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A regional unemployment model simultaneously accounting for serial dynamics, spatial dependence and common factors☆

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ABSTRACT

Regional unemployment rates tend to be strongly correlated over time, parallel the national unemployment rate, and be correlated across space. We address these key stylized facts by linking different strands of literature into a unified methodology to investigate regional unemployment disparities. This methodology simultaneously accounts for serial dynamics, spatial dependence and common factors, also known as weak and strong cross-sectional dependence. We apply this approach using provincial level data for the Netherlands. The substantial and persistent division between high and low unemployment clusters makes it an interesting case, and data availability since the early 1970s enables a comparison between prior periods of downturn and recovery to the recent economic crisis. It is found that approaches that do not simultaneously account for serial dynamics, spatial dependence and common factors, or that ignore one of these issues, may lead to biased inference.

1. Introduction

The existence of substantial and persistent regional unemployment disparities is an economic, social, and policy concern.[1] Three noteworthy stylized facts that often emerge from observing the evolution of regional unemployment rates are that they tend to: (i) be strongly correlated over time, (ii) parallel the national unemployment rate, and (iii) be correlated across space. The first key point has been addressed in studies focusing on serial dynamic effects (e.g. Blanchard and Katz, 1992; Hyclak, 1996). The second key point pertains to literature on cyclical sensitivity (Thirlwall, 1966; Brechling, 1967)[2] and common factors (Pesaran, 2006). Regional unemployment rates tend to move in tandem with the national unemployment rate, but within the common rises and falls over time, the extent to which a region's rate responds to changes in the national rate can be quite heterogeneous. The third key point concerns spatial autocorrelation in unemployment rates due to interconnections between regions, which has received considerable attention in the regional science literature (e.g. Burridge and Gordon, 1981; Molho, 1995; Overman and Puga, 2002; Patacchini and Zenou, 2007). The spatial econometrics literature has developed methods to model these interconnections (see e.g., Anselin, 1988; LeSage and Pace, 2009).

Recently, growing attention is being paid to the difficulty in distinguishing between common factors and spatial dependence, where the former is also viewed as 'strong' cross-sectional dependence and the latter as 'weak' cross-sectional dependence in the literature (Chudik et al., 2011). In the context of regional unemployment rates, the observed correlation across space can be a result of shared factors such as business cycle effects, where outcomes change together as these factors change. However, this correlation can also be a result of local interactions between regions generating spillover effects. It is thus important to have a methodology that is able to address both forms of cross-sectional dependence (Kuersteiner and Prucha, 2015; Bailey et al. 2016). A recently proposed two-stage method is to first model common factors (e.g. aggregate shocks) using cross-sectional averages of the observations (Pesaran, 2006), and second, to

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[1] In light of the recent economic crisis, for example, there is concern that marked differences in unemployment across European regions will rise (Eurostat, 2014).

[2] A critical overview of 13 studies on regional unemployment cyclical sensitivity models can be found in Elhorst (2003, Section 2.1).

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model the de-factored observations using spatial econometric techniques (Bailey et al., 2016).[3]

From the above, it can be concluded that studies on cyclical sensitivity that appeared back in the 1960s have paid attention to what can be termed common factors, and that spatial econometric studies have paid attention to spatial dependence. In this paper, we address the aforementioned stylized facts by linking these different strands of literature into a unified methodology. We propose an approach that simultaneously accounts for both forms of cross-sectional dependence, as well as serial dynamics. This contrasts two-step procedures that have been proposed in the literature, where the observations are first taken in deviation from their national average (US) as in Blanchard and Katz (1992) or continental average (EU) as in Decressin and Fatás (1995), first spatially filtered as in Getis and Griffith (2002) and Badinger et al. (2004), or first de-factored as in Bailey et al. (2016). The merging of serial dynamics, spatial dependence and common factors has been done in a series of papers to explain house prices (Holly et al., 2010, 2011; Bailey et al., 2016), but only sequentially and not to investigate regional unemployment disparities. Throughout this paper we use the terminology spatial dependence and common factors rather than weak and strong cross-sectional dependence, since these latter descriptions erroneously suggest that these forms of cross-sectional dependence are not equally important. We demonstrate that the descriptions common factors and spatial dependence do more justice to both properties of the data.

We apply the methods using data on overall unemployment for the Netherlands of 12 regions over the period 1973–2013 ($N = 12, T = 41$), which is interesting due to persistent high and low unemployment clusters, and changes in the compositions of these clusters. Moreover, data availability since the early 1970s enables a comparison between prior periods of downturn and recovery to the recent economic crisis.[4] It is found that focusing only on serial dynamics and spatial dependence or common factors, or when employing a two-step rather than a simultaneous approach can bias the inferences that are drawn.

The remainder of this paper is organized as follows. Section 2 presents observed trends in unemployment rates across provinces in the Netherlands since the 1970s, highlighting the key stylized facts. Then, the methodology is outlined in Section 3, followed by the empirical results in Section 4. The final section provides concluding thoughts.

2. Evolution and stylized facts

Table 1 reports the correlation coefficients of the regional unemployment rates for observations made on all twelve regions with their counterparts one year, five years, ten years up to 40 years apart. These correlation coefficients appear to be large and to diminish slowly over time. This feature has been accounted for in some studies by incorporating serial dynamic effects, as in the classic study of Blanchard and Katz (1992) on regional labor market evolutions in the United States.[5] Including these effects can have an important bearing on the results, and it is accordingly addressed in the model specification.

From observing regional unemployment rates alongside the national rate in Fig. 1, it is apparent that the broad movements have been quite similar over the past four decades. Five major economic downturns that have periodically inflicted unemployment rates emerge from these figures. The first is the 1970s energy crisis- in particular, the 1973 oil shock and 1979 energy crisis- in which petroleum prices peaked substantially and compared to previous recessions was marked by stagflation. Typically, major shocks have longstanding effects and in the wake of the 1970s crises came the early 1980s recession. Unemployment rose considerably at the end of the 1970s and peaked in 1983–84. In the course of a decade, the unemployment rate in the Netherlands increased by 8 percentage points, reaching 10.7% in 1983. In Groningen and other northern provinces, the unemployment rate picked up even more swiftly, reaching a high of nearly 14% in 1983.[6] A map of the twelve provinces in Netherlands with their (Dutch) names is provided in Fig. 2.

Table 1
Correlations of regional unemployment rates over time.

Year	1973	1974	1976	1981	1991	2001	2013
1973	1.00						
1974	0.82	1.00					
1976	0.67	0.95	1.00				
1981	0.45	0.73	0.83	1.00			
1991	0.34	0.43	0.41	0.67	1.00		
2001	0.37	0.35	0.36	0.57	0.73	1.00	
2013	−0.21	0.16	0.34	0.55	0.62	0.30	1.00

The mid-1980s gradually saw a fall in unemployment, but not to prior levels. In fact, some regions even had rocky trajectories from the late 1980s to early 1990s. Another notable feature is the major impact of the 1970s and early 1980s crises on levels of unemployment, which only dropped to pre-shock levels until the late 1990s and early 2000s. Following the recession of the early 1990s, unemployment peaked in 1994–96, although not as much as in 1983–84, as seen in Fig. 1. The national rate and regional rates also varied more in the timing of the peaks during this recessionary period. For example, the national rate peaked at 8.5% in 1994 and gradually decreased in 1995 and 1996, whereas in Groningen it rose during this same period from 11.1 to 12.1%.

Although there is debate that the 2000–01 recession was not as significant as the two previous widespread recessions, a quite substantial increase in unemployment occurred in the Netherlands a couple of years later with a peak in 2005 and subsequent dip in 2008. Due to the recent financial crisis of 2008, unemployment rapidly started picking up again and although the full impacts are still being felt, it can be seen that all regions have experienced increasing rates since 2008. The national rate has risen by 4.6 percentage points and the most striking increase has been experienced by Flevoland with a nearly 7 percentage point difference from the onset of the crisis.

Within the broad similarities in temporal patterns, it is also evident from Fig. 1 that there are variations across regions. The idea to link the regional to the national unemployment rate and to estimate this relationship for each single region dates back to Thirlwall (1966) and Brechling (1967), and is known as the regional cyclical sensitivity literature. Although this literature lost interest, the prevalence of recessionary shocks, and notably the recent crisis, makes it ever more pertinent to study regional cyclical sensitivity. Moreover, since the common factor literature based on cross-sectional averages developed by Pesaran (2006) and many related authors share the same central idea as explicitly demonstrated in the next section, this literature might become important again. By linking them in this paper, we hope to achieve that the cyclical sensitivity literature comes back into the picture again. Of particular importance is that regional heterogeneity is considered in both strands of literature.

Another striking observation from Fig. 1 is the quite constant persistence of above-average unemployment in Northern provinces, particularly Groningen. Flevoland has also generally exhibited higher

[3] In their application of spatial econometric techniques, the latter study also considers using a correlation-based specification of the matrix of connections, a point we come back to in the results section.

[4] Earlier economic downturns such as the 1973 oil shock and the early 1980s recession are difficult to analyze in a cross-country multiregional context because there is unfortunately no harmonized regional unemployment data across EU member states prior to 1983.

[5] An overview of other studies including the serially lagged regional unemployment rate as an explanatory variable are provided in the introduction or can be consulted in Elhorst (2003). Another approach is to allow for the error term to be influenced by first-order autocorrelation, as in Partridge and Rickman (1997). A recent study combining serial and spatial dynamic effects is Patacchini and Zenou (2007).

[6] Other countries were also hard-hit such as the United Kingdom where unemployment hit record numbers in the summer of 1984 (see for example, Martin, 1997).