 15 May 2007, on External Credit Assessment Institutions.

August

- 11 August (Circular Letter No 22/10/DSBDR, Banco de Portugal, Banking Supervision Department)

  Pursuant to paragraph 6 of Instruction No 17/2010, sends the technical specifications to be followed when notifying Banco de Portugal of transfers to offshore jurisdictions.

- 16 August (Instruction of Banco de Portugal No 17/2010, BNBP No 8/2010)

  Requires that the items of information listed in Article 118 (3) and (4) of the Legal Framework of Credit Institutions and Financial Companies be sent trough the BPnet electronic communication system.

• 16 de August (Resolution of the Council of Ministers No 57-B/2010, Official Gazette No 158, 2nd Supplement, Series I, Presidency of the Council of Ministers)	More than one year after the nationalisation of Banco Português de Negócios, S. A. (BPN), and given that there is no reason for BPN to be maintained in the public sector, Decree-Law No 2/2010 of 5 January, implementing the legal system laid down in Law No 11/90 of 5 April, approves the reprivatisation of BPN. This implies the sale of all shares representative of its capital stock, through both open tender and offer for sale exclusively to employees within the BPN group.

September

• 2 September (Law No 36/2010, Official Gazette No 171, Series I, Parliament)	Creates in Banco de Portugal a database on the bank accounts existing in the banking system, which includes the identification of accounts and respective holders and the persons authorised to operate them, including those empowered with written mandates. This law shall enter into force 180 days following its publication.
• 15 September (Instruction of Banco de Portugal No 18/2010, BNBP No 8/2010)	Amends Instruction No 21/2008, published in the Official Bulletin No 1/2009 of 15 January, which introduced changes in the Regulation Governing the Central Credit Register.
• 15 September (Instruction of Banco de Portugal No 19/2010, BNBP 10/2010)	Publishes the maximum rates applicable to consumer credit agreements concluded under Decree-Law No 133/2009 of 2 June, to prevail in the fourth quarter of 2010.
• 22 September (Instruction of Banco de Portugal No 20/2010, BNBP 10/2010)	Sets at 0.1% the base contributory rate applicable to the calculation of the contribution of each member institution to the Mutual Agricultural Credit Guarantee Fund in 2011.
• 22 September (Executive Order No 946/2010, Official Gazette No 185, Series I, Ministry of Finance and Public Administration)	Amends Executive Order No 1219-A/2008 of 23 October, which regulated the extraordinary granting of guarantees by the State, pursuant to Law No 60-A/2008 of 20 October, with a view to adopting European Commission recommendations. This Executive Order shall enter into force one day following its publication.

October

• 6 October (Instruction of Banco de Portugal No 22/2010, BNBP 10/2010)	Sets at 0.03% the base contributory rate applicable to the calculation of the contribution of each member institution to the Deposit Guarantee Fund in 2011.
• 6 October (Instruction of Banco de Portugal No 23/2010, BNBP 10/2010)	Sets at 10% the limit for the irrevocable payment commitment applicable to annual contributions in 2011.
• 14 October (Instruction of Banco de Portugal No 24/2010, BNBP 11/2010)	Credit institutions are requested to send to Banco de Portugal a copy of standard consumer credit agreements concluded under Decree-Law No 51/2007 of 7 March and Decree-Law No 133/2009 of 2 June.
• 14 October (Circular Letter No 33/10/DSBDR, Banco de Portugal. Banking Supervision Department)	Explains that valuation reports on property pledged as collateral for home loans are essential in order to comply with best practices in transparency and provision of information to bank customers.

- 15 October (Instruction of Banco de Portugal No 21/2010, BNBP 10/2010)

  Amends Instruction No 3/2009, published in the Official Bulletin No 2/2009 of 16 February 2009, which regulated the Interbank Clearing System (SICOI).

- 16 October (Notice of Banco de Portugal No 5/2010, Official Gazette No 234, Series II, Part E)

  Lays down the information requirements that must be complied with in the communication of projects to acquire and increase a qualifying holding in a credit institution, financial corporation or investment firm subject to the supervision of Banco de Portugal. This Notice shall enter into force on the day following its publication.

- 18 October (Notice of Banco de Portugal No 4/2010, Official Gazette No 125, Series II, Part E)

  Determines that Banco de Portugal may set in an Instruction a minimum annual contribution to be paid by credit institutions that are members of the Deposit Guarantee Fund, regardless of the volume of deposits covered by the guarantee.

- 26 October (Circular Letter of Banco de Portugal No 20/2010/DET, Issue and Treasury Department)

  Lays downs the conditions for the exchange of Estonian kroon banknotes into euro banknotes and coins, in the light of the Eurosystem national central banks' responsibilities pursuant to the Guideline of the European Central Bank (ECB/2006/10) of 24 July 2006 on the exchange of banknotes after the irrevocable fixing of exchange rates in connection with the introduction of the euro, concerning the introduction of the euro in Estonia on 1 January 2011

November

- 15 November (Instruction of Banco de Portugal No 25/2010, BNBP No 11/2010)

  Amends Instruction of Banco de Portugal No 33/2007, published in the Official Bulletin No 1 of 15 January 2008, which regulates the operation of the TARGET2 national system.

- 15 November Instruction of Banco de Portugal No 26/2010, BNBP No 11/2010

  Amends Instruction of Banco de Portugal No 24/2009, published in the Official Bulletin No 11 of 16 November 2009, which regulates the granting of intraday credit and the contingency liquidity facility.

- 17 November (Circular Letter of Banco de Portugal No 75/2010/DSB, Banking Supervision Department)

  Releases the Recommendations on business continuity management in the financial sector, approved by the National Council of Financial Supervisors on 9 September 2010. These recommendations were jointly drafted by Banco de Portugal, the Instituto de Seguros de Portugal (Insurance and Pension Funds Supervisory Authority) and the Portuguese Securities Market Commission, within the framework of the Better Regulation Initiative, and substantiate a number of general good practices, which, according to the National Council of Financial Supervisors must be implemented and reinforced by financial institutions.

- 19 November (Instruction of Banco de Portugal No 27/2010, BNBP No 12/2010)

  Amends Instruction of Banco de Portugal No 1/99, of 15 January 1999, which regulated the Intervention Operations Market. Changes set out in paragraphs 1 to 24 (Chapters I, II, III, IV and V) shall enter into force on 19 November 2010, while the remaining changes shall enter into force on 1 January 2011.

- 7 December (Communication from the Commission 2010/C 329/07, Official Journal of the European Union No 329, Series C) (Luxembourg)

December

Communication from the Commission on the application, from 1 January 2011, of State aid rules to support measures in favour of banks in the context of the financial crisis. It lays down the continued applicability of Article 107(3)(b) of the Treaty on the Functioning of the European Union and the extension of the Restructuring Communication (2009/C 195/04) until 31 December 2011.