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Modelling Local and Regional Economic Development in Turkey: A Curate's Egg

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Modelling Local and Regional Economic Development in Turkey: A Curate's Egg

1 Introduction

“The only way to make sense of any complex system, be it global weather or the global economy, is to work with models – simplified representations of that system which you hope help you understand how it works” (Krugman, 2008, p. 18).

The purpose of this paper is to explore the processes shaping regional economic development in Turkey using an econometric modelling strategy. Economic modelling is an important approach to the analysis and understanding of regional growth and development. Over the decades, there have been a range of attempts to measure and understand the dynamics of regional growth through the modelling of underlying internal and external forces (Brookfield, 1975; Lucas, 1988; Martin and Sunley, 1998; Plummer and Taylor, 2001a; Coe *et al.*, 2004). Although many have questioned the adequacy of quantitative methods, it has been argued that quantification can potentially make a significant contribution to understanding regional economic growth (McLafferty 1995; Moss 1995; Plummer and Sheppard 2001; Sheppard 2001; Kwan 2004). However, the real world situations that have been analysed empirically have focussed on regions in economically advanced and technologically innovative economies. Comparable studies of less developed countries and their regions that suffer from poverty, unemployment and regional disparities are far fewer (Jordaan, 2008a, 2008b). In those countries, the broader picture of the dynamics of regional development, particularly its social and political origins and the overall changes in regional inequality, have remained elusive and less clear.

This paper seeks to understand, empirically, the drivers of local and regional development in Turkey and how they can be used to develop a theoretically informed econometric analysis in the context of an emerging market economy. Not only has this form of analysis not been undertaken in Turkey, but the theories themselves have had a major impact on the Turkish regional planning process, irrespective of whether they were relevant. Indeed, this history of regional policy development raises important questions in relation to adopting into one national context the ‘successful’ regional economic planning policies and practices developed and implemented in a totally different national context. Unfortunately, processes such as globalization, Europeanization and regionalization facilitate and accelerate the implementation of such externally developed policies in a country like Turkey (Taylor and Ersoy, 2011). Those policy ideas, however, also have only partial relevance even in the developed country context (Taylor, 2009) potentially making them even less relevant in developing economies. There is an urgent need, therefore, to better understand the relevance of current local and regional economic development theories and the drivers they identify in the other emerging economies. This is the purpose of the current study using the example of Turkey.

Following the introduction, the second section of this paper briefly describes how a series of theories on local and regional economic growth have been developed in the developed country context. Within the limits of the data available for Turkey, the third section of the paper introduces surrogates that are developed to measure the drivers

drawn from this review. Empirical model design is introduced and the definition of growth is reviewed. Growth is calibrated in terms of employment and changing rates of unemployment between 2004 and 2008 in the eighty one provinces in Turkey. In section 4, a series of econometric models is developed to explore the validity of the seven sets of theoretically derived propositions in explaining the trajectories of regional economic change in Turkey in the chosen time period. Outlier values are discussed and removed to generate fuller results. In the final section, the focus returns to understanding differential regional economic development in the spatial context of Turkey to explore the ways in which quantitative modelling can offer an alternative understanding of a major research concern in contemporary economic geography.

2 Drivers of Regional Economic Growth

Existing research on local and regional economic growth has highlighted the importance of two sets of theories, all of which have been developed in the developed country contexts. These two sets of theories are:

- (1) the endogenous growth theory of the economists' (sometimes referred to as the 'new economic geography'); and
- (2) the institutionalist theories (the new regionalism and embeddedness ideas) of economic geographers, economic sociology and other similar social sciences.

Endogenous regional growth theory seeks to explain regional economic growth in terms of a set of 'stylized facts' using abstract mathematical reasoning. Firms are seen as rational, profit-seeking maximisers, and it is assumed that reality can be understood through the use of equilibrium-based models (Plummer and Sheppard, 2006). At the heart of the approach is 'endogenous' technological change (including 'social capital' and 'human capital') built on processes of learning-by-doing, knowledge spill-over, and Schumpeterian 'creative destruction' as entrepreneurs invest in knowledge and innovation (see Martin and Sunley, 1998; Jones, 1998).

The models are abstract and difficult to test. However, much of the testing and analysis attempted in this field emphasises 5 'stylised facts' as determinants of regional economic change:

1. technological change and innovation;
2. human capital, embracing research and education;
3. agglomeration and externalities;
4. knowledge spillovers, including entrepreneurship and new firm formation; and
5. sectoral specialization and/or diversification (see Glaeser, 2000).

Institutional theories, on the other hand, emphasise the role of social relations in economic transactions and they have given rise to a powerful model of local economic growth that draws on a range of complementary literatures on "new industrial spaces", "learning regions", "innovative milieu" and "regional innovation systems", "clusters", and the "creative class" (e.g. MacKinnon *et al.*, 2002; Braczyk *et al.*, 1998; Porter, 1998; Storper, 1997; Florida, 2002). Together, these sets of ideas have been labelled as "new regionalism" (Rainnie and Grobbelaar, 2004). They share the basic ideas that market conditions are not the sole determinant of differential regional economic growth. Instead, local economic growth is driven by proximity, repeated

inter-firm interaction and knowledge exchange, collaborative long-term buyer-supplier relationships, the creation of social capital (including trust, reciprocity and loyalty), and a supportive tissue of local institutional thickness (see Putnam, 1993; Malmberg and Maskell, 2006; Cumbers *et al.*, 2003; Keeble and Nachum, 2002).

What has been created is a series of explanatory frameworks building on ideas of:

1. flexible-production, flexible-specialisation (Scott and Storper, 1992);
2. clusters and competitive advantage (Porter, 1998);
3. embeddedness model (industrial districts, learning regions, innovative milieu (Maskell *et al.*, 1998);
4. enterprise segmentation (Taylor and Thrift, 1982, 1983); and
5. the creative class (Florida, 2002).

With their emphases on technological change, innovation, enterprise and proximity, they build on the conceptual foundations laid in the earlier theories on growth poles and growth centres (Perroux, 1955; Boudeville, 1966) and product-cycles (Vernon, 1966).

Plummer and Taylor (2010) had previously summarized endogenous growth theory of economics and the institutionalist theories of economic geography and related disciplines at the regional level. They had drawn on six institutionalist theories of local and regional economic development (the competitive advantage, learning regions, flexible specialization, product cycle, growth pole and enterprise segmentation models) and explored them in the empirical context of Australian regional growth. They highlighted eight drivers in these six models: technological leadership, knowledge creation and access to information, local integration of small firms, institutional support and institutional thickness, human capital, power of large corporations, market accessibility and local sectoral specialization (see Table 1).

Explanatory Variables	Theoretical Models						
	Competitive Advantage	Learning Regions	Flexible Specialization	Product Cycle	Growth Pole	Enterprise Segmentation	Creative Class
Technological Leadership	*	*	*	*	*	*	*
Knowledge Creation and Access to Information	*	*		*	*		*
Local Integration of Small Firms	*	*	*			*	
Institutional Support and Institutional Thickness	*	*	*				*
Human Capital	*	*	*	*			*
Power of Large Corporations				*	*	*	
Market Accessibility	*			*			
Local Sectoral Specialization	*	*					

* denotes that the variable is a key driver in a given theory

Table 1: Dimension of theories of local economic development
(Source: Taylor and Ersoy, 2011)

For the current analysis, it is also important to introduce ‘creative class’ (Florida, 2002) as a seventh ‘institutional’ theory in addition to the previous discussions. The concept of creative class draws on thinking on ‘New Industrial Spaces’ and emphasises the learning capacities of places with a cooperative atmosphere. Florida’s (2002, 2006) work suggests that the higher the proportion of ‘creatives’ in the workforce of a region, place or locality, the more likely it is to experience economic prosperity, particularly prosperity built on high-tech industry. The core of this creative class includes scientists and engineers, artists, architects as well as those who work in a wide range of knowledge intensive industries including the high tech sectors, financial services, the legal and healthcare professions and business management. The body of thinking is not without critics (see Markusen *et al.*, 2008) but, cast in the framework of drivers recognized by Plummer and Taylor (2001a), it emphasises four: *technological leadership, knowledge creation and access to information, institutional support and thickness and human resource base* (Taylor and Ersoy, 2011).

Theoretical dimension	Variable	Description of variable
Technological leadership	HITECH	The proportion of employment in a province in ‘High Technology Manufactures’; Source: 2002 General Census of Industry and Business Establishments
Knowledge creation and access to information	INFOACC	An index of access to information; Source: Turkish Statistical Institute General Census of Business Establishments 2002
Concentration of SMEs	MOLCN	The percentage of SMEs; Source: Turkish Statistical Institute General Census of Industry and Business Establishments 2002
Institutional support	PROT	The total number of institutions that promote and support industries such as public and Higher Education laboratories; Source: Small and Medium Enterprises Development Organisation Regional Development Research Report, 2006 (Ersoy, 2011)
Human capital	NODEG	The percentage of working population without a degree; Source: 2008 Address Based Population Registration System, Population System Database
Power of large corporations	TOTPOP	The total net profit of production for particular province; Source: ISO, 2008 “Top 500 industrial enterprises” list
Market accessibility	MKTACC	An index of market access to primary goods: Source: Turkish Statistical Institute General Census of Business Establishments 2002
Sectoral specialisation	SPEC	The counts of business establishments in each city in 2002, having been assigned to NACE 1.1 divisions; Source: Turkish Statistical Institute General Census of Business Establishments 2002

Table 2 Growth drivers with their descriptions
(Adopted after Plummer and Taylor, 2001a)

A principal element of the analysis presented in this paper is to calibrate the theoretically derived drivers of local growth so that they are appropriate to Turkey. The main challenge in calibrating these theoretical dimensions is to describe what they correspond to in the Turkish context (Table 2). *Technological leadership* is defined as the proportion of employment in a province in ‘High Technology

Manufacturing', a category defined according to the OECD criteria (see OECD, 2005). *Knowledge creation and access to information* is an index of accessibility to information. This measure considers the proportion of 'knowledge workers' in each province. The definition of this category is based on the International Standard Classification of Occupations (ISCO). After calculating the total number of these workers in each province, knowledge creation and access to information index for Turkey is created as a gravity interaction function by using simple interaction model based on number of knowledge workers in each province as a measure of size and distance between provinces measured as time distance. *The concentration of SMEs*, as an index of small firm integration in a province, is measured as the percentage of SMEs in each province.

Institutional support is calibrated as the proportion of a province's institutions that promote and support industries such as public and Higher Education laboratories (Ersoy, 2011). This measure is correlated significantly with a number of alternative measures, such as total number of NGOs, municipality expenditures, public infrastructure, the value of investment incentives and collaborative knowledge creation facilities in a province indicating the broad range of this concept. *Human capital* is measured as the percentage of working population without university degrees and hence for this analysis has a negative sign. *The power of large corporations* is developed from the "Top 500 industrial enterprises" 2008 list of Istanbul Chamber of Industry (ISO). For each corporation the measure of size used is net productive profit, which has been assigned to the province within which it is headquartered. For the analysis, the measure is expressed as production profit per resident person in a particular province. *Market accessibility* is calibrated through a simple interaction model in which size is measured as employment in manufacturing and construction, and distance is measured as road distance. It is, in essence, a measure of the market at a distance for each province of Turkey. Finally *sectoral specialization* is developed using Isard's specialization index (Isard, 1960) and is built on counts of business establishments by sector in each city in 2002, with establishments having been assigned to the categories of the Classification of Economic Activities in the European Community (NACE 1.1) divisions.

3 Empirical Modelling for Turkey

Studies of empirical modelling for Turkey tend to focus on exploring the regional economic growth and uneven development across the country. Some studies identify that the geographical location of provinces influence the level of income and education, creating spatial inequalities between the East-West parts of Turkey (Celebioglu and Dall'erna, 2009; Filiztekin, 2009; Ocal and Yildirim, 2008; Gezici and Hewings, 2004; Dogruel and Dogruel, 2003; Ozturk, 2002). Others focus on inequalities in salaries and the migration from east to west (Yildirim et al., 2009; Elveren and Galbraith, 2008; Kirdar and Saracoglu, 2007; Ozmucur and Silber, 2002). However, none of the studies has attempted to explore, empirically, the impacts of the theories of local and regional economic development in the Turkish context. In the current study, different as the theories of local and regional economic performance appear, it is argued that each involves different permutations and combinations of eight dimensions that are currently thought likely to enhance local economic capacities to create growth and enable regions to cope with change. The purpose of

the analysis of this section is to understand which of the theories or elements of these theories provide the fullest explanation of regional growth in Turkey.

Evaluating the theories of seven local and regional development entails establishing a degree of congruence between the database of the dataset of the Turkish economy and the underlying ‘gap convergence’ regression model. A general to specific modelling strategy is adopted to evaluate the theories by undertaking a series of misspecification tests to establish its ‘congruence’ with the evidence (Charemza and Deadman, 1997). A simple ‘gap convergence’ model is postulated by relating regional unemployment relativities at the end of a given period (R_{it}), to regional unemployment relativities at the start of that period (R_{it-T}) (Baddeley et al., 1998). This type of ‘gap convergence’ model can be estimated using ordinary least squares (OLS) regression. From previous discussions and identification of the theoretical dimensions, the growth drivers have been nested within a multiple regression model (see Table 2 for the notation of the dependent and explanatory variables):

$$\ln R_{it} = \beta_0 + \beta_1 \ln R_{it-T} + \beta_2 HITECH + \beta_3 \ln(INFOACC) + \beta_4 MOLCN + \beta_5 PROT + \beta_6 DEGREE + \beta_7 TOTPOP + \beta_8 \ln(MKTACC) + \beta_9 SPEC + \varepsilon_{it,t-T}$$

where, $\varepsilon_{it,t-1}$ is assumed to be normally distributed with an expected value of zero, errors independent of the set of explanatory variables, uniform variance, uncorrelated, and with fixed regressors in repeated samples. To establish whether this general model captures any specific information that is not embodied in the seven theoretical models, a variance encompassing procedure is employed to test the validity of the restrictions that are imposed on this general model by the seven models (see Plummer and Taylor, 2001b). The encompassing model is defined as the model in which variance dominates the set of alternative model specifications in the sense that the other models contain no information capable of improving the model (Hendry and Mizon, 1990; McAleer, 1994). Assuming that the linear restrictions imposed on this general model are correct, the seven theoretical models are associated with null hypotheses after the model is run.

Recent studies utilize the unemployment rate as a dependent variable in their analyses. Griffith *et al.* (2007) analyse the impact of product market competition on unemployment, and how it depends on labour market institutions. They find that increased competition reduces unemployment. Fu *et al.* (2010) studies how industry specialization, diversification, and churning affect unemployment rates in Chinese cities. They show urban growth, market maturity measured by the proportion of private sector employment, and human capital can decrease the unemployment rate. In the current analyses, the changing rate of unemployment, rather than the growth rate in employment has been utilized as a dependent variable in a local economy since measuring economic growth in terms of employment growth can only explain the determinants of growth on the demand side of the labour market. In contrast, changes in the rate of unemployment are sensitive to changes both in the demand for labour and in the supply of labour (Plummer and Taylor, 2001a). For the present analysis, therefore, the economic performance of a region is defined in terms of its prevailing unemployment rate relative to an economy wide average. Therefore, those provinces with lower unemployment rates have *ipso facto* higher employment rates and are imputed to have better economic performance.

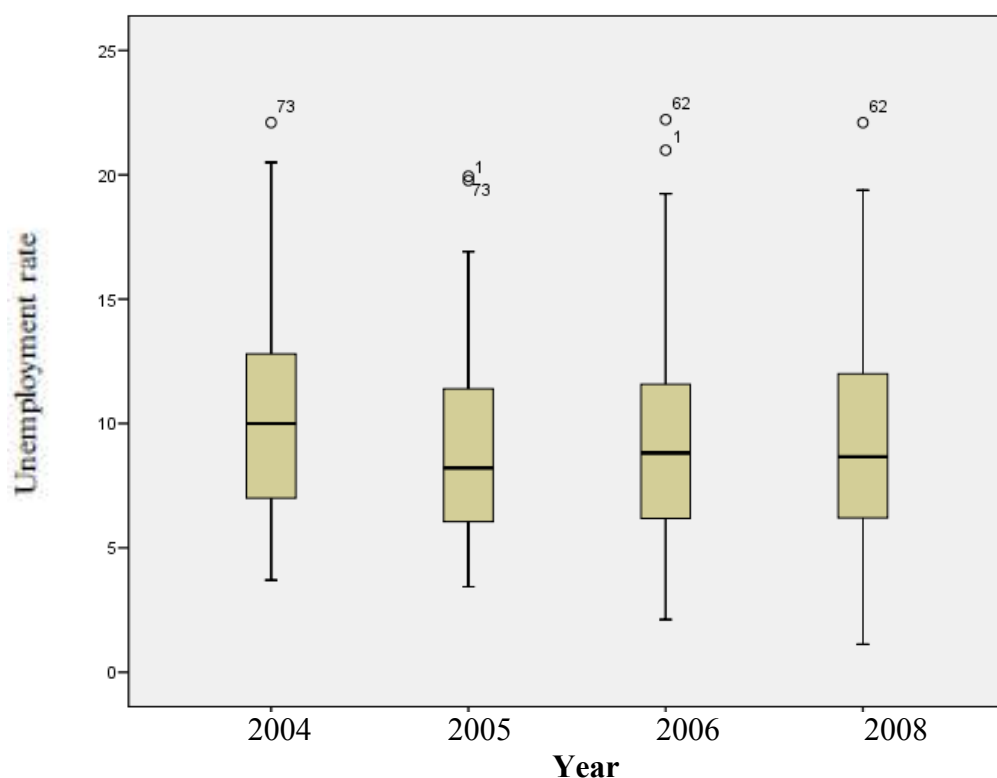


Figure 1: Unemployment dynamics, 2004-2008

		2004	2005	2006	2008
2004	Pearson Correlation	1	,946(**)	,884(**)	,811(**)
	Sig. (2-tailed)		,000	,000	,000
	N	81	81	81	81
2005	Pearson Correlation	,946(**)	1	,899(**)	,813(**)
	Sig. (2-tailed)	,000		,000	,000
	N	81	81	81	81
2006	Pearson Correlation	,884(**)	,899(**)	1	,944(**)
	Sig. (2-tailed)	,000	,000		,000
	N	81	81	81	81
2008	Pearson Correlation	,811(**)	,813(**)	,944(**)	1
	Sig. (2-tailed)	,000	,000	,000	
	N	81	81	81	81

** Correlation is significant at the 0.01 level (2-tailed).

Table 3 Correlation coefficients of the dependent variables between 2004 and 2008

	2004	2005	2006	2008
Mean	10,4012	9,084	9,2496	9,2358
Median	10	8,2143	8,8148	8,6658
Interquartile range	5,85	5,4	5,53	5,83
Standard deviation	4,09675	3,71873	4,12981	4,30697
Coefficient of variation	0,393873	0,409371	0,446485	0,466334

Table 4 Unemployment statistics, 2004-2008

The dynamics of regional unemployment for Turkey between 2004 and 2008 are summarized in Figure 1, Table 3 and Table 4. Statistics show that the unemployment ratios between 2004 and 2008 are strongly correlated to each other. Therefore, it is very likely to explain the following unemployment rate by considering the previous year's unemployment rate. During this period, average unemployment across Turkey's provincial economies ranged from about 10.4% in 2004 to 9.2% in 2008. From 2005 to 2008, the average unemployment rate remained relatively stable between about 9% and 9.2%. In some provinces, much higher levels of unemployment persisted where their socio-economic structures predisposed their communities to higher levels of unemployment. For example, Adana, Tunceli and Sirnak provinces, represented by the code numbers 1, 62 and 73 in the analysis, have been identified as outlier provinces in some years (Figure 1). The locations of these provinces are identified in Figure 2.

Figure 2: Adana, Tunceli and Sirnak as outlier provinces

In the general model specification, the set of explanatory variables accounts for almost 75% of the variability in unemployment relativities between 2004 – 2008 (Table 5). That means the regression model appears to function reasonably well, as the independent variables *explain* almost 75% of the variance of the dependent variable. Furthermore, the value of residual sum of squares (RSS), which is a measure of the discrepancy between the data and an estimation model, is 3.24 in the model. Such a low value indicates a tight fit of the model to the data. Normality test shows that the residuals are normality distributed. The heteroscedasticity tests show that there is no heteroscedasticity in the model. The RESET test of functional form shows that the linear formulation is satisfactory. As such, there is no misspecification in the

functional form of the model. The Durbin–Watson (DW) statistic is a test statistic used to detect the presence of autocorrelation in the residuals from a regression analysis. The value of DW lies between 0 and 4 and the value of 2 indicates no autocorrelation. In the current model, although the value is close to 2, it is less than 2 and that means there may be evidence of positive serial correlation amongst residuals. To check the presence of autocorrelation in the residuals, a further analysis is necessary. In statistics, the Breusch–Godfrey serial correlation LM test is a robust test for autocorrelation in the residuals from a regression analysis and is considered more general than the standard Durbin–Watson statistic. According to the LM test statistics, Observed R^2 and $\chi^2(1)$ values are insignificant meaning there is no serial autocorrelation in the model. In summary, test statistics show that there is no problem in terms of explaining the probabilities or coefficients of the variables in the model.

Variable	Coefficient	Std. Error	t-statistics	Prob.
Constant	-3.36260	0.9688	-3.47	0,001
Unemployment	0,424709	0.05089	8.35	0,000
INFOACC	0.144461	0.04778	3.02	0,003
NODEG	-0.154897	0,08558	-1.81	0,075
HITECH	-0.130009	0.1001	-1.30	0,198
SPEC	-0.0632858	0.07110	-0.890	0,376
MLOCN	-0.297871	0.1016	-2.93	0.005
TOTPOP	-7.71797e-005	0.003576	-0.0216	0.983
MKTACC	-0.113354	0,04225	-2.68	0,009
PROT	-0.0265279	0.07110	-0.890	0,376

Test Statistics { Probabilities = * denotes significance at the 5% level
 ** denotes significance at the 1% level

$R^2 = 0.749924$, $F(9,71) = 23.66$ [0.000] **; $RSS = 3.24181632$

Normality test $\chi^2(2) = 3.9879$ [0.1362]

Hetero test : $F(18,52) = 1.2445$ [0.2632]

Hetero-X test : $F(54,16) = 0.56327$ [0.9402]

RESET test: $F(1,70) = 0.59774$ [0.4420]; $DW = 1.78$

Observed * $R^2 = 0.944210$, Probability $\chi^2(1) = 0.331197$

(Breusch-Godfrey Serial Correlation LM Test result)

Table 5 The general model of regional economic growth in Turkey 2004 to 2008

Based upon the evidence from Turkey's local and regional economies between 2004 and 2008, the knowledge creation and access to information (INFOACC), the local human base (NODEG), the local integration of small firms (MLOCN), the extent and nature of local demand (MKTACC) and the institutional support (PROT) variables are the main drivers of the local and regional economic development in Turkey. According to the test statistics:

- knowledge creation and access to information (INFOACC) restricts rather than enhances local job growth;
- human capital (NODEG) enhances local job growth;

- the spatial concentration of small firms (MLOCN) increases growth;
- market accessibility (MKTACC) promotes growth.

The rest of the variables are insignificant in the current model implying they have no correlation with local job growth in Turkey's regional economies. However, the current model includes the outlier values of the data which might affect the statistical results of the correlation. It is, therefore, important to investigate the effects of the outlier values on the model.

4 Geography and the Outlier Values

To learn more about the pattern underlying the forecasting errors in the regression model, the econometric approach enables the researcher to identify the outliers in the dataset. Outlier detection is one of the major tasks of data analysis that aims to identify abnormal patterns (outliers) from large data sets. In different applications, outliers are labelled differently as anomalies, deviations, exceptions, faults, and irregularities (Chen *et al.*, 2008). Barnett's definition is widely accepted by statisticians and computer scientists, and views an outlier as one observation that appears to deviate markedly from other members of the sample in which it occurs (Barnett and Lewis, 1994). In recent years, the existence of major amounts of spatial data has made the identification of spatial outliers a significant task required to identify anomalies in a spatial context (Willmott *et al.*, 2007; Adnan *et al.*, 2010; Chen *et al.*, 2010). By definition, a spatial outlier is a spatially referenced object whose non-spatial attribute values are significantly different from those of other spatially referenced objects in its spatial neighbourhood (Shekhar and Chawla, 2002). It needs to be emphasized that the interpretation and significance of the parameter estimates and the overall model are only meaningful if the specification satisfies the assumption underlying the OLS estimation. Figure 3 shows the distribution of the variables and identifies a small number of residuals that are potential outliers.

According to the distribution of the variables in log terms, Ankara, Sirnak, Istanbul, Izmir, Mugla, Batman, Hakkari, Igdir and Duzce provinces remain as the outlier provinces (see Figure 4 for their locations). For the local human base (NODEG) variable, Ankara remains as the negative outlier. For the technological leadership (HITECH) variable, Sirnak remains as the negative outlier. For the knowledge creation and access to information (INFOACC) variable, Ankara, Istanbul and Izmir provinces are the positive outliers (above the distribution of the variables in log values). For the extent and nature of local demand (MKTACC) variable, Istanbul is the positive outlier. For the local integration of small firms (MLOCN) variable, while Mugla is the positive outlier, Batman and Sirnak provinces are the negative outliers. There are no outliers for the power of large corporations (TOTPOP) variable. For the institutional support (PROT) variable, Hakkari, Igdir and Duzce are the negative outliers. Finally, for the local sectoral specialization (SPEC) variable, Igdir is the negative outlier.

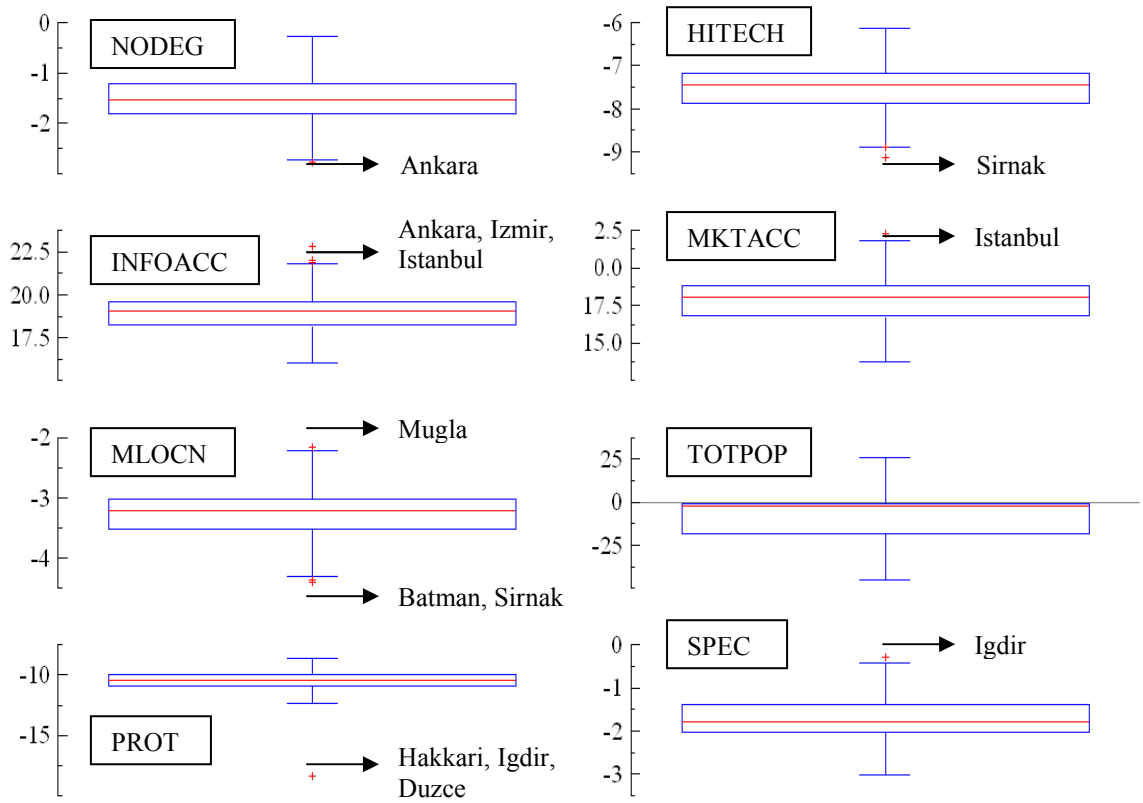


Figure 3 Distribution of the variables in log values, with outliers

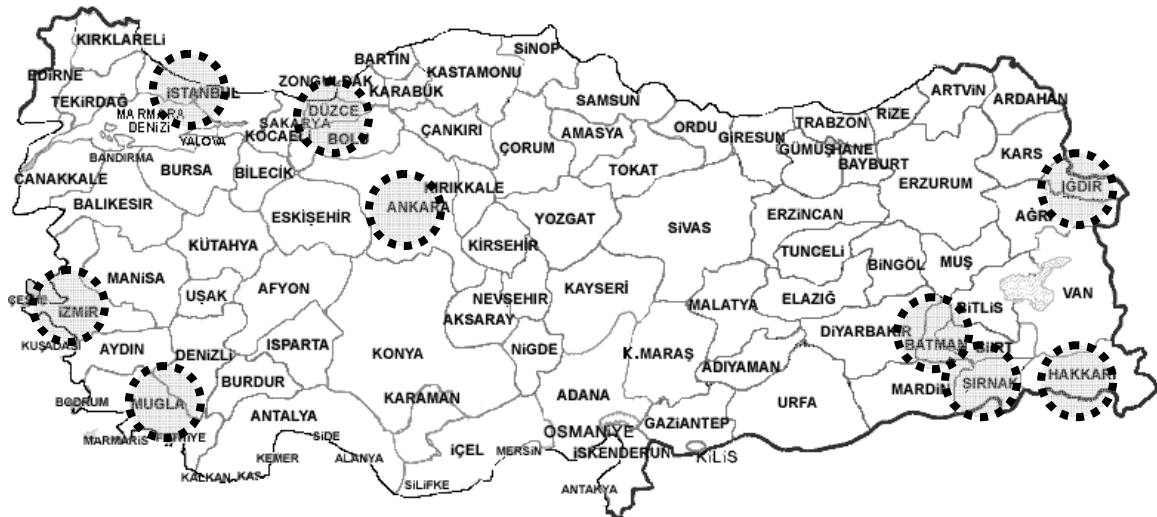


Figure 4: Outlier provinces

Although some of the outlier values are located in big metropolitan cities, some of them are excluded due to their economic performance. For example, big provinces such as Istanbul, Ankara, Izmir and Mugla are the outlier provinces in different variables because they remain above the upper quartile which means their values remain significantly higher than others. On the other hand, Duzce, Igdır, Batman, Sirnak and Hakkari provinces are under the lower quartile, their values being very low. Also it is important to note that terrorist activities in the eastern provinces as well

as lower investment level (see Ocal and Yildirim, 2010) might have effects on the identification of Batman, Sirnak and Hakkari provinces as the outlier provinces. In that sense, it may be argued that the general model should exclude ‘terror-stricken’ provinces to have a robust estimation. However, recent empirical analysis shows no relationship between economic conditions and separatist terrorism activities (see Derin-Gure, 2011). Derin-Guce (2011) shows improvements in absolute economic conditions in south-eastern Turkey do not decrease the separatist incidents. The distinction amongst outlier provinces shows a West-East divide in Turkey in terms of explaining the economic performance of the provinces (see also Filiztekin, 2009; Yildirim *et al.*, 2009). However, although Duzce is located in the western part of Turkey, it is surprising to see that province under the lower quartile of the institutional support (PROT) variable. The reason why this province is considered as an outlier province is probably because it is located between Istanbul and Ankara provinces so that Duzce is affected by the hinterland of these two big metropolitan cities and it seems likely that it is from those interactions that Duzce receives institutional support.

To reduce the forecasting errors in the model, these outlier values need to be removed from the dataset. Although there is no clear theoretical justification for omitting these values, omitting outliers in the frequency distributions can enable release of a data set whose utility is not compromised by extensive aggregation of values (Howe *et al.*, 2006). In other words, it can affect the coefficient values of the variables or the error term in the model.

Based upon the evidence from Turkey’s local and regional economies between 2004 and 2008, when the outlier values are removed from the data, although the significance levels of the general model specification (excluding outliers) has been similar to the previous one, omitting those observations does appear to impact positively upon the institutional support (PROT) variable (Table 6). In addition to the previous comments, the institutional support (PROT) variable enhances the local job growth in Turkey. More controversially, the technological leadership (HITECH) variable which remains theoretically essential for local economic growth has no relation with the local and regional economic development in Turkey. Moreover, specialization provides an essential link between the technical and spatial conditions of economic progress (Lampard, 1955: 88). Specialization and division of labour are important principles which ‘mediate between technical advance and spatial form’ (Phelps and Ozawa, 2003). However, in this analysis of Turkey, the variable (SPEC) is insignificant as well.

Variable	Coefficient	Std. Error	t-statistics	Prob.
Constant	-4.109198	0.96087	-4.28	0,0001
Unemployment	0,462563	0.05085	9.09	0,0000
INFOACC	0.203092	0.05091	3.99	0,0002
NODEG	-0.225999	0,08620	-2.62	0,0109
HITECH	-0.027723	0.09784	-0.28	0,7778
SPEC	0.003364	0.07392	0.05	0,9638
MLOCN	-0.326318	0.10289	-3.17	0.0023
TOTPOP	-0.001393	0.00336	-0.41	0.6799
MKTACC	-0.143215	0,04258	-3.36	0,0013
PROT	-0.109625	0.03727	-2.94	0,0046

Test Statistics { Probabilities = * donates significance at the 5% level
 ** donates significance at the 1% level

$R^2 = 0.781465$, $F(9,71) = 25.03$ [0.000] **; $RSS = 2.491220$

Normality test $\chi^2(2) = 3.6305$ [0.1628]

Hetero test : $F(18,54) = 1.30573$ [0.2216]

Hetero-X test : $F(54,18) = 0.94213$ [0.5866]

RESET test: $F(1,62) = 0.0008$ [0.9770]; $DW = 1.71$

Observed * $R^2 = 1.982879$, Probability $\chi^2(1) = 0.159087$

Table 6 The general model of regional economic growth in Turkey 2004 to 2008
 (excluding outlier values)

Overall, the general model appears to fit the Turkish data reasonably well and it is statistically significant. Although the diagnostic test reveals some significant misspecification issues, using a general model to evaluate the alternative specification to the theoretical models of local growth is justified. However, in light of the results of fitting the general model with and without the outlying values, it is important to test the validity of the competing theoretical models against the general model specification. In order to do this, the first step is to define a hypothesis.

Competitive advantage;	$H_0: \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_8 = \beta_9 = 0$
Learning regions;	$H_0: \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_9 = 0$
Flexible specialization;	$H_0: \beta_2 = \beta_4 = \beta_5 = \beta_6 = 0$
Product cycle;	$H_0: \beta_2 = \beta_3 = \beta_6 = \beta_7 = \beta_8 = 0$
Growth pole;	$H_0: \beta_2 = \beta_3 = \beta_7 = 0$
Segmentation;	$H_0: \beta_2 = \beta_4 = \beta_7 = 0$
Creative Class;	$H_0: \beta_2 = \beta_3 = \beta_5 = \beta_6 = 0$

Theoretical model	Full sample (probability)	Outliers removed (probability)
Competitive advantage	0,000	0,000
Learning region	0,000	0,000
Flexible specialization	0,000	0,000
Product cycle	0,000	0,000
Growth pole	0,000	0,009
Segmentation	0,000	0,002
Creative Class	0,000	0,000

Table 7 Testing linear restrictions in the general model

Testing the validity of linear restrictions in nested models involves testing the assumption that the restrictions imposed on the general model are correct (Table 7). In other words, the set of linear restrictions cannot be rejected at a given level of significance. Under the assumption that the null hypothesis is correct, for n observations and k estimated parameters in a linear regression model with a normally distributed error term, g linear restrictions can be jointly tested using an F-test with $F(g, n-k)$ degrees of freedom:

$$F(g, n-k) = \frac{(ro - r)(n - k)}{g r}$$

where ro is the residual sum of squares of the restricted model and r is the residual sum of squares in the unrestricted model (Maddala, 1988). According to the probability ratios of the theoretical models, for both the full and reduced sample cases, there is evidence to suggest that the assumption '*the set of linear restrictions imposed on the general model by all the models are correct*' can be rejected. This means that the null hypothesis constructed to test those models has to be rejected. In other words, none of these models can be applied for the Turkish context. However, in the general model, some variables remain crucial in explaining the dynamics of local and regional economy in Turkey.

5 Discussion and Conclusion

This paper seeks to explore, in a preliminary way, the dynamics of local and regional economic growth among Turkey's provinces during the period 2004 to 2008. A theoretically informed empirical modelling strategy has been used which identifies economic drivers of growth from a range of institutionalist theories. Those theories including 'flexible specialization', 'clusters' and 'the creative class' are interpreted as involving different combinations of this suite of drivers. However, when these different combinations of drivers were compared with the general model containing them all, none was found to offer a significantly improved explanation. In short, none of the seven theoretical frameworks that form the foundation of this analysis offers a significant explanation of provincial level growth in the study period in Turkey. This conclusion differs from that of earlier work on Australia by Plummer and Taylor (2001a) and Garlick *et.al.*, (2007). In those analyses, one theoretical model, the

learning region model, offered the best explanation of regionally differentiated growth, though even that model did not work entirely in the way it had been theorised.

The Turkish analyses reported here suggest that in this context none of the theoretical models that were calibrated in this study provided a significant explanation of differential regional economic growth in that country. However, in the general model, the test statistics suggest that some drivers within the theoretical models do contribute to an explanation of local and regional economic growth in Turkey. However, this explanation is one that differs from the explanations offered by other theories. It suggests that implementing policies based on the processes postulated in only one particular model and theory would be inappropriate. Individually, none of the models explored here would be enough to explain the dynamics of Turkey's regional economies. However, the general model suggests five important drivers shape the dynamics of Turkey's regions.

- The *local integration* of small firms in the country's regions appears to *enhance* local economic growth – a possible indication of an incipient enterprise culture in those places but on the local engagement of local firms and SMEs;
- *Institutional thickness*, including infrastructure support, also seems to *foster* local economic growth, possibly reflecting the success generated by local institutions and national policy efforts in building the local economic capacities of places;
- The *local human resource base* of Turkey's regions is a *driver* of local economic growth, demonstrating the importance of human capital in this country as in many others;
- Also *fostering* economic growth in Turkey is *accessibility to intermediate markets* – to markets in Turkey for products and manufactured goods rather than services of one sort or another. This is a result quite different to those of the Australian analysis, but a result that mirrors the significance of manufacturing in the Turkish economy and its major contribution to exports and to national economic growth; and
- Contrary to theory-based expectations, *knowledge creation and access to information* was shown in this analysis to *restrict* rather than to enhance economic growth across Turkey's provincial economies. This is a difficult finding, but a finding that is important and thought-provoking and needs careful interpretation and further analysis. It relates in some ways to the major concentration of the knowledge economy in Istanbul and Ankara but may also relate to the concentration of large and foreign owned firms in the Western provinces of the country. However, conjecture is no answer. What is needed is further, in-dept analysis.

As an overall assessment, the result of the current study is a veritable 'Curate's Egg – good in parts. None of the models explored in the analyses provide a full explanation of the dynamics of Turkish regional development, but elements of them all have resonance with regional economic growth in Turkey.

When these five findings are drawn together they suggest, tentatively, a very distinctive form of production-based regional economic growth across Turkey's provincial economies built on: (1) linked small firm manufacturing, (2) local human capital, (3) local institutional support, and (4) access to intermediate goods markets. It is an interpretation that is consistent with Turkey's manufacturing and production firms being subordinated within value chains dominated by large, and in many cases foreign-owned, corporations. But, as this analysis implies, this is not a situation easily addressed through current theoretical understandings of the processes shaping regional and provincial economic growth in countries at the same or similar stages of development as Turkey. More controversially, some drivers from theory have no relation with the model. The local sectoral specialization and power of large corporations variables, for example, have no impact on local growth. Similarly, the technological leadership variable has also no correlation with the model as well. This is particularly important finding in relation to the role of high tech industries in local growth process. This is a finding that does not marry with the existing models of knowledge and learning based economic growth that is said to underpin developed market economies of Europe and the world. In summary, the current study is an explanatory analysis which has highlighted major issues that need to be discussed in the future.

From the study reported in this paper two fundamental conclusions can be drawn. First, no current theory of differential regional economic growth drawn from a developed country context provides an adequate understanding of the processes shaping regional growth in a developing country context. Second, there is an urgent need to develop more nuanced and locally relevant models of regional dynamics in the developing country context. As globalization deepens and extends, developed and developing economies become increasingly intertwined. Fuller and more locally relevant understanding of local and regional economies is, therefore, essential to the formulation of appropriate regional policies that are locally nuanced and locally relevant if places are to benefit from the potential that globalization has to offer.

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