ECONOMIC Bulletin



Winter 2011



ECONOMIC BULLETIN

WINTER | 2011

Volume 17, Number 4



Banco de Portugal

Lisboa, 2011

Available at www.bportugal.pt Publications

BANCO DE PORTUGAL

Av. Almirante Reis, 71 1150-012 Lisboa www.bportugal.pt

Edition

Economics and Research Department

Design, printing and distribution

Administrative Services Department Documentation, Editing and Museum Division Editing and Publishing Unit

Lisbon, 2011

Number of copies

100 ISSN 0872-9786 (print) ISSN 2182-035X (online) Legal Deposit no 241773/06

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ECONOMIC AND POLICY DEVELOPMENTS

OUTLOOK FOR THE PORTUGUESE ECONOMY: 2011-2013

OUTLOOK FOR THE PORTUGUESE ECONOMY: 2011-2013

1. Introduction

The projections published in this article point to a contraction of the Portuguese economy in 2011 and 2012, followed by a virtual stagnation in 2013. This contraction of economic activity, which is unprecedented in the Portuguese economy, reflects a significant decrease in domestic demand, both public and private, within a framework of adjustment of basic macroeconomic imbalances. The sharp contraction in domestic demand is accompanied by significant growth in exports, which however is not enough to offset the impact of the adjustment of the demand levels by the resident agents within a framework of private sector deleveraging and fiscal consolidation.

In the context of the sovereign debt crisis in the euro area, in 2011 the Portuguese economy intensified the unavoidable adjustment process of the macroeconomic imbalances accumulated over the past years. These imbalances originated persistently high external borrowing requirements and therefore an unsustainable path for the international investment position. Amid severe tensions in international financial markets, these imbalances are a source of vulnerability for the Portuguese economy, which contributed to the loss of access of the public sector - and, consequently, of the banking sector - to market financing in regular conditions. As a result, the Portuguese government requested financial assistance from the International Monetary Fund and the European Union. This request led to the formalization of an Economic and Financial Assistance Programme (EFAP), in which the Portuguese government pledged to adopt adjustment measures to address macroeconomic imbalances and structural reforms. These measures aim to ensure the necessary conditions to increase potential growth of the Portuguese economy and foster a sustainable growth pattern, in the context of the new international financial markets operating framework, though exerting an inevitable contractionary effect over the short term. Thus the projections presented in this article for the 2011-2013 period point to an unprecedented contraction in economic

Table 1.1

| PROJECTIONS OF BANCO DE PORTUGAL: 2011-2013 ANNUAL RATE OF CHANGE, PER CENT | | | | | | | | |
|---|---------|---------------------|---------------------|---------------------|---------------------|---------------------|--|--|
| | Weights | EB Winter 2011 | | | EB Autumn 2011 | | | |
| | 2010 | 2011 ^(p) | 2012 ^(p) | 2013 ^(p) | 2011 ^(p) | 2012 ^(p) | | |
| Gross Domestic Product | 100.0 | -1.6 | -3.1 | 0.3 | -1.9 | -2.2 | | |
| Private Consumption | 66.0 | -3.6 | -6.0 | -1.8 | -3.8 | -3.6 | | |
| Public Consumption | 21.6 | -3.2 | -2.9 | -1.4 | -3.3 | -4.1 | | |
| Gross Fixed Capital Formation | 19.8 | -11.2 | -12.8 | -1.8 | -11.4 | -10.8 | | |
| Domestic Demand | 107.2 | -5.2 | -6.5 | -1.5 | -5.2 | -4.8 | | |
| Exports | 31.0 | 7.3 | 4.1 | 5.8 | 6.7 | 4.8 | | |
| Imports | 38.2 | -4.3 | -6.3 | 0.7 | -4.1 | -2.8 | | |
| Contribution to GDP growth (in p.p.) | | | | | | | | |
| Net Exports | | 4.1 | 3.9 | 1.9 | 3.8 | 2.7 | | |
| Domestic Demand | | -5.6 | -6.7 | -1.5 | -5.6 | -5.0 | | |
| of which: Change in Inventories | | -0.3 | 0.1 | 0.2 | -0.2 | 0.2 | | |
| Current plus Capital Account (% of GDP) | | -6.8 | -1.6 | 0.8 | -6.9 | -3.1 | | |
| Trade Balance (% of GDP) | | -3.7 | 0.3 | 2.4 | -4.2 | -1.0 | | |
| Harmonised Index of Consumer Prices | | 3.6 | 3.2 | 1.0 | 3.5 | 2.4 | | |

Source: Banco de Portugal.

Note: (p) – projected. For each aggregate, this table shows the projection corresponding to the most likely value, conditional on the set of assumptions considered and based on information available up to mid-December 2011.

activity and in domestic demand, accompanied by a substantial reduction in the external imbalances of the Portuguese economy (Table 1).

Given the level of external indebtedness, the decline in domestic demand needed to ensure the external solvency conditions of the Portuguese economy is of an unprecedented magnitude. Its impact on economic activity will depend largely on the external environment of the Portuguese economy. One must mention that underlying the current projection is a slowdown in global economic growth in 2012, especially in the euro area, amid escalating international financial tensions, stemming, to a large extent, from the recent intensification of the sovereign debt crisis in the euro area and the need for budgetary consolidation in several advanced economies.

On the domestic side, the current projection is strongly conditioned by the adoption of budgetary consolidation measures in the 2012 State Budget (SB2012). The budgetary targets for 2011 were only achieved by resorting to significant self-reversing measures. In particular, the partial transfer of banking sector pension funds to the Social Security stands out, which implies an increase in future State expenditure on pensions. Furthermore, the continuation of the deleveraging process of the banking sector and the reduction of the levels of indebtedness of the private sector, which is an integral part of the economic adjustment process, limit the ability of smoothing private expenditure decisions.

The composition of the aggregate expenditure in the economy will change significantly over the projection horizon. Domestic constraints imply a decline in private domestic demand, as a result of an unprecedented contraction in private consumption, especially durable goods consumption, following a protracted period of growth above Gross Domestic Product (GDP), and in private investment (both business and residential). The volume of public consumption is projected to decline cumulatively by around 7.5 per cent in the 2011-2013 period, in sharp contrast with the persistent increase observed in the past. Public sector investment spending is assumed to continue to decrease during this period. In contrast, exports are expected to continue to grow at a pace similar to that of external demand for Portuguese goods and services and are the only aggregate demand component with positive rates of growth over the projection horizon. This change in the composition of aggregate expenditure is expected to lead to a virtually balanced current and capital account in 2013. This feature is essential to ensure external debt solvency conditions, one of the requirements necessary for the return of the international investment position to a sustainable path. However, these projections are surrounded by great uncertainty, associated namely with future developments in global financial tensions, and in particular with the institutional response to the sovereign debt crisis in the euro area.

Inflation as measured by the Harmonised Index of Consumer Prices (HICP) is expected to remain at a high level in 2012, before declining to 1 per cent in 2013. The evolution in the main determinants of consumer prices would imply more moderate developments in the inflation rate in 2012. However, this projection is strongly affected by the fiscal policy measures (which determine a very significant contribution to inflation in the current year), in particular the reclassification of some goods and services previously subject to reduced VAT rates to the standard VAT rate and the increase in administered prices and some specific taxes on consumption. The contraction in economic activity in Portugal and the global economic slowdown will originate broadly favourable developments in production costs which, combined with the fading-out of the fiscal measures effects, justify a decline in inflation in 2013. The current projection includes a very moderate increase in non-energy import prices, a virtual stabilisation of commodity prices and strong wage moderation, in a context where unemployment is expected to remain at historically high levels.

The projections herein presented, indicate that the contraction in economic activity in 2011 was less pronounced than anticipated in the Autumn Economic Bulletin. This revision reflects an evolution of economic activity in the second half of 2011less unfavourable than anticipated, especially stronger export growth. Economic activity is expected to contract more severely in 2012, stemming from the revaluation of the decline in domestic demand and the budgetary consolidation measures included in the SB2012. These measures, which go beyond those detailed in the EFAP, are intended to compensate a structural

fiscal consolidation below that targeted for 2011. Moreover, the downward revision of global economic growth implied a non-negligible revision of external demand with an impact on export developments. The projection for inflation for 2011 remains virtually unchanged vis-à-vis the previous Economic Bulletin, while for 2012 the projection has been revised significantly upwards, reflecting the adoption of fiscal measures, especially the increase in indirect taxation and administered prices.

2. Conjunctural data and assumptions

The current projections incorporate a broad set of information on recent developments in the Portuguese economy in 2011, in particular on the Quarterly National Accounts of Instituto Nacional de Estatística – INE (Statistics Portugal) for the third quarter of 2011 and on conjunctural economic indicators available for the fourth quarter.

Over the projection horizon, the international framework includes a significant slowdown in global economic activity in 2012, amid renewed tensions in international financial markets, stemming, to a large extent, from the intensification of the sovereign debt crisis in the euro area. This implies a sharp slowdown in external demand for Portuguese goods and services in 2012, which is expected to recover significantly in 2013. Furthermore, in line with available market data, oil prices in USD and money market interest rates are projected to decline slightly.

Projections for public finance variables include for 2012 and 2013 the information from the SB2012, as well as the measures detailed in the EFAP. Financing conditions in the Portuguese economy are expected to remain tight over the projection horizon, marked by the gradual and orderly deleveraging process of the banking sector and the reduction in the indebtedness levels of households and corporations.

Economic contraction throughout 2011, reflecting a decline in domestic demand only partially offset by the significant growth in exports

The available information on recent developments in the Portuguese economy indicates that economic activity has contracted of 1.6 per cent in 2011 (Table 1). According to the Quarterly National Accounts of INE, GDP posted a cumulative decline of 1.1 per cent in year on year terms in the first three quarters of 2011. This development reflects a broadly based decline in the domestic demand components, contrasting with the significant growth in exports (around 8 per cent). Over the same period, private consumption fell 3 per cent, while gross fixed capital formation (GFCF) contracted around 10 per cent compared with the same period in 2010. One must highlight the sharp fall in public consumption, after consecutive years of marked increase. Notwithstanding the increase in exports, the decline in domestic demand led to a fall in aggregate demand, triggering a significant reduction in imports of goods and services, in particular due to the high import content of the demand components which posted the most severe falls.

As for the fourth quarter of 2011, the available information indicates that the contraction in economic activity has intensified and is broadly based across all domestic demand components. Exports are expected to register some slowdown, in line with developments in external demand, though presenting important growth dynamics. As for domestic demand, private consumption and residential investment are anticipated to undergo a strong contraction, owing to the effects of the budgetary consolidation measures on household income prospects. However, this estimate for the fourth quarter is still surrounded by great uncertainty due to the adoption of unprecedented fiscal consolidation measures and the difficulty of assessing with precision the extent to which the projected deceleration for external demand will pass through to exports.

Significant slowdown in external demand in 2012 and a limited decline in short-term interest rates over the projection horizon

The prospects for external demand over the projection horizon rely on the projections for the euro area published in the December 2011 issue of the Monthly Bulletin of the European Central Bank (ECB) and include a significant slowdown in external demand for Portuguese goods and services in 2012 (from 4.7 per cent in 2011 to 3.2 per cent in 2012), followed by an increase of 5.7 per cent in 2013 (Table 2). The slowdown in global demand in 2012 arises from the intensification of the international financial tensions associated, inter alia, with the sovereign debt crisis in the euro area, and from the consequent need to adjust fiscal imbalances in a larger number of euro area countries. Compared with the autumn 2011 issue of the Economic Bulletin, the current assumptions show a significant downward revision of external demand growth for 2012.

Assumptions for short-term interest rates, oil prices and commodity prices underlying these projections are based on financial market data available up to mid-December 2011 (Table 2.1).

The assumptions underlying the current projection for the exchange rate, which considers an unchanged level throughout the projection horizon at the average value observed during the two weeks prior to the cut-off date, imply a slight depreciation of the euro both in effective terms and against the US dollar in 2012. In comparison with the previous Economic Bulletin, this new exchange rate assumption implies a larger depreciation of the euro over the projection horizon.

In line with the available futures market data, oil prices are expected to fall over the projection horizon posting average annual values of USD 107 and USD 102 per barrel, in 2012 and 2013 respectively (around €80 and €77), reflecting, inter alia, global economic slowdown and its impact on demand for commodities. Compared with previous projections, these assumptions imply a virtually nil revision of oil prices in euros in 2011 and a slight upward revision in 2012.

| PROJECTION ASSUMPTIONS | | | | | | | | |
|------------------------------|-----|----------------|-------|-------|----------------|-------|--|--|
| | | EB Winter 2011 | | | EB Autumn 2011 | | | |
| | | 2011 | 2012 | 2013 | 2011 | 2012 | | |
| External demand | уоу | 4.7 | 3.2 | 5.7 | 5.4 | 4.8 | | |
| Interest rate | | | | | | | | |
| Short-term (3-month EURIBOR) | % | 1.4 | 1.1 | 1.1 | 1.4 | 1.2 | | |
| Long-term ^(a) | % | 4.9 | 3.3 | 3.7 | 4.9 | 3.3 | | |
| EUR exchange rate | | | | | | | | |
| EUR effective exchange rate | уоу | -0.1 | -1.2 | 0.0 | 0.0 | -0.7 | | |
| EUR-USD | aav | 1.39 | 1.33 | 1.33 | 1.40 | 1.39 | | |
| Oil price | | | | | | | | |
| in USD | aav | 111.1 | 106.7 | 102.4 | 111.7 | 108.6 | | |
| in EUR | aav | 79.7 | 80.2 | 77.0 | 79.5 | 78.0 | | |

Table 2.1

Sources: ECB, Bloomberg, Thomson Reuters and Banco de Portugal calculations.

Notes: yoy – year-on-year rate of change, % - per cent, aav - annual average value. An increase in the exchange rate represents na appreciation. (a) The assumption for the long-term interest rate in 2011Q1 corresponds to market interest rates. Over the projection horizon, these assumptions are an estimate of the interest rate for the public debt of the EFAP.

Financing conditions for the Portuguese economy are expected to remain tight over the projection horizon

The deleveraging process of the banking sector will continue over the projection horizon, implying the maintenance of tight credit conditions, in line with developments over the past months. The impact of this process on the financing conditions of the economy will naturally depend on the strategies that the banking sector will adopt within the framework of capital increases. Having this in mind, banks have therefore focused on selling non-strategic assets and raising stable financing sources, such as customer deposits, which will diminish the impact on the financing of the economy.¹ Banco de Portugal is permanently monitoring the orderly and gradual deleveraging process of the financial system, so as to avoid jeopardising the financing of the Portuguese economy, in the context of the adjustment pursued. More recently, bank interest rate spreads have widened vis-à-vis money market reference interest rates, which are assumed to last over the projection horizon, maintaining levels clearly above those attained prior to the financial crisis. In fact, the recent decline in interbank money market interest rates has not passed on to lending rates, in a context where Portuguese banks have resorted to active policies to attract deposits in order to circumvent financing constraints in their access to wholesale market funding.

The assumption underlying the current projection for the short-term interest rate is based on expectations regarding developments in the three-month EURIBOR implied in futures contracts and points to a descending profile for the short-term interest rates in the interbank money market throughout 2012 and a gradual and limited increase as from the fourth quarter of 2012 up to the end of the projection horizon. These assumptions imply that these interest rates will remain, on average, at levels clearly below those seen immediately before the outbreak of the international economic and financial crisis. The current assumptions for the short-term interest rate are similar to those published in the autumn 2011 issue of the Economic Bulletin.

In order to establish the assumptions for long-term interest rates, which in the current projection is essentially relevant for Portuguese long-term public debt, an estimate for the average rate of cost of external financing from the EU, the euro area countries and the IMF under the EFAP was considered as from the second quarter of 2011. This estimate takes into account the revision of the financing conditions on the European component in the EFAP and involves a slight increase in long-term interest rates for 2013.

The ongoing fiscal consolidation process will negatively impact economic growth in the Portuguese economy over the projection horizon, but should create conditions for sustainable growth in the long run

For public finance variables, and according to the rule used in the Eurosystem projection exercises, only the budgetary policy measures legally approved or likely to be approved and specified with sufficient detail, were taken into account. Therefore, the measures detailed in the EAFP and the additional measures thereafter approved, namely those in the context of the SB2012, were included in this projection.

Among the measures on the revenue side with an impact in 2012, one must highlight the reclassification of set of goods and services that were previously subject to reduced and intermediate VAT rates to the standard VAT rate, as well as the lagged impact of the increase in VAT rates on electricity and gas as of 1 October 2011, coupled with the introduction of tolls in former SCUT (motorways free of tolls) and the increase in fees charged in the healthcare sector. The SB2012 also includes an increase in direct taxes on households and corporations, specifically through the reduction or elimination of tax benefits and an increase in taxes on corporate earnings.

¹ For details, see "Box 1.2 Structural adjustment of the credit to deposits ratio in the funding and capital plans of the eight major Portuguese banking groups", Banco de Portugal, Financial Stability Report, November 2011.

Among the measures on the expenditure side stand out the differentiated and progressive suspension of the Christmas and holiday subsidy payments to civil servants, the wage scale freeze, together with the maintenance of the wage cut applied in 2011, and the reduction in the number of government employees over the projection horizon. As for social spending, the SB2012 includes the suspension of the Christmas and holiday subsidy payments for pensioners under the same terms applied to government employees, the suspension of automatic pension update rules and cuts in public spending on healthcare and changes in unemployment benefit rules. Finally, the reduction in capital expenditure, in particular by reviewing the investment plans of State-Owned Enterprises (SOEs) reclassified in the General Government sector.

These measures imply a contraction in public consumption and investment in 2013, more pronounced especially in 2012. In what concerns public consumption, with the exception of a reduction in the number of government employees, the measures approved have a stronger impact on the deflator than on volume, whereas a significant decrease is anticipated in the volume of public investment. The rise in direct taxes and the partial or total suspension of the Christmas and holiday subsidy payments to government employees, employees of SOEs and pensioners will lead to an unprecedented reduction in households' real disposable income.

3. Supply, demand and external accounts

The current projections point to a continuation of the recession that characterised the Portuguese economy throughout 2011, in the context of the adjustments of the macroeconomic imbalances that have marked the Portuguese economy over the past decade. GDP is projected to drop by 3.1 per cent in 2012 and to grow by only 0.3 per cent in 2013 (following a 1.6 per cent contraction in 2011), accompanied by a significant contraction in domestic demand up to the end of the projection horizon. These developments in economic activity in Portugal will lead to a departure of output per capita from the euro area average (Chart 3.1). The continued fall in both public and private domestic demand up to the end of the projection horizon and export growth will lead to a decline in the share of domestic demand in GDP (Chart 3.2). This pattern of spending will likely contribute to reduce considerably the chronic external deficit that characterised the Portuguese economy over the last decade.



Sources: Eurostat, ECB and Banco de Portugal.

Notes: (p) - projected. For the euro area from 2011 to 2013, the midpoints of the projection ranges published in the December 2011 issue of the ECB Monthly Bulletin are taken into account.

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

Contraction in economic activity with a special focus on the non-tradable goods and services sector

The contraction in economic activity projected for the whole economy in 2012 will likely be broadly based across the private and public sectors. In 2013 activity in the public sector should continue to shrink, determined by the fiscal consolidation process, whereas activity in the private sector is expected to increase over the year, albeit moderately. However, it should be noted that the sector of tradable goods and services – manufacturing and export-oriented services – will likely benefit from greater external demand for Portuguese goods and services in 2013, which will tend to offset, though partially, the contraction in domestic demand. Developments in the construction and non-tradable services sectors will be conditioned by the significant contraction in domestic demand over the projection horizon.

For the labour market, the current projections envisage a reduction in employment of 1.8 and 0.6 per cent in 2012 and 2013 respectively (vs 1.0 per cent decrease in 2011), reflecting contemporaneous and lagged effects of the evolution of economic activity. In 2012 the size of the contraction in employment will be relatively similar in both sectors – public and private – whereas in 2013 it will more pronounced in the public sector. Accordingly, the contribution of labour to GDP developments should remain negative throughout the projection horizon, more significantly so in 2012 (Chart 3.3). The contribution of capital stock to GDP growth is also estimated to be negative, of around 0.2 p.p. in both years, driven by the marked fall in investment. Finally, the contribution of total factor productivity to GDP growth is projected to move from -1.8 p.p. in 2012 to +1.9 p.p. in 2013. Such developments in total factor productivity suggest a lower intensive utilization of factors in 2012, followed by an increase in 2013, amid a continued fall in employment, in average annual terms, over the projection horizon.

Quantifying potential output growth is subject to a greater-than-usual uncertainty. In fact, an effective implementation of the structural measures included in the EFAP should imply a change in the long-term equilibrium of the Portuguese economy. In the current projections, most of the methods considered point to a virtual stagnation of potential GDP in 2012 and to marginally positive growth in 2013 (Chart 3.4).²



Chart 3.4



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

Chart 3.3

Sources: INE and Banco de Portugal.

Notes: (p) - projeted. UCM stands for unobserved component methodology. CD stands for the methodology based on a Cobb-Douglas.

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

Sharp drop in private consumption and gross fixed capital formation over the projection horizon, particularly intense in 2012, accompanied by a dynamic growth in exports

The current projections envisage a decrease in private consumption of 6.0 per cent in 2012 and 1.8 per cent in 2013 (3.6 per cent drop in 2011) (Chart 3.5), accounting for a cumulative decline of 11.0 per cent in the 2011-2013 period. This reduction is determined by a similar fall in households' real disposable income, against a background of tight financing conditions which should hinder consumption smoothing and will involve some restructuring of households' balance sheets. Thus, private consumption, which had grown at a similar pace to that recorded in the euro area over the 1999-2006 period and at a faster pace in 2007-2010, is expected to decrease markedly over the projection horizon, in contrast to the anticipated increase in the euro area (Chart 3.6).

The evolution of real disposable income will be mainly affected by the fiscal consolidation measures as well as by the lower employment and wage moderation over the projection horizon. In the context of maintenance of particularly adverse labour market conditions, in particular the sharp increase in unemployment, real wage compensation is expected to drop in the private sector over the projection horizon, more significantly so in 2012. The sharp reduction in disposable income must make the intertemporal budget constraints more active for a larger fraction of households and, thereby increasing the proportion of households facing liquidity constraints.

These projections anticipate a significant downward revision in households' permanent income, contributing to the significant decline in private consumption. In this context, a gradual rise in the average households' savings rate is expected in the 2012-2013 period, not only due to the forced savings associated with the redemption of loans, particularly mortgage credit, but also due to precautionary motives. In fact, the situation in the labour market will likely increase the uncertainty surrounding future developments in households' income and wealth, bearing an additional drag on the evolution of private consumption.

The durable goods consumption component is likely to drop much more severely during this downturn in economic activity, with a sharp pro-cyclical feature that will be more pronounced due to tighter consumer credit conditions. The cumulated reduction in consumption of durable goods over the 2011-2013 period is projected to exceed 40 per cent. Consumption of non-durable goods is also expected to post





Sources: INE and Banco de Portugal.

Notes: (p) - projected. The savings rate is reprented as a percentage of disposable income.

Sources: European Commission, ECB, INE and Banco de Portugal.

Note: (p) - projected.

an unprecedented contraction, reflecting the impact of the activation of solvency conditions stemming from the households' budget restrictions on expenditure smoothing capacity, against a background of reduction in permanent income.

Government consumption is also expected to contract over the projection horizon, in line with the assumptions for public finances, albeit with a less expressive adjustment than that expected for house-hold consumption.

Following a sharp contraction in 2011, of around 11.0 per cent, the current projections include a similar decline GFCF in 2012, and a 1.8 per cent drop in 2013. Although this pattern is broadly based across all institutional sectors, developments in business GFCF are expected to be relatively more favourable as of early 2013, sustained by continued buoyant exports (Chart 3.7).

The evolution of business GFCF is expected to be conditioned by the prospects of a sharp contraction in domestic demand, in a context of the slowdown and growing uncertainty surrounding developments in external demand, as well as the current environment of tight financing conditions and the need to reduce corporate indebtedness. Accordingly, current projections envisage a sharp fall in corporate GFCF in 2012, followed by a limited recovery in 2013.

Residential investment will continue along the downward trend observed over the past decade. The projected contraction is determined by the decline in both households' real disposable income and permanent income, against a background of progressive deteriorating labour market conditions. This trend is further reinforced by the maintenance of tight financing conditions over the projection horizon. As for public investment the current fiscal consolidation framework points to a significant drop in this GFCF component over the projection horizon, in line with the assumptions presented in section 2.

Exports of goods and services are expected to be the only aggregate demand component with positive growth over the projection horizon. More specifically, a marked slowdown is expected in 2012 (from 7.3 per cent in 2011 to 4.1 per cent in 2012) followed by an acceleration to 5.8 per cent in 2013. The projected evolution for exports follows closely external demand growth (Chart 3.8). In terms of components, a relatively similar pattern of growth is expected for both goods and services. Following the significant losses in market shares over the 1999-2005 period, particularly in the wake of the implementation of the last phase of the multifibre arrangement in 2004-2005, the Portuguese economy has been gradually increasing its market share since 2006. Thus it seems prudent to retain the assumption of virtually

Gráfico 3.7

GFCF, BY INSTITUTIONAL SECTORS | INDEX: 2001=100



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

unchanged market shares in 2012-2013, especially since the projection foresees virtually unchanged unit labour costs. Finally, the growth profile of exports of goods and services has followed a pretty similar path to that of the euro area average (Chart 3.9).

Imports of goods and services are expected to decrease significantly in 2012, following the estimated drop in 2011, and to grow marginally in 2013. This profile in imports is largely determined by the contraction in domestic demand and, especially, in import-intensive components. Moreover, this reflects a somewhat lower import penetration over the projection horizon, particularly in 2013.



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

Sources: European Commission (AMECO). Note: (p) - projected.

Impressive reduction in external financing requirements over the projection horizon, reflecting the marked decline in the trade account deficit

The external financing requirements of the Portuguese economy, as measured by the combined current and capital account balance as a percentage of GDP, are expected to recede over the forecast horizon from a deficit of 6.8 per cent of GDP in 2011 to 1.6 per cent in 2012 and to a slight positive surplus (0.8 per cent) in 2013 (Chart 3.10). This ongoing process of the reduction of the external imbalances of the Portuguese economy will take place against the background of a significant fall in domestic demand, – mirroring the gradual and orderly deleveraging of the private sector and the progressive decrease in the government deficit – together with the maintenance of relatively dynamic external demand.

The projected reduction in external financing requirements mirrors a significant decline in the trade account deficit as a percentage of GDP, from 3.7 per cent in 2011 to surpluses of 0.3 and 2.4 per cent, respectively in 2012 and 2013 (Chart 3.11). The decrease in the trade account deficit reflects mainly the evolution of exports and imports in volume, since the terms of trade effect is negligible. The income account deficit is projected to recede marginally in 2012 and further in 2013 to a level near 5.5 per cent of GDP, notwithstanding the deteriorating international investment position. Finally, the combined current transfers and capital account surplus as a percentage of GDP is expected to improve temporarily, in line with assumptions for the transfers from the European Union.

Chart 3.10

DEVELOPMENTS IN FINANCING REQUIREMENTS | AS A PERCENTAGE OF GDP Total investment -Domestic savings 40 - Domestic savings plus capital account balance 35 Current and capital account 30 25 20 15 10 5 0 -5 -10 -15 2001 2003 2005 2007 2011(p) 2013(p) 2009

Chart 3.11



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

4. Prices and wages

Consumer prices, as measured by the HICP, are projected to post an average increase of 3.2 per cent in 2012, a relatively similar figure to that expected for 2011 (3.6 per cent), followed by a very sharp slowdown in 2013 (1.0 per cent). The relative stability in 2012 reflects the combination of an acceleration in the non-energy component prices (from 2.3 per cent to 2.7 per cent) and a strong slowdown in the energy component (from 12.8 per cent to 6.1 per cent) (Chart 4.1). According to the main macroeconomic determinants – overall favourable developments of unit labour costs in the private sector and import prices – the expected inflation level should be clearly below 2 per cent in 2012-2013. However, the set of discretionary budgetary measures with significant impact on prices implies a projected inflation above 3 per cent in 2012.

Stabilization of the inflation rate at a high level in 2012, mainly driven by the budgetary measures, followed by a sharp decline in 2013

The projected inflation rate for 2012 reflects, on the one hand, the impact of the increase in indirect taxation and the adjustment of some administered prices and, second, the favourable developments in the main macroeconomic determinants. Among the tax measures included in the SB2012, stand out: changes in VAT tables and the rise in administered prices and in some specific consumption taxes, namely on vehicles and on tobacco. Furthermore, the rise in transport prices in August 2011, as well as the increase in the VAT rate on electricity and natural gas prices as of last October will also produce lagged effects on inflation in 2012. The contribution of these set of measures on inflation is estimated to amount to 1.8 percentage points in 2012. As from the fourth quarter of 2012, consumer prices are expected to decelerate significantly as the taxes and administered prices effects start to fade out and the effects of the slowdown in private sector unit labour costs and import prices begin to dominate, implying an average inflation level of 1.0 per cent in 2013.

The current macroeconomic scenario envisages a very sharp slowdown in unit labour costs and non energy import prices, as well as in oil prices in euros over the projection horizon. The evolution of wages in the private sector, a major determinant of consumer prices, will be conditioned by the continued deteriora-



2008

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

-1.0

2007

tion in the labour market conditions – net decline in employment and increase in the unemployment rate to historically high levels – in the current context of sharp contraction of economic activity. Against this background, the present projection envisages a slightly negative average change in unit labour costs in the private sector for the period 2012-2013, which contrasts with the 1.8 per cent rise in 2011. It should be mentioned that the value projected for labour costs in the private sector in 2012, reflects inter alia the suspension of the Christmas and holiday subsidy payments in some state-owned enterprises, in line with the SB2012. Non energy import prices are expected to slow down sharply in 2012 (from 5.3 per cent in 2011 to 0.8 per cent) and to recover moderately in 2013 (1.7 per cent).

2009

2010 2011(p) 2012(p) 2013(p)

5. Uncertainty and risks

The current projections represent the most likely scenario, based on the assumptions presented in section 2. The non-materialisation of these assumptions, as well as the possible occurrence of idiosyncratic shocks, cannot, however, be neglected. This section presents a quantified analysis of the risks and uncertainty surrounding the current projections, based on a range of factors presented hereafter.³

High degree of uncertainty surrounding the national and international framework

The current context is characterised by high uncertainty surrounding both the international framework, given the recent intensification of the sovereign debt crisis in the euro area, and the specific situation of the Portuguese economy, marked by the adoption of measures to correct the macroeconomic imbalances with impacts difficult to quantify with precision.

The most recent period has been conditional by the renewed tensions in international financial markets, particularly due to the intensification of the sovereign debt crisis in the euro area and its spreading to a wide range of other economies in the area, with a significant impact on the financing costs of both the public and private sectors. The outline of the measures of institutional resolution of the sovereign debt

³ The methodology used in this section is based on the article published in Pinheiro, M. and P. Esteves (2010), "On the uncertainty and risks of macroeconomic forecasts: Combining judgements with sample and model information", *Empirical Economics*, pp 1-27.

crisis in the euro area as well as of the economic policy measures to be adopted by the authorities in several euro area economies remain uncertain and so are their impact on economic growth in Portugal's main trading partners.

Moreover, the impact on domestic demand of both the budgetary consolidation measures and the structural measures to be implemented by the Portuguese government is surrounded by great uncertainty, both in terms of its magnitude and its time profile. In particular, the fiscal consolidation measures imply an unprecedented contraction of disposable income, in a context where financing conditions will remain tight, and therefore it is rather difficult to anticipate their effects on the spending decisions of households and corporations.

Downside risks for economic activity and broadly balanced risks for inflation over the projection horizon

With regard to the risks for the Portuguese economy arising from the international framework, an upside risk on long-term interest rates in the euro area and the United States was considered due to the possible increase in risk aversion among investors at a global scale. The budgetary imbalance in the US economy as well as well as in several euro area economies may deteriorate the perception of the quality of sovereign debt in these economies. The materialisation of these risks would also favour a depreciation of the euro in effective terms, in a framework of international investment portfolio restructuring in favour of assets denominated in other currencies. Moreover, the possibility of a larger fiscal consolidation in a number of euro area economies and in the United States, in conjunction with a sharp drop in the confidence levels of economic agents in advanced economies may lead to a contraction of domestic demand in several economies, with an impact on external demand for Portuguese goods and services (Table 5.1).

Internally, the budget target for 2011 was only achieved by resorting to significant self-reversing measures – in particular the partial transfer of banking sector pension funds to the Social Security – since the structural budget adjustment was short of the target. As is well-known, self-reversing measures, such as those that adopted, imply an increase in expenditure in the future, which may require the adoption of additional consolidation measures to ensure compliance with the current budgetary targets. Furthermore, the current projections consider virtually unchanged profit margins in 2012 and an increase in 2013. This may not materialize should the firms operating in Portugal compete through prices in a depressed demand environment, which may lead to an additional compression of profit margins with a downward impact on consumer prices. In the other direction, further rises in administered consumer prices cannot be excluded, particularly within the framework of the financial restructuring of some of the state owned enterprises.

The quantification of these factors points to clearly downward risks for economic activity in 2012 and 2013. As for consumer prices, the current risk quantification suggests virtually balanced risks, as domestically-

| RISK FACTOR PROBABILITY PER CENT | | | PROBABILITY OF AN OUTCOME BELOW THE CURRENT PROJECTIONS PER CENT | | | | | |
|------------------------------------|------|------|---|------------------|------|------|--|--|
| | 2012 | 2013 | | Weights 2010 (%) | 2012 | 2013 | | |
| Conditioning variables | | | Gross Domestic Product | 100 | 55 | 59 | | |
| Exchange rate | 60 | 60 | Private Consumption | 66 | 56 | 58 | | |
| External demand | 45 | 45 | GFCF | 20 | 53 | 55 | | |
| Oil prices | 60 | 60 | Exports | 31 | 58 | 59 | | |
| Endogenous variables | | | Imports | 38 | 58 | 61 | | |
| Private Consumption | 55 | 55 | HICP | | 48 | 48 | | |
| Source: Banco de Portugal. | | | Source: Banco de Portuga | l. | | | | |

Table 5.1

Table 5.2

driven risk factors offset each other and the upward risk for consumer prices resulting from the possible depreciation of the euro will tend to be offset by the effect on wage costs and profit margins stemming from the downside risk on economic activity.



6. Conclusions

The evolution of the Portuguese economy over the projection horizon will be indelibly marked by the adjustment process of structural macroeconomic imbalances, in the context of the EFAP agreed upon with the European Union, the euro area countries and the International Monetary Fund. This process, which is expected to intensify in 2012, will imply a strong contraction of domestic demand up to the end of the projection horizon. The success of this process is, however, determinant to ensure the restoration of the basic macroeconomic balances, the reduction of the chronic external financing needs of the Portuguese economy and the resumption of a sustainable growth path, thereby assuring the return of domestic agents to financing in international markets (see "Box 1 The challenge of resuming market financing in the medium term" of this bulletin).

With regard to public finances, it is essential to make clear choices about the level and nature of goods and services provisioned by the public sector. Public administration reform should increase the efficiency in the provision of those goods and services and eliminate rents received by agents directly or indirectly involved in those activities. A careful evaluation of all public expenditure programmes is crucial for the structural reduction of the level of public expenditure and to ensure budgetary sustainability.

The reduction of debt levels of households and firms, in conjunction with the gradual and orderly deleveraging process of the banking sector, is essential to ensure the contribution of the private sector for the recovery of economic activity over the medium term. The banking system, as a financial intermediary with privileged relationship with the customers, should channel the available financial resources to financially viable firms with sustainable business plans over the medium and long term, thus contributing to an efficient restructuring of the business sector. Market functioning structural reforms, which are expected to be implemented over the projection horizon, should catalyze the potential growth of the Portuguese economy. The implementation of these structural reforms should be speeded up so as to foster the competitiveness of the Portuguese economy and competition in labour and product markets, reduce contextual costs of business activity and raise the qualification of the labour force. By their nature, these measures do not have an immediate impact. Therefore, postponing their implementation will delay economic recovery and will prevent the Portuguese economy from evolving in line with the upward phase of the global economic cycle. It should be noted, however, that the measures to be implemented should have a significant and well-known economic impact. The mere adoption of a myriad of piecemeal, lagged or non-coherent policy measures raises great uncertainty as to their impact, as well as some weariness regarding the reform process that may jeopardise their overall efficiency.

The implementation of the reforms in the labour market is crucial to boost job creation. An efficient restructuring of the business sector involves improving the allocation of human resources to job posts and increasing internal and external flexibility of the firms, so as to ensure job creation. The reforms should eliminate rents in the labour market, associated with the strong contractual duality, which raises significant entry barriers. The existence of such entry barriers is extensive to the product market, consequently reducing contextual costs in business activity is crucial to attract new foreign direct investment projects with built-in technological progress, which will allow to promote an increase in productivity in the tradable goods sector, over the short and medium term. The reform of the judicial system plays a vital role for the improvement of market functioning in the Portuguese economy. These reforms should be accompanied by an appropriate fiscal framework, in order to promote productive investment both in terms of human capital and physical capital.

Striking a balance between the correcting measures of the structural macroeconomic imbalances, with contractionary effects in the short run, and the structural reforms aimed at promoting potential growth and job creation, is essential to ensure an efficient and swift adjustment of the Portuguese economy. These conditions are indispensible for the success of the economic and financial adjustment process and for the creation of a new economic paradigm so as to promote sustainable growth in Portugal.

This text was based on data available up to mid-December 2011.

BOX 1 | THE CHALLENGE OF RESUMING MARKET FINANCING IN THE MEDIUM TERM

Within the framework of the euro area convergence process and participation, the Portuguese economy was characterised by a wide gap between domestic investment and saving, which translated into resilient external financing needs. Up to the end of the first decade of monetary union, these needs were financed under particularly favourable conditions in international markets, given the non-differentiation of sovereign risk within the euro area. The public sector and the banking system were the main intermediaries in channelling external savings to the Portuguese economy. Hence, the high degree of financial integration ensured not only risk sharing as regards idiosyncratic and temporary shocks to the income and wealth of domestic agents, but also the financing of a continuously deteriorating international investment position, in a context of low trend economic growth.

The international financial crisis and the subsequent sovereign debt crisis in the euro area have changed this equilibrium on a permanent basis. In particular, throughout 2010 and in early 2011 international investors differentiated their sovereign risk assessment within the euro area. This led to an abrupt end to the external financing of those economies in which debt was considered highly risky. As regards the Portuguese economy, this chiefly stemmed from increasing concerns about the sustainability of public finances and the intertemporal dynamics of external debt. These factors were catalysed by contagion effects associated with the deterioration of the situation in Greece, as well as by the absence of an institutional resolution of the sovereign debt crisis in the euro area. In this context, the Portuguese economy – without access to financing by international investors – was at risk of approaching a borderline situation of defaulting to its creditors in the first quarter of 2011. At that stage, only the prior adoption of unconventional measures by the Eurosystem, notably in terms of liquidity injection into the banking system and the purchase of public debt securities in the secondary market, allowed for the *status quo* to be transitorily maintained.

This situation was clearly unsustainable, for a number of reasons. First, the Portuguese economy required an urgent structural adjustment. The process of correction of imbalances would never be achieved in an orderly manner in the absence of stable financing of the economy – given its protracted duration, its particularly demanding implementation and its contractionary impact in the short-term, which brings about high social costs. Second, the Treaty on European Union expressly prohibits the monetary financing of the public sector. Within this framework, the Eurosystem could not support directly and persistently the financing of a sovereign country. Third, the banking system exposure to sovereign risk started being a weakness within the context of the sovereign debt crisis in the euro area. Hence, an upward trend of the holding of public debt securities or a greater concession of loans to the general government and to state-owned enterprises in general would heighten the vulnerability of the banking system, with general equilibrium implications on the whole economy.

The loss of confidence of institutional investors in the Portuguese economy has thus inevitably led to the request for international financial assistance made in early April 2011. The strict pursuit of the Economic and Financial Assistance Programme agreed with the European Union, the euro area and the International Monetary Fund is an opportunity to restore the confidence of international investors. Given the rather negative international investment position of the Portuguese economy, the resumption of stable market financing is a *sine qua non* condition for the success of the Programme. This process will be necessarily long. In fact, a full reopening of financial markets to national agents will require a prior financial rebalance and a structural reform of the economy, in the sense of ensuring the intertemporal solvency conditions for the various institutional sectors, most notably the general government. According to the assumptions of the Programme, the State will likely resume financing in international markets as of mid-2013 and banks will do so as of the end of that year. These assumptions were key to the calculation of the financing required within the scope of the Programme.

In this context, the Portuguese economy will have to simultaneously converge towards a position close to balance or in surplus of the current and capital account, pursue the structural consolidation of public finances, and lay the foundations for sustained economic growth in the medium to long-term. At the same time, Portuguese banks will have to deleverage gradually and orderly, as well as to restructure some business models, converging in the medium term towards a more sustainable financing structure. This simultaneous deleveraging of the public and private sectors, aimed at closing the gap between saving and investment of the institutional sectors as a whole, is unprecedented in the Portuguese economy.

The Economic and Financial Assistance Programme is an opportunity to carry out such adjustment in an orderly fashion. In fact, in its absence, the Portuguese economy would go into immediate default, and the adjustment would take place abruptly and inefficiently, with incomparably higher welfare losses.

According to the available projections, the Portuguese economy is likely to make significant progress in terms of the adjustment of key macroeconomic imbalances. In particular, public finances are expected to record a structural primary surplus as of 2012, and the current and capital account is projected to stand close to balance in 2013. In parallel, banks are expected to reach a credit to deposit ratio of 120 per cent at the end of 2014, simultaneously reducing their financing with the Eurosystem. Household and corporate indebtedness ratios are also likely to start following a downward trend and their saving rates will tend to rise. The restart of the Portuguese economy's real convergence process towards the main European Union partners is likely to occur only after 2013, insofar as it depends on the success of the implementation of structural reforms in the functioning of markets – whose full pass-through to the economy in aggregate terms is subject to a time lag – and given the short-term recessionary impact of the adjustment measures addressing the macroeconomic imbalances.

The combination of these elements is a requirement for the gradual resumption of financing in international markets. Given the Portuguese economy adjustment process, future external financing needs will be substantially lower than in the past. Within this scope, regular bank and State financing in international markets will only tend to occur after the sovereign debt crisis is solved, at a national and systemic levels. This compounds the uncertainty and risks surrounding the ongoing economic adjustment process, namely given the possibility of adverse economic and financial developments at an international level and the uncertainty surrounding the institutional agreement regarding the financial assistance mechanisms at a European level. Resuming market financing is hence conditioned not only on a fully achieved domestic economic adjustment, but also on an orderly evolution of the Portuguese economy's external environment.



FISCAL DEVALUATION

A COMPARISON OF THE CYCLICAL EVOLUTION OF VARIOUS GEOGRAPHIC AREAS OF REFERENCE WITH PORTUGAL

PUBLIC-PRIVATE WAGE GAPS IN THE PERIOD PRIOR TO THE ADOPTION OF THE EURO: AN APPLICATION BASED ON LONGITUDINAL DATA

SECTORAL CREDIT RISK IN THE EURO AREA

FISCAL DEVALUATION*

Isabel Horta Correia**

ABSTRACT

This article discusses the state of the art relatively to policy makers decisions when the use of the nominal exchange rate is no more feasible. Namely we describe the existence of a set of instruments, conventional fiscal instruments, which under rather strict conditions, can replicate the effects of a nominal devaluation. However this is a relevant question when there is no doubt on the desirability to use the exchange rate as a policy instrument. Therefore, the two question will be jointly addressed in this article.

1. Introduction

The need for adjustment that is nowadays common to a large set of economies re-opens the question of which instruments should policy makers use. This question is more relevant for the euro area countries since each individual country cannot use nominal devaluation and this is a typical recommended instrument for that adjustment.

This article aims to review the state of the art in terms of the alternative instruments available for an economy when the change of the nominal exchange rate is not an option. However that question is only relevant when it is clear that such nominal devaluation is an efficient instrument to be used. Therefore both questions have to be taken together. As we will try to show using very stylized models of the economy the answer to the last question is much more difficult than the answer to the first one: there is little consensus on the ability of nominal devaluation to be the right instrument. The desirability to devalue is highly dependent on the shocks that hit the economy, and created the need for adjustment, as well as on the transmission mechanism both of those shocks and of the change in the exchange rate. These transmissions depend mainly on the frictions that characterize the economy under analysis. More than having an answer to the latter question we try in this article to explain why it is a difficult problem. On the contrary we will show that the question of the existence of instruments equivalent to the nominal devaluation is solved.

The idea that tax reforms can mimic the effects of exchange rate devaluation is not new. The legislation on the value added tax in the European Union establishes a taxation of goods on the destination basis (according to where they would be consumed) and is essentially equivalent to an exchange rate devaluation, because imports are taxed while exports are exempted.

This is an older idea of the time of the gold standard, as we can see by the following quotation by Keynes (1931):

^{*} The opinions expressed in the article are those of the author and do not necessarily coincide with those of the Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the author.

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"Precisely the same effects as those produced by a devaluation of sterling by a given percentage could be brought about by a tariff of the same percentage on all imports together with an equal subsidy on all exports, except that this measure would leave sterling international obligations unchanged".

When these instruments are not available the increase in the nominal exchange rate can be replicated with an increase of the VAT tax when this is imposed on imports and reimbursed on exports. To avoid effects on prices of goods that are not traded with foreign countries (tradables or nontradables) the impact of the increase of VAT on prices should be compensated by a decline on the other tax paid by firms on the same base, that is the payroll tax.¹

2. Devaluations

Exchange rate devaluations would have no real effects if prices and wages were flexible. In this case every price would move with the exchange rate so that relative prices would remain unchanged and there would be no real effects of the devaluation. When every price (including wages) is flexible the change in the exchange rate can be seen as merely a change in the unit of account used for transactions. After Milton Friedman it was clear that one advantage of having a system of flexible exchange rates would be the "gains of coordination". After a real shock that calls for a change in relative prices this change could be achieved through a move of nominal prices and wages or, for some of those, by a change in the exchange rate. Introducing some costs of changing prices and/or wages will lead to a preference for a flexible exchange rate as a substitute for movements in nominal prices.

The argument for a flexible exchange rate is, strange to say, very nearly identical with the argument for daylight savings time. Isn't it absurd to change the clock in summer when exactly the same result could be achieved by having each individual change his habits? All that is required is that everyone decide to come to his office an hour earlier, have lunch an hour earlier, etc. But obviously it is much simpler to change the clock that guides all than to have each individual separately change his pattern of reaction to the clock, even though all want to do so. The situation is exactly the same in the exchange market. It is far simpler to allow one price to change, namely, the price of foreign exchange, than to rely upon changes in the multitude of prices that together constitute the internal price structure. (Friedman (1953)).

Nominal devaluations have been seen as an important policy instrument. This instrument is effective when the economy displays nominal rigidities. However its efficiency depends on the nominal exchange rate having, directly or indirectly, effects on relative prices which are not flexible and were distorted by the real shocks that caused the need for adjustment. The rigidities can be temporary and the devaluation then just alleviates the temporary distortions that characterize the economy. These rigidities disappearing in the long run, when every price is flexible. But as we said in the long run the change of the nominal exchange rate is neutral. Alternatively the rigidity can be permanent, meaning that every agent has no incentive to change the price, and in this case the devaluation continues to have effects in the long run. Therefore it is normal that the effect of a nominal devaluation depends heavily on the type of nominal rigidity that is stronger in the economy, as well as the analysis of the transmission mechanism of the devaluation, which depends crucially on the sectorial characteristics of the economy represented in the model.

¹ The base of the tax on the value added is the return of the primary inputs in production. Therefore the compensation should be executed with a tax that is paid by the firm on the same basis.

The nominal devaluation also has an additional effect to the one just described: it can lead to important aggregate wealth effects, and the magnitude and sign of these effects depend on the assets portfolio held by the private and the government sectors in the economy. If those agents hold assets and the devaluation is unexpected the value in foreign currency of assets denominated in domestic currency changes. This can generate substantial wealth effects that significantly changes the equilibrium, even if prices and wages were perfectly flexible.

Except for the wealth effect just described, the devaluation tries in most models to replicate the equilibrium of flexible prices (and wages). Therefore we can say that its efficiency depends on three things: 1) the ability to replicate those flexible prices using just one instrument; 2) the desirability of replicating flexible prices, given other distortions that normally characterize the economies; and 3) the wealth effects that are created by the devaluation, which can interact with point 2).

Notice that, even if we are always taking into account a permanent devaluation, it is difficult to call it a reform since, as we said in the beginning, in most environments this policy is neutral in the medium/ long run.

2.1. Fiscal devaluations

As we just said the idea that tax reforms can mimic the effects of exchange rate devaluations can be found already in Keynes (1931). The idea that this simple policy can be not completely equivalent to a nominal devaluation called for a recent discussion with a different set of ideas coming to the public discussion (e.g. Cavallo and Cottani (2010)), to policy prescriptions (Franco (2010)) and BoP (2011),² and to academic work (Farhi *et al.* (2011)). The main focus is on the so-called fiscal devaluation where the main instruments used are a VAT increase and a decline of the employers' social contributions (SC).

We will now discuss both the effects of a nominal devaluation and the existence of fiscal instruments that can replicate a nominal devaluation into three different models. They will be introduced by increasing complexity.

2.2. The model of unemployment - Model 1

Let us take the simplest model that reflects the nominal rigidity that is common to most models that are able to replicate reality nowadays, the nominal wages rigidity, and that interferes with devaluation. Schmitt-Grohe and Uribe (2011) employ this kind of model to analyze the costs of a fixed exchange rate, abstracting from any other type of distortion or of rigidity.

The economy is described as a small open economy with a representative household that consumes tradables (C_T) and nontradables (C_{NT}) . This household holds a real bond in units of the tradable good. The supply of tradables (Y_T) is a fixed endowment for this economy and total labor supply (\overline{h}) is constant and free to be used in the production of nontradables, which has only one input of production.

The price of the tradable good (P_T^*) in foreign currency is given from abroad and prices of nontradables (P_{NT}) are perfectly flexible. Firms, that produce the nontradable using just labor, operate in a competitive market, taking prices and wages as given. Optimal decision of these firms leads to

² Both Franco (2010) and BoP (2011 try to describe the quantitative impacts of a tax reform similar to a devaluation: an increase of the value added tax compensated by a decline of the payroll tax. None of these works guarantee that this reform is equivalent to a nominal devaluation. The results obtained in BoP (2011) are derived from the model developed in Almeida *et al.* (2010).

$$\frac{P_{\scriptscriptstyle NT}}{EP_T^*} = p = \frac{w}{F'(h)}$$

where p represents the real exchange rate, the relative price of goods, and F' the marginal productivity of labor used in production, represented by h. The real wage in units of the tradable is represented by

$$w = \frac{W}{EP_T^*}.$$

Clearing of the nontradable is guaranteed by $F(h) = C_{NT}$. The nominal wage, W, is downward rigid. In this case the labor market does not clear and unemployment is given by $\overline{h} - h$, being \overline{h} the inelastic labor supply. The trade balance is given by $Y_T - C_T$ and net external debt, in units of the tradable, is given by $d_{t+1} = (1 + r_t)d_t + C_{Tt} - Y_{Tt}$. The real interest rate, r_t , is exogenous.³

In this model if a devaluation is implemented under full employment it will be neutral since the only effect would be an increase in P_{NT} and W, and given the same real exchange rate and real wage the allocations are maintained.

When the economy is characterized by unemployment this means that the nominal wage is too high (relative to the full employment one) and will not decline, as the nominal wage is sticky downwards. This leads to a real wage and to a real exchange rate which are too high. In this case a devaluation declines the real exchange rate increasing the consumption of nontradables relative to the consumption of tradables, declines the real wage in terms of tradables increasing employment and the production of nontradables and declines unemployment. Because the consumption of tradables declines. The devaluation leads to an expansion and to a better position in external accounts. Notice that in this very simple model if the price of the nontradable good was also sticky the results would be similar, because in the described transmission of the devaluation the change in the relative price of goods occurs through the exchange rate. The price of nontradables plays no role in the adjustment described and is constant.

What caused the unemployment? – To understand the desirability of a devaluation, or any other policy, we should understand to which shock that specific policy is reacting. In the present case we could have for example a historically high nominal wage, resulting from the power of insiders versus outsiders in the labor market. As we just described, this high nominal wage (and its persistence) caused unemployment, too low consumption of nontradables, too high consumption of tradables, too low trade balance and too high increases in external debt. A devaluation has similar effects than a fall in the nominal wage. Notice that these effects occur even if the real wage is always identical to productivity. We cannot say that the external positions are due to wages being higher than productivity as usually measured. In this very simple model a decline of the nominal wage, and flexible prices (wages) achieve the first best in this simple economy.

In this model the real rigidity comes when the downward nominal wage rigidity is coupled with a fixed exchange rate. In this case the real wage in units of the tradable is sticky. When there is a relative scarcity of the tradable good and therefore a relative abundance of the nontradable one the price system is not effective in signalling it.

³ And in Schmitt-Grohe and Uribe (2011) negatively correlated with Y_T .

In the paper by Schmitt-Grohe and Uribe (2011) the unemployment was caused by a real shock represented by a decline of the endowments of the tradable good. This can be interpreted as a loss in the terms of trade, or a loss in external assets. In this case the allocations after the shock without a reaction of the exchange rate, would be characterized by a reduction in the consumption of nontradables and therefore higher unemployment, and by a reduction in the consumption of tradables (higher than the decline in the endowment if the real interest rate also increases given the worse situation of the economy). This leads to a positive trade balance associated with an increase in external debt if the real interest rate increases. Notice that in this model the shock does not move the relative price of nontradable, even if we assume as here that the nominal price on nontradable is perfectly flexible: the rigidity of the marginal cost in units of the tradable leads to a constancy of the relative price of nontradables, and of the real exchange rate.

If instead of a fixed nominal wage the economy was characterized by a fixed price of nontradables the results would be identical: without a reaction of the nominal exchange rate the real exchange rate is constant, implying that the ratio of the consumption of tradables and nontradables is maintained. The shock leads to a decline in the consumption of both goods and therefore to a lower value of h that clears the nontradable sector. Even if wages were flexible the value of W would not move with the shock. Then in this model the results are identical whether are wages fixed, or the price on nontradables is fixed or both are fixed.

A devaluation that reacts to these shocks can return the economy to full employment, together with an increase of production (of nontradables), an increase of the trade balance and a decline of the debt. Again given the exogenous shock in this very simple model the devaluation has the ability to guarantee the first best, which is characterized by a recession and a large positive effect on the trade deficit. While the first best is obtained with a devaluation and is therefore characterized by a recession, it does not allow us to state that the devaluation per se is contracionary. The real shock, given the rigidity, creates a recession too strong, and the devaluation corrects in part that recession, because as we have seen the devaluation is expansionary. However as the fall of output due to the real shock is larger than the reaction crated by the devaluation the join result is still a contraction of output.

The real rigidity that occurs in this model is due to the nominal wage rigidity and when the exchange rate is fixed it is the only distortion present in the model. This leads to a very tractable model that includes the main channel that is referred when there is a devaluation: the change in terms of trade and the change in the costs of labor, in units of the tradable.

When we look to the euro area these problems become more acute the higher the initial nominal wage rate relative to the full employment, the more unionized the country, the higher the country risk, the higher the level of external debt and the higher the deterioration in the terms of trade.

Fiscal devaluation – In this model the proof that there are fiscal instruments equivalent to the nominal exchange rate is very simple. As we saw the distortion arises when, given the downward nominal wage rigidity, the exchange rate is fixed and it creates a real wage rigidity (real wage to the producer in units of the tradable). Then the problem is solved if there exists an instrument that can lower the real wage in terms of tradables and the real exchange rate. This can be done with a subsidy to labor paid to firms, or a decline in the payroll taxes, τ^p , if those were already paid by firms.

$$\frac{P_{NT}}{EP_T^*} = p = \frac{(1+\tau^p)w}{F'(h)}$$

Notice that in this very simple model the payroll can be reduced just for the firms that produce the nontradable good.⁴ This will decrease unemployment and the relative price of nontradables. It is the relative reduction in the consumption of tradables that allows for the better trade balance and lower external debt. In this case the financing of the subsidy (or the compensation of the lower payroll tax receipts) can be done with a tax on labor paid by workers, that in this simple model is lump sum. The same would happen with a value added tax (or a common consumption tax on tradable and nontradable goods that is also lump sum). It is the sum of the reduced payroll, and this lump sum used to financed it, that replicates the effect of the nominal exchange rate in this model, and can therefore be called fiscal devaluation. In this model the composition of taxes that replicate the nominal devaluation is very simple, both due to the inelastic supply of labor and to the assets held by the households being denominated in foreign currency.

2.3. A similar model – Model 2

Let us now consider a model economy slightly more complex. Let us take the model used by Farhi *et al.* (2011) in its simplified form, which turns out to be an equilibrium model very similar to the one just described. It's a small open economy with a constant real interest rate and where households just hold foreign assets. Consumption is composed of a good produced domestically and a good that is imported. Contrary to the simple model described in the previous section, here every good in the model is tradable. Labor creates a disutility for the household and therefore labor supply is elastic. The home producer sets the price in home currency $P_{H_{,}}$ and the foreign producer in foreign currency, P_{F}^{*} . In the simplified model these prices are flexible but nominal wages are sticky but not fixed. Wages react just in part to contemporaneous information.

Let us assume that in this environment the economy suffers a real shock, a significant unexpected permanent drop in domestic productivity. In reaction to this shock two relative prices should adjust in the model economy: the real wage and the terms of trade, $\frac{EP_F^*}{P_H}$. Both should decline. With sticky wages, the nominal wage declines slowly, converging to its flexible price value over time. Then the flexible price of the domestic good increases also slowly to its higher value in the long run. This leads to a lower value for the terms of trade which increases over time to its long run value. Then given the relatively higher wages (relative to the flexible wage equilibrium) labor is lower as well as output. The lower value for the terms of trade, that is a lower relative price of imports, leads to a lower value for the trade balance and to a decline in external debt. In this environment a devaluation can replicate the effect on the economy of the lower productivity with flexible wages. The devaluation is the amount necessary to allow a constant wage to replicate the flexible wage allocation with a zero devaluation. This implies that the devaluation has to be symmetrical to the long run decline of sticky nominal wages following the decline in productivity. In this way output declines less than without the devaluation and the trade balance as well as external assets do not react to the shock. Compared with the equilibrium without the devaluation the change in the exchange rate was expansionary and led to an improvement in the trade balance.

In this case the nominal rigidity of the nominal wage and of the home produced goods price are no longer equivalent. In the case of a flexible wage but a sticky price of home goods the slow price increase, until matching the new long run value, leads to a higher value for the terms of trade, for output and for external balances (each one relative to the value they take in case prices were flexible). The change of the exchange rate is now a revaluation. Therefore here we would still observe a contraction of output and a negative trade balance (consumption on tradable goods increases) but the efficient solution would be a revaluation of the nominal exchange rate. When both rigidities coexist the optimal exchange rate policy is not general to every parametrization of the model, and the first best would not be attained.

⁴ If we had a model with production of the tradable (instead of being an endowment) then the payroll tax should be lowered for every firm, producing either nontradable or tradable.

If we compare model 1 with this model it is important to notice that very small changes in the environment lead to a much more complex model in terms of exchange rate policy.

Fiscal devaluation – In this model the nominal devaluation could again be replicated with fiscal instruments: The increase of the VAT would replicate the effect on the price of imports in domestic currency of the nominal devaluation. Assuming an identical passthrough for the VAT and the SC (let us assume that is zero), the decline of the payroll tax would offset the effect of that VAT on the setting of the price of the good produced domestically. Therefore a nominal wage and a price of home goods in domestic currency identical to the ones that would occur with a nominal devaluation as a reaction to the real shock can be accomplished. As we assumed that the VAT can be deducted for goods that are exported, the price of exports is also the same as the one obtained under the nominal devaluation. In this way as a reaction to a particular shock, whatever is the preferred nominal devaluation, there is a fiscal devaluation that decentralizes the same equilibrium.

2.4. An even more complex model – Model 3

Burstein *et al.* (2007 and 2005) argue that large devaluations are generally associated with large declines in the real exchange rate and concomitant low rates of inflation and they argue that the primary force that induces these low rates of inflation is the slow adjustment in the price of nontradable goods and services, not the slow adjustment in the price of goods that are imported or exported. However contrary to the models described before such rigidity of the nontradables prices is not a characteristic of the short run reaction of firms but characterizes the economy both at short and long horizons.⁵

Let us describe a more complex model that includes a production function for tradables, labor supply is endogenous and it has a more complex structure of production. This model is based on Burstein *et al.* (2007). As before, consumption is an aggregate of consumption of tradables and consumption of nontradables. The household holds a nominal bond in foreign currency with a constant interest rate. Note that we are still not introducing the additional complexity of the devaluation effects on balance sheets.

To simplify let us assume that the tradable consumption is imported. The price of this good "at the dock" in domestic money is simply E. To sell one unit of this good it is necessary to distribute it. It requires φ units of the final nontradable good. Then the price to the consumer is

$$P_{\rm T}\,=E+\varphi P_{\rm NT}$$

Exports are produced with labor with a linear technology. The market is monopolistically competitive and exporting firms face an external demand with a constant price (in the foreign currency) elasticity of γ . The price charged by this sector is given by⁶

$$P_X \ / \ E = \frac{\gamma}{\gamma-1} \Bigl(W \ / \ E + \varphi^* \Bigr)$$

Consumption of the nontradable good is produced by competitive firms that use nontradables intermediate goods as inputs. These intermediate goods are produced with labor in a monopolistic competitive market. Prices in this sector are given by

⁵ That the rate of passthrough from exchange rates to prices is much lower for nontradable goods than it is for goods that are actually traded is documented in Burstein *et al.* (2005).

⁶ Where φ^* represents the equivalent to φ in the foreign market.

$$p_i = \frac{\varepsilon_i}{\varepsilon_i - 1} W \, / \, A^N$$

where ε_i is the demand elasticity of good *i*.

Therefore we have two important margins where the exchange rate interacts with other prices: the intratemporal marginal rate of substitution between consumption of tradables and nontradables (the real exchange rate) $\rightarrow \frac{E+\varphi P_{NT}}{P_{NT}} = \frac{E}{P_{NT}} + \varphi$; and the intratemporal margin between labor and consumption (the real wage) $\rightarrow \frac{W}{F(E+\varphi P_{NT}, P_{NT})}$. In addition we have the price of exports in foreign currency that determines the volume and therefore the value of exports $\rightarrow P_X / E = \frac{\gamma}{\gamma-1} \left(W / E + \varphi^* \right)$.

It is assumed that prices of nontradables are sticky and test, a fortiori, whether there are gains for an individual firm to deviate from the price set before. When there are no incentives to deviate the stickiness is, contrary to what happened in the models described before, a permanent one.

A devaluation in this model would have no real effects if every price (and the nominal wage) was flexible. However if the price on nontradables is fixed this is no longer true. After a devaluation the relative price of consumer tradables increases and therefore the consumption of nontradables increases, as well as the production of those goods. Hours worked increase as well as real wages. Nominal wages increase more than the CPI but less than the devaluation and therefore the price of exports decreases and the volume of exports increases. Given that this is a permanent shock and there was no change in the value of external assets the value of exports and the value of imports in foreign currency increase by the same amount.

The mark-up of nontradables declines and the loss of keeping prices constant is large. Therefore when the only shock is a devaluation there is a huge incentive for these firms to increase prices, and the economy would converge to the flexible prices economy.

However if we begin by asking to what shock are policy makers reacting when deciding to devalue the currency the stability of the price set in advance can be maintained. One reason pointed out in Burnstein *et al.* (2007) for the devaluation is the reaction to a negative real shock, like a fall in terms of trade or a decline in assets. This permanent shock will lead to an increase in the trade balance. This is obtained both from a decline in imports and an increase in exports. The price of exports decline and therefore the nominal wage declines. The real wage declines and the same happens to the labor supply. Both the price of tradable and nontradable consumer goods are constant, and the real exchange rate is constant. Therefore the consumption of both goods decline.

Will the devaluation achieve the first best in this case? No. In this case with flexible prices total hours should decline more, hour in the production of exports should have increased more, as well as the volume of exports, and consumption of both imports and nontradables should have declined more. However it is true that the overvaluation caused by the negative real shock with sticky prices, that created a high real exchange rate and a high contraction (higher than the one that should have occurred with flexible prices), is minimized by the devaluation that leads to an expansion of the activity and to a realignment of the real exchange rate.

Contrary to the case of just a permanent devaluation, when we take together a devaluation plus the real shock the incentive of the firm to adjust its prices is eliminated and therefore the resulting equilibrium can be seen as a sustainable equilibrium.

Fiscal devaluation – Could we replicate the nominal devaluation using fiscal instruments in this model? Using the important margins and prices affected by the nominal exchange rate we can see that if a VAT, τ_v , was already taken as part of the decision when setting P_{NT} (zero passthrough), and if it is
imposed on the prices of imports then $\frac{(1+\tau_v)E+\varphi P_{NT}}{P_{NT}}$. The VAT is a perfect substitute of devaluation in this intratemporal margin. Also necessary would be a deduction of the VAT on the price of exports and a decline in the payroll tax to replicate the effect of the devaluation on export prices in domestic currency. That is $P_X = \frac{\gamma}{\gamma-1} \left((1+\tau^p)(1+\tau_v)W \right)$ in domestic currency and $P_X / (1+\tau_v)E + \varphi^*$ in foreign currency. With a fixed P_{NT} , the intratemporal margin between labor and consumption is replicated as long as the real exchange rate is maintained. In summary the nominal devaluation can be replicated with a fixed

the real exchange rate is maintained. In summary the nominal devaluation can be replicated with a fiscal devaluation that uses an increase in the VAT with zero passthrough, completely deducted on exports and imposed on import prices, and a decline on the payroll tax.

As $P_{NT} = \frac{\varepsilon_i}{\varepsilon_i - 1} (1 + \tau^p) (1 + \tau_v) W / A^N$ the incentives to maintain the price would be identical in the nominal or fiscal devaluation.

3. Important caveats

The passthrough – We just showed that a nominal or a fiscal devaluation can reach the same allocation, using for the fiscal devaluation an increase in the VAT identical to the increase of the exchange rate and a decline of the SC such that $(1 + \tau^p)(1 + \tau_v)$ does not change after the increase of the VAT. In every model described we imposed three characteristics that were important for this result: 1) the first is that external assets (or liabilities), both for the private or the government should be denominated in foreign currency; 2) the second is that the passthrough of the exchange rate and the tax on value added should be identical in import and export prices; and 3) the third is that the passthrough to domestically produced goods prices of social contributions by firms and the value added tax is the same.

Let us begin by discussing whether 2) and 3) are plausible. This is a difficult question because it should be tested empirically but there aren't many episodes where, under the same environment both types of experiments were performed: a country that made a large permanent devaluation and a large permanent change in VAT, and where these effects can be distinguished from other shocks in the economy; and a country that made a large permanent change in social contributions paid by firms and large and permanent increases in VAT. There are some examples of changes in VAT and large devaluations, not necessarily in the same environment, and a few experiences of lower social contributions in a small scale. Crossing this evidence we can say that with some probability the passthrough of VAT and exchange rates on imports and exports prices are similar. This is the result of the evidence for devaluation of Berstein *et al.* (2005) for no slow adjustment in the prices that are imported or exported after a large devaluation. And the institutional framework described initially that the VAT should be imposed on import prices and deducted from export prices. Notice that these elements are very weak for the validation of the hypothesis imposed.

However, the confidence on the same degree of passthrough for VAT and SC is much lower. As we said the experiments and studies of changes of SC taxes are very scarce. What happens if the assumption is a different one? The first problem is that every firm should have the same degree of passthrough for each one of those taxes. If this does not happen and we impose the same change across the board we will create a distortion through changes in relative prices which can have, as it is well known, large costs for the economy. The second problem is that even if every firm has the same passthrough, and is not zero as we assumed in our examples, we have to know precisely how the change in VAT can be compensated on the pricing decisions by a change in SC. There is a special case where we know that the fiscal devaluation is no longer equivalent to the nominal devaluation: it is the case in which the passthrough of VAT is complete and the passthrough of the SC is zero. In this case, as shown in Adão *et al.* (2008), the equivalence needs another fiscal instrument, that differentiates between goods produced domestically and abroad. This type of instrument cannot be used in the European Community or in any free trade zone.

The balance-sheet effects – The assumption 1) is also extremely important for the results: when external assets held by households (or by the government) are denominated in foreign currency the devaluation does not affect its value in foreign currency. But as referred in the Keynes' guotation written above, the fiscal devaluation (in his case using tariff and subsidies) leaves liabilities in domestic currency unchanged what is not true with the nominal devaluation. When a country devalues the value of its external liabilities (denominated in domestic currency) decline in foreign currency. Therefore with positive net assets the devaluation leads to a decline in wealth, while negative net assets it would lead to a positive wealth effect. But what if the assets are denominated in domestic currency and the external debts in foreign currency? In this case the devaluation creates a negative wealth effect, measured in foreign currency. This effect on wealth has no counterpart when we use instead a fiscal devaluation. Farhi et al. (2011) suggests that the fiscal devaluation should be complemented in this case with a transfer between the domestic economy and abroad to achieve the equivalence with the nominal devaluation. For a composition of assets in which a devaluation leads to a negative wealth effect, the fiscal instruments described above should be complemented with a transfer from the domestic country to abroad, or by a partial default of foreign countries on the assets held by domestic agents. The opposite should occur when the nominal devaluation leads to a positive wealth effect.

Notice that in addition to the need for a nonstandard fiscal instrument to guarantee the equivalence, the effects of the nominal devaluation in reaction to a particular shock should be also amended relative to the ones described before.

4. And what about "Competitiveness"?

As we just described the fiscal instruments have some ability to replicate nominal devaluations. However may be the most important question is not whether we can replicate the nominal devaluation but whether, having the policy maker the ability to change the exchange rate, should he use it? One reason appointed to explain the recent interest on the fiscal devaluations is the fact that a country that belongs to a monetary union or to a currency board lost an (the) instrument to gain competitiveness. In this section we will try to explain this sentence by describing the connection that exists (or not) between competitiveness and devaluation.

In case we interpret the gain in competitiveness as an increase of total productivity in domestic production, this will lead to the increase of the level, and probably of the growth rate of output, at least in a transitory path. The effect of this permanent shock over the trade balance will, in principle, be negative, when the increase of productivity increased the capital productivity and the investment. However this is a favorable change because the increase of the productivity represents new investment opportunities, higher consumption and higher welfare.

Nothing similar to what is described in the last paragraph happens with a devaluation. How can the two concepts still be related?

Let us say that a country has an external imbalance that calls for an adjustment when it has systematic trade balance deficits. Can in this case a devaluation that improves the situation of the external accounts be interpreted as an intervention that improves the competitiveness? As we have seen the devaluation can increase the volume of exports through the decline of its prices in foreign currency, and assuming that the external demand reacts to changes in prices. In a simplified way the effect on the value of exports depends on the demand price elasticity of those goods. Let us assume that the impact of the devaluation on the value of exports is positive. The effects of the devaluation on imports is simpler: given the price in foreign currency its price in domestic currency increases. Ceteris paribus this will lead to a decline in demand by domestic agents of imported goods. Therefore the devaluation will have a positive effect of the trade balance. Is that change desirable for the economy? Notice that this answer cannot

be given without understanding why the initial imbalance occurs. If we look simply at the effect of the devaluation described until now it will improve the balance of trade, and if strong enough it will reduce external debt, but at the cost of a loss in terms of trade: the country now exchanges one unit of exports for a much smaller volume of imports. And, in a way, this is exactly the opposite from the gains that a country can have from trading with the rest of the world (and of competitiveness in strict sense). The gain from trade derives from de ability that the country has to exchange a good that has a higher value abroad for another that has higher value domestically. That is, because it improves the terms of trade. If, however, we take into account the shock that is the origin of the "disequilibrium" in the external accounts, nominal devaluation can, as we saw, alleviate the effects of this shock that are derived from the existence of nominal rigidities. Due, for example, to a decline in total productivity, nominal rigidity could imply a relative price of exports to imports, higher than the one that would occur without the existence of nominal rigidities. This leads to a deficit in the balance of trade, but the country is importing a lot for each unit that is exported. In this case a deterioration of the terms of trade can improve the situation of the economy, even if we say that the country is less competitive because it declined the prices of exports for the same productivity.

A second way to connect competitiveness with devaluation is to analyse the effects on real wages for a given productivity. What is equivalent to understanding the effects on relative labor costs (relative to those costs in our trade partners). The real wage declines after a devaluation. Then for the same productivity the "competitiveness" would have increased. If we were analyzing the devaluation as a reaction to a shock we have seen, for example in model 2, that when there is a negative shock in total productivity and the exchange rate reacts to that shock, the real wage declines. However the real wage declines less than the decrease in productivity. The gap between the productivity and real wages, in the equilibrium when the only shock is the decline in productivity, is larger than the gap when the devaluation reacts to that shock. As we saw this is a better outcome for the economy but it is difficult to derive the link between the evolution of labor costs and competitiveness.

In most models where devaluation has real effects due to nominal rigidities the devaluation that can aim at correcting the nominal rigidity after the permanent shocks has uniquely temporary effects. This is derived from the usual nominal rigidities being temporary, and the more temporary the larger and more permanent is the shock. This means that a devaluation in those environments has a very short run effect. Competitiveness is a medium to long term feature of the economy and therefore it is not clear whether a devaluation should be seen as a measure to solve problems of "competitiveness". In the particular case of the third model presented the sticky price is of a very different nature than the ones usually analyzed in the literature. There the stickiness can be permanent. However the question is not easy here because if there would be no devaluation the price would be revised after the shock and it is the devaluation that leads to a permanent constant price. So again here it is difficult to argue that the devaluation is a measure that increases competitiveness.

5. Conclusions

We have shown in this article that there are fiscal instruments which can be used to replicate a nominal devaluation. We show that in specific conditions an increase of the tax on the value added compensated by a decline of social contributions paid by firms can play this role. Note that the adjustments in fiscal policy are not automatic and would require a knowledge of the model and the shocks to be fully effective. But the movements in exchange rates that would be necessary to accomplish the same goal could be market determined, but would not be automatic either. The information that is necessary to conduct policy under flexible exchange rates so that the path for exchange rates is a particular one is exactly the same information necessary to affect directly the relative prices using tax rates.

However we should stress that the conditions imposed for the equivalence between nominal and fiscal devaluation, namely the passthrough of value added and payroll taxes, and the denomination of assets are extremely strong. And if they fail it is very difficult to have a fiscal devaluation that replicates the nominal devaluation.

In addition we want to stress that it is not clear that the advantages usually advanced for the use of the exchange rate as a stabilization policy instrument are the ones that can be obtained from the policy described in this article. As we said the potential need for a exchange rate comes here associated to a "disequilibrium" which calls for a permanent adjustment. In this sense if the exchange rate was the effective and efficient policy instrument the desirable policy would be a large devaluation. The literature uses exchange rate policy as a response to small, cyclical and short lived shocks, to which price and wage setting does not have an incentive to react. But the question under review result from permanent and of significative magnitude shocks. In this case we have to discuss in a very different way the type of distortions characterizing the economy which policy makers want to minimize through a devaluation, nominal or fiscal.

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A COMPARISON OF THE CYCLICAL EVOLUTION OF VARIOUS GEOGRAPHIC AREAS OF REFERENCE WITH PORTUGAL*

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ABSTRACT

This article evaluates the existing relative degree of association among several developed economies, including Portugal. Using the Kalman filter the cyclical evolution of GDP in Portugal is compared with the cyclical evolution of GDP from several other economies of reference, such as the euro area, France, Germany, Greece, Ireland, Italy, Japan, Spain, the UK and the US.

1. Introduction

The perspectives about the enlargement of the European Union (EU) and the consequent increase of the geographical and population dimensions of the euro area have motivated researchers to analyze the main characteristics of the business cycles in the new member states and the synchrony of cycles between these countries and the euro area as a whole. On the other hand, the determinants of cyclical co-movement and the possibility of the existence of a "common European cycle" have motivated a growing literature.

An exhaustive analysis of the literature, with relevant contributions to the topic, resorting to different theoretical and methodological approaches, can be found among others, in Artis (2003), Artis, Krolzig and Toro (2004), Woźniak and Paczyński (2007) and Guerreiro (2010). In general terms, the measure of joint evolution of cycles frequently used has been the coefficient of correlation between national cycles. In line with this research, the conclusions point towards an evident homogeneity of economic cycles in the EU (Agresti and Mojon, 2001, Christodoulakis *et al.*, 1995, Wynne and Koo, 2000), with some studies supporting the existence of a common cycle in the EU¹ (e.g. Agresti and Mojon, 2001, and Wynne and Koo, 2000). However, there is a general consensus that cycles have become more similar since the process of monetary integration, *i.e.*, from the 90s onwards (e.g. Ambler *et al.* 2004; Artis and Zhang, 1997, 1999; and Artis, Kontolemis and Osborn, 1997, among others).

A large number of studies focus on a particular country. For example, studies that focused on the UK have concluded that the country presented a stronger correlation with the US than with any other European country, in particular when data from the 60s and 80s are considered. A larger correlation with European countries has been observed in the period after the German unification in the 90s (see for example, Massmann and Mitchell, 2002, and Hall and Yhap, 2003, among others). Another set of studies are regionally focused and aim to investigate the existence of a regional economic cycle. However, the

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- 1 These studies, in general, refer to the period from 1980 to 1999.

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

exclusion of some regions of the euro area has made it difficult to obtain consensual conclusions (see, for example, Belke and Heine, 2006, Barrios and de Lucio, 2003, and Barrios *et al.*, 2002).

There are only a few studies about the specific situation of Portugal and the position of the respective cycle relatively to other member states. Cavalcanti (2007), for example, uses growth accounting to analyze the Portuguese economic cycle relatively to the US; Almeida, Castro and Felix (2009, pp.74-79) analyze the cyclical characteristics of the Portuguese economy and compare them with the euro area; and Valle e Azevedo (1999) presents a descriptive analysis of the economic cycles of the EU countries including Portugal. The contribution of this paper is twofold. On the one hand, it attempts to analyze the relation between the cyclical evolution in the EMU countries, relatively to the euro area, Portugal and the US, with the objective of analysing the existing relative degree and nature of association. On the other hand, in methodological terms, we chose to use the Kalman² filter and the development of specific tools to conduct simulations.

To compare the cycles of the euro area (limited to 15 countries)³ and a group of ten countries (France, Germany, Greece, Ireland, Italy, Japan, Portugal, Spain, the UK, and the US), quarterly GDP data was used (in PPP terms) for the period from the first quarter of 1961 to the first quarter of 2011, obtained from www.oecd.org.

The structure of the paper is as follows: Section 2 presents briefly the main aspects related to the methodology of analysis of the cycle and the comparative analysis between the economic cycles of several countries relatively to Portugal and the euro area; Section 3 reports the main conclusions.

2. Cyclical co-movement in the GDP of several economies

This section presents the general aspects of the methodology adopted to analyze the joint evolution of the economic cycles, followed by an analysis of results, first of the cycles of the several economies considered relatively to the Portuguese and the euro area cycles, for the period between 1961-Q1 and 2011-Q1, and at a disaggregated level of the countries of the euro area, for the period before and after the introduction of the euro.

2.1. Methodological framework

In this analysis an additive structural model is considered, where the dependent variable, $\{y_t\}$, represents the values of the observed time series of interest⁴, so that,

$$y_t = \Gamma_t + C_t + \varepsilon_t \tag{1}$$

The representation in (1) decomposes $\{y_t\}$ into a nonstationary component (trend) and a stationary component (cycle), considered as unobserved variables (Clark, 1987). Therefore, in equation (1), Γ_t represents the trend function, C_t the cyclical component and ε_t the noise component (Maybeck, 1979).

The modeling of the trend and cycle in the structural model in (1) can be carried out in different ways and with different representative models. However, according to Clark (1987) and Wada and Perron (2006), the structural model most frequently used, among the class of models found in studies that involve the economic cycle, is (1) with the following specification:

² In this analysis we will refer to the term "economy" to mention the evolution of the deviation of the cyclical component of GDP.

³ The euro area (15 countries) will be referred to hereafter as the euro area.

⁴ It is considered that the time series are seasonally adjusted.

$$\begin{cases} \boldsymbol{\Gamma}_{\boldsymbol{t}} = \boldsymbol{\Gamma}_{\boldsymbol{t}-1} + \boldsymbol{\beta}_{\boldsymbol{t}-1} + \boldsymbol{\delta}_{\boldsymbol{t}} \\ \boldsymbol{\beta}_{\boldsymbol{t}} = \boldsymbol{\beta}_{\boldsymbol{t}-1} + \boldsymbol{\theta}_{\boldsymbol{t}} \\ \boldsymbol{\phi} \Big(L \Big) \boldsymbol{C}_{\boldsymbol{t}} = \boldsymbol{\omega}_{\boldsymbol{t}} \end{cases}$$

where the trend, β_t , uses the known formulation of Theil and Wega (Crato, 1990), in which the variable follows an expected linear growth; both the trend (β_t) and level (Γ_t) evolve according to a "random walk" (Gilchrist, 1976) and $\phi(L)$ is a finite order polynomial in the lag operator, L, which, in this case, adopting the proposal of Clark (1987) and Wada and Perron (2006), is autoregressive of second order, AR(2), *i.e.*, $\phi(L) = 1 - \phi_1 L - \phi_2 L^2$ and consequently, the cyclical component, C_t , follows a second order autoregressive process. The complete representation of the structural model is,

$$\begin{cases} y_t = \Gamma_t + C_t + \varepsilon_t \\ \Gamma_t = \Gamma_{t-1} + \beta_{t-1} + \delta_t \\ \beta_t = \beta_{t-1} + \theta_t \\ C_t = \phi_1 C_{t-1} + \phi_2 C_{t-2} + \omega_t \end{cases}$$

$$(2)$$

The structural model in (2) is therefore the basis of this investigation, which is used for the representation of the observed data, y_t , and its unobserved components (trend, cycle and error).⁵

In this way, using the Kalman filter and GDP data for the euro area, France, Germany, Greece, Ireland, Italy, Japan, Portugal, Spain, the UK, and the US a study to isolate the cyclical component was carried out, based on (2) and its respective state space representation.

2.2. Aggregate analysis of the GDP cycle of several economies relatively to Portugal

Table 1 presents a set of summary results that compare the cyclical components of GDP relatively to the whole sample, *i.e.*, from the first quarter of 1961 to the first quarter of 2011, for the euro area, France, Germany, Greece, Ireland, Italy, Japan, Spain, the UK, and the US in relation to Portugal, sustained through statistical measures of the average characteristics of the economic cycles.

The analysis of table 1 allows for the identification of several stylized facts that need to be highlighted. **First**, all cycles have a positive correlation with the Portuguese cycle in the period under analysis, with values between 0,24 and 0,74. **Second**, there is an apparent moderate high (≥70%) contemporaneous correlation between Portugal and France and also with the euro area, and a moderate (>50%) correlation with Spain, Germany and Italy. The lowest contemporaneous correlation values are observed with respect to the countries which are not members of the Economic and Monetary Union, namely the US, Japan and the UK, but also Greece. **Third**, the different values of correlation indicate larger or smaller lagged periods between cycles. The lags (or leads) indicate the average number of quarters that the cycle of each country is lagged (or leading) in relation to Portugal, and their values vary between -4 and 4 quarters, during which a maximum correlation is observed. The tuning between the strength of contemporaneous correlation and the degree of lagging of the cycles of the countries is observed. In general, a small lag is related to strong contemporaneous correlation of the GDP cycles of the different countries. Hence, no lags are observed relatively to the euro area, France and Germany, a lag of one quarter is observed in relation to the Spanish cycle, which anticipates the Portuguese cycle, and a large lag in relation to the US and Greek cycles, which anticipate the Portuguese cycle by 12 months (4 quarters), respectively. This

⁵ The model in (2) will later be transformed into state-space formulation (see Guerreiro, Rodrigues and Andraz, 2010 for details), to make the subsequent application of the Kalman filter possible (Guerreiro, 2010), for the extraction of the signals (values) of each of the components (variables of interest).

| GDP CYCLE STATISTICS OF SEVERAL REFERENCE ECONOMIES 1961-Q1 TO 2011-Q1 | | | | | | | | | | | |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| | G | EA | S | US | F | G | Ire | I. | J | Р | UK |
| Correlation (Pearson) | 0,55 | 0,70 | 0,56 | 0,26 | 0,74 | 0,24 | 0,42 | 0,54 | 0,39 | | 0,35 |
| Lead (+) Lag (-) | 0 | 0 | 1 | 4 | 0 | 4 | 0 | 0 | -2 | | -2 |
| Synchrony (%) | 65,50 | 65,50 | 63,00 | 59,00 | 68,00 | 54,50 | 53,50 | 62,50 | 58,00 | | 59,50 |
| Standard deviation | 0,46 | 0,43 | 0,44 | 0,43 | 0,47 | 0,29 | 0,40 | 0,47 | 0,37 | 0,36 | 0,39 |
| Ratio of the standard deviation with GDP | 1,28 | 1,19 | 1,22 | 1,19 | 1,31 | 0,81 | 1,11 | 1,31 | 1,03 | 1,00 | 1,08 |
| Autocorrelation $x(t) - x(t-1)$ | 0,95 | 0,94 | 0,95 | 0,96 | 0,96 | 0,90 | 0,94 | 0,91 | 0,91 | 0,97 | 0,93 |
| Autocorrelation $x(t) - x(t-2)$ | 0,82 | 0,82 | 0,81 | 0,87 | 0,87 | 0,70 | 0,80 | 0,72 | 0,70 | 0,88 | 0,78 |
| Autocorrelation $x(t) - x(t-3)$ | 0,65 | 0,66 | 0,63 | 0,75 | 0,73 | 0,52 | 0,61 | 0,50 | 0,45 | 0,75 | 0,59 |

Source: Authors' calculations.

Note: Countries are represented as follows: G-Germany, EA - the euro area, S-Spain, US-United States, F-France, G-Greece, IRE-Ireland, I-Italy, J-Japan, P-Portugal and UK - the United Kingdom.

lag is quite long relatively to the average duration of the cycle, making it difficult, with these data and these statistical measures to associate the cyclical evolution of one variable with another, in the case of these countries. For Japan and the UK, the existence of a moderate/low (>30%) correlation is followed by a lag of the Portuguese cycle anticipating the cycles of these countries in about 6 months (2 quarters). Fourth, the synchronization⁶ of the cycles presents a low amplitude of variation, between 53,5% and 68%. The largest level of synchronization occurs with the French cycle, 68%, and with the German and euro area cycles, 65,5%. The lowest value, of 53,5%, corresponds to the level of synchronization with the Irish cycle. Fifth, the degree of volatility, measured by the standard deviation, presents a small interval of variation, between 0,29 and 0,47. The less volatile series are the Greek (0,29), the Portuguese (0,36), the Japanese (0,37) and that from the UK (0,39), so that an impact of a shock in these economies, taking into consideration these values, will eventually have smaller impacts than on the other countries under analysis, which present volatility values between 0,40 and 0,47. It is also observed that, in general, the cyclical fluctuations in the economies considered are greater than the fluctuations of the Portuguese cycle, except for Greece, where the fluctuations correspond on average to about 81% of the cyclical fluctuations in Portugal. Sixth, strong persistence is observed in all economies, when evaluated through the values of the autocorrelation, with values that vary between 0,90 and 0,97, 0,70 and 0,88, and 0,45 and 0,75, when one, two and three lags are considered, respectively.

The existence of historical relationships between economies such as, for instance, between the US and the UK, the geographical proximity, such as, for example, between Portugal and Spain, as well as the effects associated with the integration in the euro area of some economies under analysis and the dimension of the individual economies, among others, are important factors that need to be taken into consideration, in the analysis of the cyclical influences in the different economic areas.

Using only summary average values, such as those in table 1, can in certain circumstances be less useful than the immediate contemporaneous information about the cyclical evolution of the different economies, thus leading us to complement the previous analysis with a graphical analysis. For the graphical comparison of the cyclical evolution of the different economies under analysis, the values of the series have been normalized using the following formula:

⁶ The values of "synchronization" define the percentage points of positive and negative growth in common (in time) in the series under analysis, *i.e.*, define the points where the cyclical components increase and decrease simultaneously.

$$Norx_{t} = \frac{\left(x_{t} - x_{\textit{Minimum}}\right)(Norx_{\textit{Maximum}} - Norx_{\textit{Minimum}})}{x_{\textit{Maximum}} - x_{\textit{Minimum}}} + Norx_{\textit{Minimum}}, \ t = 1, \dots, n$$

where $Norx_t$ is the normalized value of the series, x_t is the value of the series at time t, and $Norx_{Maximum}$ and $Norx_{Minimum}$ are the maximum and minimum normalized values, respectively. In the present study, the normalized values, $Norx_t$, are defined in the closed interval [-1, 1], *i.e.*, $Norx_{Maximum} = 1$ and $Norx_{Minimum} = -1$, so that the previous expression can be simplified as,

$$Norx_{t} = \frac{2\left(x_{t} - x_{Minimum}\right)}{x_{Maximum} - x_{Minimum}} - 1, \ t = 1,...,n$$

From the analysis of the normalized cyclical evolution over the complete sample, from 1961-Q1 to 2011-Q1, it is observed that there is cyclical synchronization (*i.e.* common periods of positive and negative growth) between Portugal and the euro area, as well as with the largest economies, such as France, Germany, Italy and the UK. However, contrary to these economies, Portugal did not register, at the end of the sample, a change in the recessive trend of the last years. Portugal also presents a high cyclical coincidence with Spain, in particular since the adhesion of these two countries to the European Community in 1986, however, registering contrary movements from 2009 onwards. It is also possible to establish an almost perfect synchrony between Portugal and the US from 1995 onwards. The situation in relation to Greece presents some non-synchrony between 1960 and 2000, but since 2002 there seem to exist similarities in their evolutionary paths, with the Greek cycle slightly anticipating that of the Portuguese economy. Also Ireland and Portugal present many non-synchrony with the euro area and, therefore, with Portugal. Finally, comparing the cyclical evolution of Japan and Portugal, common periods of evolution and nonsynchronous phases of positive and negative growth are observed.

These facts suggest some uniformity between the different economies of the euro area countries under analysis, where we highlight in some more recent periods the non-synchrony behavior of the Portuguese and Greek cycles in relation to the other euro area economies, the US and Japan.

From chart 1 a strong cyclical uniformity in the evolution of some euro area countries can be observed, namely for France, Germany, Ireland, Italy and Spain, in the period from 1961-Q1 to 2011-Q1, high-lighting the extreme affinity over the last decade, *i.e.*, in the period after 2001.

Chart 2 presents the joint evolution of the two largest economies of the euro area (France and Germany) relatively to Greece and Portugal, where the existing synchrony/ nonsynchrony in these four economies over the last decade is highlighted.



2.3. Analysis of the GDP cycle of various economies relatively to Portugal over the last 10 years

Following the previous analysis of identification of the main stylized facts in the sample period under analysis, it becomes relevant to investigate the cycles of these economies in the periods before and after the introduction of the euro. Consequently, the values obtained with the Kalman filter for the variables observed over the period from 1961-Q1 to 2011-Q1, normalized between -1 and 1, were compared in the time periods 1961-Q1 to 2001-Q4 and 2002-Q1 to 2011-Q1.⁷ Tables 2 and 3 present the same set of statistical measures of table 1, thus facilitating the comparison with the cyclical components of GDP for the two sub-periods under analysis.

Table 3 indicates that there is an apparent high contemporaneous correlation between Portugal on the one hand, and the euro area, France, Germany, Ireland and Italy, on the other, with values ranging between 0.70 and 0.82. Between Portugal and Spain and the UK, the contemporaneous correlation is moderate/ high, 0.69 and 0.67, respectively. Finally, it should be noted that the gap between the cycles in Portugal and Greece is large, and that contemporaneous correlation is very low. The comparison with the levels of correlation observed in the period before the introduction of the euro, given in table 2, allows us to conclude that with the exception of Greece, correlation between Portugal and other economies, inside and outside the European area, increased significantly over the last decade.

The degree of synchrony of the Portuguese economy with all the other economies increased after 2001, and the maximum value was observed with the euro area, 80.56%, followed by Ireland, Japan, France and Germany, which denotes an increase in synchronization with the Irish and Japanese economies in the post-euro period.

Volatility, measured by the standard deviation increased over the last period considered, with values ranging between 0.49 and 0.68, when compared with the range between 0.31 and 0.50 obtained for

⁷ Given the specific characteristics of the Kalman Filter, the results for the period from 2002-Q1 to 2011-Q1 are less sensitive to the choice of the starting values of the filter (for more details see Guerreiro, Rodrigues and Andraz, 2010).

| GDP CYCLE STATISTICS FOR SEVERAL REFERENCE ECONOMIES 1961-Q1 TO 2011-Q1 | | | | | | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| | G | EA | S | US | F | G | Ire | 1 | J | Р | UK |
| Correlation (Pearson) | 0,57 | 0,76 | 0,59 | 0,24 | 0,78 | 0,23 | 0,43 | 0,54 | 0,41 | | 0,34 |
| Lead (+) Lag (-) | 0 | 0 | 2 | 4 | 0 | 4 | -1 | 0 | -2 | | -2 |
| Synchrony (%) | 64,42 | 61,69 | 60,74 | 58,28 | 66,26 | 51,53 | 51,53 | 58,90 | 53,37 | | 56,44 |
| Standard deviation | 0,45 | 0,50 | 0,44 | 0,42 | 0,46 | 0,31 | 0,43 | 0,47 | 0,41 | 0,39 | 0,39 |
| Ratio of the standard deviation with GDP | 1,15 | 1,28 | 1,13 | 1,08 | 1,18 | 0,79 | 1,10 | 1,21 | 1,05 | 1,00 | 1,00 |
| Autocorrelation $x(t) - x(t-1)$ | 0,95 | 0,95 | 0,95 | 0,96 | 0,97 | 0,89 | 0,94 | 0,90 | 0,91 | 0,96 | 0,93 |
| Autocorrelation $x(t) - x(t-2)$ | 0,83 | 0,83 | 0,81 | 0,86 | 0,87 | 0,69 | 0,79 | 0,71 | 0,73 | 0,88 | 0,78 |
| Autocorrelation $x(t) - x(t-3)$ | 0,68 | 0,69 | 0,62 | 0,75 | 0,75 | 0,51 | 0,59 | 0,48 | 0,50 | 0,75 | 0,60 |

Source: Authors' calculations.

Note: Countries are represented as follows: G-Germany, EA - the euro area, S-Spain, US-United States, F-France, G-Greece, IRE-Ireland, I-Italy, J-Japan, P-Portugal and UK - the United Kingdom.

Table 3

| GDP CYCLE STATISTICS FOR SEVERAL REFERENCE ECONOMIES 2002-Q1 TO 2011-Q1 | | | | | | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| | G | EA | S | US | F | G | Ire | 1 | J | Р | UK |
| Correlation (Pearson) | 0,82 | 0,75 | 0,69 | 0,54 | 0,72 | 0,19 | 0,70 | 0,76 | 0,52 | | 0,67 |
| Lead (+) Lag (-) | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | -1 | | 0 |
| Synchrony (%) | 75,00 | 80,56 | 72,22 | 61,11 | 75,00 | 66,67 | 63,89 | 77,78 | 77,78 | | 72,22 |
| Standard deviation | 0,55 | 0,57 | 0,58 | 0,68 | 0,58 | 0,62 | 0,57 | 0,56 | 0,49 | 0,50 | 0,50 |
| Ratio of the standard deviation with GDP | 1,10 | 1,14 | 1,16 | 1,36 | 1,16 | 1,24 | 1,14 | 1,12 | 0,98 | 1,00 | 1,00 |
| Autocorrelation $x(t) - x(t-1)$ | 0,93 | 0,94 | 0,95 | 0,94 | 0,95 | 0,91 | 0,95 | 0,93 | 0,88 | 0,81 | 0,93 |
| Autocorrelation $x(t) - x(t-2)$ | 0,74 | 0,79 | 0,82 | 0,84 | 0,83 | 0,75 | 0,82 | 0,77 | 0,62 | 0,53 | 0,75 |
| Autocorrelation $x(t) - x(t-3)$ | 0,49 | 0,58 | 0,64 | 0,71 | 0,65 | 0,58 | 0,65 | 0,56 | 0,30 | 0,28 | 0,50 |

Source: Authors' calculations.

Note: Countries are represented as follows: G-Germany, EA - the euro area, S-Spain, US-United States, F-France, G-Greece, IRE-Ireland, I-Italy, J-Japan, P-Portugal and UK - the United Kingdom.

the previous period. The lowest values are recorded for Japan (0.49), Portugal (0.50) and the UK (0.50), and higher values are observed for the US (0.68) and Greece (0.62). In terms of the Portuguese cyclical fluctuation, it appears that the other economies report higher oscillations, having, however, registered a decrease in almost all cases, except for Greece, Ireland, Spain and the US.

The autocorrelations in the various countries under study continue to suggest the continuity of strong persistence. However, there is a reduction in the values of correlation after 2001, particularly in the higher-order correlations, which is certainly not independent from the effects of adopting the single currency by the EMU member states. However, there are exceptions, such as Greece, Ireland and Italy, where persistence was accentuated over the last decade.

The standard cyclical evolution of the euro area, France, Germany, Greece, Ireland, Italy, Portugal, Spain, the UK and the US, over the last decade, is presented in chart 3.

Chart 3



Source: Authors' calculations.

-1.2

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

The observed facts suggest that the great uniformity observed over the whole sample period between the different economies of the euro area, namely France, Germany, Ireland, Italy and Spain, continues to hold over the last decade. This is clear from chart 4.

It appears that, in most recent years, in particular from the mid-2009 onwards, Greece differs from the group of other euro area member countries, by evolving in descending order, contrary to the general tendency. For Portugal a similar behavior is observed from mid-2010 onwards. Chart 5 highlights this aspect by comparing the cyclical evolution of the euro area, Portugal and Greece.



Source: Authors' calculations.

Source: Authors' calculations.

2.4. Analysis of the GDP cycle of several advanced economies in relation to the euro area

Taking into account the differences in monetary units in circulation in the countries under analysis, it was also decided to investigate the cyclical coincidences between the US, Japan and the UK with the euro area during the period from 1961-Q1 to 2011-Q1 and the sub-periods before and after the introduction of the euro.

Tables 4, 5 and 6 and chart 6 present the main results. Japan, the US and the UK report a moderate and moderate/high contemporaneous correlation with the euro area, and it is observed that this correlation has increased significantly over the past 10 years, denoting an increased level of economic integration. However, it appears that the US cycle anticipates the average cyclical phenomenon in the euro area by two quarters. Instead, the cycles of Japan and the UK anticipate, on average, the cycle of the euro area by a quarter. The degree of synchronization is also high throughout the period, but again, over the last period economies have become more synchronized, registering values of 91.7% for the US. Volatility registered an increasing trend in all economies in the sample period under analysis, recording the highest figures over the last 10 years, suggesting higher volatility in the US and lower volatility in Japan, the UK, and the euro area.

Given the existing similarities between the Portuguese cyclical evolution and that of the euro area, the conclusions can, therefore, be extrapolated from those made for Portugal with the cycles of the US, Japan and the UK.

| STATISTICS OF THE GDP CYCLE IN THE EURO AREA, US, JAF | PAN AND TH | ε υκ | | |
|---|------------|-------|-------|-------|
| | EA | US | J | UK |
| Correlation (Pearson) | | 0,51 | 0,63 | 0,65 |
| Lead (+) Lag (-) | | -2 | -1 | -1 |
| Synchrony (%) | | 63,50 | 61,50 | 71,00 |
| Standard Deviation | 0,43 | 0,43 | 0,37 | 0,39 |
| Ratio of the standard deviation with GDP | 1,00 | 1,00 | 0,86 | 0,91 |

Source: Authors' calculations.

Table 5

| STATISTICS OF THE GDP CYCLE IN THE EURO AREA, US, JAP | AN AND THE | UK 1961-Q | 1 TO 2001-Q4 | |
|---|------------|-------------|--------------|-------|
| | EA | US | J | UK |
| Correlation (Pearson) | | 0,41 | 0,54 | 0,56 |
| Lead (+) Lag (-) | | -2 | -1 | -2 |
| Synchrony (%) | | 61,69 | 58,28 | 66,26 |
| Standard Deviation | 0,50 | 0,42 | 0,41 | 0,39 |
| Ratio of the standard deviation with GDP | 1,00 | 0,84 | 0,82 | 0,78 |

Source: Authors' calculations.

Table 6

| TATISTICS OF THE GDP CYCLE IN THE EURO AREA, US, JAPAN AND THE UK 2002-Q1 TO 2011-Q1 | | | | | | | | | | | |
|--|------|-------|-------|-------|--|--|--|--|--|--|--|
| | EA | US | J | UK | | | | | | | |
| Correlation (Pearson) | | 0,79 | 0,83 | 0,97 | | | | | | | |
| Lead (+) Lag (-) | | -1 | -1 | 0 | | | | | | | |
| Synchrony (%) | | 69,44 | 75,00 | 91,67 | | | | | | | |
| Standard Deviation | 0,57 | 0,68 | 0,49 | 0,50 | | | | | | | |
| Ratio of the standard deviation with GDP | 1,00 | 1,19 | 0,86 | 0,88 | | | | | | | |

Source: Authors' calculations.



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Source: Authors' calculations.

3. Conclusion

This study analyses the evolution of the Portuguese GDP cycle and that of several reference economies, in particular the euro area, France, Germany, Greece, Ireland, Italy, Japan, Spain, the UK and the US. The results underpin several ideas referenced in the literature regarding the cyclical association of the economies investigated.

The medium and high contemporaneous correlation between Portugal and some countries of the euro area and the fact that the Portuguese cycle decreases from mid-2010 onwards seem to be relevant factors. On the other hand, it appears that cyclical synchronization of Portugal in the period 2001-Q1 to 2011-Q1 is mostly with the euro area. When we consider the period 1961-Q1 to 2011-Q1, the synchronization is greater with France. In the period 2001-Q1 to 2011-Q1, the Portuguese economy was the least volatile (after Greece), among all economies of the euro area, suggesting that the impact of a shock in the Portuguese and Greek economies, have a lower amplification. In this same period, the US emerged as the more volatile economy.

The US cycle also anticipates the cycle of the euro area member states and displays great synchronization with those economies. In late 2010, the US cycle seems to start a process of descent that is not accompanied by most countries in the euro area.

It is natural that the evolution of the Portuguese business cycle, as well as other economies' cycles, undergoes changes resulting from the process of economic and financial adjustment. The future evolution of the Portuguese trend and cycle will be determined largely by the balance of the results of the profound changes that the economy is undergoing.

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PUBLIC-PRIVATE WAGE GAPS IN THE PERIOD PRIOR TO THE Adoption of the Euro: An Application based on longitudinal data*

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ABSTRACT

This paper analyses the evolution of public wages and the public-private wage gaps in the period prior to the adoption of the euro in the countries then engaged on the fulfillment of the Maastricht criteria. The results suggest a relative moderation in the growth of public sector wages in several European countries in the 1990s and the existence of a positive wage differential benefiting public employees that appears to have increased along the period. Therefore, the fact that European countries were undertaking efforts to comply with the requirements for adopting the single currency does not seem to have contributed to the reduction of the wage premium that the literature has typically associated with public sector employment. It is noteworthy that the countries where the wage differential is higher are Portugal, Ireland, Greece and Spain. This differential is, to a large extent, an actual wage premium associated with the public sector, but self-selection effects determining that the best workers prefer the public sector cannot be neglected. Nevertheless, the wage premia tend to be smaller in the case of individuals with higher earnings, making it difficult for the public sector to attract the more qualified workers. This difficulty may be worsened by across-theboard measures to reduce wages and employees.

1. Introduction

Compensation of employees is one of the main drivers of public expenditure in the euro area. In the current context, where most Member-states are undertaking consolidation efforts, the size of the public sector wage bill has been under scrutiny and measures aiming at its reduction have been announced across Europe. Campos (2011) identified and analysed episodes of fiscal adjustment taking place in a period in which, as currently, European countries were engaged in fiscal consolidation, then with the goal of fulfilling the criteria for adopting the single currency. That paper confirmed that on the transition to the European Monetary Union no major cuts were made in primary expenditure items such as social transfers and compensation of employees. Nevertheless, the need to comply with the Maastricht criteria could have allowed European governments to eliminate positive public-private wage gaps without major political costs. In order to assess the validity of this idea, in this paper we focus on the analysis of these gaps in several Member-states in the period bounded by the coming into force of the Maastricht Treaty and the inception of the euro area (1993-1999).

^{*} The authors are thankful to Cláudia Braz, Jorge Cunha, José Ferreira Machado, Ricardo Martinho, Álvaro Novo and Manuel Pereira for helpful comments and suggestions. The opinions expressed in the article are those of the authors and do not necessarily coincide with those of the Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the authors.

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To analyse the evolution of public wages and the public-private wage gaps on the run-up to the euro area, we use data from the European Community Household Panel (ECHP), that covers EU-15 Member-states in the period from 1993 to 2000. In order to measure this wage differential while controlling for unobservable individual attributes of workers, we take advantage of the longitudinal structure of the ECHP and resort to fixed effects regressions. An exploratory analysis of the data suggests that in the period leading to the adoption of the euro, there is evidence of a certain degree of wage moderation in several Member-states. However, the estimates suggest that European governments did little to reduce the markup that the literature generally associates with public employment.

2. Data

We use data drawn from the ECHP. This dataset, made available by Eurostat, is a longitudinal survey of households and individuals that covers 15 EU Member-states. Eight waves of data have been released, spanning from 1994 to 2001. However, not all countries participated in the survey from the beginning: Austria, Finland and Sweden were only added in the second, third and fourth years, respectively. The main advantage of this data source is that the questionnaire and methodology are standardized, thus cross-country comparisons are allowed. The panel is supposed to be representative of the EU population both in cross-sectional and longitudinal terms, at the level of households and individuals. The dataset comprises information on gender, age, education, wage and other income sources, marital status and occupation, among other variables.

A few preliminary points should be made regarding some of the variables that are used to estimate the public-private wage gap. We use the hourly wage as a measure for individual earnings. As the information on gross wages is not available for the Luxembourg we excluded this country from our analysis and, for the remaining countries, we computed the logarithm of hourly earnings using data on the weekly number of working hours.¹ Moreover, the wage variables in the ECHP do not include elements such as performance-related and in-kind payments, that can be an important part of the individuals' total earnings (particularly in the private sector). Other differences between sectors stemming from pension entitlements, health-care schemes or implicit benefits such as life-long job protection are also difficult to quantify. Finally, it is worth highlighting that, while most of the other variables refer to the year of the interview, those related to individual earnings report values for the year prior to the survey. Thus, for the purpose of our analysis, we consider that the period covered is actually 1993-2000.

The information on educational attainment is restricted to a very general categorical variable that distinguishes between third level education and two stages of secondary education. There is no information on the experience accumulated by the individuals since joining the labour force. However, it is possible to identify the tenure in the current job. The inclusion of the "age" variable in our regressions mitigates the absence of data on the total work experience.

The sample was selected according to several criteria. In particular, we excluded the observations corresponding to individuals that are not working in paid employment, do not have a full-time job, do not report the employment sector, are not of working age (*i.e.*, that are younger than 15 or older than 65 years) or are not followed for, at least, two consecutive years. Finally, we detected that the sample referring to Belgium suffered considerable depletion along the eight years of the ECHP. As the small size of the Belgian sample may compromise the validity of the results, we excluded this country from the analysis. Denmark, Sweden and the United Kingdom were also excluded. By restricting the sample according to these conditions, we ended up with 206,468 observations, corresponding to 46,752 individuals, from 10 euro area countries.

¹ The observations for which the computation resulted in an amount of hourly earnings below the 1st or above the 99th percentile of the distribution for each country-year pair were excluded from the sample.

3. Exploratory analysis of the data

Table 1 compares the share of public sector employees in total employment, as reported in the Eurostat's NewCronos database, with the sub-sample of ECHP we are using. It shows that the composition of employment by sector in the sample is close that what would be obtained in official statistics (with the exception of Germany in 1993 and Finland).

| PROPORTION OF PUBLIC SECTOR EMPLOYEES IN THE LABOUR FORCE PER CENT | | | | | | | | |
|--|------|-------|------|------|--|--|--|--|
| | Euro | ostat | ECHP | | | | | |
| | 1993 | 2000 | 1993 | 2000 | | | | |
| Germany | 21.3 | 25.1 | 32.7 | 26.2 | | | | |
| Netherlands | 30.3 | 28.3 | 28.6 | 25.4 | | | | |
| France | 29.3 | 29.5 | 25.8 | 24.9 | | | | |
| Ireland | 24.6 | 22.1 | 23.5 | 22.0 | | | | |
| Italy | 28.1 | 29.0 | 38.6 | 37.5 | | | | |
| Greece | 29.3 | 28.8 | 46.4 | 39.4 | | | | |
| Spain | 21.8 | 20.6 | 32.8 | 25.8 | | | | |
| Portugal ^(a) | 21.0 | 21.5 | 22.5 | 21.1 | | | | |
| Austria ^(b) | 22.0 | 22.3 | 21.2 | 22.2 | | | | |
| Finland ^(b) | 32.3 | 28.9 | 46.2 | 39.3 | | | | |

Table 1

Sources: Authors' calculations based on data from the ECHP and Eurostat's Labour Force Survey.

Notes: (a) The Labour Force Survey data features a structural break in the case of Portugal. Thus, as an alternative, we use National Accounts data, that is only available from 1995 onwards. (b) For Austria and Finland the earlier figures refer to 1995.

Approximately 86.8 per cent of the individuals that report being a public sector employee have remained in that sector during the entire time span covered by the panel, while 7.6 per cent report having worked in both sectors in the period considered. Table 2 compares public and private sector employees across a set of individual characteristics as of time of the first and last waves of the ECHP. It shows, in particular, that public employees are, on average, older and have more tenure than private sector workers. There is also evidence that, in every country in our sample with the exception of Greece in 1993, the proportion of women in the public sector is higher than in the private sector. Finally, the table indicates that the percentage of individuals reporting tertiary educational level is considerable higher amongst public employees.

The fact that public and private sector employees are different in terms of the individual characteristics depicted in table 2 brings about differences in what regards their hourly wages. In fact, as shown in table 3, in general, the average hourly wage is higher among public sector employees. In the first wave of the ECHP the difference averages 17.3 per cent, ranging from 3.2 per cent in Finland to 36.0 per cent in Portugal. In the last year of the survey, the average gap stands at 17.4 per cent, Portugal continues to present the highest public-private wage differential (36.6 per cent), while France features the smallest gap (1.8 per cent).

As shown in chart 1, the raw wage gap between the public and the private sectors narrowed along the 1993-2000 period in most countries. Greece, Ireland, Italy and Portugal are the only exceptions, with the gap widening by 10.6, 4.7, 1.0 and 0.6 percentage points, respectively. It is noteworthy that results in Campos (2011) suggest that, in this set of countries, consolidation efforts in the period prior to the adoption of the euro were not substantial: only a limited number of small episodes of fiscal adjustment was identified, none of which was persistent in reducing the fiscal deficit and public debt ratios. In terms of monthly wages, the gap between public and private sectors is considerably less pronounced (averaging 13.0 per cent and 12.1 per cent, respectively in the first and last waves), which is explained by the fact that the average number of working hours per week is higher in the private sector (a feature that is observable in every country in our sample). We also find important differences between the two sectors' wage distributions. In the first place, the coefficients of variation, computed using the figures in

| PUBLIC VS PRIVATE SECTOR WORKERS: SUMMARY STATISTICS | | | | | | | | | | |
|--|---------|---------------------------|--------|---------------|--------|---------|------------|-----------|---------|-----------|
| | | | | 19 | 93 | | | | | |
| | A | Age | | Married Males | | | Tertiary I | Education | Ter | iure |
| | (averag | (average, years) (per cen | | cent) | (per | cent) | (per | cent) | (averag | e, years) |
| | Public | Private | Public | Private | Public | Private | Public | Private | Public | Private |
| Germany | 40.6 | 39.0 | 70.3 | 69.8 | 58.3 | 71.8 | 35.2 | 20.9 | 13.7 | 11.2 |
| Netherlands | 39.9 | 37.5 | 65.3 | 66.5 | 67.9 | 78.4 | 41.2 | 17.2 | 13.9 | 11.4 |
| France | 40.4 | 38.4 | 65.8 | 63.7 | 42.6 | 65.4 | 34.0 | 21.4 | 16.3 | 12.6 |
| Ireland | 39.5 | 35.3 | 75.6 | 57.3 | 54.8 | 71.3 | 37.6 | 16.1 | 16.2 | 10.9 |
| Italy | 41.9 | 36.6 | 80.6 | 64.1 | 63.5 | 69.9 | 11.0 | 4.3 | 17.7 | 13.3 |
| Greece | 40.4 | 36.5 | 80.0 | 65.5 | 68.9 | 65.2 | 38.5 | 21.9 | 15.6 | 9.4 |
| Spain | 40.8 | 38.7 | 74.6 | 68.5 | 60.5 | 75.4 | 50.0 | 18.3 | 15.9 | 12.3 |
| Portugal | 40.9 | 36.6 | 79.3 | 65.4 | 46.9 | 64.9 | 19.0 | 2.6 | 16.3 | 11.7 |
| Austria ^(a) | 39.7 | 36.0 | 67.8 | 57.6 | 54.3 | 71.9 | 21.0 | 4.2 | 10.7 | 8.6 |
| Finland ^(a) | 43.2 | 40.1 | 76.0 | 66.2 | 39.7 | 62.1 | 51.3 | 32.4 | 10.8 | 8.7 |
| | 2000 | | | | | | | | | |

| | Age (average, years) | | Married (per cent) | | Males (per cent) | | Tertiary I (per | Education cent) | Ter (averag | nure e, years) |
|------------------------|-------------------------|---------|-----------------------|---------|---------------------|---------|--------------------|--------------------|----------------|-------------------|
| | Public | Private | Public | Private | Public | Private | Public | Private | Public | Private |
| Germany | 42.5 | 40.6 | 66.6 | 68.0 | 52.9 | 68.9 | 43.5 | 26.6 | 11.7 | 9.7 |
| Netherlands | 42.8 | 39.6 | 61.5 | 62.3 | 63.9 | 76.7 | 25.4 | 13.7 | 11.5 | 9.1 |
| France | 43.0 | 39.6 | 65.6 | 57.9 | 42.1 | 61.7 | 38.2 | 32.9 | 15.5 | 11.4 |
| Ireland | 43.1 | 36.7 | 70.0 | 56.4 | 55.2 | 66.7 | 49.3 | 21.2 | 15.0 | 8.3 |
| Italy | 43.8 | 37.7 | 76.0 | 66.7 | 56.4 | 68.6 | 17.4 | 6.7 | 16.0 | 10.7 |
| Greece | 42.4 | 36.3 | 75.6 | 59.5 | 60.6 | 64.1 | 45.6 | 21.6 | 14.5 | 7.6 |
| Spain | 41.4 | 37.0 | 70.9 | 63.2 | 55.0 | 68.9 | 61.2 | 31.3 | 13.4 | 8.3 |
| Portugal | 40.9 | 36.4 | 74.3 | 66.9 | 40.9 | 61.2 | 32.0 | 6.2 | 13.9 | 9.8 |
| Austria ^(a) | 41.4 | 37.6 | 64.5 | 54.0 | 53.6 | 70.2 | 26.5 | 5.5 | 14.2 | 11.0 |
| Finland ^(a) | 44.1 | 40.0 | 71.4 | 58.6 | 35.9 | 62.6 | 57.3 | 35.7 | 12.0 | 8.3 |

Sources: Authors' calculations based on data from the ECHP.

Note: (a) Data for Austria and Finland refer to 1994 and 1995, respectively.

table 3, are generally higher in the private sector, implying that the wage distribution tends to be more compressed in the public.

Chart 2 shows that the densities vary greatly across countries. As a matter of fact, there are countries, such as Germany, France and Ireland, in which both sectors' wage distributions are relatively disperse, but in Italy, Greece and Portugal they feature heavier tails. A within-country comparison between the distributions referring to the public and private sector wages also points out several interesting differences. On the one hand, in the cases of Germany or Austria, the wage distribution in the private sector is very similar to that of public employees. On the other hand, data concerning countries such as Greece, Spain, Portugal and Ireland suggest that the distributions of public and private sector wages are quite different, with the distribution estimated for the private sector skewed to the left and the probability mass concentrated around lower wage levels.

The public sector wage evolution in the period covered in the ECHP is consistent with a feature documented in Alesina *et al.* (2008): in the period leading to the adoption of the euro, the countries that were then engaged in fulfilling the Maastricht criteria experienced a certain degree of wage moderation.² This feature is naturally less obvious in a set of countries coinciding with those for which evidence in Campos (2011) suggests that consolidation efforts undertaken during the period immediately before the inception of the euro area were not remarkable. Notwithstanding, the need to comply with the requirements for adopting the single currency could have offered European governments a window of opportunity to

² For more details on the evolution of public and private sector wages in the countries in the sample, see Campos and Centeno (2012).

| HOURLY WAG | | | | | | | | | | | |
|------------------------|--------|---------|---------------------|----------|-----------|---------|---------|----------|---------|--|--|
| | | | | 1993 | | | | | | | |
| | | Mean | | Standard | deviation | Me | dian | Skewness | | | |
| | Public | Private | Differential (%) | Público | Privado | Público | Privado | Público | Privado | | |
| Germany | 8.9 | 8.0 | 9.6 | 3.5 | 3.1 | 8.0 | 7.6 | 1.2 | 1.0 | | |
| Netherlands | 8.9 | 7.9 | 10.3 | 2.4 | 2.3 | 8.5 | 7.5 | 1.0 | 1.1 | | |
| France | 9.6 | 8.7 | 9.2 | 4.1 | 4.1 | 8.6 | 7.7 | 1.9 | 1.7 | | |
| Ireland | 9.2 | 6.5 | 28.8 | 3.6 | 3.0 | 8.5 | 6.0 | 0.7 | 1.1 | | |
| Italy | 6.2 | 5.2 | 16.2 | 1.6 | 1.6 | 5.8 | 4.8 | 1.9 | 1.4 | | |
| Greece | 3.5 | 2.7 | 21.1 | 1.0 | 1.1 | 3.3 | 2.5 | 0.9 | 1.5 | | |
| Spain | 6.8 | 4.7 | 30.3 | 2.5 | 2.1 | 6.2 | 4.2 | 1.0 | 1.5 | | |
| Portugal | 3.5 | 2.2 | 36.0 | 1.7 | 1.1 | 3.0 | 1.9 | 1.0 | 2.0 | | |
| Austria ^(b) | 8.6 | 7.9 | 8.7 | 2.6 | 2.7 | 8.1 | 7.5 | 0.8 | 0.9 | | |
| Finland ^(b) | 7.5 | 7.2 | 3.2 | 2.1 | 2.0 | 7.0 | 6.8 | 1.0 | 1.1 | | |
| | | | | 2000 | | | | | | | |

| | | Mean | | | deviation | Me | dian | Skewness | | |
|-------------|--------|---------|---------------------|---------|-----------|---------|---------|----------|---------|--|
| | Public | Private | Differential (%) | Público | Privado | Público | Privado | Público | Privado | |
| Germany | 10.1 | 9.2 | 9.1 | 3.4 | 3.3 | 9.5 | 8.6 | 0.9 | 1.0 | |
| Netherlands | 10.7 | 9.9 | 8.2 | 3.0 | 3.2 | 10.4 | 9.2 | 1.1 | 1.2 | |
| France | 10.5 | 10.3 | 1.8 | 3.8 | 4.5 | 9.8 | 9.2 | 1.1 | 1.5 | |
| Ireland | 16.4 | 10.9 | 33.5 | 7.1 | 3.9 | 14.7 | 10.3 | 1.0 | 1.0 | |
| Italy | 7.9 | 6.5 | 17.2 | 2.2 | 2.0 | 7.3 | 6.1 | 1.5 | 1.4 | |
| Greece | 6.2 | 4.3 | 31.7 | 2.2 | 1.7 | 5.7 | 3.8 | 1.0 | 1.8 | |
| Spain | 8.9 | 6.5 | 26.8 | 3.3 | 2.9 | 8.1 | 5.8 | 0.7 | 1.5 | |
| Portugal | 5.3 | 3.4 | 36.6 | 2.6 | 1.6 | 4.5 | 2.8 | 1.1 | 2.4 | |
| Austria | 8.8 | 8.2 | 6.9 | 2.5 | 2.3 | 8.2 | 7.9 | 1.2 | 0.9 | |
| Finland | 9.2 | 9.0 | 2.0 | 2.5 | 2.5 | 8.8 | 8.4 | 1.1 | 1.1 | |

Sources: Authors' calculations based on data from the ECHP.

Notes: (a) The information on wages and salaries was originally expressed in national currency, but we converted it in euro to ensure cross-country comparability. (b) Data for Austria and Finland refer to 1994 and 1995, respectively.

Chart 1

PUBLIC VS PRIVATE SECTOR: RAW WAGE DIFFERENTIAL



Sources: Authors' calculations based on data from the ECHP.

Note: The raw wage gap is measured as the difference between the public and private sector average wages as a percentage of the former.



Sources: Authors' calculations based on data from the ECHP. **Note:** The charts depict, for each country, the distribution of hourly wages estimated using the Epanechnikov kernel function.

eliminate the markup rate that the literature generally associates with public service. In order to assess the validity of this idea, in what follows we analyse how the public-private wage gap changed along the period corresponding to the run-up to the inception of the euro area.

4. Empirical analysis: Estimation of the public-private wage gap

4.1. Methodology

In the previous section we point out that public and private sector employees differ in terms of their personal characteristics. In particular, we provide evidence that, on average, public employees are older, have more tenure and are more educated than workers in the private sector, which can explain the existence of the raw wage differential depicted in chart 1, as well as the differences between both sectors' wage distributions shown in chart 2. These differences may reflect the sorting of workers between sectors or distinct distributions of employee attributes and not necessarily an actual sector effect. Therefore, to assess whether individuals that otherwise share the same productivity-related characteristics are paid differently because they work in the public sector, those characteristics must be controlled for.

Previous works on this matter include Disney and Gosling (1998), focusing on data for the United Kingdom, Jurges (2001) and Melly (2002), that study the German case, Lucifora and Meurs (2004), that analyse the cases of France, Italy and the United Kingdom, Boyle *et al.* (2004), that focused on Ireland, Bargain and Melly (2008), that shed light on the public sector pay gap in France, and studies by Portugal and Centeno (2001) and Campos and Pereira (2009), applied to Portugal. The public wage gap varies considerably across countries, reflecting differences in the institutional settings that govern employment and wage determination both in the public and the private sector. However, in general, these studies provide evidence of a positive public-private wage gap. This gap tends to be higher in the case of women and typically narrows as one moves up the earnings distributions.

In order to identify the existence of significant public-private wage gaps, the most extensively used strategy consists in a wage regression including work-related characteristics of individuals (X_i) and a dummy indicating public sector employment (P_i). The coefficient referring to this dummy (δ) is interpreted as a premium, if positive, or a penalty, if it is negative:

$$y_{i} = X_{i}^{'}\beta + \delta P_{i} + \varepsilon_{i} \tag{1}$$

As Melly (2002) points out, the dummy-based approach has an important shortcoming: implicitly, it assumes that the returns to individual attributes and job characteristics are equal in the public and the private sectors and limits the effect of the sector of employment to a single coefficient. An alternative approach consists in the break-down of the wage gap in two components: differences between the public and private sector in terms of measurable attributes of its workers and differences in the returns to the same attributes. The latter difference is interpreted as the wage premium. These differences may be evaluated at the means of the two sectors wage distributions (as in the seminal works of Blinder (1973) and Oaxaca (1973)) or at different quantiles (as in Machado and Mata (2001)). The analysis undertaken in this paper relies on the dummy approach, applied to cross-section and longitudinal data.

We begin by computing the public-private wage gap using cross-sectional methods. In particular, to obtain estimates of the impact of working in the public sector at the mean of the distribution of wages, we run Ordinary Least Squares (OLS) regressions pooling data for public and private sector employees. This method is complemented by the estimation of quantile regressions, introduced by Koenker and Basset (1978), to estimate θ different coefficients that measure the marginal effect of the sector of employment on the logarithm of wages at θ different points of the distribution.

Cross-sectional methods do not take into account unobserved (and thus unmeasurable) individual heterogeneity. In fact, there are features that can affect differently individuals in the two sectors but cannot be assessed by simple raw wage comparison and that are not captured by estimations conditional on observables. This includes not only unobserved personal skills that may affect wages, but also individual preferences determining the sorting of employees between the sectors (for instance, the utility obtained from working in the public sector *per se* or from benefiting from a stable employment relationship). These aspects determine unmeasured individual heterogeneity and may generate self-selection into one of the sectors, in which case cross-sectional results are hampered by endogeneity. Therefore, in addition to provide a more accurate assessment of the wage gap, controlling for individual heterogeneity is also useful to obtain insight on the relative quality of the human resources in each sector.

As Bargain and Melly (2008) and Bargain and Kwenda (2009), we take advantage of the longitudinal structure of our data to control for selection and use a fixed effects model to obtain results for the mean of the distributions. To control for the time-specific effects, we include dummies for the first seven waves of the panel. The same strategy cannot be used to control for the individual-specific effects given the short length of our panel and the large number of individuals. Instead, we remove the individual fixed effects by time-demeaning the data using the within transformation that is undertaken by subtracting to the variables the corresponding individual means (for additional details on the fixed effects estimations, see Campos and Centeno (2012)).

4.2. Results

4.2.1. Cross-sectional approach

The results of the estimation of the public-private wage gap based on OLS for each country and each wave of the panel are summarized in table 4.³ This table shows that the evolution of the gap (conditional on observables) is similar to the trend obtained for the raw differential (Chart 1), but its level is - in some cases considerably - lower. This suggests that, although the better human capital endowments of civil servants explain part of the wage gap between the two sectors, a non-negligible part remains attributable to a pure sector effect. In most countries in our sample the unexplained part is favourable to public employees and represents a wage premium, but results vary greatly. The highest average gaps were obtained for Portugal (19.8 per cent), Ireland (18.9 per cent) and Greece (18.6 per cent). On the contrary, the smaller gaps correspond to France and Austria (2.9 and 3.0 per cent, respectively), while Finland is the only country for which the estimate for the public sector coefficient is negative across the entire period. Table 4 also shows that the average public-private wage gap decreased along the time-span covered in our analysis. Nonetheless, small increases are observable in the cases of Germany and the Netherlands, while in Greece and Ireland the gap considerably widened.

The estimates presented in table 4 are broadly in line with previous literature on public-private wage gaps. For instance, using data from the Bank of Italy Survey of Household Income for 1998, Lucifora and Meurs (2004) presents figures that are very similar to those we estimate for Italy using the 1998 wave of ECHP, but their results for France point to higher gaps. Bargain and Melly (2008) also obtained higher values for the public-private wage gap in France, using data from the French Labour Force Survey for the 1991-2002 period. Campos and Pereira (2009) used the Portuguese Public Administration Census and matched employer-employee data from "*Quadros de Pessoal*" to estimate the public-private wage gap in Portugal in 1996 and 1999 and obtained figures very close to ours. Finally, Boyle *et al.* (2004)

³ The full set of results of OLS-based estimations (available from the authors upon request) shows that, in the majority of cases, the coefficients have the expected sign and are statistically significant. In particular, our results for every country point out that, both for men and women, earnings are positively related to tenure, age (although there is evidence of non-linearity), and third-level education.

| PUBLIC-PRIVATE WAGE GAP AT THE MEAN PER CENT | | | | | | | | | | |
|--|-------|-------|-------|-------|-------|-------|-------|-------|---------|--|
| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | Average | |
| Germany | 7.9* | 8.2* | 9.2* | 8.6* | 8.4* | 8.1* | 10.4* | 9.5* | 8.79 | |
| Netherlands | 3.6* | 5.3* | 5.1* | 6.6* | 7.5* | 6.5* | 5.6* | 4.4* | 5.58 | |
| France | 3.9* | 7.7* | 7.6* | 5.7* | 2.8* | 0.2 | -1.5 | -3.2* | 2.90 | |
| Ireland | 16.3* | 21* | 21.9* | 19.2* | 18.6* | 16* | 17.3* | 20.5* | 18.85 | |
| Italy | 10.3* | 12.1* | 10.3* | 12.1* | 11* | 10.7* | 11* | 10.1* | 10.95 | |
| Greece | 9.6* | 12.5* | 15.8* | 20.8* | 20.1* | 21.8* | 21.8* | 18.2* | 17.58 | |
| Spain | 20.3* | 18.8* | 17.6* | 15.3* | 15.2* | 16.4* | 13.5* | 13.8* | 16.36 | |
| Portugal | 22.9* | 23* | 21.3* | 19.6* | 16.7* | 17.4* | 17.8* | 19.7* | 19.80 | |
| Austria | n.a. | 3.9* | 4.3* | 3* | 2.8* | 2.2 | 3.4* | 1.5 | 3.01 | |
| Finland | n.a. | n.a. | -0.2 | -0.1 | -0.1 | -1.3 | 0 | -1.6 | -0.55 | |
| | | | | | | | | | | |
| Average | 11.85 | 12.50 | 11.29 | 11.08 | 10.30 | 9.80 | 9.93 | 9.29 | 10.33 | |

Sources: Authors' calculations based on data from the ECHP.

Notes: The table presents, for each country-year pair, the coefficient for the public sector dummy estimated by OLS (using a robust variance-covariance matrix) and multiplied by 100. The covariates included in the regressions are the following: dummy variables for gender, marital status, age, age squared and tenure in the current job. Coefficients tagged with "*" are significant, at least, at the 10 per cent level.

estimated the wage gap in Ireland using the ECHP and focusing on the same period and, although the covariates in the regressions and the sample selection criteria are slightly different, obtained essentially the same results.

Regarding the estimates of the wage gap across the distribution, based on the traditional QR for each country and repeated for each of the eight years covered by the ECHP, they are synthesized in table 5. The table shows that the gap generally decreases with the wage level, suggesting that the public sector compresses the wage dispersion. It also shows that the narrowing of the public-private differential between 1993 and 2000 is noticeable in most countries across the entire distribution, albeit more obvious below the median. However, it should be highlighted that the decrease in the differentials across the distribution is not as obvious as in previous studies, a feature that may be justified by the fact that we are estimating the premia using hourly wages (*i.e.*, controlling for differences in the number of working hours in each sector), while monthly wages are generally used.

| THE PUBLIC-PRIVATE WAGE GAP ACROSS THE DISTRIBUTION PER CENT | | | | | | | | | | | | |
|--|-------|--------|-------|-------|--------|-------|-------|--------|-------|--|--|--|
| | 1993 | | | 1996 | | | 1999 | | | | | |
| | Q25 | Median | Q75 | Q25 | Median | Q75 | Q25 | Median | Q75 | | | |
| Germany | 9.6* | 6.7* | 6* | 10.9* | 6* | 4.7* | 12.4* | 7.6* | 7.6* | | | |
| Netherlands | 5.8* | 4.5* | 2.8* | 8.4* | 7.8* | 5.9* | 8.2* | 7.8* | 4.5* | | | |
| France | 7.5* | 4.3* | -0.6 | 7.2* | 5.2* | 2.4 | 1.8 | -2.1 | -4.9* | | | |
| Ireland | 17.2* | 14.8* | 14.2* | 18.2* | 16.3* | 16.3* | 16.4* | 14.1* | 13.7* | | | |
| Italy | 14.1* | 10.4* | 9.5* | 13.3* | 11.5* | 10.5* | 11.4* | 10.6* | 11.6* | | | |
| Greece | 15.2* | 10.8* | 5.5* | 24.2* | 21.8* | 20* | 24.5* | 19.7* | 21.9* | | | |
| Spain | 22.8* | 18.9* | 16.8* | 19* | 14.5* | 9.7* | 15.1* | 12.6* | 10.3* | | | |
| Portugal | 23.6* | 20* | 20.7* | 16.6* | 19.2* | 21* | 19.5* | 17.7* | 14.7* | | | |
| Austria | - | - | - | 3.1* | 4.7* | 3.5* | 3* | 4.2* | 2.3 | | | |
| Finland | - | - | - | 1.9* | -0.9 | -1.9 | 0.8 | -0.6 | -2.5* | | | |

Table 5

Sources: Authors' calculations based on data from the ECHP.

Notes: The table presents, for each country-year pair, the coefficient estimated for the public sector dummy using traditional QR, multiplied by 100. The covariates included in the regressions are listed in the note in table 4. Coefficients tagged with "*" are significant, at least, at the 10 per cent level.

4.2.2. Longitudinal approach: the public-private wage gap controlling for the role of unobservable characteristics

A first assessment of the role of unobservable attributes in explaining pay differences between public and private sector employees can be drawn from the analysis of chart 3. This chart provides a comparison between the coefficients estimated using a fixed effects model (controlling for endogenous sector choice) and those obtained through a pooled-OLS approach with time-dummies.⁴

Chart 3 shows that the estimates for the public-private wage gap based on the fixed effects approach are, in general, lower than those obtained using the pooled model. According to Bargain and Melly (2008), this fact suggests a positive selection effect determining that better-endowed individuals choose to work in the public sector rather than in the private. The only exception refers to Finland, in which case pooled-OLS estimates yield penalties associated with public employment that are attenuated when unobserved and time-invariant factors are taken into account. Note that, while the OLS-based estimates are generally statistically different from zero, the fixed effects estimator typically yields non-significant mean gaps. The only countries for which our findings suggest that the average gap is not nil are Greece, Ireland, Portugal and Netherlands. Thus, these results suggest that in most countries, once both observed and time-invariant unobservable factors are controlled for, there is no evidence of a positive wage gap between the public and the private sectors. It is worth noting that consolidation efforts in these countries in the period analysed were not striking. In fact, Campos (2011) identified a relatively small number of fiscal adjustments for these country-year pairs, none of which was considered to be successful.

As in Bargain and Melly (2008), we assessed how the public-private wage gap evolved over time by including terms expressing the interaction between the public sector dummy and time dummies for the first seven years of the panel. The differential between this time-varying gap and the one depicted in table 4 can be attributed to the fact that we are now controlling for unobserved individual heterogeneity. Table 6 confirms, in the first place, that controlling for unobserved characteristics generally brings down the public-private wage gap and in several cases the results imply statistically significant penalties.

The difference between results obtained by fixed effects and OLS suggests that the latter may be hampered



Chart 3

Sources: Authors' calculations based on data from the ECHP.

Note: The figure presents, for each country-year pair, the coefficient for the public sector dummy (multiplied by 100) estimated using fixed effects regressions (on the axis of ordinates) and pooled OLS (on the axis of abcissas). The covariates included in the regressions are listed in the note in table 4.

4 The pooled estimation consists of a regression on data for the entire period.

| PUBLIC-PRIVATE WAGE GAP AT THE MEAN CONTROLLING FOR UNOBSERVABLES: EVOLUTION ALONG TIME PER CENT | | | | | | | | | | |
|---|-------|-------|-------|-------|------|-------|-------|---------|--|--|
| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | Average | | |
| Germany | -1.4* | -1.2* | -0.9* | -0.5* | -0.1 | -0.5* | 1.5 | -0.4 | | |
| Netherlands | 0.5 | 0.9 | 1 | 2.6* | 2.6* | 1.9* | 0.1 | 1.4 | | |
| France | -4.5* | -1.5* | -0.4* | -0.9* | -2* | -2.9* | -4.9* | -2.4 | | |
| Ireland | 3.3 | 4.8* | 3.5 | 4.6* | 3.9* | 3.1 | 0.3* | 3.4 | | |
| Italy | 1.2 | 1.1 | -0.6 | 1.3 | 0.9 | 0.3 | 0 | 0.6 | | |
| Greece | -2.8* | -1.6* | 1.8* | 6.9* | 7.5* | 11.4* | 10.6* | 4.8 | | |
| Spain | 5.2* | 4.3* | 2.8* | 2.3* | 1.4* | 1.3* | -1.7 | 2.2 | | |
| Portugal | 0.1* | 1.7* | 2.6* | 1.2* | 0.9* | 1.4* | 4.4* | 1.8 | | |
| Austria | n.a. | 0.4 | 0.9 | -0.5 | -0.3 | -0.6 | 0.2 | 0.0 | | |
| Finland | n.a. | n.a. | 1.7 | 2.5* | 0.9 | -0.3 | 0.7 | 1.1 | | |
| Average | 0.2 | 1.0 | 1.2 | 2.0 | 1.6 | 1.5 | 1.1 | 1.2 | | |

Sources: Authors' calculations based on data from the ECHP.

Notes: The table presents, for each country-year pair, the estimated coefficient (multiplied by 100) for the public sector dummy in a fixed effects equation including interaction terms between the public sector dummy and year dummies. The covariates included in the regressions are listed in the note in table 4. Coefficients tagged with "*" are significant, at least, at the 10 per cent level.

by an upward bias stemming from the omission of relevant determinants of wages (and sector of employment). Note however that if the variability in the "sector" regressor is mostly cross-sectional and there is a relative stability over time, fixed effects estimates also tend to be imprecise (Cameron and Trivedi (2007)). Although we identify 2,888 changes from the public to the private sector and 2,554 switches in the opposite direction, we cannot rule out that our estimates are hampered by a lack of variability. Moreover, fixed effects results are particularly prone to attenuation bias arising from measurement errors. In fact, since the model is identified using a differencing of the data, the estimate for the coefficient associated to the variable "sector" is obtained based on switches between sectors. Thus, if this variable is miscoded or misreported, those switches did not actually take place, resulting in a measurement error that also changes from wave to wave and that tends to bias the coefficient towards zero (Angrist and Pischke (2009)). This inconsistency caused by measurement error may possibly offset the bias generated by the omitted factors. In order to assess to what extent this issue is actually affecting our results, we performed a series of robustness checks that confirmed the findings described above (see Campos and Centeno (2012)).

5. A robustness test of sector effects on wages

The existence of a public sector effect can be further analysed by focusing on results obtained specifically for the sub-sample of sector switchers. In particular, such analysis is useful to assess whether the publicprivate conditional wage differential should be seen as an actual public sector premium, as a result of the sorting of individuals across sectors determined by their unobserved idiosyncratic characteristics or the combined effect of the two. In order to do so, we undertake an exercise similar to that in Gibbons and Katz (1992), focusing on the sub-sample of individuals constituted by sector switchers and assuming that there are only two moments in time: pre- and post-switch (respectively, t = 1 and t = 2).

We begin by estimating the pre-switch wage differential between the public and private sectors:

$$y_{i,1} = X_{i,1}^{'}\beta + \delta P_{i,1} + \varepsilon_{i,1}$$

$$\tag{2}$$

where $X_{i,1}$ represents a set of individual attributes observable in period 1.5 $P_{i,1}$ is the dummy for the public

5 See the note in table 4 for the set of covariates included in the regressions.

sector, that equals one if the individual left that sector and joined the private and zero if the transition was in the opposite direction. The δ parameter represents the public-private wage gap.

Second, we estimate an equation for the wage change between the two periods:

$$\Delta y_{i,2} = X_{i,2}^{'}\beta + \rho \Delta P_{i,2} + \Delta \varepsilon_{i,2} \tag{3}$$

where the dependent variable represents the percentage change in the individual's hourly wage and the remaining variables are measured after the switch. Note that this estimation takes into account individual-specific and time-invariant unobservable factors, under the assumption that they are equally valued in the public and private sectors.

Finally, we estimate the effect of the pre-switch sector on the post-switch wage:

$$y_{i,2} = X_{i,1}^{'}\beta + \eta P_{i,1} + \varepsilon_{i,2} \tag{4}$$

where, since the set of covariates in vector $X_{i,1}$ and $P_{i,1}$ are measured in t = 1, the impact of the preswitch sector on the post-change earnings, $y_{i,2}$, is given by η .

As Gibbons and Katz (1999) points out, if the conditional wage differential given by $\hat{\delta}$ is exclusively due to the sorting of employees across sectors as a result of individual-specific factors, the $\hat{\rho}$ parameter in equation (3) should be nil. Moreover, one would expect that if individual unobserved heterogeneity is the sole explanation for public-private wage gap, employees in better-remunerated positions that switch sector would have higher post-switch wages than those that were originally in low-pay jobs. This would imply a positive relationship between the $\hat{\eta}$ and $\hat{\delta}$ parameters. On the contrary, if the wage differential is an actual public sector premium, then $\hat{\rho}$ should equal $\hat{\delta}$.

Results in Panel A of chart 4 (that plots $\hat{\delta}$ against $\hat{\rho}$) show that, in general, individuals that move from the private to the public sector are affected by wage changes of the same sign and of similar magnitude of the public-private gap estimated from equation (2). Moreover, as expected, the premia estimated for



Sources: Authors' calculations based on data from the ECHP.

Notes: The figure plots the estimates for the public-private wage gap obtained from equation (2) against $\hat{\rho}$, from (3), and $\hat{\eta}$, from (4) (respectively in panels A and B). Note that, in both cases, the estimations were conducted only for the sub-sample of individuals that switch sectors along the 1993-2000 period.

the sub-sample of switchers are generally smaller than that obtained using the fixed effects estimator for the entire sample (depicted in chart 3), suggesting that the individuals that change sector are those for which the premia were originally lower. These pieces of evidence seem to suggest that movements across sectors are motivated by pay differences, implying the existence of a "sector effect" associated to the estimated gaps. Additionally, the absence of a positive relationship between the $\hat{\eta}$ and $\hat{\delta}$ parameters (depicted in Panel B of chart 4) implies that in most countries the individuals that move from high pay jobs in the public sector do not continue to benefit from a positive wage differential. This is consistent with a "pure" public sector premium, an effect that is particularly clear in the cases of Ireland, Greece and Portugal. On the contrary, results for Germany, Netherlands, Italy and Austria suggest that individual unobserved heterogeneity justifies the maintaining of the wage differentials after a switch of sector.

Therefore, the robustness analysis presented seems to suggest that, although the public-private wage gap is partially explained by self-selection effects, in most countries there is evidence of non-negligible "sector effects".

6. Concluding remarks

This paper focuses on the estimation of the public-private wage gap in several European countries in the period immediately before the adoption of the euro. The estimation is undertaken by using methods that control for the impact of differences in both observable and unobservable endowments on wages and sector selection.

In the period prior to the inception of the euro area there is evidence of a relative wage moderation in the public sector in the countries that were then engaged in the fulfillment of the Maastricht criteria. This is less obvious in a set of countries including Greece, Portugal and Ireland, for which results in Campos (2011) suggest that no major consolidation efforts were undertaken in the period in analysis. As regards the public-private wage gap, the estimates obtained controlling for the impact of unobserved and time-invariant individual characteristics show, on average, a slight increase along the period. Note that the widening of the gap is particularly noticeable in countries coinciding with those for which fiscal adjustments identified in Campos (2011) were small in magnitude and were not accompanied by remarkable cuts in primary expenditure items and, in particular, in compensation of employees. Note also that the premia estimated using the fixed effects methodology are considerably lower than the obtained using OLS, a feature that, to a large extent, can be explained by the fact that in the latter case unobserved individual characteristics are not taken into account. However, fixed effects estimates may be underestimated as a result of a downward bias arising from measurement errors, while those obtained using cross-sectional methods may be hampered by an overestimation stemming from the omission of relevant unobserved factors. Thus, the actual wage premia are expected to lie in between.

The public-private wage gaps typically narrow along the distribution. At the upper part of the wage distribution results point to a considerable decrease in the premia and, in several cases, to the existence of penalties associated with public employment. These results imply that, in several euro area countries, the wage compression generally associated with the public sector can make it difficult to retain the more capable workers in better-remunerated positions. This problem may hamper the efficiency in the provision of services by the public sector, with possible consequences as regards its quality. Notwithstanding, it is note highlighting that the decrease in the differentials across the distribution is not as obvious as in previous studies, a feature that may be justified by the fact that we are estimating the premia using hourly wages (*i.e.*, controlling for differences in the number of working hours in each sector), while monthly wages are generally used.

Measures specifically aiming at reducing the weight of the public sector wage bill have recently been adopted in several European countries. It will be interesting to assess if these measures will be reflected in the public-private wage gaps or if the consolidation efforts will not be accompanied by relevant developments in this regard - as appears to have been the case along the 1990s. Note, however, that wage cuts that compress the wage distribution may be effective in reducing general government primary expenditure and raw wage differentials, but fail to reduce pure premia benefiting particular categories of public employees. In order to do it, the implementation of this sort of measures should be carefully thought of and should ideally be underpinned by a full understanding of the factors determining the pay differential between the public and the private sector (along the entire wage distributions).

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SECTORAL CREDIT RISK IN THE EURO AREA*

Martín Saldías**

ABSTRACT

This article outlines a method to compute market-based corporate default risk indicators at sectoral level and evaluates systemic and idiosyncratic determinants of default risk. This approach takes into account observed and unobserved common factors and the presence of different degrees of cross-section dependence in the form of economic proximity. The results contribute to the financial stability literature with a contingent claims approach to a sector-based analysis with a less dominant macro focus while being compatible with existing stress-testing methodologies in the literature. A disaggregated analysis of the different corporate and financial sectors allows for a more detailed assessment of specificities in terms of sectoral risk profile, *i.e.* heterogeneity of business models, risk exposures and interaction with the rest of the macro environment.

1. Introduction

Financial stability analysis has embarked on a growing research agenda. One of these new areas of research addresses the credit risk interactions between the financial system and the rest of the economic agents and sectors. Most of the emerging literature on this topic has focused on the analysis of risk in financial sector or the non-financial corporate sector in terms of their sensitivity to shocks generated in the macroeconomic environment or the financial markets.

Although the general economic conditions are a very important and arguably the most relevant factor explaining credit risk at sectoral level, little attention has been given so far to the risk interactions across corporate sectors due to the many and complex relationships that take place among them. In turn, these linkages matter significantly in both the direction and intensities of the macro-financial shocks and they also constitute channels of direct risk shocks across sectors.

Understanding the nature of these risk determinants and channels of risk transmission is therefore of great relevance for policy and crisis management. This article takes a step to address this question. In the following section, it reviews a method to compute a forward-looking credit risk indicator, the Portfolio Distance-to-Default (*PDD*), at sectoral level for corporate sectors based in the euro area using firm level information from company statements and sector level data from equity and option markets. These indicators inform about market expectations as regards aggregate sector profitability, capitalization and asset volatility, which constitute the main drivers of corporate default risk.

Then, the article highlights the ability of the *PDD* series to detect sector-wide stress and analyse their dynamics since the introduction of the euro. Finally, an econometric model is set up in order to reassess

^{*} The opinions expressed are those of the author and not necessarily those of Banco de Portugal or the Eurosystem. Any errors and omissions are the sole responsibility of the author. The special feature draws on Saldías, M. (2011), "A Market-based Approach to Sector Risk Determinants and Transmission in the Euro Area", Banco de Portugal Working Paper 30.

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the common findings in the literature as regards sectoral sensitivity to macro-financial shocks and to shed some light to the role that the cross-sectional dependence plays in these credit risk relationships.

The results of this analysis make a strong argument for a sector-level analysis to monitor systemic risk and the spillover of corporate default risk, that highlights sectoral heterogeneity. From a financial stability perspective, these findings call attention to the inclusion of these relationships for stress testing exercises of the financial system, as a natural extension of what is happening with the inclusion of the government sector.

2. A Sectoral Risk Measure for the Financial and Corporate Sectors

Sectoral analysis of risk entails two practical and largely subjective choices. The first concerns the corporate default risk measure and the second is the definition of sectors included in the analysis.

As for the choice of the corporate default risk measure, this article analyses Portfolio Distance-to-Default series (*PDD*). *PDD* is an extension of the Distance-to-Default (*DD*) modeling. *DD* is a market-based indicator of default risk with extensive applications in quantitative modeling and stress testing. It is based on the Black-Scholes-Merton model of option pricing and it measures the standardized distance between the market value of assets and a default barrier defined by a given liabilities structure,¹ under the assumption that firm equity is a call option on the assets in the event of default. A decrease in *DD* reflects a deteriorating risk profile, as a result of the combination of lower expected profitability, weakening capitalization and increasing asset volatility. At aggregate corporate sector-level, *DD* signals the probability of generalized distress or joint failure and its dynamics contains valuable informational signals of market valuation of distress.

For a given choice of sectoral classification, the analysis of an entire corporate sector turns into the analysis of a portfolio of companies that need to be aggregated together into a single, tractable and highly representative metrics. Most studies apply an ex-post aggregation of individual *DD* series via weighted or simple averages or medians. This approach highlights the overall risk outlook in the sector and captures the intensity of distress but it tends to overemphasize the large companies in the portfolio and it may largely neglect interdependencies among constituents. In contrast, the use of *PDD* treats the set of companies by sector as a single and large entity via the ex-ante aggregation of balance sheet and equity-based data and the use of portfolio volatility before calibrating the *PDD*.

PDD series have complementary informational properties with respect to average *DD* and enhances them in several ways when they include market expectations via index option implied volatilities. First, *PDD* series do not only detect overall risk in the sector and distress intensity but they have the ability to capture market expectations of interdependences among the portfolio constituents without assuming the correlation structure. In particular, in periods of low market volatility, *PDD* is considered the upper bound of joint distance to distress (the lower bound in terms of joint probabilities of distress) and exceeds the average company *DD*. In times of high market volatility, there is a generalized increase in (expected) returns covariance within a given sector, even if the company fundamentals of portfolio may be solid. As a result, the *PDD* series tend to decrease sharply and converge with the average *DD* for as long as the state of high volatility persists.

The forward-looking properties embedded in option implied volatilities add three additional features. First, for a given state of market volatility, options react very quickly but for a short period to market news. Second, as option implied volatilities are shown to be good predictors of realized market volatility, the *PDD* are endowed with early turning points nearing systemic crisis events and record breaks before

¹ See Gray and Malone (2008), for an extensive discussion about the *DD* technicalities and modeling assumptions. Echeverría *et al.* (2006, 2009), and Saldías (2010), provide an overview of the differences between methods to aggregate *DD* series into sectoral measures.

most other risk indicators. Finally, *PDD* incorporate information content from index implied volatilities about tail events in episodes of crisis.

The second empirical question is the selection of sectors of analysis. In this article, the sample selection is based on the Industry Classification Benchmark (ICB) at Supersector level,² which is a method that aggregates companies according to their main sources of revenue and thus ensures a large degree of homogeneity in business models and sectoral characteristics in each portfolio.

Accordingly, the *PDD* series are computed for 12 of the 19 Supersectors that constitute the core of the EURO STOXX Index. These sectors comprise the financial sector, – Banks and Insurance – and 10 Supersectors from the non-financial corporate sector. These measures aggregate information of over 250 companies in the reference index between December 2001 and October 2009.

These 12 Supersectors are the most relevant corporate sectors by different measures of size such as assets, market value, employment and geographical diversification of corporate activities. This sector selection also ensures the best informative quality of their *PDD* and is based on two criteria, namely the stock market capitalization of their corresponding Supersector STOXX Indices and availability and high liquidity of their associated Eurex Index options quotes. A brief summary is presented in Table 1.

| Turk | | | | | | | | | |
|--------|-----------------------------|--------------------|-----------|--|--|--|--|--|--|
| SAMPLE | | | | | | | | | |
| | Supersector | Industry | Portfolio | | | | | | |
| | ICB | ICB | Size | | | | | | |
| 1 | Banks | Financials | 40 | | | | | | |
| 2 | Telecommunications | Telecommunications | 17 | | | | | | |
| 3 | Oil & Gas | Oil & Gas | 19 | | | | | | |
| 4 | Insurance | Financials | 17 | | | | | | |
| 5 | Technology | Technology | 21 | | | | | | |
| 6 | Automobiles & Parts | Consumer Goods | 13 | | | | | | |
| 7 | Utilities | Utilities | 22 | | | | | | |
| 8 | Industrial Goods & Services | Industrials | 56 | | | | | | |
| 9 | Chemicals | Basic Materials | 14 | | | | | | |
| 10 | Food & Beverage | Consumer Goods | 13 | | | | | | |
| 11 | Media | Consumer Services | 25 | | | | | | |
| 12 | Health Care | Health Care | 17 | | | | | | |
| | | | 274 | | | | | | |

Table 1

Source: Industrial Classification Benchmark.

3. Preliminary Analysis and a primer on Sectoral Cross-section Dependence

3.1. PDD series dynamics

The resulting 12 *PDD* series are displayed in Chart 1 together with the EURO STOXX index. As marketbased indicators, *PDD* move along with the benchmark stock index but they anticipate turning points along the entire period due to the information embedded via index option implied volatilities. As an

² Even though Industries, Supersectors and Sectors are clearly differentiated as ICB Categories, the use of these terms in this paper will uniquely refer to Supersectors.

Chart 1

PORTFOLIO DISTANCE-TO-DEFAULT SERIES | MONTHLY VALUES



Sources: Thomson Reuters and author's calculations.

example, the *PDD* series start to recover from the dot-com bubble before the end of 2002, while the EURO STOXX index does it at least one quarter later. Similarly, the *PDD* reach their bottom from the subprime crisis at the end of 2008 while the reference equity index only starts to pick up after the end of the first quarter of 2009.

The *PDD* series do not show a linear trend but they suggest a high degree of comovement along the whole time span. In addition, the correlation coefficients among them for the time span of analysis are very high both in levels (0.84) and in first differences (0.60) and statistically significant.

Charts 2 and 3 show the median and quartile regions of sectoral bilateral correlation coefficients across sectors using 24-month moving windows of *PDD* series levels and first differences in order to illustrate the changing pattern of cross-section sectoral risk correlation over time.

Median correlation is high over the entire sample. However, there is greater dispersion in tranquil times where sectoral-specific drivers of sector risk dominate. Median correlation increases and its dispersion across sectors narrows significantly in episodes of higher stress in financial markets, *e.g.* in the aftermath of the dot-com bubble burst in 2002; after the subprime crisis start in August 2007; and especially in the third quarter of 2008, after Lehman Brothers' collapse. At the end of the sample, median risk correlation across sectors remains high, but there is greater dispersion suggesting a moderation in the role of sector-wide risk drivers prior to the European sovereign debt crisis.

This overall high correlation pattern points out to a high degree of cross-section dependence (*CD*) across the sectors in sample. The reported correlation coefficients are good preliminary approximations but more robust results confirm the graphical inspection of the series if cross-section dependence tests are applied. Indeed, the Pesaran (CD_p) and Lagrange Multiplier ($CD_{LM'}$) cross-section dependence tests applied to the series displayed in the Charts 2 and 3 show very high values that confirm the existence of high *CD* in the *PDD* series.³

³ $CD_p=66.7$ and $CD_{LM}=4486.4$ for the series in levels and $CD_p=46.9$ and $CD_{LM}=2245.4$ for the series in differences. These results lead reject the null hypothesis of no CD. These results are robust after controlling for serial correlation in the series.

Chart 2

Chart 3



Source: Author's calculations.

Source: Author's calculations.

3.2. Cross-section Dependence and Corporate Credit Risk

The *CD* tests highlight the strong interrelations of corporate default risk across the Supersectors in the sample. There are several factors driving the common behavior of sectoral risk and they may be both observable and unobservable in nature. The general economic conditions are naturally strong candidates as observable common factors. In addition, as *PDD* are market-based indicators, financial markets are also a strong common source of cross-section dependence among sectors. As a result, most literature on corporate default risk evaluates these effects. Very comprehensive studies in this area can be found in Alves (2005), Bernoth and Pick (2011), Carling *et al.* (2007), Castrén *et al.* (2009a, 2009b, 2010) and other references cited in Saldías (2011).

Additionally, strong comovement and high and time-varying correlation in *PDD* series is likely to be caused by risk diffusion across sectors as a result of different degrees of economic proximity. As in other economic groups, sectoral characteristics are interrelated and non independent to those of their closest peers but this cross-sectoral dependence is heterogeneous as their intensities change over time. These sources of default risk determinants and channels are often neglected in the literature but do play a relevant role.

In particular, similarity of business lines is a first source of this form of economic proximity and it includes inter alia a common customer or inputs channels and competition relationships. Financial linkages create another source of shock spillovers. They take place predominantly, yet not exclusively between the financial sector and the non-financial corporate via credit relationships and corporate governance linkages. Among non-financial companies, trade credit chains and counterparty risk relationships in securities markets do play a role in this sense. Finally, there are other several and relevant complementarity relationships across sectors that produce common risk movements. They can take place through technological linkages or collateral channels of risk through the securities channel.

4. Econometric Model

In order to assess the relevance and intensity of these relationships at sectoral level, the analysis of sectoral risk determinants and transmission is conducted using a dynamic panel, where the dependent variables are the *PDD* series. The risk determinants comprise three sets of variables.

The first set of regressors are observed common factors that capture common macroeconomic and systemic market shocks. In line with the literature, they are assumed to be exogenous and include the annual

rate of change of the Industrial Production Index (ΔPI_l) and the Harmonised Index of Consumer Prices (ΔCP_t) in the euro area, in order to capture the effect of demand shocks. Brent Oil (1-Month Forward Contract) prices changes denominated in euro (ΔOIL_l) detect supply shocks. The short-term benchmark interest rate is also included using the 3-Month Euribor Rate $(R3M_l)$, which also reflects developments in the money market affecting the financial sector and serves as a proxy for corporate debt yields and borrowing costs. They also are linked to corporate asset return growth. Finally, the Chicago Board Options Exchange Volatility Index (VIX_l) is included to gauge global equity market sentiment. The *VIX* index tends to be low when markets are on an upward trend and tends to increase with market pessimism, therefore its relationship with *PDD* series is expected to be negative.

The second set of regressors are sector-specific regressors and it includes the first lag of PDD in order to capture credit risk persistence $(PDD_{i,t-1})$ and the effect of the PDD inputs, *i.e.* market-implied assets' returns and volatility and aggregated leverage. The model also includes the direct risk spill-overs from "neighboring sectors"⁴ and two other sector-specific variables related to the performance of each Supersector, namely the annual rate of change of the Price-Earnings Ratio, $(\Delta PE_{i,i})$, and the annual rate of change in Dividend Yields, (ΔDY_i) .

The general model specification is the following:

$$PDD_{i,t} = \alpha_i d_t + \beta_i X_t + u_{i,t} \tag{1}$$

where $PDD_{i,t}$ is vector of PDD series of sector *i* at time *t*. The vector d_t includes the intercepts and a set of observed common factors that capture common macroeconomic and systemic market shocks. $X_{i,t}$ group the sector-specific regressors. All coefficients are allowed to be heterogeneous across sectors and all remaining factors omitted are captured in the error term ut although the effect of unobserved common regressors is captured in the estimation. The CCE Mean Group estimator can be computed by OLS applied to sector-individual regressions where the observed regressors are augmented with cross-sectional averages of the dependent variable and the individual-specific regressors.⁵

5. Results and Discussion

The results from estimation of Equation (1) are reported in Table 2. The first three columns are estimates of naïve OLS Mean Group (MG) models that neglect cross-section dependence (*CD*) induced by unobserved common factors. The last three columns are Common Correlated Effects (CCE) estimates of these same specifications, hence more consistent given the *CD* in the data.

5 For the correct model specification, panel unit root tests were conducted on the *PDD* series and the sector specific regressors. The results of *CIPS* tests showed that they are stationary after controlling for *CD*, which means that these series are a combination of non-stationary common factors and stationary idiosyncratic components. These results mean that there is long-run equilibrium in sectoral risk, with temporary deviations caused by the macro-financial environment, sector-specific shocks and the cross-sectoral dynamics. Individual ADF tests were run for the exogenous macro-financial variables and they were differentiated when required to enter the econometric model.

⁴ Credit spill-overs from sector *i*'s neighboring sectors $PDD_{i,t}^{n}$ is defined as the simple average of the *n PDD* series of the sectors that are assumed to be sector I's neighbors. The definition of neighbors relies on similarity of business lines embedded in the ICB methodology and covers important and overlapping dimensions of sectoral interdependencies, namely: balance-sheet exposures, financial linkages, common accounting practices, technological linkages, etc. Supersectors are first assumed to be neighbors if they belong to the same Industry, an upper level of aggregation to Supersectors in the ICB methodology structure. For instance, the Industry of Consumer Goods links the Supersectors of Automobiles & Parts and Foods & Beverages while Banks and Insurance Supesectors are bundled together as Financials. The second proximity relies on the most frequent company reclassifications across Supersectors such as Industrial Goods & Services, Oil & Gas and Utilities, which do not belong to the same ICB Industries. For more discussion on this approach, refer to Saldías (2011).

When the *CD* is controlled for in the model, the CCE estimates show interesting results. First, there is a loss of aggregate significance of macro-financial variables and only sector-specific regressors do exert statistically significant effects in aggregate terms. This result has been previously detected Sorge and Virolainen (2006) and can be interpreted as a consequence of the market-based nature of the *PDD* series, as they are less responsive to macroeconomic variables due to non-linearities in their interaction and as they are smoothed from business cycle volatility by construction. The role of the general economic environment hence becomes more indirect way, via market news already embedded in the *PDD* inputs and/or through cross-dynamics transmitting risk across industries.

The model CCE estimates also shows that risk persistence dominates, which emphasizes the effect of market-implied assets) returns and volatility and aggregated leverage in aggregate sectoral credit risk. In addition, the sectoral performance, as measured by dividend yields growth, is a relevant risk driver, where the associated negative sign highlights the negative relationship between risk taking and aggressive dividend policies (Acharya *el at.*, 2011).

The role of the neighboring sectors at aggregate level seems non-significant. However, individual results at sectoral level show additional insights about this. Based on the last column in Table 2, Table 3 reports the individual results of the most comprehensive CCE model estimates in order to illustrate the heterogeneity of risk determinants across sectors. In particular, macroeconomic variables do matter for some sectors directly and with different signs and intensities. In addition, risk persistence is also diverse across sectors while the neighboring risk-spill-over effects show alternate signs.

Finally, it is worth mentioning that the results based on the CCE estimates are unbiased, as the model checking based on *CD* tests applied to the residuals show that *CD* is no longer present. The implication of this difference is very relevant for policy analysis, as any policy recommendation based on models that neglect the role of *CD* in the risk determinants and interrelations is dangerously misleading.

6. Conclusions

This paper laid out a framework to model and analyze risk in the corporate sector that takes into account their strong sectoral linkages and comovement. First part, the article outlined a methodology to compute comprehensive forward-looking risk indicators at sector-level based on Contingent Claims Analysis with information from balance sheets, equity markets and, more importantly, index option prices. The rest of article reviewed the properties of the resulting Portfolio Distance-to-Default series and evaluated the determinants of corporate default risk with an econometric model that incorporates the cross-section dependence of the *PDD* series.

Controlling for cross-section dependence among the *PDD* series, the first result of this analysis shows that sectoral risk comprises a stationary idiosyncratic component and a non-stationary common factor. This result provides empirical support to the notion that aggregate sectoral risk evolves to a long-run equilibrium, with temporary deviations caused by the macro-financial environment, sector-specific shocks and the cross-sectoral dynamics.

Results of the econometric model estimation using the Common Correlated Effects (CCE) method find evidence supporting a more relevant role of sector-specific variables as sectoral risk determinants in the corporate sector overall at the expense of the impact from macro-financial variables. The sector-specific drivers include risk persistence, measures of overall sectoral performance and also direct risk spill-overs

| ECONOMETRIC RESU | ULTS | | | | | | |
|--------------------------------|-----------|-----------|-----------|--------------|--------------|--------------|--|
| Variable PDD _{i,t} | MG [1] | MG [2] | MG [3] | CCEMG [4] | CCEMG [5] | CCEMG [6] | |
| Intercept | 0.481** | 0.612** | 0.402** | -0.058 | 0.033 | -0.008 | |
| ΔVIX_{t} | -0.083** | -0.081** | -0.082** | 0.000 | -0.001 | 0.000 | |
| $\Delta R3M_t$ | 0.670** | 0.617** | 0.614** | -0.010 | 0.004 | -0.004 | |
| ΔOIL_t | -0.004 | -0.003 | -0.005 | 0.000 | 0.000 | 0.000 | |
| ΔPI_t | 0.000 | 0.001 | -0.003 | 0.000 | 0.002 | 0.000 | |
| ΔCP_t | -0.025** | -0.021 | 0.002 | 0.011 | -0.004 | 0.003 | |
| $\Delta DY_{_{i,t}}$ | | 0.000 | 0.000 | | -0.002** | -0.002* | |
| $\Delta PE_{_{i,t}}$ | | 0.002 | 0.002* | | 0.001 | 0.000 | |
| $PDD_{i,t-1}$ | 0.921** | 0.897** | 0.798** | 0.740** | 0.672** | 0.591** | |
| $\overline{PDD}_{i,t-1}^n$ | | | 0.123** | | | 0.013 | |
| Observations | 1128 | 1072 | 1072 | 1128 | 1072 | 1072 | |
| $\frac{-}{\rho}$ | 0.424 | 0.431 | 0.434 | -0.082 | -0.081 | -0.077 | |
| CD_p | 33.4 | 33.2 | 33.4 | -6.5 | -6.3 | -5.9 | |
| $CD_{_{LM}}$ | 1207 | 1202 | 1208 | 176.7 | 195 | 175.4 | |
| $IPS W_t$ -stat | -31.724 | -31.306 | -31.486 | -31.197 | -31.59 | -31.127 | |
| CIPS-stat | -6.19 | -6.19 | -6.19 | -6.19 | -6.19 | -6.19 | |

Source: Author's calculations.

Table 2

Note: Definitions: ΔVIX_t are changes in the Chicago Board Options Exchange Volatility Index; $\Delta R3M_t$ is the 3-Month Euribor Rate (in first differences); ΔOIL_t are Brent Oil (1-Month Forward Contract in euro) price changes. $\Delta PE_{t,t}$ annual rate of change of the Price-Earnings Ratio; $\Delta DY_{t,t}$ is the annual rate of change in Dividend Yields, $PDD_{t,t}$ is the lag of the dependent variable; $\overline{PDD}_{t,t}^n$ measures the direct risk spill-overs from "neighboring sectors". ρ , $CD_{P,t}$ CD_{LM} are test statistics of cross-section dependence and the *IPS* and *CIPS* stats are statistics of panel unit root tests applied to the residuals. See Saldías (2011) for more details.

from risk in related sectors. The macroeconomic and financial common variables are found to play a less direct role. This empirical finding challenges much of the literature that focuses mainly on macroeconomic risk drivers and tends to ignore sector-specific characteristics and specially interactions either explicitly or implicitly through an aggregate analysis of the whole corporate sector.

This study also provides empirical evidence of the high degree of heterogeneity as concerns the relevance and responsiveness to the risk drivers used in the model, both in macro-terms as in sector-specific terms. These results show that a macro-only focus of the analysis of financial stability would be misleading for policy if cross-section dependence and sectoral heterogeneity are ignored. These results make a case for a more disaggregated analysis of risk across sectors without neglecting the inherent interactions that take place among them.

| Table 3 | | | | | | | | | | | | |
|--------------------------------------|-----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|---------|
| ECONOMETRIC RESULTS: HETEROGENEITY | | | | | | | | | | | | |
| | Supersector ICB | | | | | | | | | | | |
| PDD _{i,t} | BNK | TLS | ENE | INS | TEC | ATO | UTI | IGS | CHM | FOB | MDI | HCR |
| Intercept | -1.280** | 0.600** | 0.386 | -0.393 | -0.098 | 0.698** | -0.234 | 0.384 | -0.292 | 0.697 | -0.341 | 1.175** |
| ΔVIX_t | 0.004 | 0.013 | -0.001 | 0.003 | -0.014 | -0.021 | -0.008 | 0.026** | -0.008 | 0.001 | -0.001 | 0.005 |
| $\Delta R3M_{t}$ | -0.362 | 0.248 | -0.030 | -0.010 | 0.105 | 0.318 | 0.331 | -0.270 | 0.314 | -0.151 | -0.550** | 0.007 |
| ΔOIL_t | -0.012 | 0.006 | 0.022* | -0.015* | 0.009 | -0.008 | -0.011 | 0.009 | 0.019 | -0.016 | -0.006 | 0.000 |
| ΔPI_t | 0.005 | -0.008 | 0.018 | 0.014 | -0.005 | -0.012 | -0.010 | -0.002 | -0.006 | -0.006 | -0.006 | -0.006 |
| ΔCP_{i} | -0.016 | -0.038 | -0.069 | 0.015 | -0.017 | 0.132 | 0.080 | -0.047 | 0.029 | 0.112 | -0.001 | -0.140 |
| $\Delta DY_{\scriptscriptstyle i,t}$ | 0.001 | 0.002** | | -0.003 | -0.001 | -0.002 | -0.004 | -0.005 | -0.003 | 0.000 | 0.003** | -0.005 |
| $\Delta PE_{\scriptscriptstyle i,t}$ | 0.001 | 0.001 | | 0.000 | 0.000 | 0.000 | -0.008 | 0.001 | 0.000 | 0.011** | 0.000 | 0.000 |
| $PDD_{i,t-1}$ | 0.420** | 0.555** | 0.796** | 0.646** | 0.846** | 0.299** | 0.761** | 0.334 | 0.370** | 0.688** | 0.784** | 0.591** |
| $\overline{PDD}_{i,t-1}^n$ | 0.034 | 0.168 | 0.121* | 0.046 | 0.160 | -0.045 | 0.029 | -0.838* | 0.020 | 0.057 | 0.433** | -0.039 |

Source: Author's calculations.

Nota: Definitions: ΔVIX_t are changes in the Chicago Board Options Exchange Volatility Index; $\Delta R3M_t$ is the 3-Month Euribor Rate (in first differences); ΔOIL_t are Brent Oil (1-Month Forward Contract in euro) price changes. $\Delta PE_{i,t}$ annual rate of change of the Price-Earnings Ratio; $\Delta DY_{i,t}$ is the annual rate of change in Dividend Yields, $PDD_{i,t-1}$ is the lag of the dependent variable; $\overline{PDD}_{i,t}^n$ measures the direct risk spill-overs from "neighboring sectors. See Saldías (2011) for more details.

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