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Unemployment and Inflation from a Spanish Regional Perspective.

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to my father, Tomás,

in memoriam

ABSTRACT

This Doctoral Thesis is rooted in the field of applied macroeconometrics. PANIC (Panel Analysis of Nonstationarity in Idiosyncratic and Common components) techniques, among others, are used. The econometric techniques are basically applied to two fundamental macroeconomic variables (unemployment and inflation), from a Spanish regional perspective. Among other results, we find out a high persistence for both variables. Economic and labour policy prescriptions are offered and discussed.

This thesis investigates the time series properties of the unemployment rate of the Spanish regions as well as of the inflation rates of the Spanish regions and provinces. For that purpose, we employ the PANIC procedures, which enable us to decompose the observed series under study into common and idiosyncratic components. This allows us to identify the exact source behind the possible nonstationarity found in either Spanish sub-national unemployment or inflation rates. Overall, our analysis with three different proxies for the excess of labour supply renders strong support for the hysteresis hypothesis, which appears to be caused by a common stochastic trend driving all the regional unemployment series. The application of median-unbiased estimation techniques to obtain the persistence parameter and the half-life of a shock to the idiosyncratic and common components in which the Spanish regional unemployment rates can be decomposed renders evidence fully consistent with that obtained from the PANIC analysis. In addition, we try to determine the macroeconomic and institutional factors that are able to explain the time series evolution of the common factor, and in turn help us shed light on the ultimate sources of hysteresis. Our results show how the variables that our empirical analysis emphasises as relevant closely fit into the main causes of the Spanish unemployment behaviour.

As regards the analysis of inflation persistence, we investigate the stochastic properties of several inflation rates for the Spanish economy using the Consumer Price Index (CPI) for the regions and 12 groups of goods and services, and the Producer Price Index (PPI) for 26 industrial sectors through the PANIC approach. Our analysis provides strong evidence of the presence of a common stochastic trend driving the observed series in the panel of CPI-based inflation rate series for the 17 regions. This, coupled with the presence of a jointly stationary idiosyncratic component, implies the existence of pairwise cointegration across

the Spanish regional CPI-based inflation rates, which show a clear pattern of convergence over time. This gives an indication of increased geographical homogeneity in the consumption patterns exhibited by consumers in the different regions of Spain. This contrasts with the existence of more heterogeneity in the patterns of production across regions, as reflected in the fact that regions are not specialising in the same manufacturing and energy products.

This thesis also investigates the behaviour of the Spanish CPI-based inflation rates at the provincial level over two different spans of time (1955-1981, 1982-present). The results indicate that the second period appears to exhibit more convergence across provincial inflation rates, which are found to be driven by a common stochastic trend. We point to a long list of institutional and economic changes, at national and international levels, as the potential factors that might have led to this new pattern. In addition to confirming the remarkable persistence shown by the Spanish inflation, already put forward in previous works, the PANIC analysis identifies a higher importance of the common component of the series in the second period studied. Besides inflation, we draw attention to a battery of economic and labour variables, mostly through regional data, and we conclude that they tend to converge as well, particularly in the case of our second period of analysis. As with the analysis of regional inflation, we also find that the shopping basket across Spanish provinces has tended to become more homogeneous. In summary, a variety of institutional and economic changes, which we regard as having increased essentially since the beginning of the 80s, have brought about a regime shift in the area under study, in the form of a marked pattern of geographical convergence in the inflation rates.

RESUMEN

Esta Tesis Doctoral se sitúa en el campo de la macroeconometría aplicada. Se usan, entre otras, técnicas PANIC (Análisis de Panel de la No-Estacionariedad en los Componentes Comunes e Idiosincrásicos). Las técnicas econométricas son básicamente aplicadas a dos variables macroeconómicas fundamentales (desempleo e inflación), desde una perspectiva regional española. Entre otros resultados, detectamos una elevada persistencia para ambas variables. Se ofrecen y debaten prescripciones de política económica y laboral.

Esta tesis estudia las propiedades de series temporales de la tasa de desempleo de las regiones españolas, así como las de la tasa de inflación de las regiones y provincias españolas. Para ese propósito, empleamos procedimientos PANIC, que nos permiten descomponer las series observadas objeto de estudio en componentes comunes e idiosincrásicos. Esto nos permite identificar la fuente precisa subyacente en la posible no-estacionariedad encontrada en las tasas de desempleo e inflación españolas sub-nacionales. En conjunto, nuestro análisis, con tres indicadores diferentes del exceso de oferta de trabajo, ofrece un fuerte respaldo a la hipótesis de "histéresis", que parece estar causada por una tendencia estocástica común que impulsa a todas las series de desempleo regionales. La aplicación de técnicas de estimación sin sesgo en la mediana para obtener el parámetro de persistencia y la vida media de una perturbación a los componentes comunes e idiosincrásicos en que las tasas de desempleo regionales españolas pueden ser descompuestas, ofrece evidencia muy consistente con la obtenida del análisis PANIC. Además, intentamos determinar los factores institucionales y macroeconómicos que permiten explicar la evolución de serie temporal del factor común, y que a su vez nos ayudan a arrojar luz sobre las fuentes últimas de la "histéresis". Nuestros resultados muestran cómo las variables que nuestro análisis empírico enfatiza como relevantes encajan muy bien con las principales causas documentadas sobre el comportamiento del desempleo español.

Respecto al análisis de la persistencia de la inflación, estudiamos mediante la aproximación PANIC las propiedades estocásticas de varias tasas de inflación de la economía española, usando el Índice de Precios de Consumo (IPC) para las regiones y 12 grupos de bienes y servicios, y el Índice de Precios Industriales (IPRI) para 26 sectores

industriales. Nuestro análisis proporciona evidencia robusta de la presencia de una tendencia estocástica común que dirige las series observadas en el panel de tasas de inflación regionales basadas en el IPC. Esto, aparejado con la presencia de un componente idiosincrásico estacionario conjuntamente, implica la existencia de cointegración por pares entre las tasas de inflación de las regiones españolas basadas en el IPC, las cuales muestran un claro patrón de convergencia a lo largo del tiempo. Esto indica una creciente homogeneidad geográfica en los patrones de consumo exhibidos por los consumidores en las diferentes regiones españolas. Ello contrasta con la existencia de más heterogeneidad en los patrones de producción de las regiones españolas, como queda reflejado en el hecho de que las regiones no se están especializando en los mismos productos energéticos y manufactureros.

Esta tesis también analiza el comportamiento de las tasas de inflación basadas en el IPC a nivel provincial en dos periodos de tiempo (1955-1981, 1982 hasta la actualidad). Los resultados indican que el segundo periodo parece exhibir más convergencia entre las tasas de inflación provinciales, que aparecen conducidas por una tendencia estocástica común. Apuntamos a una larga lista de cambios económicos e institucionales, a nivel nacional e internacional, como los factores potenciales que podrían haber conducido a este nuevo patrón. Además de confirmar la importante persistencia mostrada por la inflación española, ya apuntada en anteriores trabajos, el análisis PANIC identifica una mayor importancia del componente común de las series en el segundo periodo estudiado. Además de la inflación, dirigimos nuestra atención hacia una batería de variables económicas y laborales, fundamentalmente a través de datos regionales, y concluimos que tienden a converger también, particularmente en el caso de nuestro segundo periodo de análisis. Al igual que en el análisis de la inflación regional, también encontramos que la cesta de la compra de las provincias españolas ha tendido a ser más homogénea. En resumen, un conjunto de cambios económicos e institucionales, que consideramos que se han acelerado esencialmente a principios de la década de los ochenta, han producido un cambio de régimen en nuestra área de estudio, en forma de un marcado patrón de convergencia geográfica en las tasas de inflación.

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NOTE

The contents of the second chapter of this Thesis have already been published as (2014): S*panish Regional Unemployment. Disentangling the Sources of Hysteresis*, SpringerBriefs in Economics, Springer, Berlin. ISBN: 978-3-319-03686-1.

The contents of the third chapter have been presented in the *Workshop on Labour Economics* (Pablo de Olavide University, Sevilla, 2014), the *16th INFER Annual Conference* (Pescara, 2014) and the *XVII Encuentro de Economía Aplicada* (Gran Canaria, 2014).

The contents of the fourth chapter have been presented in the *16th INFER Annual Conference* (Pescara, 2014) and the *XL Reunión de Estudios Regionales* (Zaragoza, 2014).

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CHAPTER 1: INTRODUCTION

The first article investigates the time series properties of the unemployment rate of the Spanish regions over the period 1976-2011. For that purpose, we employ the PANIC (Panel Analysis of Nonstationarity in Idiosyncratic and Common components) procedures of Bai and Ng (2004), which allows us to decompose the observed unemployment rate series into common factor and idiosyncratic components. This enables us to identify the exact source behind the hysteretic behaviour found in Spanish regional unemployment. Overall, our analysis with three different proxies for the excess of labour supply renders strong support for the hysteresis hypothesis, which appears to be caused by a common stochastic trend driving all the regional unemployment series. In the second part of the analysis we try to determine the macroeconomic and institutional factors that are able to explain the time series evolution of the common factor, and in turn help us shed light on the ultimate sources of hysteresis. We shall see how the variables that our empirical analysis emphasises as relevant closely fit into the main causes of the Spanish unemployment behaviour. Finally, some policy considerations drawn from our results are presented.

The second article applies median-unbiased estimation techniques to obtain the persistence parameter and the half-life of a shock to the idiosyncratic and common components in which the Spanish regional unemployment rates can be decomposed. The results from this analysis largely back up those obtained from the PANIC analysis conducted in the first article. The median-unbiased estimation of the persistence parameter equals one for the common factor and the half-life estimate obtained from impulse-response functions equals 12.5 years for the case of shocks hitting the common trend. This persistence analysis also provides evidence of stationarity for most of the idiosyncratic series (two regions being the exception), as found in the PANIC analysis.

The third article shifts the focus from unemployment to inflation. More specifically, it studies the stochastic properties of several inflation rates for the Spanish economy using the Consumer Price Index (CPI) for the regions and 12 groups of goods and services, and the Producer Price Index (PPI) for 26 industrial sectors. Toward this end, we employ the PANIC approach proposed by Bai and Ng (2004) and further extended by Bai and Ng (2010). This methodology, which has barely been used so far in the analysis of disaggregated series along the regional or sectoral dimensions, enables us to decompose the

observed inflation rate series into a common and an idiosyncratic component, thus allowing us to identify the exact source of nonstationarity in Spanish inflation rates. Our analysis provides strong evidence of the presence of a common stochastic trend driving the observed series in the panel of CPI-based inflation rate series for the 17 regions. This, coupled with the presence of a jointly stationary idiosyncratic component, implies the existence of pairwise cointegration across the Spanish regional CPI-based inflation rates, which show a clear pattern of convergence over time. This gives an indication of increased geographical homogeneity in the consumption patterns exhibited by consumers in the different regions of Spain. This contrasts with the existence of more heterogeneity in the patterns of production across regions, as reflected in the fact that regions are not specialising in the same manufacturing and energy products. The evidence for the panels of CPI-based inflation of groups of goods and services and PPI-based inflation of manufacturing sectors indicates the existence of four independent common stochastic trends. This, combined with jointly stationary idiosyncratic series, provides much weaker evidence of cross-cointegration among the individual series forming these two panels.

In similar spirit to the third article, the fourth one investigates the behaviour of the Spanish CPI-based inflation rates at the provincial level over two different spans of time (1955-1981, 1982-present). The results indicate that the second period appears to exhibit more convergence across provincial inflation rates, which are found to be driven by a common stochastic trend. We point to a long list of institutional and economic changes, at national and international levels, as the potential factors that might have led to this new pattern. In addition to confirming the remarkable persistence shown by the Spanish inflation, already put forward in previous works, the PANIC analysis we undertake identifies a higher importance of the common component of the series in the second period studied. Besides inflation, we draw attention to a battery of economic and labour variables, mostly through regional data, and we conclude that they tend to converge as well, particularly in the case of our second period of analysis. There are several theoretical avenues whereby the geographical convergence of these variables and the observed inflation convergence could be related. Moreover, a relevant additional analysis, which is only feasible for the second period, is implemented by focusing on the weightings attributed to the different groups of goods and services that make up the CPI at the provincial level. The outcome we obtain is straightforward: the shopping basket across Spanish provinces has

tended to become more homogeneous. In summary, a variety of institutional and economic changes, which we regard as having increased essentially since the beginning of the 80s, have brought about a regime shift in the area under study, in the form of a noticeable geographical convergence in the inflation rates.

References

Bai, J. and Ng, S. (2004): "A PANIC Attack on Unit Roots and Cointegration", *Econometrica*, **72** (4), pp. 1127-1177.

Bai, J. and Ng, S. (2010): "Panel Unit Root Tests with Cross-Section Dependence", *Econometric Theory*, **26** (4), pp. 1088-1114.

CHAPTER 6: CONCLUSIONS

In the first article we have investigated the time series properties of the unemployment rate of the Spanish regions over the period 1976-2011. For that purpose, we have employed the PANIC procedures of Bai and Ng (2004, 2010), which allows us to decompose the observed unemployment rate series into a common factor component and an idiosyncratic component. This has enabled us to identify the exact source behind the hysteretic behaviour found in Spanish regional unemployment. Overall, our analysis with three different proxies for the excess of labour supply renders strong support for the hysteresis hypothesis, which appears to be caused by a common stochastic trend driving all the regional unemployment rate series. The PANIC procedures have provided strong evidence that the idiosyncratic series are stationary and that a common stochastic factor appears to be the driving force behind the nonstationarity in the observed series.

An important policy implication of our result (hysteresis) is that stabilisation policy may have permanent (or at least long-lasting) effects on Spanish unemployment. In this context, the level of aggregate demand and the corresponding policies deserve great attention. Restrictive demand policies aimed at the achievement of the Maastricht criteria and the disinflation targets of central banks may have imposed a very costly burden on the Spanish economy. This has contributed to the prevailing tendency of Spanish regional unemployment rates to rise from the already high level reached after the first oil shock. In addition, this high degree of persistence in unemployment further gives an indication that labour market reforms implemented in the Spanish economy in recent decades were not optimally designed to combat the underlying sources of hysteresis. In this regard, it will take some time for economists and analysts alike to utterly assess with hindsight the effects of the 2010-2012 Spanish labour reforms, undertaken in the midst of a severe economic crisis, characterised by a lack of growth and a sharp increase in unemployment. In essence, these flexibility-enhancing labour market reforms provide firms with greater bargaining power.

In the second part of the analysis we have tried to determine the macroeconomic and institutional factors that are able to explain the time series evolution of the common factor obtained, and in turn help us shed light on the ultimate sources of hysteretic behaviour in Spanish unemployment. In addition to a group of variables whose relationship with the unemployment rate proves hard to be explained straightforwardly, it is worth stating that our empirical analysis points to some of the variables highlighted by the literature as the main

causes of the high and persistent Spanish unemployment (employment protection legislation, unions, unemployment benefits, minimum wage, labour cost pressure, mismatch, low productivity, insufficient active labour market policies, etc.). This aforesaid literature is comprised by different theories such as "Eurosclerosis", segmented or dual labour markets (insider-outsider model), long-term unemployment predicament, union models, wage rigidity models, etc. In this sense, our empirical work can be deemed to be a good supplement to previous contributions in this field; a kind of confirmatory analysis. Finally, once the current crisis comes to an end, we again advise that careful evaluations of the recent labour market reforms should be conducted, which might have eroded some of the well-rooted persistence mechanisms at work in the Spanish labour market.

The second article has constituted an extension of the first article in that we have applied the median-unbiased estimation of the persistence parameter and the half-life of a shock associated with the idiosyncratic and common components in which the unemployment rate of the Spanish regions can be decomposed. The results appear much in line with those obtained from the PANIC analysis. The common component appears to be consistent with a unit root on the basis of the persistence parameter estimated. In contrast, most of the idiosyncratic series are found to be stationary.

It is worth highlighting that our results carry some important policy implications. In short, according to our results, to combat the source of hysteresis in Spanish regional unemployment, it is necessary to implement policy measures aimed at reducing the sluggishness of the Spanish labour market in adjusting to adverse shocks hitting the common component of regional unemployment rates. This is because there exist important rigidities in the labour and goods and services markets that prevent regional unemployment rates from returning to pre-shock levels, thus making unemployment rises largely permanent.

In the spirit of the aforementioned line of advice from international organisations, have recent labour market reforms been conducted in Spain (2010, 2011 and 2012)[1] aiming, among other things, at making wages more responsive to increases in unemployment. Mainly, these reforms have facilitated the objective dismissal on economic grounds; fostered company-based bargaining whereby firms, under certain conditions, can opt out from the wages and other labour conditions bargained at a superior level; and reduced the

[1] See Bentolila *et al.* (2012a, b).

gap in the severance pay between open-ended and fixed-term contracts.[2] In short, the reforms have tried to reallocate bargaining power from workers and unions to firms, although the way these changes are brought into fruition remains to be seen, especially the interpretation of these new rules by labour courts. Furthermore, the contentious debate over the proposal of introducing a single open-ended labour contract, with increasing –with tenure– severance pay, for all new hiring, remains prominent today. On the other hand, over the past four years wages and unit labour costs have experienced a downward adjustment in Spain relative to other Eurozone members and some steps have recently been taken towards helping attenuate the indexation of the economy. We shall see whether all these new factors significantly affect the observed patterns in the Spanish labour market, inter alia reducing the high unemployment persistence.

The third article shifts the focus from the analysis of unemployment rates to the investigation of inflation rates. For that purpose, we have applied the PANIC approach using both unit root and stationarity statistics that shift their respective null hypotheses to several inflation rates for the Spanish economy using the CPI for the regions and 12 groups of goods and services, and the PPI for 26 industrial sectors over the last decades. Our confirmatory PANIC analysis has provided clear-cut evidence of nonstationarity driven by a common stochastic trend present in the panel of Spanish regional CPI-based inflation rate series. This, coupled with the finding of a jointly stationary idiosyncratic component, has provided evidence of pairwise cointegration across regional CPI-based inflation rates. This is tantamount to saying that a common stochastic trend is linking these inflation rate series together over time, which may favour the occurrence of convergence of CPI-based inflation rates at the regional level, as observed in the actual data. A solid interpretation of this fact is that the typical CPI shopping basket has become more homogeneous across regions over time. Spaniards no longer consume different items depending upon the region in which they live, at least not to the same extent as in the past. In contrast, the evidence of cross-cointegration is considerably lower for the other two panels of CPI-based inflation of groups of goods and services and sectoral PPI-based inflation, since there are four independent

[2] These reforms have also removed a wide range of administrative procedures that previously hindered entrepreneurial activity, adopted partially the German model of working hours, taken some preliminary steps to adopt the Austrian capitalisation fund scheme, and limited the inertia of labour agreements, among other minor measures. However, a greater emphasis should be placed on active labour market policies. Likewise, the reforms in goods and services markets implemented up to now have not gone far enough, e.g. those with regard to competition enforcement.

common stochastic trends (instead of a single one) behind the nonstationary behaviour of the observed series.

Not surprisingly, these results overall have confirmed that Spanish CPI-based inflation rate series exhibit a very high degree of persistence, particularly from the geographical perspective, for which the observed series are driven by a single common stochastic trend that links all individual series together. However, CPI-based inflation disaggregated into distinct groups of goods and services exhibits a more heterogeneous behaviour, which is hard to capture and hence renders the existence of more than a single stochastic trend, as in the case of regional CPI-based inflation. In addition, CPI-based inflation rates of groups of goods and services are found to show a slightly lower-persistent behaviour than in previous works –Romero-Ávila and Usabiaga (2012)–, closely resembling here the pattern followed by the sectoral PPI series involved.[3]

Finally, as already indicated above, PPI-based inflation rates of 26 industrial sectors over the past decades also exhibit a less homogeneous behaviour than regional CPI-based inflation, which again explains why we need several common stochastic trends (and not just a single one) to track the behaviour of sectoral inflation rates. Besides, they display a relatively flexible pattern, as the secondary sector tends to rely less intensively on labour, whose price (wages) is typically regarded as the most rigid, and more on other inputs, like energy, whose price fluctuates widely. Moreover, industry is usually subject to greater competition than, for example, services. Indeed, the former after all constitutes the tradable sector par excellence.

The overall result of our analyses, of high persistence, should come as no surprise whatsoever, given what the economic literature has come up with as regards the determinants of inflation persistence: lack of or insufficient competition in goods and services markets, a dysfunctional labour market (insider-outsider considerations, long-term unemployment problem, intermediate-level collective bargaining, etc.), the prevalence of backward-looking expectations, widespread indexation, the high proportion of services over total GDP, real wage rigidity, dual inflation problems, among others; all of them "diseases" the Spanish economy "contracted" long ago and is yet to get completely cured from them.

[3] It is worth mentioning that, differences in the methodologies applied in both works aside, both consumer price inflation series –ours and that analysed in the referred article– are not fully comparable since they differ in the range of groups of goods and services included, 8 groups (PROCOME) in the case of Romero-Ávila and Usabiaga (2012) and 12 groups (COICOP) in this paper, as well as in the span of time available for the analysis, 1978(1)-2000(12) versus 1994(1)-2013(9), respectively.

Against this background, sufficiently intense shocks to the economy (let us think of an oil supply shock) may either drive the inflation rate up or down, depending on its type. The aforementioned inflation persistence mechanisms coming into play ensure that it will take inflation a long time to go back to its original value, which we could assume, being optimistic, to be the inflation target. In other words, if not permanent, the shock can have long-lasting effects on the inflation rate. Countries deprived of control over monetary policy can commit to structural reforms so as to prevent or correct for the deviation of the actual inflation from the target and eliminate the differential between national inflation and its competitors' inflation rate. These structural measures should attempt to give rise to more consumer price flexibility. Crucial reforms are those involving the strengthening of competition policy responsible for better regulating competitive conditions in product markets and a labour market reform that removes other roots of persistence in inflation. In the case of Spain, the goal of carrying out a profound labour reform has been attained in the 2010 and 2012 reforms (particularly in the last one). Its medium-run effects on unemployment and inflation, which are currently being debated, are yet to be seen, but this last reform can be considered an in-depth one, even though several national and international institutions call on the country to further deepen it –see for example IMF (2014). On the competition-enhancing reforms, nearly all the main necessary actions are yet to be completely implemented.

In summary, it is uncertain to what extent the prolonged and deep current crisis and the recent and announced reforms can succeed in helping decrease the high inflation persistence shown by the robust results of our work, which uses especially fitting econometric techniques according to the nature of the relevant problem analysed.

The fourth article has investigated the behaviour of the Spanish CPI-based inflation rates for the 50 Spanish provinces over two well-differentiated time periods: 1955-1981 and 1982-present. For that purpose, we have applied the PANIC approach, which has allowed us to decompose provincial CPI-based inflation rates into an idiosyncratic and common component. It is remarkable that our initial hypothesis has proven to be right. The behaviour of the Spanish provincial inflation rates differs between the two well-defined periods of time explored, and mainly a stronger convergence is found over the second period. In this work we list a large number of institutional, political and economic changes, both at national and international levels, which might be behind that pattern change.

Overall, the PANIC analysis we develop, in addition to demonstrating the notable persistence of Spanish inflation, fits well with the expected results: higher importance of the common component of the series in the second period analysed (stronger convergence). Besides inflation, we focus on a battery of economic and labour variables, mostly by scrutinising regional data, and conclude that they converge as well, mainly throughout our second period of analysis –with the exception of the real GVA per capita, which converges faster in the first period.

These variables' convergence at the geographical level is likely to have contributed to inflation's convergence –think for instance of wages, productivity and unit labour costs. A fundamental additional assessment undertaken, only possible for the second period, as the necessary data start in 1992, centres on the weightings given to the CPI's groups of goods and services across Spanish provinces. We arrive at a very robust outcome: those weightings clearly tend to converge. That is, the shopping basket in the Spanish provinces has become more homogenous over the second period of our analysis.

All in all, a number of institutional, political and economic changes, which we assume, based on several reasons, to have become more intense since the beginning of the 80s, have caused a regime shift in the area under study, in the form of a straightforward spatial convergence in the inflation rates. Our work, besides capturing that phenomenon via PANIC econometric techniques and sigma convergence analysis of the provincial inflation rates, has also sought to account for this fact by assessing a number of possible underlying factors, and it successfully finds a greater spatial homogeneity concerning certain relevant economic and labour variables and the shopping basket's composition in the most recent period.

In other words, in our second period the idiosyncrasy of the different Spanish geographical units seems to become less important in a general way. Our study paves the way for more specific analyses, using alternative techniques, on the results and potential underlying factors that our study has brought into light.

References

Bai, J. and Ng, S. (2004): "A PANIC Attack on Unit Roots and Cointegration", *Econometrica*, **72** (4), pp. 1127-1177.

Bai, J. and Ng, S. (2010): "Panel Unit Root Tests with Cross-Section Dependence", *Econometric Theory*, **26** (4), pp. 1088-1114.

Bentolila, S., Dolado, J.J. and Jimeno, J.F. (2012a): "The "New" New Labour Market Reform in Spain: Objectives, Instruments, and Shortcomings", *CESifo DICE Report*, **10** (2), pp. 3-7.

Bentolila, S., Dolado, J.J. and Jimeno, J.F. (2012b): "Reforming an Insider-Outsider Labor Market: The Spanish Experience", *IZA Journal of European Labor Studies*, **1** (4), pp. 1-29.

International Monetary Fund (2014): *Jobs and Growth: Supporting the European Recovery*, International Monetary Fund (IMF), Washington.

Romero-Ávila, D. and Usabiaga, C. (2012): "Disaggregate Evidence on Spanish Inflation Persistence", *Applied Economics*, **44** (23), pp. 3029-3046.