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Regional airports and regional growth in Europe: which way does the causality run?

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1. Introduction

The role of airports has become increasingly important with growing globalization. Air transportation as well as transportation in general can be seen as a facilitator that allows the economic potential of a region to be realized (Alkaabi and Debbage 2007; Debbage and Delk 2001; Goetz 1992). The provision of transportation does not, however, automatically lead to economic development. It may also be the other way round: economic development leads to the provision of transportation. Thus, while there is typically a strong correlation between air traffic and economic growth, the direction of causation is not entirely clear (Green 2002; Button et al. 2009). The causality may run primarily from transport infrastructure and accessibility to economic development, stressing supply side elements. In this case, airports act as a catalyst for local investment. On the other hand, it may primarily be economic development which determines transportation needs and services, stressing demand side elements. A largely unsettled question is which is stronger effect, the demand effect or the supply effect.

Evaluating the character of the causal relationship between two variables is not without problems. Attempting to get to the core of causal processes is an issue that is central to what econometricians do, and some progress has been made. Earlier airport studies by Brueckner (2003) and Green (2007) took advantage of the method of instrumental variables (IV) in panel data to control for the potential endogeneity of airline traffic. The problem, as almost always with the IV method, is to find appropriate instruments which, in this case, would explain only airport activity but not regional growth.

Button et al. (1999) used Granger causality tests to elicit that airport traffic leads development. Granger causality tests are designed to show causation by examining whether lagged values of (say) one variable, x, carry explanatory power in the presence of lagged values of the dependent variable, y and possibly other covariates, z. This exploits the fact that in time series there is temporal ordering, and the belief that effects cannot occur before causes. Conventional Granger causality test utilize time series data only from one observation, as was the case in the study of Button et al. (1999). Granger tests are, however, increasingly being used to evaluate causal relationships in panel data. Panel Granger tests are significantly more efficient than conventional Granger tests (Baltagi 2005; Hurlin and Venet 2001 and 2005; Hood III et al. 2008). But a potential flaw shared by many analyses is an inappropriate assumption of causal homogeneity. The literature based on early work by Hsiao (1986) and Holtz-Eakin et al. (1988) largely ignores the possibility of heterogeneity. A causal relationship may be present only in a subset of cross-sections and not in others. In our case, some airports may have a causal effect on development, while others do not have it, and vice versa.

To address the existence of causality, the nature of the relationship between regional development and transport infrastructure, i.e., air traffic is evaluated in this paper. We ask whether accessibility is a key factor to economic success, or rather a consequence of it. As this question is of utmost importance for regional policy makers, we will analyze this causality in detail. In order to test the relative importance of various effects, the Granger non-causality method in a panel framework is applied. To be able to deal with the possible problem of heterogeneity, we employ the Hurlin and Venet (2001 and 2005) procedure, in which three distinct scenarios are identified to describe the possible causal processes: homogeneous non-causality, homogeneous causality and heterogeneous non-causality.

The paper aims to shed further light on the relationship between regional airports and economic performance in different type of regions, including also remote and small airport regions. Prior studies of the economic impact of air transportation on regional development are small in number and concentrated mainly on large airports of the core regions (see, however, Button et al. 2009). In this paper, we are especially interested in whether there are differences in causal processes between core and peripheral regions. Causality between regional performance and air traffic may vary according to peripherality, since especially remote regions need to be accessible via air connections in order to grow. The development of core regions are led by many agglomerative forces - their success is not inevitably dependent on the impact of airports, although they also naturally need efficient airlines. Within the new economic geography framework, the key question is whether reducing transport costs between the core and the periphery allows the periphery to capitalize on its production cost advantage or whether economies of scale predominate (Krugman 1991; Martin and Rogers 1995). This theory suggests that there is an inverse U-shaped relationship between transport costs and regional inequalities, with transport cost reductions first increasing regional inequality then reducing it. Transport improvements narrow output and wage differentials between the two regions only if initial transport costs are not too high (Venables and Gasiorek 1998).

The empirical analysis is based on European level annual data from 86 regions and 13 countries on air traffic and regional economic performance in the period 1991-2010. Our results suggest that the causality processes are homogenous from regional growth to air traffic. But what is more important, the results also suggest that there is causality from air traffic to regional growth in peripheral regions, but not so markedly in core regions. Thus, as expected, air transportation plays a crucial role especially in remote regions by giving a boost to regional development.

The paper is organised as follows. Section 2 discusses about the role of transport, especially air traffic in regional development. Section 3 presents the data, implementation and methodology of the study. Section 4 presents the results and Section 5 concludes.

2. The role of air transport in regional growth

It is generally assumed that as regions grow in population and national and international economic activity, air travel demand increases in those regions accordingly (Goetz 1992). On the other hand, the transportation is one of the prerequisites for increased growth and competitiveness, but, not evidently, the only one. Air traffic provides a timely and reliable manner to transfer individuals and goods and services from one place to another in a globalized world. The high-quality of airline service matters to firms because it facilitates face-to-face contacts with colleagues, suppliers, customers and other business collaborators. Hence, it supports the international competitiveness of firms and regions, and forms a crucial part of the well-functioning transportation infrastructure.

In peripheral regions, air traffic may decrease the negative effects of long distances. Improved accessibility will cause firms in those regions to be more productive and more competitive than the firms in regions with inferior accessibility. The improved transport infrastructure (e.g. shorter travel time, better schedules) may create new locational advantages (Vickerman et al. 1999). The easy accessibility attracts firms and other economic activity to the region and stimulates (employment) growth at established firms (Brueckner 2003). Earlier studies and surveys indicate clearly that access to air transportation has an important effect on location decisions of many businesses (Debbage 1999; Ministry of Transport and Communication Finland 2010). High-tech industries, in particular, benefit from the proximity of airport due to the importance of face-to-face interaction in their operation (Button & Taylor 2000; Markusen et al. 1986). There is a continuing debate about whether supply of transportation secures or simply allows for the possibility of economic development in general (Debbage and Delk 2001). Earlier literature is focused on the role of airports from the view point of metropolitan development, whereas the relationship between airports and peripheral regions is a less studied field. However, the competitive and location advantage of peripheral regions may be strongly influenced by airline networks.

Debbage (1999) has defined two ways through which the air transportation can affect the regional economy. First, construction of airport is a direct investment into the regional economy and generates on-site employment. Furthermore, the multiplier effects of such a large investment can be very significant (e.g. in wholesale and ground transportation sectors). Second, the airline transportation can alter the economic linkages a region has with other regions that leads to differences in regional competitiveness. On the other hand, the nature of the link between transport infrastructure and regional development can be non-spatial and spatial. The former refers to effects of infrastructure investment on the aggregate level of economic activity, productivity and competitiveness in an economy. Spatial impacts consider the role of infrastructure in differentiating the performance in different locations, either between regions or within regions.

Poor transport infrastructure may limit the growth potential of the local economy (Vickerman 1996).

Goetz (1992) focused on the relationship between the air passenger flow volume and both previous and subsequent population and employment growth. He found a positive relationship but it remained unclear whether the relationship is stronger for either previous or subsequent growth. According to Green (2007), there is a causal relationship between airports and economic growth, but the direction of causality is not clear. Under a variety of specifications, Green (2007), however, found that passenger activity can predict growth. Brueckner (2003) focused on the link between airline traffic and employment in the US metropolitan area. The potential reverse causality was taken account by using instrument variables. The empirical findings confirm the view that good airline services are an important factor in urban economic development. Button et al. (1999) explained the level of high-technology employment in US metro areas by a number of explanatory variables, including an airport dummy. They found a positive relationship. Yao and Yang (2008) found that in China the airport development is positively related with economic growth, industrial structure, population density and openness, but negatively related with ground transportation. They argue that the development of air transport should be considered as an important stimulus to promote economic growth in remote provinces and to reduce the country's overall spatial income and economic inequality. Button et al. (2009) analyzed the role of small airports in economic development with a panel data in Virginia, US, by using an econometric approach. They received somewhat varying results depending on the way the model was specified, but concluded that local air transportation had importance to regional per capita income.

3. Implementation of the study

To address the existence of causality, the nature of the relationship between transport infrastructure and economic development is evaluated. Evaluating the character of the causal relationship between two variables is, of course, problematic. A standard tool used in econometrics is the Granger technique, which can, at any rate, be used as a first step in this evaluation. In the case of two variables, say x and y, the first variable, x, is said to cause the second variable, y, in the Granger sense if the forecast for y improves when lagged values for x are taken into account (Granger 1969). By estimating an equation in which y is regressed on lagged values of y and lagged values of x, we can evaluate the null hypothesis that x does not Granger-cause y. If one or more of the lagged values of x is significant, we can reject the null hypothesis that x does not Granger-cause y.

The introduction of a panel data dimension permits the use of both cross-sectional and time series information to test causality relationships, which apparently improves the efficiency of Granger causality tests (Baltagi 2005; Erdil and Yetkiner 2009). Granger tests can generate significant results with shorter time periods as the number of observations increases. Following Hurlin and Venet (2001; see also Hood III et al. 2008; Erdil and Yetkiner 2008), we consider the variables to be covariance stationary, observed for T periods and N cross-section units (which consist of regions in our case). For each region $i \in [1, N]$, the variable $x_{i,t}$ causes $y_{i,t}$ if we are better able to predict $y_{i,t}$ when using all the available information than when using only some of it.

Let us consider a time-stationary VAR representation, adapted to a panel context. For each region i (i = 1,…, N) and time period t (t = 1,…,T) we have

$$(1) \qquad y_{i,t} = \sum_{k=1}^{p} \gamma^{(k)} y_{i,t-k} + \sum_{k=1}^{p} \beta_i^{(k)} x_{i,t-k} + v_{i,t} \,,$$

where $v_{i,t} = a_i + \varepsilon_{i,t}$ are *i.i.d.* $(0, \sigma_\varepsilon^2)$ and p is the number of lags. The autoregressive coefficients $\gamma^{(k)}$ and the regression coefficients slopes $\beta_i^{(k)}$ are assumed constant for all lag orders $k \in [1, p]$. It is also assumed that $\gamma^{(k)}$ are identical for all regions, whereas $\beta_i^{(k)}$ are allowed to vary across individual regions. This is a panel data model with fixed coefficients.

Employing conventional Granger tests with panel data is not unproblematic. These problems may be caused by heterogeneity between the cross-section units. The first potential type of cross-section variation is due to distinctive intercepts. This variation is addressed with a fixed effects model in which heterogeneity is controlled by the introduction of individual effects a_i. Another basis for heterogeneity is caused by heterogeneous regression coefficients $\beta_i^{(k)}$. This is a more problematic situation than the first one, and requires a more complex analytical response. If we consider model (1), the general definitions of causality imply testing for linear restrictions on these coefficients. The procedure has three main steps which are related to the homogeneous non-causality, homogeneous causality and heterogeneous non-causality hypotheses (Figure 1).

Figure 1. Testing procedure

The empirical analysis is based on regional level data from Europe in the period 1991-2010.[1] To carry out causal analysis between regional development and airport activity, we need two variables for their measurement for which we have different options. For the measurement of regional development, we use two variables, the first one measuring growth in employment and the second one growth in purchasing power corrected real GDP. For the measurement of airport

[1] Bak Basel Economics has produced the data set.

activity, we use a variable depicting development in the number of commercial air passengers. An alternative variable depicts development in freight and mail cargo, but as e.g. Green (2007) and Freestone (2009) stated, this variable is imperfect. In addition, we use a geographical accessibility variable which measures weighted average travel time to 202 NUTS Level 2 regions in Western Europe. The measure is multimodal which takes into account the best combination of air, rail and road. The weight used is the relative GDP ("market share") of each region.

Airport Council International produces data on the use of airports in Europe but this data is limited by the number of reporting airports. The availability of airport data diminishes further as we go back in time. As the availability of airport data is incomplete it reduces remarkably the number of observations (regions) in the analysis. A complete airport data is available in the period 1991-2010 for 86 NUTS Level 2 or 3 regions from 13 countries in Europe (see Appendix). This data set includes 3 regions from Austria, 3 from Switzerland, 13 from Germany, 1 from Denmark, 22 from Spain, 12 from France, 2 from Ireland, 7 from Italy, 1 from Luxembourg, 2 from Holland, 2 from Norway, 3 from Portugal and 15 from the UK. To accomplish the panel causal tests, we have an adequate number of cross-sectional and time-series observations – in fact, the number of cross-sectional observations (regions) in relation to the length of time-series cannot be too large from the point of view of the method. However, there remains a question about the representativeness of the data. As the regions included in the data are distributed quite evenly across Europe, we may consider the data to represent Europe rather well.

To test the heterogeneous non-causality hypothesis in the third step of our testing procedure, we categorize the regions into three groups of equal size by means of the accessibility variable. This allows us to find out whether peripherality explains differences in causal processes. Accessibility is lowest in peripheral regions, highest in core regions and in between in intermediate regions. Table 1 shows that employment as well as real GDP is the higher the more accessible the region is. The number of air passengers is also lowest in peripheral regions and highest in core regions.

Table 1. Means of the variables by region type (yearly averages in 1991-2010)

Region type	Accessibility	Air passengers (1000)	Employment (1000)	Real GDP (Mio euro ppp)
Peripheral	88.7	1 981.8	376.4	19.992.3
Middle	102.4	4 794.8	703.2	44 819.7
Core	113.3	16 539.6	1 154.0	77 196.3
All regions	101.5	7 806.7	745.0	47 365.3

The Granger causality tests between regional growth and air transport in 86 European regions are performed for the period 1991-2010, with lags one and two. For both side variables in the analysis, we first take natural logarithms and then difference them in order to eliminate possible unit roots and to reach time stationarity. Consequently, we are in fact analysing growth rates. We follow the nested procedure described above to test different causality relationships. The tests are based on Wald statistics.

4. RESULTS

As a first step in exploring bi-directional Granger causality between airport activity and regional development, the homogeneous non-causality (HNC) hypothesis is assessed. The HNC hypothesis implies the non-existence of any individual causality relationships. In model (1), the corresponding test is defined by

(2) $$H_o: \beta_i^{(k)} = 0 \ \forall \, i \in [1, N], \ \forall \, k \in [1, p]$$
$$H_1: \exists \, (i, k) \, / \, \beta_i^{(k)} \neq 0 \, .$$

For testing Np linear restrictions in (2), the following Wald statistic is computed:

(3) $$F_{HNC} = \frac{(RSS_2 - RSS_1)/Np}{RSS_1/(NT - N(1+p) - p)} \, ,$$

where RSS_2 denotes the restricted sum of squares residuals obtained under H_o and RSS_1 corresponds to the residual sum of squares of model (1). If the individual effects a_i are assumed to be fixed, the sum of squared residuals are obtained from the maximum likelihood estimation (MLE), which in this case corresponds to the fixed effects (FE) estimator. It has been shown that the FE estimator is biased in the case where T is small (Nickell 1981), but the bias decreases with T. We favour the FE estimator, since the bias may not be large and its use enables us to follow the testing procedure. Accordingly, the testing procedure can be implemented using the constrained regression technique (Hurlin and Venet 2001; Hood III et al. 2008). Interpretation of the statistic relies on the Fischer distribution with Np and $(NT - N(1+p) - p)$ degrees of freedom.

For the measurement of regional performance (y), we use two variables, GDP growth and employment growth, while for the measurement of air traffic (x) we also have two variables, the number of air passengers and accessibility. Table 2 includes the results from four possible combinations of the variables: air passengers and GDP; air passengers and employment; accessibility and GDP; and accessibility and employment.[2]

Table 2. Test results for homogeneous non-causality (HNC hypothesis)

Direction of causality and lags	*F-statistic and its significance*			
	Air passengers - GDP	Air passengers - employment	Accessibility - GDP	Accessibility -employment
Causality from air traffic to regional growth				
Lag 1	1.602***	1.591** *	1.947***	1.947***
Lag 2	0.576	0.716	0.991	1.391***
Causality from regional growth to air traffic				
Lag 1	0.956	1.206*	0.694	1.016
Lag 2	0.420	0.604	0.470	0.586

[2] In addition, despite its shortcomings, we also estimated the model with the air cargo-variable. The homogenous non-causality hypothesis was not rejected in either case, for which reason the testing procedure stopped in the first step, implying that there would not be causal relations in either direction between air traffic and regional development. This result, however, probably tells more about the limitations of the cargo variable than about the actual state of affairs.

All the test statistics related to the homogenous non-causality hypothesis are statistically significant with one lag, when the direction of causality is from air traffic to regional development. With two lags, they are not significant, with the exception of the pair of variables "accessibility – employment". These results allow us to reject the homogeneous non-causality hypothesis: for at least some regions (and possible all), there is statistical evidence of Granger causality from air traffic (accessibility) to regional growth.

The evidence of the opposite direction of causality - from regional development to air traffic - is only partial. The test statistic cannot be rejected even at lag one when using the combination of variables "air passengers – GDP", "accessibility – GDP" or "accessibility – employment". It is, however, rejected at the 10% significance level when airport activity is measured with the number of air passengers and employment is used instead of GDP. This result calls for the next step in the testing procedure.

If the HNC hypothesis is rejected, the next step is to test the hypothesis of homogeneous causality (HC). The F_{HC} test statistic is calculated using the sum of squared residuals from the unrestricted model described above (RSS_1) and the sum of squared residuals (RSS_3) from a restricted model in which the slope terms are constrained to equality for all the panel members in the sample. Thus, the hypotheses are

(4) H_0: $\forall\, k \in [1, p] \,/\, \beta_i^{(k)} = \beta^{(k)} \;\; \forall\, i \in [1, N]$
H_1: $\exists\, k \in [1, p],\ \exists\, (i, j) \in [1, N] \,/\, \beta_i^{(k)} \neq \beta_j^{(k)}$,

and the test statistic is

(5) $$F_{HC} = \frac{(RSS_3 - RSS_1)/\,p(N-1)}{RSS_1\,/(NT - N(1+p) - p)} \ .$$

As in the case of HNC, if the individual effects a_i are assumed to be fixed, the ML estimator is consistent with the FE estimator. As the results related to the use of two lags showed insignificance above in most cases, we used here only lag 1.

The results shown in Table 3 indicate significant test statistics for all pairs of variables when the direction of causality is from air traffic to regional growth.

Accordingly, at this point we can say that there are causal processes from air traffic (accessibility) to regional growth, but these processes are not uniform. The opposite direction of causality according to which regional growth as measured in employment causes air traffic in all regions is not rejected which implies a homogenous causal process. An alternative interpretation is that there are no causal processes at all. This the result we obtain with all other pair of variables.

Table 3. Test results for homogenous causality (HC hypothesis)

Direction of causality	*F-statistic and its significance*			
	Air passengers - GDP	Air passengers - employment	Accessibility - GDP	Accessibility -employment
Causality from air traffic to regional growth				
Lag 1	1.646***	1.521***	2.018***	1.950***
Causality from regional growth to air traffic				
Lag 1	-	0.925	-	-

The results so far indicate that air traffic, or accessibility in general, Granger – causes regional growth in some regions but not in all regions. The data generating process is non-homogeneous and homogeneous causality relationships cannot be obtained. It may, however, still be possible that for one or more cross regions, causality relationships still exist. There is need for further analysis, i.e. for testing the heterogeneous non-causality hypotheses. As the number of regions is high, 86, we do not test individually the contribution of each region to the existence of causality, but use the categorization of the regions into three groups according to their peripherality. The categorization is important, since we especially want to analyze the significance of remote airports for their regions.

The third step is to test the heterogeneous non-causality hypothesis (HENC). The F_{HENC} statistic is calculated using RSS_1, obtained above, in addition to the sum of squared residuals (RSS_4) from a model in which the slope coefficients for the panel members in the sub-group in question is constrained to zero.

The test examines the joint hypothesis that there are no causality relationships for a subgroup of regions. In this case, the Wald statistic is

(6) $$F_{HENC} = \frac{(RSS_4 - RSS_1)/(n_{nc}p)}{RSS_1/(NT - N(1+p) - n_c p)} ,$$

where RSS_4 corresponds to the realisation of the residual sum of squares obtained in model (1) when one imposes the nullity of the k coefficients associated with the variable $x_{i,t-k}$ on the n_{nc} regions of the subgroup. n_c is the number of regions not belonging to the subgroup (for which β is not constrained to 0).

Interestingly, the results shown in Table 4 suggest that peripherality indeed matters: the more peripheral the region is the more important for its development is to have efficient air connections. This result is most evident with the pair of variables "air passengers – GDP". For peripheral regions, the test statistics is significant with all combinations of variables, but for the other types of regions the result somewhat varies depending on the variables.

Table 4. Test results for heterogeneous causality (HENC hypothesis, lag 1)

Direction of causality and region type	*F-statistic and its significance* Air passengers - GDP	Air passengers - employment	Accessibility - GDP	Accessibility -employment
Causality from air traffic to regional growth				
Peripheral regions	2.527***	3.533***	2.952***	4.685***
Middle regions	1.374*	0.760	1.152	0.618
Core regions	0.873	0.393	1.607*	0.385

5. Conclusions

This study focuses on the importance of air transportation in different European regions. We are interested, particularly, in the relationship between air transportation and regional growth in peripheral regions. This starting point is different as compared to many prior studies which have concentrated hub airports and the development of metropolitan areas. In peripheral regions, air traffic may decrease the negative effects of long distances. Easy accessibility attracts firms, investments and other economic activity to the region and stimulates employment and production at established firms. Earlier studies and surveys clearly indicate that access to air transportation has a very important effect on location decisions of many businesses. A well-developed transport infrastructure is a facilitator that allows the economic potential of a region to be realized.

The Granger non-causality method in a panel framework which allows possible heterogeneity between regions provides a new approach to the analysis of the relationship between air traffic and economic development. Our results give evidence in favor of causal processes in these relationships. The results suggest that air transportation is even more than a facilitator in remote regions - in addition that regional growth causes airport activity, air activity also gives a boost to regional development. Supply side effects are important for distant regions. In core regions, the reverse is only true: airport activity does not cause growth, but regional growth causes airport activity.

In the light of these results, the message for regional policy makers is apparent: there are good reasons to defend local airlines since they are important for the development in remote regions. The traditional challenge with many small local airports is that they are not financially viable which has led to the provision of financial support to airports and airport companies. Though subsidies often distort competition or are wasted money, our results suggest that there indeed might be a case for them if the result is increased regional growth and welfare.

It should be, however, remembered that although Granger causality represents an advance towards uncovering true causal processes, it is indicative rather than confirmatory. While airport activity may seem to cause economic development because lagged airport activity values carry explanatory power, the apparent causation may be due to some omitted variables that move in tandem with airport activity, and which are not being picked up by lagged economic development values, suggesting airport activity is the cause. Moreover, lagged airport values may in fact be in response to anticipated future economic development values. It may happen, e.g., that airports have originally been built to regions that have most potential for economic success.

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Appendix. Regions in the data

Country	NUTS	Name of the region	Region type*
Austria	AT12	Niederösterreich	m
	AT13	Wien	c
	AT32	Salzburg	m
Switzerland	CH01	Bassin Lémanique	c
	CH03	Basel	c
	CH04	Zurich	c
Germany	DE11	Regierungsbezirk Stuttgart	c
	DE21	Regierungsbezirk Oberbayern	c
	DE25	Regierungsbezirk Mittelfranken	c
	DE30	Regierungsbezirk Berlin	c
	DE42	Brandenburg- Südwest	m
	DE50	Regieringsbezirk Bremen	m
	DE60	Regierungsbezirk Hamburg	c
	DE71	Regierungsbezirk Darmstadt	c
	DE92	Hannover	c
	DE94	Weser-Ems	c
	DEA1	Regierungsbezirk Düsseldorf	c
	DEA2	Regierungsbezirk Köln	c
	DEA3	Regierungsbezirk Münster	c
Denmark	DK01	Hovedstaden	m
Spain	ES111	A Coruña	p
	ES114	Pontevedra	p
	ES12	Principado de Asturias	p
	ES13	Cantabria	p
	ES211	Álava	p
	ES212	Guipúzcoa	p
	ES213	Vizcaya	p
	ES243	Zaragoza	p
	ES415	Salamanca	p
	ES418	Valladolid	p
	ES431	Badajoz	p
	ES512	Girona	p
	ES514	Tarragona	p
	ES521	Alicante	p
	ES523	Valencia	p
	ES611	Almería	p
	ES613	Córdoba	p
	ES614	Granada	p
	ES617	Málaga	p
	ES618	Sevilla	p
	ES62	Región de Murcia	p
	ES64	Ciudad Autónoma de Melilla	p

France	FR22	Picardie	c
	FR24	Centre	m
	FR3	Nord-Pas-de-Calais	c
	FR421	Bas-Rhin	c
	FR422	Haut-Rhin	c
	FR61	Aquitane	m
	FR717	Savoie	m
	FR72	Auvergne	m
	FR81	Languedoc-Roussillon	m
	FR823	Alpes-Maritimes	m
	FR824	Bouches-du-Rhône	m
	RF825	Var	p
Ireland	IR21	Dublin	m
	IR23	Mid-West Ireland	p
Italy	IT111	Torino	m
	IT133	Genova	m
	IT201	Varese	c
	IT325	Venezia	m
	IT333	Gorizia	m
	ITE4	Lazio	m
	ITF3	Campania	m
Luxembourg	LU	Luxembourg	c
The Netherlands	NL32	Noord-Holland	c
	NL42	Limburg	c
Norway	NO033	Vestfold	p
	NO043	Rogaland	p
Portugal	PT11	Portugal Norte	p
	PT15	Algarve	p
	PT17	Lisboa	p
United Kingdom	UKC1	Tees Valley and Durham	m
	UKC2	Northumberland and Tyne and Wear	m
	UKD3	Greater Manchester	c
	UKE1	East Riding and North Lincolnshire	m
	UKE4	West Yorkshire	m
	UKF1	Derbyshire and Nottinghamshire	m
	UKF2	Leicestershire, Rutland and Northamptonshire	c
	UKG3	West Midlands	c
	UKH2	Bedfordshire and Hertfordshire	c
	UKI1	Inner London	c
	UKI2	Outer London	c
	UKK1	Gloucestershire, Wiltshire and North Somerset	m
	UKL2	East Wales	m
	UKM1	Aberdeen Region	m
	UKM2	Eastern Scotland	m

* p = peripheral; m= middle; c = core