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"Mismatch" in the Labor Market and Inflation: An Integrative Model with Lessons from the Spanish Experience

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"Mismatch" in the Labor Market and Inflation: An Integrative Model with Lessons from the Spanish Experience

by

Manuel Pérez Trujillo/Santos M. Ruesga/Friedrich L. Sell

Abstract

The Great Recession (2009/10) resulted in the need of different economic policies and structural reforms to boost economic growth both in the advanced and in the emerging economies. In this paper, we start from a theoretical concept that is relatively new—the modified output gap (MOG), based on both the Phillips and the Beveridge curve, initially introduced by Sell and Reinisch (2013) and Sell (2016), revealing the explicit positive relationship between the vacancy ratio on the one hand and the inflation rate on the other hand. Empirically, we estimate this relationship by developing three different panel data models: Fixed Effects (FE), Random Effects (RE) and a GMM System (Generalized Method of Moments).

The obtained results show that the loss in the efficiency of matching in the labor market combined with an increase in the demand in the markets for goods and services will push up inflation. We show the empirical relevance of the modified output gap for Spain during the Great Recession and explain how it affected the implementation of the economic stimulus plan that was introduced by the then socialist government in Spain with the aim of boosting the economy.

Keywords: Mismatch, Beveridge curve, Philipps curve, modified output gap, great recession

JEL Classification: J63, J41, E65, E31

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1. INTRODUCTION

The Great Recession has resulted in a wide divergence in the behavior of the developed economies. It has also emphasized the need to formulate different economic policies and implement structural reforms. During this period, the crisis negatively affected labor markets. These consequences forced the *policy makers* to implement various economic proposals that should allow recovering the level of employment experienced before the recession and would improve the efficiency of the interaction between the supply and demand in the labor market. It seems worthwhile and necessary to assess the outcome of these economic programs by employing appropriate theoretical and empirical tools.

In this study, we have used two theoretical tools: the Beveridge curve (BC) (see Beveridge 1944)[1], and the Phillips curve (PC) (see Phillips 1958)[2]. Firstly, the use of these tools allows us to determine theoretically how the negative shock introduced by the Great Recession on the economy may have raised the level of structural and cyclical unemployment in the labor market.

Secondly, we have combined both the tools to construct the theoretical concept of the *modified output gap* (MOG) (Sell and Reinisch 2013, Sell 2016). The analytical framework of the MOG will allow understanding the ineffectiveness of expansionary economic policies in case of a negative shock, affecting the (in)efficiency of adjustment in the labor market, which is also known as a *mismatch* (Petrongolo and Pissarides 2001).

The present study focuses on such a case pertaining to the economic recession in Spain. Both the country and the period are appropriate to test the empirical relevance of the MOG. A few recent studies have shown the evidence of a loss in the efficiency of a *mismatch* for the Spanish labor market after the onset of the economic crisis (see ECB 2012, Haincourt and Mogliani 2012, Hobijn and Sahin 2012, OECD 2013 and 2013, EC 2013, Ruesga *et al.* 2015). All of the earlier studies associate this situation to the bursting of the housing bubble and the collapse of the production model that characterized the expansion of the economy before the period of crisis.

[1] The BC is a theoretical tool that is useful for analyzing the labor market in the presence of frictions that affect its equilibrium. It is a function that represents the number of jobs held at any given moment in terms of the number of workers seeking employment (unemployment), the number of firms seeking workers (vacancies open), and a small set of other variables (Petrongolo and Pissarides 2001). Assuming that the curve is in a stationary state, in which the variation in the number of vacancies and employed workers from one period to another is 0 (since the flow of entry into and exit from unemployment is constant); the curve's equilibrium is characterized by a relationship of negative elasticity between vacancies and unemployment.

[2] The PC, named for New Zealand's economist William Phillips (1958), establishes the familiar negative relationship between unemployment and inflation.

Because of the recession and the rapidly increasing unemployment at the onset of the crisis, the Socialist government led by Zapatero decided to adopt an economic stimulus plan, known as *Plan E*, which was implemented from November 2008 to the first half of 2010 with an aim to boost the economy and revitalize the labor market.

However, the overall impact of this economic plan was limited. On the one hand, this plan could not stop, throughout its implementation, the advancing loss of jobs and growing unemployment, especially in the industries mostly affected by the crisis. On the other hand, the industries, where the labor demand increased during the implementation of this economic plan, were the service sectors, viz., education, health, public administration, and electricity, gas, steam, and air conditioning supply. It also resulted in a simultaneous increase in the working hours, due to the lack of adequate workers available in the market to occupy the new vacancies emerging in these industries. This situation favored an increase in the salaries in these sectors, affecting, in a medium term, the costs of production, thus created a risk for maintenance of the level of inflation in the whole economy.

Overall, the *Plan E* became an example of a poorly designed economic policy that boosted demand in the market for goods and services without correcting the imbalance between the supply and demand in the labor market, thus putting the macroeconomic equilibrium at a risk[3]. It highlights the importance of understanding the theoretical implications of MOG.

In this paper, at first, we integrate the BC and PC to derive conceptually the MOG. Thereafter, the performance of the Spanish economy is described with a focus on the labor market during the Great Recession and on the effect of the economic stimulus plan, developed by the

[3] As alternatives to the "failed" economic stimulus plan developed by the socialist government in Spain, numerous reform plans have been carried out whose structure aimed to flexibilize the labor market. These plans are similar to those implemented in other countries affected by the crisis of 2008, primarily in the Eurozone, the most significant of which was the labor reform introduced in 2012. The main consequence of this reform was a decrease in labor costs, enabling the Spanish economy to gain competitiveness in the short term relative to its competitors in the international markets and thus to improve the level of exports and employment, at least slowing the decrease in employment level (OECD 2013, Lacuesta and Puente 2013). But the effectiveness of this type of reform was limited in a medium-to-long term regarding job creation. In an economic context in which all commercial partners perform similar reforms (like those applied in other EU countries to which over 60% of all Spanish merchandise and services are exported)—reforms oriented to reduce labor costs, influencing primarily salary level and thus families' spending ability and consumption—this policy created a reduction in the external demand that undercuts the profits obtained by the gains in competitiveness, affecting growth of the economy and causing unemployment. It is thus crucial to carry out monetary and fiscal stimulus plans (particularly fiscal ones in countries with a surplus at the commercial level), as such plans guarantee sustained demand and enable restoration of the level of economic growth and employment prior to the crisis in the most affected countries (Capaldo and Izua 2013). This paper thus does not seek to criticize the effectiveness of the economic stimulus programs for solving the current economic crisis, but rather shows the additional problems that should be evaluated, such as the worsening in match efficiency between supply and demand in the labor market, to ensure that the policies are applied and developed properly.

Government to put back the economy on the path of growth. Further, the performance of the BC, PC, and MOG during the crisis is empirically determined. Finally, some policy implications in this regard are derived.

2. THE MODIFIED OUTPUT GAP (MOG)

The BC and PC are two of the theoretical tools, which have commonly been used by economists during the last century for understanding the imbalances in the labor market. We combine these two theoretical concepts to obtain the relationship, herein referred to as the MOG (Sell and Reinisch 2013, Sell 2016)[4]. The logic of this relationship can be explained as follows: When the labor market is strong, the number of vacancies grows and unemployment decreases, following the logic of the BC. When unemployment decreases and the conditions of aggregate demand grow stronger, the price level tends to increase, following the logic established by the PC. Because of both the processes, there exists a positive relationship between the job vacancies and inflation within the general macroeconomic equilibrium, as defined by the MOG (Sell 2010).

It is thus important to distinguish between the movements throughout the MOG and the changes that affect its stability (Figure 1). The idea of a change in the stability of a function is quite simple. On the one hand, deterioration in match efficiency in the labor market pushes the BC toward the outside of the coordinate axis[5], so that it moves from equilibrium ***an*** over BC^0 to the equilibrium defined by ***b*** located over BC^1—a movement associated with arrow 1 (see quadrant I). This deterioration of efficiency or increase in *mismatch* has short-to-medium-term consequences to the stability of the MOG. The immediate effect of lower match efficiency and labor demand on the increase in unemployment thus depresses aggregate demand, which leads to a short-to-medium-term decrease in prices. This result shifts the MOG from MOG^0 to MOG^1, changing equilibrium from ***a''*** to ***b''***, as indicated by arrow 1 in quadrant IV, where the inflation-vacancies ratio is smaller.

Figure 1.

In the long term, however, as Kaufman and Hotchkiss indicate, "the so-called natural rate of unemployment ... is given by the intersection between the BC and the 45 degree line, where the

[4] See Sell (2010) for a better approach to explaining the mathematical development of the MOG.

[5] The economics literature relates gains or losses of *matching* efficiency to technological advancements, the divergence between workers' education level and the training required by firms, mobility of the factor of work, the cost of layoffs, and the model of passive labor market policies (Blanchard and Diamond 1989, Petrongolo and Pissarides 2001).

number of job seekers/vacancies is equal to the number of job openings/vacancies, and the labor market is in its long-run equilibrium" (2006, p. 217). Thus, in a long term, any change in the BC will move the PC shifting from equilibrium ***a'*** in PCL^0 to ***b'*** in PCL^1, as indicated by arrow 1 in quadrant II. The change that occurs in the labor market will affect the inflation rate in the long term, generating a positive shift of the PC. In a short-to-medium term, as the agents anticipate the future, the price level grows, while shifting the PC to the right of the coordinate axis, locating the equilibrium of ***b'*** over PC^0 to ***c'*** over PC^1, as indicated by arrow 2 in quadrant II. This second movement of the PC will cause the MOG to move inward from ***b''*** in MOG^1 to ***c''*** in MOG^2, as indicated by arrow 2 in quadrant IV, indicating a higher inflation level for each level of vacancies in the market, *ceteris paribus*[6].

On the other hand, the twofold impact of the stimulus policy—whether fiscal or monetary—on the equilibrium of the MOG can be explained as follows. On the one hand, we assume that the government decides to act on the economy at an unfavorable moment in order to stimulate growth and thus employment. The undesired *first-round effects* of this policy would be an increase in the demand for employment, i.e., number of vacancies, and in price levels. Based on the dynamics illustrated in Figure 2, the situation described would shift the PC from PC^0 to PC^1, thus shifting the equilibrium from ***a'*** to ***b'***, where the unemployment level would be lower but prices would increase (see quadrant II). The curve shifts because the increase in supply does not compensate for the impulse of aggregate demand generated by the stimulus plan, creating expectations of higher inflation, which cause the PC to shift positively in the short term (Sell 2010).

Figure 2.

Owing to the dynamics occurring in the PC, the MOG will also shift, moving inward from MOG^0 to MOG^1. Any number of vacancies will now be accompanied by higher inflation rates—an equilibrium determined by ***c''***.

The theoretical combination of the BC and the PC in the analytic context of the MOG provides us with a better understanding of other inefficiencies in macroeconomic policy when there is a negative shock that affects match efficiency on the labor market. Any positive boost to the economy, such as resulting from an extensive government spending program to increase

[6] The stability of MOG will be affected by both movements, at first, by the BC and then by the PC. It will shift inward—a worse—or outward the inflation-vacancies ratio that will improve the relationship, depending on whether the intensity of movement of the BC or the PC exerts a stronger influence on the MOG or the elasticity of both curves.

aggregate demand, will be much less effective, given the presence of low efficiency in the labor market match. Further aggregate demand will thus result in an increase in the inflation level. Why? Firms cannot hire enough workers (qualified or less qualified, since there is no heterogeneity in terms of work skills and no explicit bargaining process in the MOG model) to increase their production level according to the new demand level. Consequently, they will have to use their existing labor factor endowment more intensively, which will eventually increase the production cost. At some significant level of monopolistic competition, firms will pass over these higher production costs to final demand.

3. THE SPANISH ECONOMY DURING THE GREAT RECESSION: THE MISMATCH AND THE EFFECT OF FISCAL EXPANSION MEASURES[7]

In this section, we conduct an analysis of the evolution of the Spanish economy—the main subject of this research—in order to demonstrate the empirical relevance of the MOG and the labor market during the beginning of the economic recession. With the bursting of the housing bubble and the collapse of the prevailing economic model during the period of growth of the economy between 1995 and late 2007, there occurred major changes that negatively affected the labor market.

In the period between the fourth quarter of 2007 and the second of 2010 (last quarter analyzed), the unemployment experienced a much higher increase in relative terms: about 1.4 times over this period, reaching to 4,645.5 thousand individuals unemployed at the end of the period, compared to the decline observed for the number of vacancies which fell only to 4.5 percent. The different pace of variations for both the vacancy and unemployment rate may indicate an existence of frictions that affected the mismatch during the crisis.

An analysis of the evolution of the employment structure could help understand what occurred in the labor market during this period. In this regard, the expansion of low and medium-low technology intensity and knowledge industries during economic growth and in the aftermath of the recession in these sectors explain the downturn in the labor market. From 2001 to 2007, the employment grew up around 4.6 million, where the construction sector alone created 20 percent of the total jobs. The economic activity in this phase was driven mainly by industries

[7] The data of this section concerning the level of employment and unemployment are obtained from the *Spanish Labour Force Survey* (Encuesta de Población Activa –EPA-), while the data of vacancies come from the *Quarterly Survey of Labour Costs* (Encuesta Trimestral de Coste Laboral –LCI-), elaborated by the Spanish Labour Ministry.

with intensive labor input that occupied workers with a low- and medium-low level of qualification (Ruesga *et al.* 2015).

However, when the recession started, these industries were the main contributors in the decline of the total employment, for instance, in the construction sector 52.5 percent of the total jobs reduced between the first quarter of 2008 and the second of 2010. As the recession proceeded, the workers employed in less competitive industries were the most affected ones by the job destruction process due to their low employability (Bell and Blanchflower 2011, OECD 2013).

In order to mitigate the negative impact of the recession on the labor market at the beginning of the crisis, the Spanish government, led by the socialist Rodríguez Zapatero, decided to apply an economic stimulus plan known as *Plan de Estímulo de la Economía y el Empleo (Plan E)* (see Real Decreto-Ley 9/2008). This plan was implemented from November 2008 to the second half of 2010 with a rough amount of €11,000 million, encompassing 80 economic, financial, and fiscal measures to boost economic growth and create employment.

The *Plan E* initially favored job creation—similarly to the stimulus economic plans executed at the beginning of the recession by other OECD countries (Capaldo and Izurieta 2013)—and increased vacancies available in the labor market by 10.6 percent between the fourth quarter of 2008 and the second of 2010. In addition, this plan reduced the unemployment growth rate; nevertheless, it indeed increased by 44.8 percent in the period. In this regard, the industries that contributed most to the employment destruction at the beginning of the recession continued with the process of adjustment; wherein again the construction sector was on the top with 37.1 percent of the total employment declined.

Furthermore, the growth of vacancies experienced during the economic stimulus plan was concentrated in the service sector. In this sector, the increase in the vacancies was 24.6 percent. This process boosted the employment in sectors like education, health services, public administration, and electricity, gas, steam, and air conditioning supply. These sectors compensated the overall fall in the employment during this period with the creation of more than 144,300 new jobs, while simultaneously the number of hours worked increased (see Table 1). In this regard, both the values indicate that the labor demand grew in these sectors during the stimulus plan.

The higher demand in the sectors that require skilled labor or a specific level of training contrasted to the simultaneous rise of unemployment. This demand reinforced with an inflow

from the intensive labor sectors occupying workers with a low- and medium-low level of qualification. In this regard, the difficulty for the workers with a low level of employability to find a new job, in the sectors that were demanding new employees, could have affected the mismatch on the labor market and the level of structural unemployment (Bouvet 2012).

Table 1. Variations in the working time per worker occupying a full-time employment, during the period between the fourth quarter of 2008 to the second quarter of 2010

According to Woo (2012), "if there is a serious issue of structural unemployment then the sectors those are having trouble in finding workers should be bidding up wages". Then, looking at the evolution of total wage costs and the extra-working time (see Figure a.1 and a.2 in Statistical Appendix), in the period of performance of the stimulus plan, the rising of labor costs in the sectors identified for driving the labor demand during this period can be highlighted.

Figure 3a.

Figure 3b.

This increase, experienced in the labor costs (see Figure 3a y 3b) in the industries that were occupying 21.9 percent of the overall employment in the second quarter of 2010, could have had a negative impact on the macroeconomic equilibrium, mainly on the rising up of the level of prices. In this regard, "if unemployment is 'structural' then government policy that seeks to increase demand, for example, low interest rates or fiscal stimulus (like *Plan E*), will have little or no effect on the national unemployment rate and could even make matters worse by igniting inflation" (Woo 2012)[8].

Since the beginning of the stimulus plan, it is important to note the growing up process experienced by the job vacancies. This growth is also accompanied by a positive evolution of the inflation rate, which seems to be lagged between two-three quarters related to the evolution of vacancies, beginning the phase of inflation growth from the third quarter of 2009 (see Figure 4).

Figure 4.

This procyclical and lagged evolution of the price level in contrast to vacancy evolution is due to the time taken by the economic agents for updating their expectations and incorporating them into the process of negotiation of the labor conditions, carried out mainly through the collective

[8] See also Sell and Reinisch (2013).

bargaining. In this regard, the concomitant increase in the level of vacancies in different industries, which indicates worsening of the mismatch process in the labor market, makes the firms to intensively use their staff in order to meet the increase in the demand for goods and services in the market. This implies an increasing number of working hours for the staff in the company, as it is not possible to find new workers with the same abilities in the market. This increases the power of the staff for demanding higher salaries in the collective bargaining process if the production continues to rise in a medium term (Layard *et al.* 1994). Thus, this process would produce a negative impact on production costs and level of inflation.

4. AN EMPIRICAL ANALYSIS: THE SPANISH CASE

In this study, we performed three different analyses, each for BC, PC, and MOG, for the period from the fourth quarter of 2007 to the second quarter of 2010, spanning from the onset of the economic crisis—which is worsening of *mismatch* in Spain (Ruesga *et al.*, 2015) to the stimulus economic plan carried out by the ruling socialist government. The aim of this section is to prove the empirical relevance of the MOG using the econometrical techniques.

In order to analyze the BC and its stability, we consider the methodology proposed by Wall and Zoega (2002), Bouvet (2012), Sell and Reinisch (2013), Dixon *et al.* (2014), and Ruesga *et al.* (2015) and we used the following equation:

$$Ln\, u_{it} = \beta_0 + \beta_1 \cdot Ln\, v_{it} + \beta_2 \cdot Ln\, v_{it}^2 + \lambda_t + \varepsilon_{it} \qquad (1)$$

where u_{it} is the unemployment rate and v_{it} is the vacancy rate, both are expressed in logs for the region "i" in the quarter "t"[9], and λ_t is the time-effect. In this equation, we include the square of v_{it} to test it for the convexity of this function. The estimated coefficients for time-effects will determine the stability of the BC along the period analyzed.

On the other hand, for the estimates of the PC, we use the methodology proposed by Sell and Reinisch (2013):

$$\pi_{it} = \beta_0 + \beta_1 \cdot u_{it} + \beta_2 \cdot u_{it}^2 + \lambda_{year} + \varepsilon_{it} \qquad (2)$$

[9] The functional form commonly used to represent the BC is the Cobb-Douglas function (Wall and Zoega, 2002):

$$M = m(U,V) = A \cdot U^{\alpha} \cdot V^{1-\alpha}$$

being the number of hiring (M) depending on the number of matches in the labour market ($m(\cdot)$) between unemployed (U) and job vacancies (V). It is necessary to carry out the linearization of this equation by applying the logarithmic transformation for its estimates.

Herein, the inflation rate (π_{it}) depends on the unemployment rate (u_{it}), its square, and on the time-effects for every year (λ_t).

Finally, we estimate the MOG using the same methodology proposed by Sell and Reinisch (2013), including again the square of the dependent variable:

$$\pi_{it} = \beta_0 + \beta_1 \cdot v_{it} + \beta_2 \cdot v_{it}^2 + \lambda_{year} + \varepsilon_{it} \qquad (3)$$

Since to the possible worsening of the *mismatch* process in the labor market does not occur simultaneously with the rising up of the labor costs, we estimate equation **(3)** for different lags of vacancy rate, including in the regression of variables in period 't–2', 't–3', and 't–4'[10]. We use three different lags in the vacancy rate owing to their significant correlation with price level (see Tables a.3, Statistical Appendix, which shows the correlation between both variables for seven lags in the vacancy rate). This proves the lagged effect of vacancy rate on inflation.

The data used in this analysis are taken from regional observations of 17 different Spanish regions[11], for a period from the fourth quarter of 2007 to the second of 2010, thus this serves as a panel dataset[12]. The data come from two different sources: The data for the number of employees in the labor market are taken from the *Encuesta de Población Activa* (EPA), whereas the data for job vacancies[13] available in the labor market are taken from the *Encuesta Trimestral de Coyuntura Laboral* (ETCL).

In the analysis, we propose three different panel data models: Fixed Effects (FE), Random Effects (RE), and System GMM (Arellano and Bover 1995, Blundell and Bond 1998), the latter is intended to obtain consistent and efficient estimators for the equations stated after including the lags of the dependent variables in the estimates.

We show, in Appendix I, the estimates for the period analyzed[14]. The estimates for the BC indicate that the system GMM model (6) is the best fit for the analysis (see Table a.1). This estimate indicates a negative elasticity between unemployment and vacancy rate of –0.06 points.

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[10] We also estimated Equation **(3)** for the vacancy rate in 't' and 't–1'. The results indicate a negative and significant relationship between vacancy rate and price level for 't' and a positive and significant relationship (as expected) for 't–1'. The results are available to readers upon request.

[11] We do not consider in the analysis the observations for Ceuta and Melilla.

[12] The analysis of panel data offers better outcome than the time series data because it allows controlling the observable and unobservable heterogeneity, under the logic that each region that comprises the market operates differently, avoiding the possible existence of aggregation bias affecting the estimates (Börsch-Supan, 1991).

[13] A job vacancy is defined by this source as the vacancy not occupied, which exists the last day of the quarter of reference at the time of elaborating the sample. The employer could fill this vacancy with a worker coming from the staff of the firm or from the labor market.

[14] All variables used in the different estimates have been seasonally adjusted (see Fok et al., 2005).

The interesting results are the estimated time coefficients (λ_{year}), which indicate a positive and significant shift of the curve, which is especially intense during the years 2008 and 2009, with an estimated coefficient of 0.109 and 0.127 for each year, respectively, where the curve undergoes a positive movement relative to 2007. These results indicate worse behavior of labor market efficiency during the recession.

These results are similar to those obtained by Haincourt and Mogliani (2012), Hobijn and Sahin (2012) and Ruesga *et al.* (2015), who concluded that the lower efficiency is due to the change in the sectorial structure of the employment related to bursting of the housing bubble and falling down of the construction sector. Thus, quoting Bouvet (2012: 9), "sectoral shifts induce skills mismatch between unemployed workers and unfilled jobs, which results in shifting the BC outwards", something that happened in Spain during the Great Recession.

As for the estimates of the PC, similar to the BC, the best-fitted model is the System GMM (6) (see Table a.2). In this model, the coefficients show an expected negative and significant relationship between the inflation and unemployment rate of –8.38 points. In addition, the coefficients of time-effects indicate an outward shift of this curve for the years 2009 and 2010, similar to the estimates obtained for the BC. Herein, the lower efficiency in the matching process and the effect of the economic program have affected the equilibrium of the PC, increasing the level of unemployment, which results in a positive shift of this curve and its equilibrium in the long run (Sell and Reinisch 2013). However, this path of growth in the outward shift of the PC seems to decelerate in 2009. It could be consequent to the *Plan E* effect, which favored slowdown in the growth of unemployment rate from the beginning of the year.

Taking into consideration the estimates of MOG, we consider the GMM estimates without the squared dependent variable ($Vacancies_{it-n}^{2}$) (System GMM [5]) in all regressions applied as the best-fitted model, the outcomes indicate a positive and significant relation between vacancy and inflation rate, when the former is lagged in two to four quarters[15] (see Table a.3.3 to a.3.5). In analyzing the dynamics of the MOG using the results obtained for the time dummies (λ_{year}), we find a significant inward shift in the curve in 2008[16]. The curve takes the opposite sign starting

[15] The estimated coefficient between the job vacancies rate and the inflation is over 0.5 to 1.79 percentage points.
[16] This result would initially be unexpected according to the dynamics of the MOG and may be due to the impact on prices of the rise in the price of crude oil in 2008, which reached record quotation at the beginning of July of that year. This rapid price growth—with an average interannual variation of 4.1 percent, 1.3 percentage points above the average for 2007 (data from the Spanish National Statistics Institute), a result of the external shock suffered—could have given rise to the higher level of the inflation-vacancies ratio, causing the MOG to shift inward. The MOG, even

from 2009, with an estimated coefficient of λ_{2009} that is significant from 0.286 to 0.403, indicating that the MOG moves outward with respect to 2007. This positive shift agrees with the worse behavior of labor market efficiency in this period, this behavior is similar to what is shown in Figure 1 and influences the MOG to move outward.

During 2010, however, we see that the MOG undergoes a significant inward shift toward the opposite sign, indicating a worse relationship between the price level and market vacancies relative to the situation at the start of the crisis. This result provides empirical evidence that the government stimulus plan implemented at a moment of loss of efficiency in the labor market match would have affected the price level negatively, causing a worsening in the price-vacancy rate. We may emphasize that the worsening of the relationship appears lagged, as the stimulus plan began in November 2008 and its effect on the stability of the MOG noted in 2010, according to our estimations. This lag is associated with the time it takes to translate the greater demand for employment not covered on the market in salary costs and these costs into market prices.

Finally, Figure 4 shows the dynamics of the estimated MOG, taking into account the different movements identified by the BC and the PC throughout the time period analyzed. We must thus consider that two different phases affect the MOG:

- the first, in which, worse labor market match occurs, with the resulting impact on the stability of the BC, combined with a strong fall in aggregate demand
- and the second, with the economic stimulus plan initiated by the government to increase the level of employment and its impact on the PC.

The initial equilibrium (Figure 5) is located at point ***a*** of quadrant I, with an unemployment level (u_0) and vacancy level (v_0) defined on BC^0. The equilibrium is altered by the recession and the collapse of the construction sector in Spain. This process causes an outward shift of the BC, from the equilibrium defined by ***b***, with higher unemployment (u_1) and lower vacancy levels (v_1), as usually occurs in the period of recession combined with *mismatch* (see Hobijn and Şahin [2012]).

The negative impact of the recession on aggregate demand causes an increase in unemployment and reduces the demand in the labor market to depress the price level in the short term, thus shifting the equilibrium of the PC to ***b'*** (see quadrant II). The new equilibrium in the BC and the

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the price of crude oil has stabilized, would tend to remain unchanged or if the external shock is corrected, will return to its initial position.

PC thus alters the stability of the MOG (in the short term[17]), shifting it outward (with equilibrium ***a''*** in MOG^0 moving to ***b''*** in MOG^1), where the inflation and vacancy levels are lower.

Figure 5

This description refers to the first phase of the MOG dynamics, in which, the match between the supply and demand on the labor market worsens; all of these movements were marked by arrows (1) in Figure 5.

In the second phase, the effect of an economic stimulus plan on the MOG's equilibrium, marked by arrows (2) in the same figure, is as follows. On the one hand, the stimulus plan affects the price level positively in the short term, motivated by the impact of aggregate demand and change of economic agents on price expectations, shifting the PC outward (from PC^0 to PC^1). As a result, the equilibrium in quadrant II in the figure changes from ***b'*** to ***c'***, where unemployment is lower and the price level is higher. The impact of the aggregate demand gives firms greater incentive in hiring from the labor market, increasing the number of existing vacancies and decreasing unemployment (situating it at u_2 and v_2, respectively), and placing equilibrium in quadrant I at point ***c***. The outward shift that occurs in the PC tends to cause the MOG function to shift back inwardly, as described in the dynamics in Figure 2, moving the equilibrium of ***b''*** in MOG^1 to ***c''*** in MOG^2, where the inflation and vacancy levels tend to be less favorable.

Overall, the outcomes confirm that the worsening of mismatch process experienced in the Spanish labor market combined with the operation of *Plan E*, affected negatively the equilibrium of MOG during the economic crisis. Thus, simultaneously, we can see a higher level of vacancy and inflation rate, due to the lack of well-educated workers in the labor market to occupy the job vacancies posted by firms and an intensive usage of the staff, which face a higher pressure on labor cost because workers demand higher salaries in the collective bargaining. Therefore, labor costs increase for the firm and make the inflation to grow up.

5. FINDINGS AND POLICY SUGGESTIONS

The two concepts, BC and PC, together generate the explicit relationship between the inflation rate and the vacancy ratio, which we have labeled as MOG. Given our theoretical reasoning about this relationship, the empirical correlation between these two macroeconomic variables should

[17] Since we are examining the short term (we performed our analysis only for the period from the fourth quarter of 2007 to the second of 2010), we do not consider the effect that an outward shift of the BC might have on the PC in the long term, as explained in Figure 1.

be positive. Concisely, the idea was that the observed vacancy ratio could be conceived as a signal for a significant mismatch or as a degree for skill shortage in the labor market. If there is a lack of skilled workers in the market along with a rise in the vacancy ratio, the wages will rise because of a higher bargaining power of the skilled workers for negotiating their labor conditions. The employers consider this factor and recalculate the prices for goods, which, ceteris paribus, results in a higher observed inflation rate.

In this research, we have analyzed the Spanish case, taking into consideration the period between the beginning of the economic recession and the end of the stimulus plan for the economy, introduced by the socialist government to boost the economic growth. This country and the period are ideal for analyzing the empirical consistency of the MOG. The evidence obtained indicate that the Spanish labor market has faced a worsening process of mismatch that limited labor market adaptation to the increasing demand in the market for goods and services, being the latter driven by the economic stimulus plan.

The collapse of the Spanish economic model before the economic crisis, ruled by the construction sector, affected the industries those were pioneers in the economic and employment growth during 1995−2007. These industries occupied workers with a low to the medium-low level of education, which affected negatively their possibility to find a new job during the recession.

In conclusion, this analysis emphasizes the need to combine simultaneously public economic stimulus policies and structural reforms to expand the aggregate demand and adapt the economy for a new model.

According to the President of the *Federal Reserve Bank of Philadelphia*, Charles Plosser (O'Grady 2011:1),

"you can't change the carpenter into a nurse easily, and you can't change the mortgage broker into a computer expert in a manufacturing plant very easily. Eventually, that stuff will work itself out. People will be retrained and they'll find jobs in other industries. But monetary (and fiscal) policy can't retrain people. Monetary (and fiscal) policy can't fix those problems".

Thus, combining demand and supply side policies will increase the effectiveness and efficiency of both. Each of these policies alone can easily fail. Improving the mediation in the labor market, when the lack in total demand is the key reason for a crisis, can hardly overcome unemployment. As far as demand policies are concerned, a second "policy ineffectiveness lemma" emerges, at

high levels of mismatch, expansive measures of monetary and/or fiscal policies will lead to higher inflation in the first place with little (positive) repercussions on the real side of the economy.

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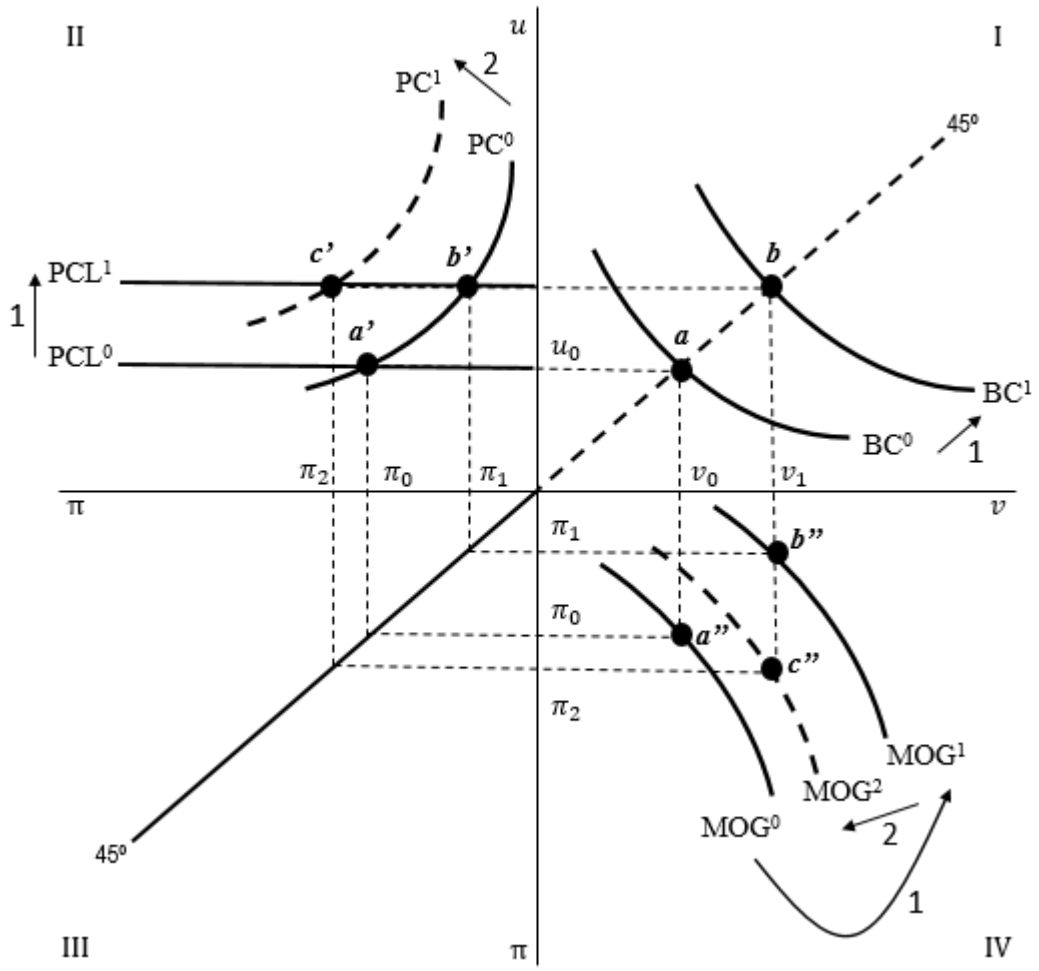
7. TABLES AND FIGURES

Table 1. Variations in the working time per worker occupying a full-time employment, during the period between the fourth quarter of 2008 to the second quarter of 2010

Industry	Working time in hours (variation in %)	Employment (variation in %)
Mining and quarrying	1.25%	–4.24%
Manufacturing	1.37%	–14.51%
Electricity, gas, steam, and air conditioning supply	1.88%	5.36%
Water supply	1.75%	–11.11%
Construction	2.07%	–22.20%
Wholesale and retail trade	0.92%	–9.15%
Transportation and storage	0.93%	–7.16%
Accommodation and food service activities	1.22%	0.50%
Information and communication	–0.26%	–10.42%
Financial and insurance activities	2.12%	–0.49%
Real estate activities	0.45%	–25.22%
Professional, scientific, and technical activities	0.40%	–1.71%
Administrative and support service activities	0.13%	–3.51%
Public administration and defense	0.65%	5.62%
Education	1.53%	3.68%
Human health and social work activities	1.93%	1.53%
Other service activities	–1.24%	–2.85%

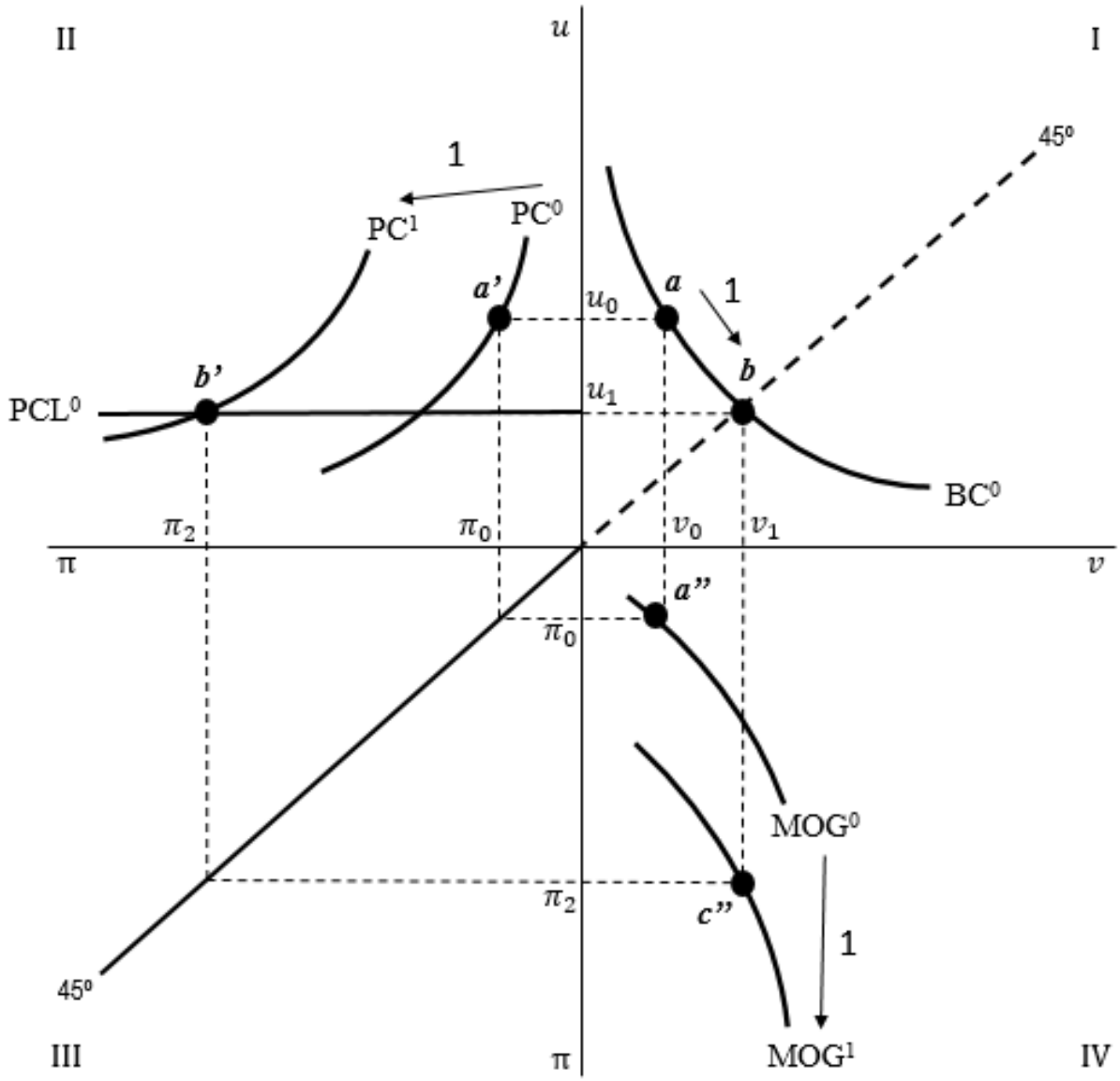
Source: Self-elaborated with the data from the Spanish National Statistical Institute (INE).

Figure 1. Effect of loss of labor market efficiency on the MOG



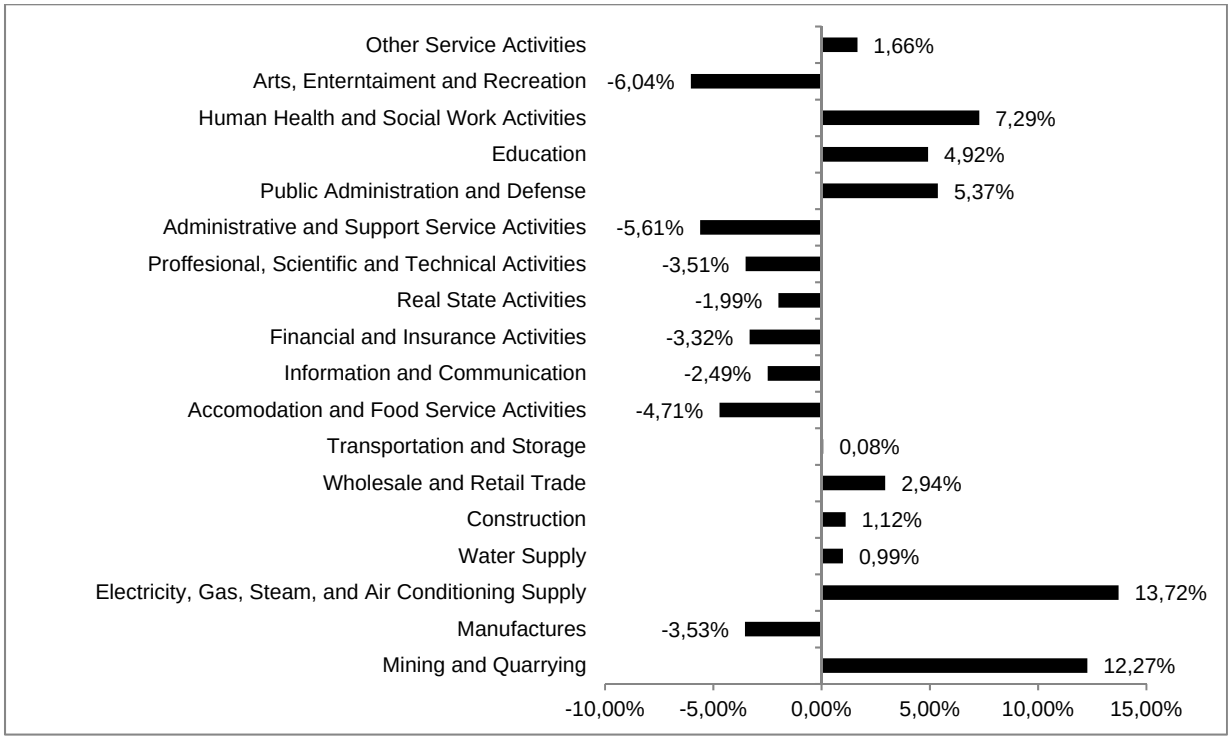
Source: Developed by the authors.

Figure 2. Effect of an economic stimulus policy on the equilibrium in the BPM



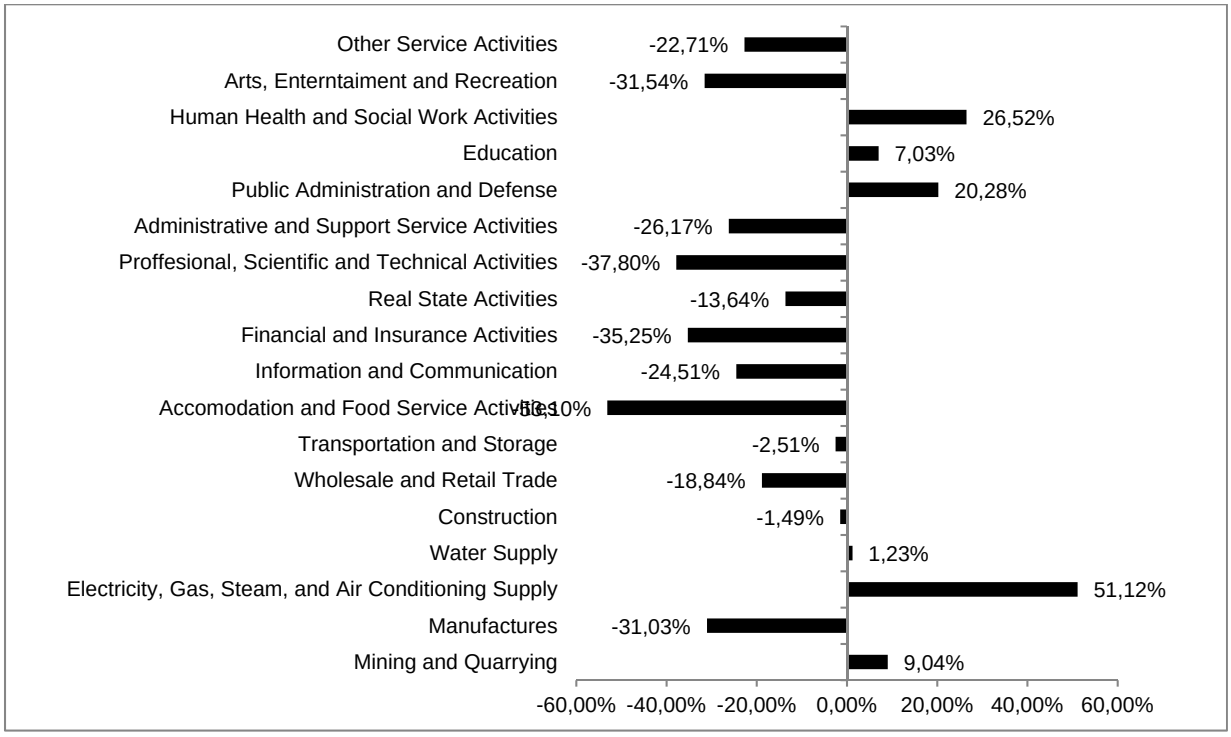
Source: Developed by the authors.

Figure 3a. Variations in wages by industries, during the period between the fourth quarter of 2008 to the second quarter of 2010



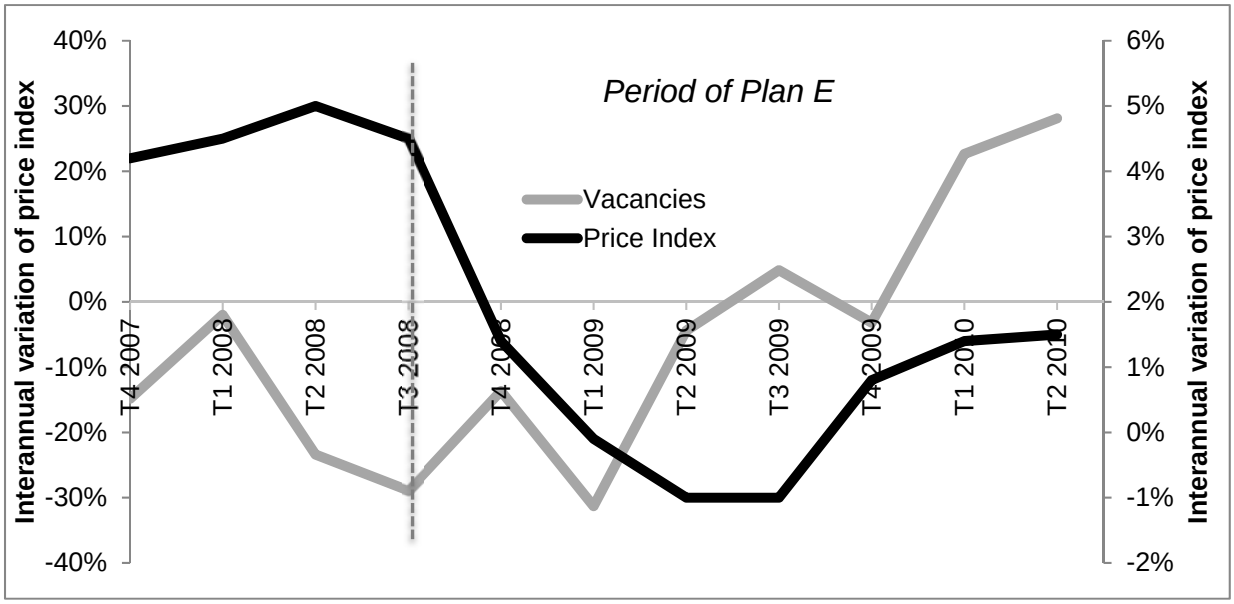
Source: Developed by the authors with the data from the Spanish National Statistical Institute (INE).

Figure 3b. Variations in the time extra wages by industries, during the period between the fourth quarter of 2008 to the second quarter of 2010



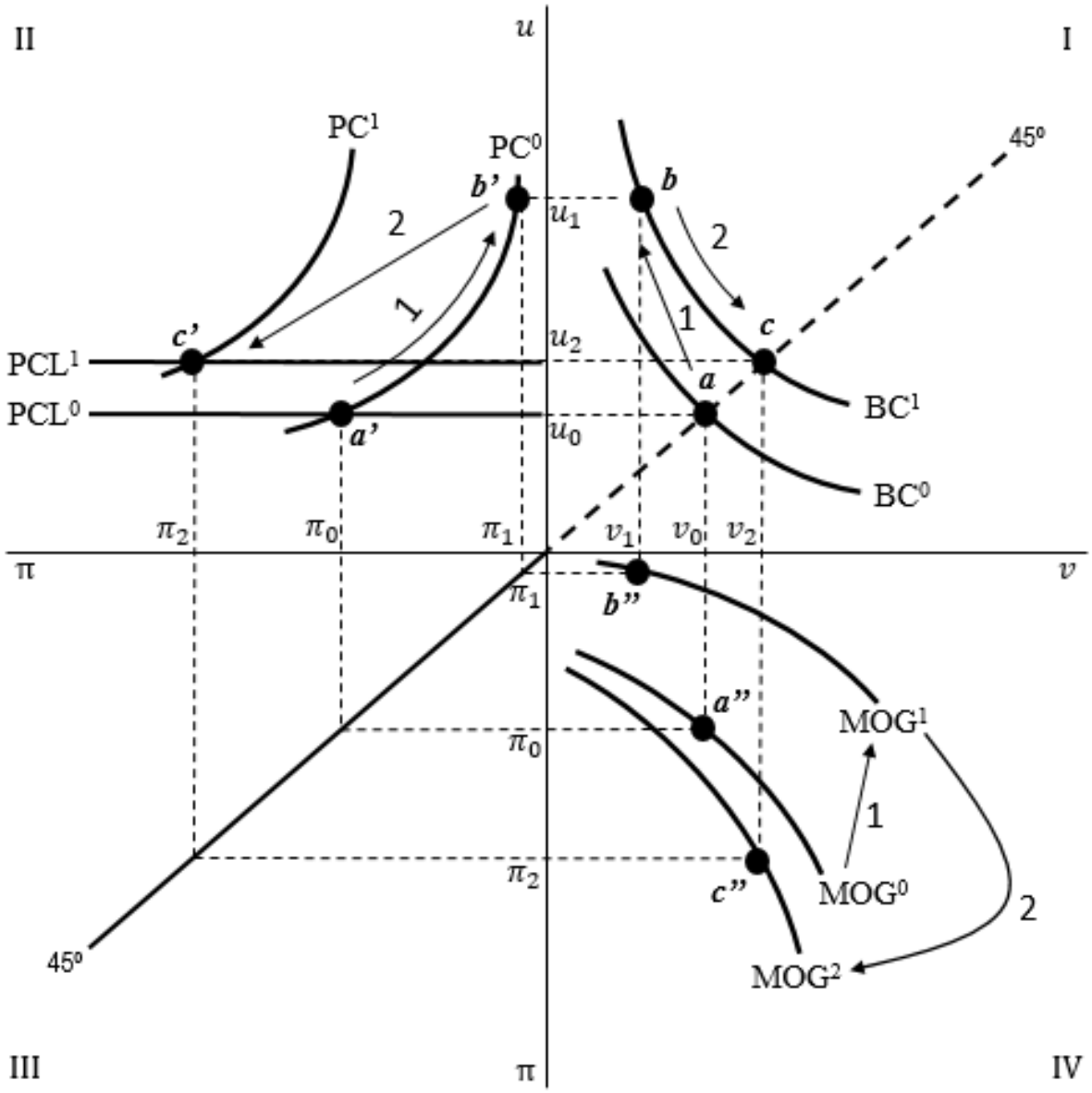
Source: Developed by the authors with the data from the Spanish National Statistical Institute (INE).

Figure 4. Interannual growth of the job vacancies and price index, during the period between the fourth quarter of 2007 to the second quarter of 2010.



Source: Developed by the authors with the data from the Spanish Labour Ministry (ETCL) and the National Statistical Institute of Spain (INE).

Figure 5. Interpretation of the dynamics of the MOG according to the estimations of MOG



Source: Developed by the authors.

8. STATISTICAL APPENDIX

Table a.1. Beveridge curve estimates

	FE-OLS (1)	RE-GLS (2)	FE-OLS (3)	RE-GLS (4)	System GMM (5)	System GMM (6)
γ_{2008}	0.262***	0.261***	0.262***	0.261***	0.117***	0.109***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.012)	(0.013)
γ_{2009}	0.746***	0.745***	0.746***	0.745***	0.142***	0.127***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.017)	(0.019)
γ_{2010}	0.830***	0.831***	0.830***	0.831***	0.113***	0.097***
	(0.039)	(0.039)	(0.040)	(0.039)	(0.019)	(0.021)
$log\ Vacancies_{it}$	0.004	–0.003	0.076	0.083	–	–
	(0.021)	(0.022)	(0.321)	(0.324)	0.050***	0.584***
					(0.017)	(0.204)
$log\ Vacancies\ _{it}^{2}$	-	-	0.006	0.007	-	–0.044**
			(0.027)	(0.027)		(0.017)
$log\ Unemployment_{it-1}$	-	-	-	-	0.867***	0.879***
					(0.016)	(0.020)
β_0	–	–	–	–2.352**	–	–
	2.560***	2.608***	2.348***	(0.964)	0.611***	2.177***
	(0.123)	(0.165)	(0.944)		(0.114)	(0.611)
Number groups	17	17	17	17	17	17
$H_0: \gamma_{2008} = \gamma_{2009} = \gamma_{2010} = 0$^	0.000	0.000	0.000	0.000	0.000	0.000
$\frac{d\ log\ \widehat{Unemployment}_{it}}{d\ log\ Vacancies_{it}} = \hat{\partial}$	-	-	0.005	–0.003	-	–0.067*
			(0.021)	(0.022)		(0.034)
Mundlack test^	0.264		0.255		-	-
Hansen test^	-	-	-	-	0.965	0.963

Arellano-Bond test AR (1)^	-	-	-	-	0.028	0.023
Arellano-Bond test AR (2)^	-	-	-	-	0.214	0.114

^p-value. *significance level at 10%, **significance level at 5%, and ***significance level at 1%. In the GMM estimates, we use as instruments the second and third lag and first difference of the endogenous variable ($log\ Unemployment_{it}$).

Table a.2. Phillips curve estimates

	FE-OLS (1)	RE-GLS (2)	FE-OLS (3)	RE-GLS (4)	System GMM (5)	System GMM (6)
γ_{2008}	–0.680***	–0.934***	–0.471***	–0.852***	–1.140***	–0.925***
	(0.059)	(0.038)	(0.092)	(0.058)	(0.037)	(0.053)
γ_{2009}	–0.496***	–1.380***	–0.001	–1.218***	–0.708***	–0.900***
	(0.142)	(0.051)	(0.188)	(0.125)	(0.057)	(0.069)
γ_{2010}	0.068	–0.966***	0.565**	–0.821***	–0.356***	–0.582***
	(0.177)	(0.048)	(0.215)	(0.121)	(0.105)	(0.084)
$Unemployment_{it}$	–12.328***	–2.016***	–32.277***	–11.460***	–6.380***	–27.183***
	(1.664)	(0.371)	(3.813)	(4.181)	(0.579)	(4.147)
$Unemployment_{it}^2$	-	-	53.807***	28.693**	-	68.151***
				(12.923)		

			(12.585)			(13.579)
$Inflation_{it-1}$	-	-	-	-	1.375*** (0.053)	1.288*** (0.056)
$Inflation_{it-2}$	-	-	-	-	– 0.186*** (0.021)	– 0.176*** (0.023)
$Inflation_{it-3}$	-	-	-	-	0.297*** (0.031)	0.289*** (0.031)
β_0	2.530*** (0.159)	1.709*** (0.048)	3.734*** (0.222)	2.256*** (0.219)	0.692*** (0.070)	1.894*** (0.308)
Number groups	17	17	17	17	17	17
$H_0: \gamma_{2008} = \gamma_{2009} = \gamma_{2010} = 0$^	0.000	0.000	0.000	0.000	0.000	0.000
$\frac{d\widehat{Inflation}_{it}}{dUnemployment_{it}}$	-	-	– 17.434*** (1.937)	– 3.545*** (0.756)	-	– 8.383*** (0.859)
Mundlack test^	0.000		0.000		-	-
Hansen test^	-	-	-	-	0.914	0.887
Arellano-Bond test AR (1)^	-	-	-	-	0.001	0.001
Arellano-Bond test AR (2)^	-	-	-	-	0.682	0.672

^p-value. *significance level at 10%, **significance level at 5%, and ***significance level at 1%. In the GMM estimates, we use as instruments the second and third lag and first difference of the endogenous variable ($log\ Inflation_{it}$).

Table a.3. Correlation matrix between inflation rate, vacancy rate, its square and seven different lags for these two latter variables

	$Inflation_{it}$
$Vacancies_{it}$	–0.003
	(0.930)
$Vacancies_{it-1}$	0.026
	(0.476)
$Vacancies_{it-2}$	0.077
	(0.038)
$Vacancies_{it-3}$	0.089
	(0.018)
$Vacancies_{it-4}$	0.088
	(0.021)
$Vacancies_{it-5}$	0.033
	(0.393)
$Vacancies_{it-6}$	0.013
	(0.725)
$Vacancies_{it-7}$	–0.054
	(0.169)
$Vacancies_{it}^2$	–0.001
	(0.962)
$Vacancies_{it-1}^2$	0.022
	(0.540)
$Vacancies_{it-2}^2$	0.063
	(0.092)
$Vacancies_{it-3}^2$	0.074
	(0.050)
$Vacancies_{it-4}^2$	0.077
	(0.043)
$Vacancies_{it-5}^2$	0.020
	(0.593)

$Vacancies_{it-6}^2$	0.019
	(0.624)
$Vacancies_{it-7}^2$	–0.047
	(0.233)

P-value in brackets.

Table a.4. MOG estimates using the second lag of $\boldsymbol{Vacancies}_{\boldsymbol{it}}$

	FE-OLS (1)	RE-GLS (2)	FE-OLS (3)	RE-GLS (4)	System GMM (5)	System GMM (6)
γ_{2008}	–	–	–	–	–	–
	0.938***	0.952***	0.922***	0.939***	1.249***	1.070***
	(0.051)	(0.045)	(0.059)	(0.051)	(0.061)	(0.084)
γ_{2009}	–	–	–	–	0.395***	0.537***
	1.480***	1.502***	1.458***	1.485***	(0.102)	(0.182)
	(0.074)	(0.057)	(0.084)	(0.063)		
γ_{2010}	–	–	–	–	–0.124**	0.033
	1.121***	1.135***	1.092***	1.112***	(0.081)	(0.139)
	(0.055)	(0.042)	(0.062)	(0.048)		
$Vacancies_{it-2}$	0.575	0.400*	1.243	0.974	1.003***	5.979*
	(0.352)	(0.222)	(0.950)	(0.703)	(0.340)	(3.176)
$Vacancies_{it-2}^2$	-	-	–0.688	–0.605	-	–4.860
			(0.697)	(0.557)		(3.475)
$Inflation_{it-1}$	-	-	-	-	1.402***	1.336***
					(0.067)	(0.118)
$Inflation_{it-2}$	-	-	-	-	–	–0.062*
					0.117***	(0.035)
					(0.021)	
$Inflation_{it-3}$	-	-	-	-	0.299***	0.228***
					(0.030)	(0.042)
β_0	1.300***	1.375***	1.157***	1.256***	–0.328**	–1.382**

	(0.159)	(0.102)	(0.273)	(0.195)	(0.159)	(0.662)
Number groups	17	17	17	17	17	17
$H_0: \gamma_{2008} = \gamma_{2009} = \gamma_{2010} = 0$^	0.000	0.000	0.000	0.000	0.000	0.000
$\frac{d\widehat{Inflation}_{it}}{dVacancies_{it}}$	-	-	0.771 (0.507)	0.559* (0.339)	-	2.643*** (0.875)
Mundlack test^	0.3563		0.3081		-	-
Hansen test^	-	-	-	-	0.917	0.902
Arellano-Bond test AR (1)^	-	-	-	-	0.002	0.004
Arellano-Bond test AR (2)^	-	-	-	-	0.937	0.445

^p-value. *significance level at 10%, **significance level at 5%, and ***significance level at 1%. In the GMM estimates, we use as instruments the second and third lag and first difference of the endogenous variable ($log\ Inflation_{it}$).

Table a.5. MOG estimates using the third lag of $\boldsymbol{Vacancies_{it}}$

	FE-OLS (1)	RE-GLS (2)	FE-OLS (3)	RE-GLS (4)	System GMM (5)	System GMM (6)
γ_{2008}	– 0.960***	– 0.966***	– 0.957***	– 0.964***	– 1.406***	– 1.415***
	(0.041)	(0.039)	(0.043)	(0.040)	(0.067)	(0.044)
γ_{2009}	– 1.497***	– 1.512***	– 1.488***	– 1.504***	0.403*** (0.069)	0.397*** (0.090)
	(0.061)	(0.051)	(0.066)	(0.055)		

γ_{2010}	–	–	–	–	–0.129**	–
	1.124***	1.136***	1.105***	1.117***	(0.054)	0.174***
	(0.047)	(0.038)	(0.056)	(0.047)		(0.064)
$Vacancies_{it-3}$	0.347*	0.257**	0.808	0.707	0.500**	–0.303
	(0.195)	(0.121)	(0.577)	(0.490)	(0.202)	(0.878)
$Vacancies_{it-3}^2$	-	-	–0.471	–0.465	-	0.783
			(0.472)	(0.432)		(0.991)
$Inflation_{it-1}$	-	-	-	-	1.513***	1.511***
					(0.058)	(0.048)
$Inflation_{it-2}$	-	-	-	-	–	–
					0.144***	0.145***
					(0.020)	(0.022)
$Inflation_{it-3}$	-	-	-	-	0.374***	0.365***
					(0.035)	(0.036)
β_0	0.633***	1.430***	1.295***	1.340***	–0.182*	0.002
	(0.022)	(0.066)	(0.172)	(0.136)	(0.108)	(0.233)
Number groups	17	17	17	17	17	17
H_0: $\gamma_{2008} = \gamma_{2009} = \gamma_{2010} = 0$^	0.000	0.000	0.000	0.000	0.000	0.000
$\frac{d\widehat{Inflation}_{it}}{dVacancies_{it}}$	-	-	0.474*	0.378*	-	0.251
			(0.277)	(0.203)		(0.400)
Mundlack test^	0.6739		0.6429		-	-
Hansen test^	-	-	-	-	0.911	0.884
Arellano-Bond test AR (1)^	-	-	-	-	0.001	0.001
Arellano-Bond test AR (2)^	-	-	-	-	0.468	0.740

^p-value. *significance level at 10%, **significance level at 5%, and ***significance level at 1%. In the GMM estimates, we use as instruments the second and third lag and first difference of the endogenous variables ($log\ Inflation_{it}$).

Table a.6. MOG estimates using the fourth lag of $\boldsymbol{Vacancies}_{\boldsymbol{it}}$

	FE-OLS (1)	RE-GLS (2)	FE-OLS (3)	RE-GLS (4)	System GMM (5)	System GMM (6)
γ_{2008}	– 0.953***	– 0.965***	– 0.951***	– 0.957***	– 1.165***	– 1.148***
	(0.040)	(0.038)	(0.040)	(0.041)	(0.077)	(0.084)
γ_{2009}	– 1.474***	– 1.504***	– 1.471***	– 1.493***	0.286*** (0.094)	0.285*** (0.101)
	(0.058)	(0.046)	(0.059)	(0.050)		
γ_{2010}	– 1.074***	– 1.110***	– 1.071***	– 1.098***	–0.017 (0.074)	–0.003 (0.103)
	(0.060)	(0.041)	(0.062)	(0.048)		
$Vacancies_{it-4}$	0.532	0.331*	0.718	0.748	1.792***	2.308**
	(0.309)	(0.195)	(0.916)	(0.773)	(0.429)	(0.941)
$Vacancies_{it-4}^{2}$	-	-	–0.224	–0.461	-	–0.593
			(1.020)	(0.811)		(1.060)
$Inflation_{it-1}$	-	-	-	-	1.308***	1.302***
					(0.089)	(0.096)
$Inflation_{it-2}$	-	-	-	-	– 0.229***	– 0.238***
					(0.021)	(0.023)
$Inflation_{it-3}$	-	-	-	-	0.278***	0.278***
					(0.040)	(0.049)
β_0	1.298***	1.393***	1.265***	1.309***	– 0.534***	– 0.629***
	(0.143)	(0.086)	(0.209)	(0.177)	(0.162)	(0.224)
Number groups	17	17	17	17	17	17
$H_0: \gamma_{2008} = \gamma_{2009} = \gamma_{2010} = 0$^	0.000	0.000	0.000	0.000	0.000	0.000

$\frac{d\widehat{Inflation}_{it}}{dVacancies_{it}}$	-	-	0.555*	0.412*	-	1.875***
			(0.327)	(0.239)		(0.450)
Mundlack test^	0.5333		0.5648		-	-
Hansen test^	-	-	-	-	0.923	0.897
Arellano-Bond test AR (1)^	-	-	-	-	0.001	0.001
Arellano-Bond test AR (2)^	-	-	-	-	0.503	0.637

^p-value. *significance level at 10%, **significance level at 5%, and ***significance level at 1%. In the GMM estimates, we use as instruments the second and third lag and first difference of the endogenous variables ($log\ Inflation_{it}$).

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