The Consumption-Investment-Unemployment Relationship in Spain: an Analysis with Regional Data

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Abstract

In this paper we analyse the consequences of changes in the consumption patterns on unemployment through an intermediate channel via investment. Specifically, after presenting our theoretical framework, we build a dynamic econometric multiequational model, in which we estimate a consumption function, an investment function and an unemployment rate equation, using a panel of 17 Spanish regions. This model is characterised by its dynamics and the cross equation relationships. After estimating the model, we run a number of dynamic simulations in order to verify our starting hypothesis, namely that temporary and persistent shocks to consumption have long lasting effects on unemployment, both directly and indirectly, through investment. Our results are especially relevant in the current recessive context of the Spanish economy, which is characterised by severe falls in consumption and unprecedented increases in unemployment.

Key words: Consumption, investment, unemployment, panel data
JEL Codes: E21, E22, E24

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1.- Introduction

One of the most prominent and worrying characteristics of the Spanish economy nowadays is the magnitude of the unemployment rate, which after reaching a 25-year low value in the second quarter of 2007 at 7.9%, at of the writing of this paper it has peaked to an unprecedented 24.6% at the second quarter of 2012. Therefore it is not surprising that the declared objective of the main policies followed since the beginning of the recession is to resume the growth and employment creation path that characterised the 2000's.

While labour economists have focused their attention into a vast number of issues throughout the last decade, more recently their attention has turned back to unemployment and its persistence, precisely when the current recession has brought the unemployment figures back to the high levels of the 80's. In this context, the aim of the paper is to analyse the relationship between consumption, investment and unemployment.

The interest in the analysis of the relationship between aggregate demand variables (consumption and investment) and unemployment is derived from the observed discrepancy between the assumptions and implications of the main macro-labour models on the one hand, and what economic and policy agents (as well as existing data) suggest.

The main social agents (politicians, trade unions, businesses representatives) use to link swings in employment with the evolution of investment.[1] However, such relationship cannot be derived from the main theoretical approaches on the labour markets functioning. The effects of an expansion in the aggregate demand on unemployment would only be observed in the short run, being therefore temporary, given that in the longer run these effects vanish and the unemployment rate would return to its equilibrium value (either the natural rate of unemployment, NRU, or the non accelerating inflation rate of unemployment, NAIRU), when the economy reaches again the vertical long run Phillips Curve. The existence of hysteresis in the labour market allows for prolonged effects of changes in the aggregate demand on unemployment, such that cyclical variations in the unemployment rate become structural. This goes against the standard NRU models, which rely on the assumption that the cyclical and

[1]The current President of the Spanish Government, Mariano Rajoy, asserted recently in a partisan meeting in June, 2012, that "Without credit there are no banks, without banks there is no investment, and without investment there is no employment" (see http://noticias.es.msn.com/rajoy-sin-cr%c3%a9dito-no-hay-bancos-y-sin-bancos-no-hay-inversi%c3%b3n-ni-hay-empleo).

structural components of unemployment are independent of each other, such that in the absence of errors in expectations, and once that the Walrasian equilibrium conditions are fulfilled, the unemployment rate reaches its natural value, as Friedman (1968) describes.

Most of the theoretical approaches to unemployment, though different analytical perspectives, follow one of these conflicting theories. However, the Chain Reaction Theory (CRT hereafter) asserts that the short, medium and long run are not compartmentalised, but that they interrelated in an intertemporal continuum, through slow and prolonged adjustment processes.[2] Under this view it is shown that the cyclical and structural components of unemployment are interdependent, i.e., temporary and permanent components are interrelated through time, such that the effects of shocks in the labour market (as those steaming from changes in demand) persist in the medium and the long run. In fact, this theory holds that the differentiation between the cyclical and structural component of unemployment is meaningless. The interaction between dynamics in the labour markets and growing exogenous variables gives rise to the so-called "frictional growth" phenomenon, which precludes the unemployment rate approaching towards the NRU. This different perception on the causes of unemployment and its persistence has its ultimate reflection in the proposed policy measures targeted at reducing the unemployment rate. While the NRU argues in favour of supply side policies (labour market flexibilization, tougher conditions for access to unemployment benefits, etc.) the CRT proposes the use of aggregate demand policies to stimulate economic activity and to reduce unemployment and its persistence (tax cuts on consumption, increased government spending, investment stimuli, etc.).[3] In this context, in spite of the statements and electoral promises by policymakers, the standard policy rule is to flexibilize the labour market and its institutions, which in many cases has the opposite effect on the final target.[4]

The existence of an explicit relationship between unemployment and aggregate demand has not been popular in the macro-labour literature so far. However, a growing number of authors, from very different analytical approaches and for different countries and

2 The CRT was proposed and developed by Dennis Snower and Marika Karanassou in a series of papers. See Karanassou *et al* (2010) for a general view on this theory.

3 The papers by Karanassou *et al* (2008), Karanassou and Sala (2012) or Bande and Karanassou (2012) emphasize the role of frictional growth in the explanation of unemployment in different economies.

4 For instance, in the Spanish case, the current government proposed during the electoral campaign of November 2011, to reduce unemployment through an investment boost. Nevertheless, the legislative reforms implemented since it took office consisted in a deep reform of the labour relations framework.

periods, have found a significant negative relationship between the growth in the capital stock and the equilibrium unemployment rate.

Since the paper by Rowthorn (1999), who takes a CES production function in the context of the Layard, Nickell and Jackman (1991) model, and finds that increases in the capital stock may reduce theoretically the equilibrium unemployment, many papers have also shown this type of negative relationship between investment (growth of capital stock) and the equilibrium unemployment rate, both in the medium and long run.[5] This result seems to be robust across different type of modelizations and countries. Malley and Moutos (2001), using data for OECD countries, find that differences across countries in capital accumulation explain to a greater extent the existing differences in unemployment. Countries with greater capital accumulation (with respect to its trade partners) are those exhibiting lower unemployment rates. Alexio and Pitelis (2003), in an applied exercise for different European countries, also find that one of the potential factors explaining the high and persistent unemployment rates in Europe is an insufficient capital stock growth, as well as an inadequate aggregate demand. They conclude that variations in the components of the demand (and not only in investment) are relevant to explain unemployment fluctuations, a result which is in line to our appraisal. Kapadia (2005) introduces a production function with capital restrictions, in which installed capacity is determinant. When the capital stock is low, investment has a positive effect on the employment level, and modifies the equilibrium (it reduces the natural rate of unemployment). However, new investment above a given threshold has a neutral effect on (un)employment, it exclusively pushes up real wages. In other words, when the firm has spare capacity, capital accumulation is not able to reduce equilibrium unemployment, and we would be under the standard framework. As long as the firm reaches its potential capacity (which takes place when the capital-labour ratio falls short of the capital restrictions threshold), labour participation in the product, and therefore the wage participation, is reduced, while the capital (and profits) participation rises. This increase in the expected revenues affects investment, and directly reduces the natural rate of unemployment. In this same line, Arestis*et al.* (2007), in a study about the importance of capital stock in the determination of real wages and (un)employment for a panel of nine European countries, confirm their starting hypothesis, namely that

5 The existence of such relationship is known in the literature as the *Modigliani Puzzle*. However, Modigliani himself does not regard it as a puzzle, but the natural expression of the Keynesian paradigm, Modigliani (2000).

capital stock is key in the determination of the wage and unemployment levels in an economy. Moreover, capital scarcity will persistently affect the equilibrium unemployment rate, and for prolonged periods of time. According to these authors, the low capital accumulation rates in the countries under scrutiny led to lower capital stocks and a consequent scarcity. Thus, real wages were too high given the changes in productivity, and due to a limited factor substitution, the predominance of capital-intensive investment brought restrictions in the adjustment between demand and supply of labour.

If we regard the capital stock as a main determinant of the NRU or the NAIRU, we are assuming that there exists a changing factor which modifies continuously the equilibrium unemployment rate. The pace and structure of investment will be influenced by the level of economic activity and other relevant variables, as profitability. Therefore, the variability of the NAIRU will be continuously affected by the path of the aggregate demand.

Even though standard macro models focused on the performance of the labour market do not allow for these types of relationships apart from the short run, the interrelations between consumption, investment and unemployment behind a negatively-sloped Phillips Curve in the medium and long run can be easily justified from standard economic theory.

In this context, the contribution of the paper is twofold. Firstly, we show theoretically the existing interrelation between the two major components of aggregate demand (they usually sum up to a 75% of a country's GDP), and their joint effect on unemployment rate dynamics, as well as the effects of variations in unemployment on consumption. Secondly, we provide empirical evidence supporting this view, based on the estimation of a panel data econometric model, using information gathered for the 17 Spanish regions.[6]

The paper is organised as follows. Section 2 provides the theoretical foundations of the relationship between consumption, investment and unemployment. Section 3 presents the econometric model and the main empirical results, while Section 4 summarises the results of a number of dynamic simulations. Finally, Section 5 concludes.

6 The reasons for using regional data are summarised in Section 3, and are, essentially, the need to compensate with a cross section component the relatively short time dimension of some of the series used in the empirical exercise.

2. The theoretical relationship between consumption, investment and unemployment

In this Section we provide the theoretical linkages between the three macroeconomic variables considered in the econometric model. Firstly, we consider the employment (and therefore, the unemployment) effects of changes in the aggregate demand. Next, we summarise the relationship between consumption and investment, focusing particularly on the effects of changes of the former on the latter. Finally, we analyse the role played by unemployment on consumption decisions.

According to the Keynesian view, increases in any of the aggregate demand components have positive effects on employment, because prices increase more than nominal wages, lowering thus the real wage. An alternative scenario, in which an increase in aggregate demand triggers an increase in production and employment would be that of sticky prices and wages, not responding thus to the changes in the aggregate demand.

The New Classical Macroeconomics (NCM) school (as the Neoclassical Synthesis had already done) accepts these explanations of the effect of aggregate demand on employment, and therefore on unemployment, but only for the short run. In the long run, when wages and prices are completely flexible and errors in expectations have been corrected, the real effects of changes in demand vanish, and the equilibrium in the labour market returns to the natural rate of unemployment.[7]

The New Keynesian Macroeconomics (NKM) School does not conclude either that changes in aggregate demand should have any significant employment effect in the long run. The equilibrium in the labour market, which corresponds to the NAIRU, is found when the level of employment that makes compatible the wage aspirations of workers in wage bargains and real wages that firms are willing to pay (given their labour costs and the degree of competition in product markets) is reached.

These approaches have, at least, two counterfactual implications. First, the effects of changes in aggregate demand should only be observed in the short run, i.e., they would not be persistent. Secondly, the variations in employment and in real wages should go in opposite directions, i.e., real wage should move counter-cyclically, precisely because it is the fall in real wages which triggers employment growth. However, available data

[7] If rational expectations were considered, the employment effects of expected changes in aggregate demand would be absent even in the short run, given that agents foresee perfectly the forthcoming increase in inflation, and adjust their labour market behavior immediately.

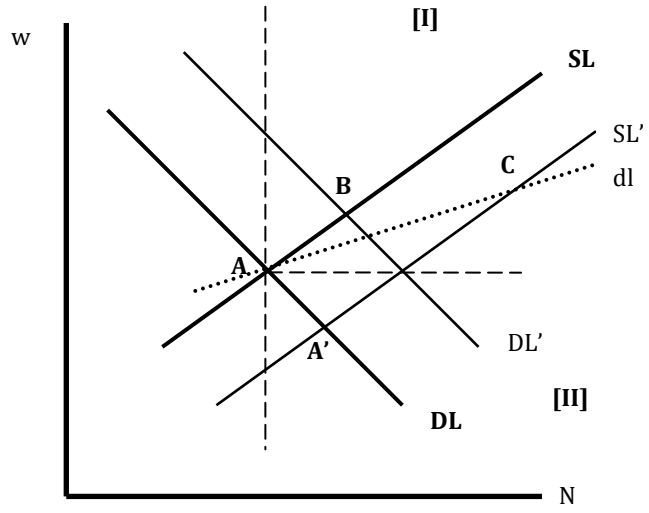
suggest that movements in real wage are, in general, cyclical, and that, as we will show, the effects of changes in the aggregate demand have prolonged effects on employment and unemployment.

Let us use a rather simple framework to show how a change in aggregate demand may persistently affect employment. Assume that the equilibrium in the labour market is determined by the intersection of a labour demand curve, *DL* (which can represent either the marginal product of labour in a perfectly competitive context, or the relationship between real wages and demand for labour by imperfectly competitive firms fixing prices and employment for a given nominal wage), and a labour supply curve, *SL* (which can be the outcome of a leisure-income choice process in a perfectly competitive context, or the relationship between real wages and employment arising from a wage bargaining process between firms and labour unions), as Figure 1 shows. Departing from an initial equilibrium in point A, both the NCM and the NKM claim that given the labour demand curve *DL*, the only way to increase the equilibrium level of employment after an increase in aggregate demand is through a greater supply of labour at a lower real wage, reaching a new equilibrium in quadrant [II] of Figure 1, in A', for instance. This positive effect on employment will disappear when the real wage reverts to its initial value, once that the adjustment in wages and prices is complete, and/or when error have been revised and expectations are correct.

However, it is possible to find an equilibrium in which the increase in aggregate demand implies a persistent increase in employment, compatible with a rise in real wages, i.e., graphically we would reach equilibrium in quadrant [I] in Figure 1. For this to occur it is necessary that as a result of the increased demand, the labour demand curve *DL* shifts rightwards (reaching an equilibrium in B, for instance), or that the labour supply curve *SL* shifts, assuming an upward sloping demand curve *dl*, reaching a new equilibrium at point C.

Lindbeck and Snower (1994) summarise the different transmission channels which must be open in each case for changes in aggregate demand to have persistent effects on the labour market. These channels make compatible an increase in employment with higher real wages, both in the medium run (when we assume that capacity is fixed, either fully utilized or under excess) and diminishing labour returns, as well as when full flexibility in the productive capacity is assumed (in the long run), with a perfect adjustment of capital stock.

Figure 1.Effects of an increase in aggregate demand on employment



Let's assume that capital stock is given in the medium run and fully utilised. Thus, the production function of each of the *F* firms operating in the product market would be given by:

$$q = q(n), q_n > 0; q_{nn} < 0 \qquad (1)$$

where*q* represents the production of each firm, *n* denotes their individual employment level and q_i is the partial derivative of *q* with respect to *i-th*production factor. Profit maximization by firms implies that aggregate employment in the economy, which is equal to the individual level of employment multiplied by the number of firms, is given by the usual negatively-sloped labour demand function:

$$N = FL\left(\frac{w}{1-m}\right); L' < 0 \qquad (2)$$

where*L* is the inverse of the marginal product of labour (MP_N), *w* is the real wage and *m* is the Lerner index of monopoly power.

Given this labour demand function, an increase in aggregate demand will lead to greater employment without a fall in the real wage only if the labour demand curve shifts rightwards. Lindbeck and Snower (1994) show that this will happen if and only if as a result of the increase in aggregate demand monopoly power is reduced (due, for instance, to an increase in the total number of firms or an increased product demand price elasticity), or to an increase of the marginal product of labour. This rightward shift

of the labour demand curve would also take place whether the capital stock is flexible, in the long run.[8]

If in the short and medium run we consider that there is excess of capacity, the increase in aggregate demand can also lead to a rightward shift of the labour demand curve if it triggers an increase in the marginal product of capital (MP_K). On the other hand, an increase in employment would be followed by an increase in capital utilization, and therefore the slope of the labour demand curve will not only depend on how will the MP_N react to the increased employment (negatively in the case of decreasing returns of labour), but also on how will the MP_K respond: it will increase if capital and labour are complementary. In this case, the production opportunities for each firm would be:

$$q \leq q(n,k), q_n > 0, q_k > 0, q_{nn} < 0, q_{kk} < 0 \qquad (1')$$

The slope of the labour demand curve, in the presence of excess of capacity, is given by:

$$\frac{dw}{dN} = F(1-m)(q_m + \bar{h}q_{kn}), \qquad (3)$$

where $\bar{h}$ is the upper limit of the *k/n* ratio range chosen by the firms.[9]

Thus, in a imperfect competition context, if the degree of complementarity is high enough as to allow for a greater variation of the MP_K than the variation of the MP_N, the slope of the labour demand curve, *dl*, is positive, such that an increase in aggregate demand, which shifts the bargained real wage curve (or the labour supply curve), may increase the employment level without a reduction in real wages.

Following this line of reasoning, an increase in aggregate demand, due for instance to a greater investment in public infrastructures, would trigger in the short run an excess of capacity, which in turn, if labour and capital are complementary enough, would imply an upward sloping labour demand curve. This would increase employment, due to the shift to the right of the *SN* curve, without a reduction in the real wage. In the medium and long run, the labour demand curve *DL* would shift to the right as the marginal product of labour rises.

However, the employment effect would also be present and (as will be shown later) greater if the event that triggers the increase in aggregate demand is greater

8 Moreover, when capacity is flexible, the rightwards labour demand shift can also happen when, as a consequence of the increased aggregate demand, the user cost of capital falls, being capital and labour complementary, or the user cost of capital increases, being both production factor substitutive, but this effect is not the most relevant.

9 Firms choose, in a first stage, the capital stock level and technology (the *k/n* ratio) which maximize expected profits. In a second stage they fix the employment level, the production level and the price, given the available information on the rest of variables.

consumption. In this case, in addition to the direct effect of an increased consumption on employment, and in the absence of barriers to entry, more firms would enter in the market, and monopoly power would be reduced. This would shift in the medium run the labour demand curve to the right. Therefore, we may express the unemployment rate in each period *t* as a negative function of both realized consumption (C_t) and investment, I_t

$$u_t = u(C_t, I_t); u_C < 0, u_I < 0 \quad (4)$$

Consumption and investment are also intertwined. Particularly, the growth in consumption is likely to affect positively investment, which implies a second round effect on employment, with a subsequent further reduction in unemployment, given the increase in the marginal product of labour.

Firm *i*, who produces a good *X*, takes decisions on an investment project. Therefore, it will relate the decision with the cost of undertaking the project, which is normally defined by the user cost of capital, which we can proxy through the real interest rate (*i*) and with the expected return of the project, which will be directly related with the consumption demand that the firm expects for the good *X*. This demand, in turn, is affected by the business cycle, which we can proxy through the income level (or its growth). Therefore, at an aggregate level, investment will depend positively on consumption and income, and negatively on the interest rate:

$$I_t = I(Y_t; C_t; i_t); I_Y > 0, I_C > 0, I_i < 0 \quad (5)$$

Lastly, let us discuss the relationship between consumption and the unemployment rate. Consumption in each period depends negatively con the unemployment rate. According the life cycle hypothesis (Ando and Modigliani, 1954, Modigliani and Brunberg, 1954, Modigliani, 1970) and the permanent income hypothesis (Friedman, 1957), individuals take decisions on consumption trying to maximize lifetime utility, which depends on the lifetime consumption they can afford to with their lifetime income and wealth. Thus, consumption in each period (which is aimed to be kept at a steady lifetime or slightly upward sloping path) depends on lifetime permanent income (or broad income) which includes present and future earnings derived both from labour and from real and financial assets.

The intertemporal utility maximization problem for the consumer, subject to the restrictions imposed by her lifetime expected income and wealth, and under standard

assumptions, gives that consumption in each period is a function of present and future labour income, Y, and income from accumulated assets, W,[10]

$$C_t = f(W_t; \sum_{s=0}^{T} E_t Y_{t+s}) \quad (6)$$

In order to proxy the expected future labour income, no doubt the main determinant for a great part of the workforce is the likelihood of being employed. This likelihood, in turn, may be proxied by the unemployment rate. The greater the unemployment rate, the lower the probability assigned by an individual to the likelihood of being employed in the future, and therefore the lower the future expected labour income, and consequently, current consumption.[11]Thus, we may establish a functional form between aggregate consumption in each period, C_t, and income (Y_t), wealth (W_t) and the unemployment rate (u_t):

$$C_t = C(Y_t; W_t; u_t)\ C_Y > 0, C_W > 0, C_u < 0 \quad (7)$$

3.-Econometric results

This section summarises the specification and estimation of a macroeconometric model, consisting in empirical versions of equations (4), (5) and (7), i.e., a multiequational model, which tries to explain the interrelations between the three variables under scrutiny, consumption, investment and unemployment.

3.1. Data

The data used in our empirical analysis has been gathered from different statistical sources, which are detailed in Table A1 in the Appendix, providing also the

10 The specification of the function depends on the assumptions on the utility function, the interest rate and the intertemporal discount rate. For an individual living for T years, which leaves no debts, and assuming quadratic utility functions, real interest rates and intertemporal discount rate equal to zero, and strictly positive marginal utility, the consumption function would be of the type (Hall, 1982):

$$C_t = \frac{1}{T}\left(W + \sum_{t=1}^{T} E_t(Y_t)\right)$$

11 Note that this fall in current consumption implies an increase in current savings for precautionary reasons. There exists a vast literature focused on the effect of uncertainty about the evolution of expected future income on consumption and savings decisions (see *inter alia* the papers by Leland, 1968, Sandmo, 1970 or Drèze and Modigliani, 1972). This literature, however, has not yet got to a consensus as regard as how to measure this uncertainty, both at the micro and the macroeconomic level. Thus, some authors suggest the use of measures based on the volatility of future expected income (see Blanchard and Mankiw, 1988, Hahm, 1999, Hahm and Steigerwald, 1999 or Menegatti, 2007, 2010), while other group of authors base their attention on measures related to the unemployment (Dynarski and Sheffrin, 1987, Carroll, 1991, Malley and Moutos, 1996). More recent papers, as those of Mody*et al*., (2012) or Bande and Riveiro (2012) take into account both type of measures in empirical models of precautionary savings. In any case, given that in the present paper we are interested in the effect of the probability of perceiving future income on current consumption decisions, we assume that this probability can be proxied correctly through the unemployment rate.

corresponding definition for each variable. The reduced time dimension of some of the potentially important variables to explain the evolution of the variables of interest led us to make use of regional data, which allow to outweigh the limited time dimension of some variables with the cross-section component, maximizing thus the available number of observations. For this reason, and given that there exist data for the 17 Spanish regions for the main macroeconomic figures (consumption, disposable income, gross fixed capital formation, the unemployment rate, etc.) we opted for a panel data approach. The criteria for choosing the data were, firstly, homogeneity, and secondly the time dimension. All of the variables have been deflated, in order to insulate from the effect of inflation on consumption and investment decisions, such that our estimated model is completely real. The sample is initially 1980 to 2007, but for some of the variables (for instance the Madrid stock index, which proxies financial wealth) there is only available data since 1985. In any case, in the estimation of the model we have adjusted the sample size of each equation to data availability.

3.2. Econometric methodology

We construct a structural vector autoregresive distributed lag model (VARDL), with the aim of explaining the dynamics of the three variables under study. Moreover, as we have mentioned, in order to maximize the available statistical information, this model will be estimated as a panel data model, using the breakdown of the 17 Spanish regions (*ComunidadesAutónomas*). The specific functional form of the econometric model is:

$$A_0 y_{it} = \sum_{j=1}^{p} A_j y_{it-j} + \sum_{s=0}^{q} B_{it-s} X_{it-s} + \sum_{r=0}^{k} C_r Z_{t-r} + e_{it} \qquad (8)$$

wherey_{it} is a (3x1) vector of endogenous variables (consumption, investment and the unemployment rate), $X_{it}$is a vector of regional exogenous variables, while Z_t is a vector of exogenous national variables (which are common to all regions). Matrices **A**, **B** and **C** are of coefficients to be estimated, while e_{it} is a vector of error terms identically and independently distributed.

The estimation of model (8) is done by steps. Firstly, the dynamic structure of each equation is identified following the "general to specific" approach, i.e., we start with a high number of lags of each endogenous and exogenous variables, and then we reduce the model to a more parsimonious representation following the standard statistical information criteria, as the Akaike Information Criteria (AIC). This type of modelization implies a certain level of discretion in the selection of variables to include in each equation, as well as the initial number of lags to include. Vector

Autoregresions(VAR's), on the contrary, imply a minimum degree of discretion, given that the main decision in the modelization process is the ordering of the variables in the VAR, decision that conditions enormously the empirical results. For this reason, the econometric literature has developed the so-called Structural Vector Autoregresion (SVAR), in which the atheoretical identification of the equations in the VAR is replaced by the imposition of an economic structure in the error terms. While the main advantage of the SVAR is the opportunity to conduct structural analysis, through inspection of the impulse-response functions, their main disadvantage is the individual equations have no economic interpretation, and are largely ignored.

VARDL models overcome these limitations of the SVAR models, given that the estimated coefficients in each of the equations can be directly interpreted as elasticities, which allow assessing the degree of plausibility and economic intuition of individual results in each equation. Moreover, this technique allows for the construction of impulse-response functions, whose shape is not dependent on the ordering of the variables within the model. For all these reasons we decided to construct our econometric model in terms of a VARDL.[12]

As regards the type of panel data model we choose for our econometric exercise, we first must take into account the properties of the series with respect to stationarity. The use of dynamic panel data models in the context of time series has generated an important debate in the literature. Banerjee (1999), Baltagi and Kao (2000) or Smith and Fuertes (2011) provide a good approximation to such debate. Whether the involved variables in the analysis are stationary or not conditions the type of econometric modelization to follow next (see Smith and Fuertes, 2011). Thus, if the variables are non-stationary (i.e., *I(1)*) we should first test for panel cointegration, and construct a error correction model if such cointegration exist, or estimate the model in first differences otherwise. If the variables are stationary, then we can proceed with the standard techniques for stationary panel data models (Baltagi, 2008).

Therefore, our second modelling stage is to test for unit roots in the variables of our model, both regional and aggregate. For the latter we have chosen the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test,[13]even though results with alternative unit root tests,

12 For a detailed account of ARDL for the analysis of long run relationships see Pesaran*et al.*(1996) and Pesaran and Shin (1999).

13 See Kwiatkowski *et al*. (1992)

as the ADF, are similar to those reported.[14]Table 1 summarises these results, from which we observe that for all of the national variables (financial wealth, GDP volatility, social security benefits, real short run interest rates and public debt/GDP ratio) we cannot reject the null hypothesis of stationarity at the conventional statistical confidence levels.

Table 1. Unit root tests. National variables

Variable	KPSS
FW_t	0,053
$\Delta YVOL_t$	0,08
B_t	0,15
$RSHIR_t$	0,14
$DEBT_t$	0,16

Notes: The critical value for the test at the 5% is 0.14

As regards the panel unit roots tests, among the different available options in the literature, we opted for the Maddala-Wu (1999) test, based on a exactly non-parametric test based on Fisher (1932). Specifically, the test statistic is

$$\lambda = -2\sum_{i=1}^{N} \ln p_i$$

which is distributed as a $\chi^2(2N)$, where p_i is the p-value of the ADF unit root test for each *i-th* cross section unit, $i=1,...,N$. This decision is based on the interesting characteristics of the test (see Maddala-Wu, 1999).

Table 2 summarises the results of the test for the regional variables included in the model. Note that the null hypothesis is non-stationarity, and therefore the value of the statistic for each variable is greater than the critical value for a $\chi^2(34)$, which is approximately 48. On the light of these results we may conclude with sufficient statistical confidence that the regional variables involved in our model are panel-stationary, and therefore we may use standard stationary panel techniques.

14 We do not show these alternative tests for brevity, but they are readily available from the authors upon request.

Table 2. Panel unit root test

Variable	Fisher Statistic
C_{it}	62,17
Yd_{it}	52,28
NFW_{it}	114,63
U_{it}	47,65
Y_{it}	59,59
I_{it}	59,54

Given these initial results we thus construct a panel VARDL model with regional fixed effects, through the following specification:

$$A_0 y_{it} = \sum_{j=1}^{p} A_j y_{it-j} + \sum_{s=0}^{q} B_{it-s} X_{it-s} + \sum_{r=0}^{k} C_r Z_{t-r} + e_{it} \qquad (9)$$

$$e_{it} = \mu_i + v_{it}, i = 1,..,N, t = 1,...T$$

In other words, we assume that the error term e_{it} follows a "one-way" error component, also known as a "fixed effects model", in which $v_{it} \sim iid(0,\sigma^2)$ with $Cov(e_{it},e_{jt})=0$ for $i \neq j$. The vector of scalars μ_i represents the specific regional effects, which we assume are constant through time. In other words, in this model we assume that regions exhibit a similar behaviour as regards the slope coefficients for the different variables, and that they only differ in the intercept (Baltagi, 2008).

3.3. Econometric results

Once we have obtained the preferred dynamic specification for each equation in the model (estimated by OLS, see results in the Appendix), we estimated the whole panel as a system, by Three Stages Least Squares, in order to take into account the potential endogeneity of some regressors and the cross-equation correlation. Table 3 summarises the results of this estimation, which in general are good, being all of the variables statistically significant and all of the coefficients show the expected signs.

Column (1) in Table 3 shows the estimated consumption function. We observe that, in addition to a great level of inertia (value of the autoregressive coefficient of 0.87) disposable income affects consumption decisions with a high degree of persistence. Financial and nonfinancial wealth have the expected positive effects (greater in the case of non financial wealth, which is reasonable in a period in which housing prices experienced a larger increase in returns than average financial assets). Lastly, the unemployment rate has a dampening effect on consumption, in line with our theoretical

discussion in Section 2: an increase in the unemployment rate implies a decrease in expected future labour income, which in turn should be translated into reductions in current consumption. The inclusion of the public debt stock (as a % of GDP) in this equation has the purpose to test the Ricardian equivalence hypothesis, by which current tax cuts should be followed by current consumption falls, given that families anticipate the future tax increase to compensate current public deficit, and its corresponding increase in debt, rising their current savings to face such increase. The negative and statistically significant coefficient allows validating partially this hypothesis, even though with a limited impact, in line with previous studies for similar countries (see, for instance, Loayza *et al.*, 2000).

The results of the investment equation estimation are summarised in column (2) of Table 3. Investment shows a lower degree of inertia, depending negatively on current income, consumption (greater sales incentive firms to engage into investment projects), and negatively on short run interest rates (which proxy financial costs of the investment projects). We tried several alternative specifications for the investment function, including proxies for the Tobin's *q*, or real long run interest rates, but none of them provided better statistical results. Lastly, the degree of macroeconomic uncertainty (proxied by the estimated volatility of aggregate GDP growth rate on the sample period, obtained from the estimation of a GARCH (1,1) model, see Table A1) affects negatively investment, being one of the variables (together with consumption) which exerts a greater contemporaneous impact on capital formation.

The estimation of the unemployment rate equation is summarised in column (3) of Table 3, and show results in line with previous literature. Firstly, unemployment exhibits a high degree of persistence.[15] Secondly, the aggregate demand variables show the expected signs (consumption and investment reduce the unemployment rate in the short run), while the aggregate supply variable (social benefits) exerts the expected positive effect (increases in benefits tend to rise the reservation wage of workers, and therefore increases the rate of unemployment).

The model in Table 3 provides an excellent fit of the endogenous variables of the model, especially the unemployment rate.[16] Figure 2 depicts the actual and fitted values by the model. Note that the degree of fit to the actual values is remarkable, which indicates, on

[15] Note, however, that the unit root tests rejected the hypothesis that this series was *I(1)*, and therefore the hypothesis of pure hysteresis in the regional Spanish unemployment.

[16] The aggregate unemployment rate is computed as the average of the regional unemployment rates.

the one hand, that the dynamic specification of the model is adequate, and on the other hand, that the selected exogenous variables within each equation reflect well the underlying forces behind unemployment rate swings through time.[17]

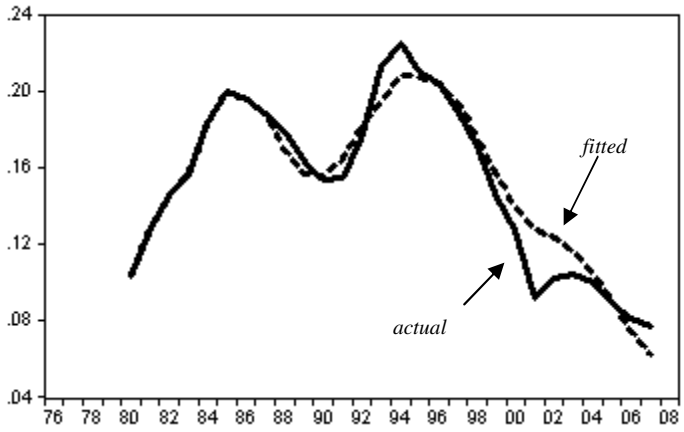
Table 3. Model Estimation. 3SLS

(1)			(2)			(3)		
Consumption			***Investment***			***Unemployment***		
	Coef.	*p*-value		Coef.	*p*-value		Coef.	*p*-value
c_{it-1}	0,878	0,00	I_{it-1}	0,701	0,00	u_{it-1}	0,78	0,00
	(0,02)			(0,03)			(0,02)	
Yd_{it}	0,214	0,00	y_{it}	0,404	0,00	I_{it}	-0,02	0,08
	(0,03)			(0,07)			(0,01)	
Yd_{it-1}	-0,17	0,00	Δc_{it}	2,06	0,00	c_{it}	-0,593	0,00
	(0,03)			(0,07)			(0,08)	
ΔNFW_{it}	0,034	0,00	$RSHIR_t$	-0,234	0,09	c_{it-1}	0,555	0,00
	(0,008)			(0,15)			(0,07)	
Δu_{it}	-0,508	0,00	$\Delta YVOL_t$	-0,63	0,01	b_t	0,029	0,09
	(0,09)			(0,43)			(0,01)	
FW_t	0,022	0,00						
	(0,003)							
$DEBT_t$	-0,059	0,00						
	(0,01)							
R^2	0,99		R^2	0,99		R^2	0,93	
SER	0,01		SER	0,06		SER	0,01	
DW	1,93		DW	1,88		DW	1,88	
Obs	374		Obs	374		Obs	374	

Notes. Standard errors in parentheses. SER is the standard error of regression, while DW refers to the Durbin-Watson statistic.

[17] Note that to obtain the fitted unemployment rate we first had to solve the model formed bythe three estimated equations, allowing that the endogenous and exogenous variables take their initial values. We next solve dynamically the model, which implies that the model takes the actual values of the exogenous variables and computes the corresponding values for the endogenous variables, which in turn feed the model in the next period computation.

Figure 2. Actual and fitted unemployment rates.



4.- Unemployment effects of consumption and investment shocks

With the model summarised in Table 3 we next run a number of dynamic simulations which aim at verifying our starting hypothesis, namely that changes in consumption patterns exert a direct effect (via aggregate demand) as well as an indirect effect (through investment) on unemployment. To this end we firstly compute the impulse-response functions associated with the model in Table 3, which inform us about the impact of innovations in the system on the endogenous variables. The IRF are computed by allowing the model to stabilize at its long run steady state, such that all exogenous variables are constant. Next, we impose a shock on each one of the equations and compute the response of the endogenous variables of the system to such shock (specifically, we consider the response to a one-off shock, an AR(0.4) and a AR(0.8) shocks).[18] The results of the calculations are depicted in Figures 3 and 4.

[18] A transitory (or one-off) shock is defined as a unitary exogenous change in the inspected equation (consumption, investment or unemployment), with a one year duration. In other words, the shock is present in period $t=0$, and disapears in period $t=1$. An AR(0.4) shock, in turn, is more persistent, since it takes value 1 in period$t=0$ and values $\varepsilon_t=0.4\varepsilon_{t-1}$ for $t=1,2\ldots T$. Finally, the AR(0.8) shock takes value 0 for $t=0$ and $\varepsilon_t=0.8_{t-1}$

Figure 3. Impulse-Response Functions to consumption shocks

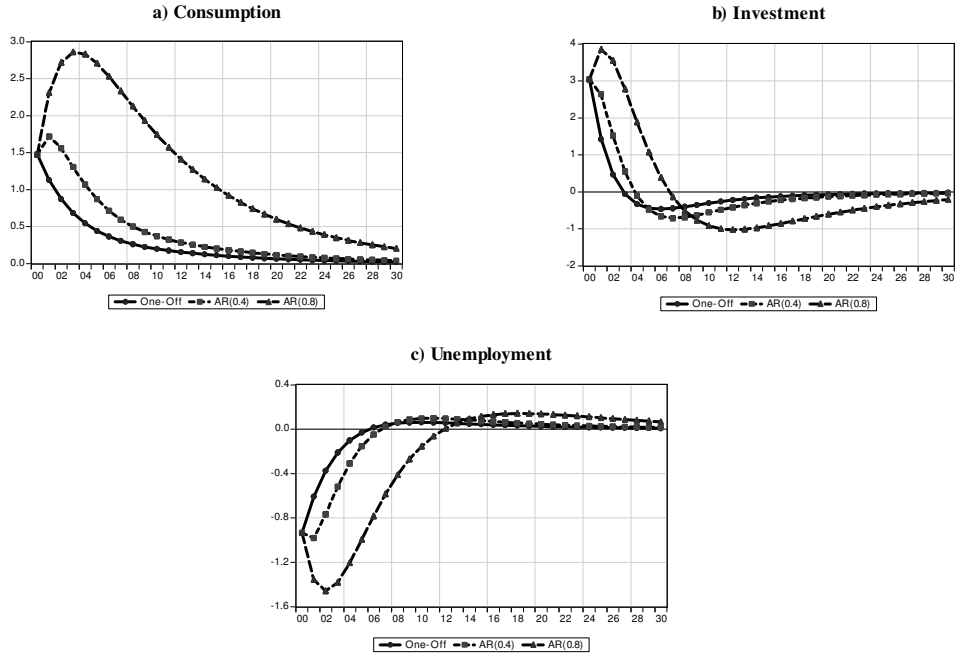
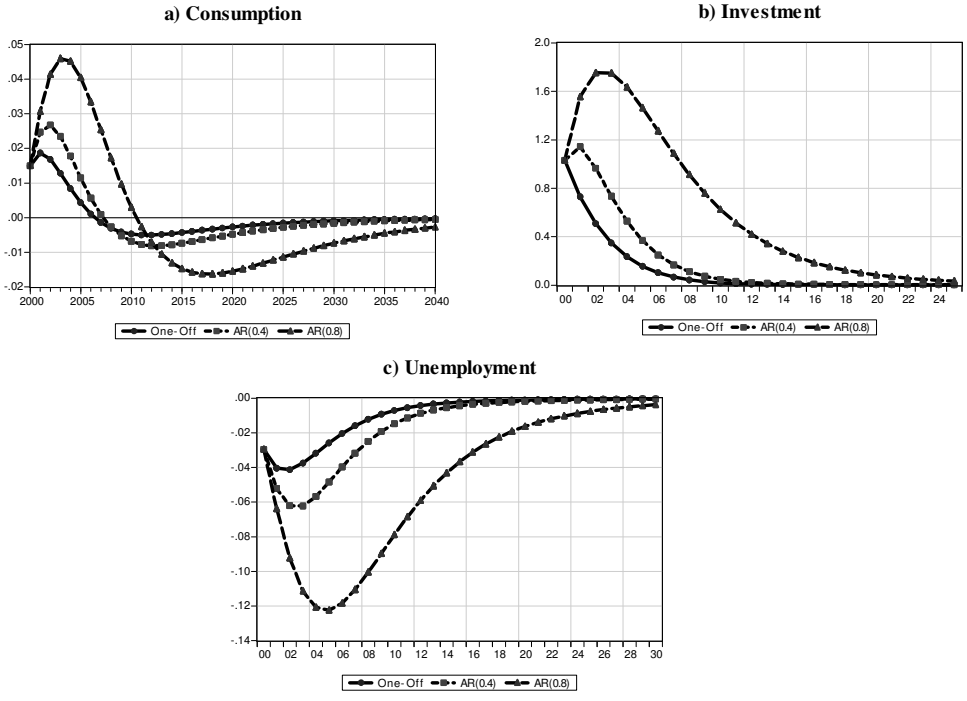


Figure 4. Impulse-Respose Functions to investment shocks



From the information in these graphs we may point that, first, shocks on consumption (regardless of the degree of persistence of the shock) exert an important effect on the unemployment rate, affecting also investment. Thus, when we consider a temporary

one-off shock on consumption, there exists an important contemporaneous impact on investment (which is increased by more than a unit), which would indicate an accelerator effect. The unemployment rate, in turn, is reduced by 0.9 points contemporaneously, with a prolonged effect through 6 periods before reaching is initial value. Therefore, this IRF allows validating the hypothesis that changes in consumption affect unemployment through first and second round effects. Obviously, the more persistent is the shock on consumption, the greater the unemployment effects (see panel c) on Figure 3.

If we consider shocks on investment, the effects are similar, however the contemporaneous impact on the unemployment rate is lower than that of consumption shocks. In any case, an exogenous increase in investment is followed by further increases in consumption through the reductions in unemployment, with prolonged effects on the system.

A synthetic way of summarising the information provided by the IRF is to calculate the accumulated impact of each shock on the endogenous variables in the long run. Assuming that the long run value of an endogenous variable is represented by x^{LR} (where x represents consumption, investment and the unemployment rate, respectively), let $\theta_t=x_t-x^{LR}$ be the difference between the actual value of variable x and its long run value in each period t, $t=1,2\ldots$ once that a shock in the system has occurred. If the shock took place in period $t=j$ then it is possible to compute the *accumulated short run effect* on variable x as:

$$\pi=\sum_{t=j}^{\infty}\theta_t \qquad (10)$$

Note that this measure is the area below the IRF, therefore the greater the former, the larger the accumulated effect of a given shock on the variable under study. We may complement this measure with a temporal quantification of the shock. In this case, we would analyse the number of periods required for an endogenous variable to reach again its long run value (or a neighbourhood of it). The first type of measures will be referred to as *quantitative persistence*, while the latter will be referred to as *temporal persistence*. Table 4 summarises these calculations.[19]

[19] Given that we have considered three types of shocks, we should provide persistence measures for each. However, autoregresive shocks are persistent temporary shocks, and thus the persistence measures would only reflectan amplification of the effects of a temporary one-off shocks. For this reason we provide the results for this latter type of innovations.

Table4. Measures of Quantitative and Temporal Persistence.

	Consumption shock			***Investment shock***		
	Cons.	*Invest.*	*Unemp.*	*Cons.*	*Invest.*	*Unemp.*
Quantitative persistence (π)	8,25	0,00	-1,46	4,31	3,33	-0,31
Temporal persistence (τ)	13	11	4	6	6	13

Notes: Cons., Invest. andUnemp. refer to consumption, investment and unemployment, respectively. Temporal persistence is computed as the number of periods required for the system to absorb 90% of the initial impact of the shock.

These results reinforce those provided by the IRF. The shocks generating more unemployment quantitative persistence are the consumption shocks, in spite of the larger effect in temporal terms of investment shocks. As regards the response of the two other endogenous variables, the quantitative effect on consumption of self and investment shocks is similar, while the self-effect of investment shocks is greater than consumption shocks.

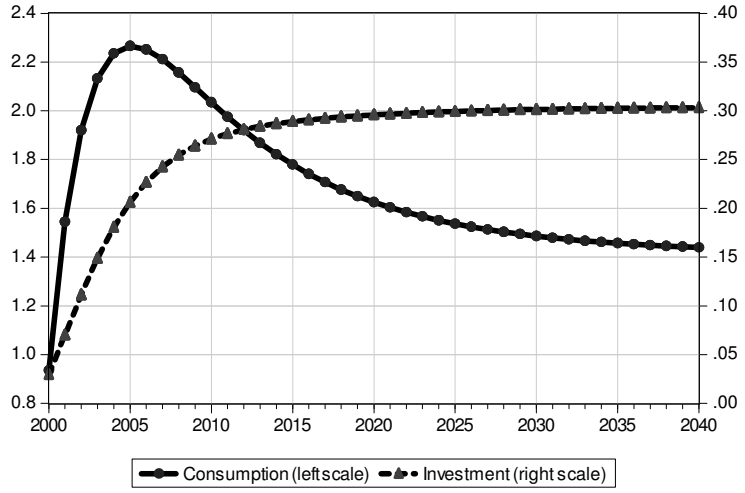
In any case, these results suggest that should persistent falls in consumption levels occur (as it is the case in the Spanish economy), the unemployment rate would be largely and persistently affected, which would further complicate the labour market adjustment.

An additional exercise allows analysing the effects on the equilibrium unemployment rate of *permanent* changes in consumption. The idea is to simulate what would happen with the equilibrium unemployment rate whena permanent fall in consumption or in investment levels occurs. Which of these aggregate demand shocks would affect unemployment most in the long run? To answer this question we use the model presented in Table 3 and introduce a permanent shock in the consumption equation and in the investment equation (in different simulations), and compute the responses of the unemployment rate, which are depicted in Figure 5.

From this figure we conclude that there are very different long run effects. Thus, a permanent unit shock on consumption increases equilibrium unemployment by 1.5 points, whereas in the case of investment shocks the unemployment rise is of 0.31, i.e., a permanent consumption shocks generates a long run effect which is 5 times larger than that of investment shocks. Secondly, the dynamic adjustment towards the new long run unemployment rate is remarkably different. In the short run, the unemployment rate overreacts to the consumption shock, increasing by 2.3 points, and then it progressively approaches its new long run value. In the case of an investment shock, the dynamic response is softer, approaching smoothly the new equilibrium unemployment rate. This indicates that in the case of consumption, the short run effects are greater than the long

run effect, while the contrary holds for the investment shocks. This results calls for caution in the design of public budget adjustment policies, since any measure targeted at increasing public revenues taxing (and therefore lowering) consumption are likely to exert catastrophic effects on the equilibrium unemployment rate.

Figure 5. Impulse-Response functions to permanent shocks in consumption and investment



5.- Conclusions

This paper provides new evidence as regards the existence of an empirical relationship between the main components of aggregate demand (consumption and investment) and the labour market equilibrium. Specifically, and taking into account that the main economic thought paradigms in macroeconomics (the New Keynesian Macroeconomics and the New Classical Macroeconomics) do not support the idea that aggregate demand shocks have prolonged labour market effects, we have shown that through a highly stylised macroeconomic model it is possible to establish a number of transmission mechanisms of aggregate demand shocks to the equilibrium level of employment, as a function of the adjustment of the capital stock and its level of utilization. In essence, this model indicates that if changes in the aggregate demand are associated to permanent shifts in the labour demand curve (due for instance to increases in the marginal product of labour o to an increase in the number of firms), there will be permanent effects on the equilibrium level of employment. These permanent effects would also be present if the labour demand function has positive slope and the change in aggregate demand affects

the wage setting curve (or the labour supply curve). Combining this model with standard macroeconomics models of investment and consumption behaviour allows us to establish a close relationship between consumption, investment and the labour market equilibrium (measured through the unemployment rate). The empirical evidence provided in Section 3 proves the existence of such relationship for the Spanish economy, while the dynamic simulations in Section 4 allowed quantifying the potential effects of demand shocks. Thus, we found that temporary shocks on consumption exert greater accumulated effects on unemployment than investment shocks, due to the feedback between both variables. In the presence of permanent consumption shocks, the equilibrium unemployment rate increases more than with investment shocks, as well as triggering stronger short run effects.

The implications for policy making are very relevant, especially in the current recessionary context of the Spanish economy, which is joined by a strong fiscal adjustment process. As in Malley and Moutos (2001), from our results we may deduce that any policy mix targeted at reducing the unemployment rate should include measures to incentive capital accumulation. In this sense, we agree with Kapadia (2005) in that policies fostering investment would help in reducing unemployment, and that in the case that policy focuses exclusively on labour market reforms, the effect on the employment level may be negative. In this same line, Arestis*et al.* (2007) conclude that policies should not be focused on the deregulation of the labour market and the promotion of flexibility, but should incentive sufficient capital accumulation.

Notwithstanding, from this paper we may also conclude that focusing exclusively on capital accumulation and leaving aside measures to stimulate aggregate consumption may not solve the labour market adjustment problem. Our empirical results suggest that current falls in consumption during the present recession may generate a very strong effect on the unemployment rate, through the accumulated first and second round effects (via investment). At the same time, credit restrictions which are characterizing this turmoil will not allow for increases in investment, even with historically low real interest rates. Lastly, fiscal adjustment will lead to further falls in aggregate demand and tax rises, which will curtail disposable income even further. Therefore, the outlook as regards the evolution of the unemployment rate is quite pessimistic.

The negative recentbehaviour of the Spanish unemployment rate is, no doubt, the result of a series of unfavourable factors (excessive dependence of low-productivity sectors, high temporary employment rate, duality in the labour market, excessive rigidities in the

wage bargaining processes, etc.), but the insufficient private spending in consumption and investment, which far from being outweighed by public spending, has been reinforced by recent public budget adjustment plans, has contributed to amplify the magnitude of the problem in recent years. It seems clear that the chronic unemployment problem in Spain (and its deterioration in the last years) is not uniquely attributable to labour market institutions and regulations. Therefore, any measure focused on those aspects, affecting negatively consumption and investment will not be able to solve the unemployment problem.

Measures targeted at increasing aggregate demand components without compromising the public budget balance are, therefore, needed. In this sense, a deep reform of the tax system which lowers tax pressure on the income levels with greater propensity to consume would be an adequate stimulus to start with the multiplier effects. At the same time, deepening into the financial system reform is essential to revert credit flows towards the real sector of the economy, such that economic activity starts creating employment again.

Note that in the context of a monetary union there would be an additional adjustment mechanism, through an internal devaluation via wage cuts, that if the inflation rate is to be kept stable, should be achieved through nominal wage reductions. However, our results show that this type of adjustment, being an attack to the welfare system, also would be associated to falls in the disposable income of households, with a likely deterioration of the unemployment problem. Therefore, these type of measures should be avoided by policymakers. We hope that in this context, the option of fostering labour supply reductions via external out-migration (which seems to be already in place) instead of via employment creation is not chosen by policy makers as the via to solve the labour market adjustment problem in Spain.

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Apendix

Table A1. Definitions and data sources

	Variable	Definition	Source
REGIONALVARIABLES	C_{it}	Final consumption expenditure by households	BD-MORES, Dirección general de Presupuestos, Instituto de Economía Internacional, University of Valencia
	Yd_{it}	Gross household disposable income	BD-MORES
	Y_{it}	GDP at market prices	BD-MORES
	I_{it}	Gross Fixed Capital Formation	BD-MORES
	u_{it}	Regional unemployment rate	Encuesta de Población Activa, INE
	NFW_{it}	Non financial wealth: value of the residential capital stock= residential capital stock x average price of squared meter of real estate	Residential capital stock: IVIE, Universidad de Valencia Averagesq. M. price: Sociedad de Tasación
NATIONALVARIABLES	FWt	Financial wealth: anual average of the Madrid stock index	Bolsa de Madrid
	Bt	Social benefits per inhabitant	OCDE, Economic Outlook
	RSHIRt	Real short run interest rate: nominal short run interest rate-rate of inflation	OCDE, Economic Outlook
	DEBTt	Public debt stock as a % of GDP	OECD, Economic Outlook

Table A2

Estimation of the model. OLS

Consumption			Investment			Unemployment		
	Coefficient	*p*-value		Coefficient	*p*-value		Coefficient	*p*-value
c_{it-1}	0,844	0,00	I_{it-1}	0,754	0,00	u_{it-1}	0,75	0,00
	(0,02)			(0,02)			(0,02)	
Yd_{it}	0,326	0,00	y_{it}	0,321	0,00	I_{it}	-0,033	0,00
	(0,04)			(0,05)			(0,007)	
Yd_{it-1}	-0,270	0,00	Δc_{it}	1,51	0,00	c_{it}	-0,243	0,00
	(0,04)			(0,15)			(0,03)	
ΔNFW_{it}	0,042	0,00	$RSHIR_t$	-0,352	0,02	c_{it-1}	0,196	0,00
	(0,01)			(0,15)			(0,03)	
Δu_{it}	-0,141	0,01	$\Delta YVOL_t$	-0,856	0,10	b_t	0,068	0,00
	(0,04)			(0,59)			(0,01)	
FW_t	0,030	0,00						
	(0,003)							
$DEBT_t$	-0,06	0,00						
	(0,05)							
R^2	0,99		R^2	0,99		R^2	0,94	
SER	0,01		SER	0,07		SER	0,01	
DW	2,05		DW	2,12		DW	1,94	
NxT	374		NxT	459		NxT	459	

Notes. Standard errors in parentheses. SER is the standard error of regression, while DW refers to the Durbin-Watson statistic.