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Infrastructure development and employment – the case of Turkey

This study illustrates the interaction effects between human capital and transport infrastructure taking into account the gender differences and the roles of sociocultural factors on employment in Turkey. It is shown that a considerable part of the variation in paid employment is at a regional scale and that significant associations exist between the interaction effects of education and transport infrastructure and paid employment. Although the role of regional context is roughly comparable for men and women, there are gender differences in the associations between sociocultural and physical characteristics and employment.

JEL codes:

J6 - Mobility, Unemployment, and Vacancies

R4 – Transportation Systems

R12 - Size and Spatial Distributions of Regional Economic Activity

O18 - Urban, Rural, Regional, and Transportation Analysis; Housing; Infrastructure

Keywords: transport infrastructure, female employment, Turkey, public investment, gender and transport

Title: Infrastrukturentwicklung und Beschäftigung - der Fall der Türkei

Keywords: Verkehrsinfrastruktur, Frauenbeschäftigung, Türkei, öffentliche Investitionen, Geschlecht und Verkehr

Diese Studie zeigt die Wechselwirkungen zwischen Humankapital und Verkehrsinfrastruktur unter Berücksichtigung der Unterschiede zwischen den Geschlechtern und der Rollen von soziokulturellen Faktoren auf die Beschäftigung in der Türkei. Es wird gezeigt dass ein erheblicher Teil der Variation in bezahlter Beschäftigung auf regionaler Ebene existiert und dass signifikante Assoziationen zwischen den Wechselwirkungen von Bildung, Verkehrsinfrastruktur und Erwerbsarbeit bestehen. Obwohl die Rolle des regionalen Zusammenhangs für Männer und Frauen etwa vergleichbar ist, gibt es Unterschiede zwischen den Geschlechtern in den Zusammenhängen zwischen soziokulturellen und physikalischen Eigenschaften und Beschäftigung.

Title:基础设施的发展和就业---基于土耳其的案例分析

Keywords: 交通基础设施，女性就业，土耳其，公共投资，性别与交通

这篇文章说明了人力资本与交通基础设施之间的互动效应， 其中着重考虑分析了性别差异作为社会文化因素在土耳其的就业市场中所起的作用。研究结果表明，有相当一部分的变动在有偿就业中是在区域范围内的， 同时，教育、交通基础设施和有薪就业之间的互动效应存在着明显关联。尽管区域范围的作用对于男性和女性来说是基本相同的， 但是仍然有性别差异存在于在社会文化、物理特性和就业之间。

Title: El desarrollo de infraestructura y el empleo - el caso de Turquía

Keywords: infraestructura de transporte; empleo femenino; Turquía; inversión pública; género y transporte

Este estudio demuestra los efectos de las interacciones entre el capital humano y la infraestructura de transporte tomando en cuenta las diferencias que existen en los factores socio-culturales que afectan el empleo en Turquía bajo un enfoque de género. Se muestra que una parte considerable de la variación en el empleo asalariado se da a escala regional y que existen asociaciones significativas entre los efectos de las interacciones entre educación e infraestructura de transporte y el empleo asalariado. Pese a que el rol del contexto regional es aproximadamente similar entre hombres y mujeres, hay diferencias de género en las asociaciones que se dan entre el empleo y las características socio-culturales y físicas.

Title: Développement d'infrastructures et emploi - le cas de la Turquie

Keywords: Infrastructures de transport; emploi féminin; Turquie; investissements publics; genre et transport

Cette recherche illustre les interactions entre le capital humain et les infrastructures de transport en analysant les relations entre le genre, les facteurs socioculturels et le taux d'emploi en Turquie. Il est montré qu'une part très importante de la variation des salaires est interrégionale. En outre, des associations significatives sont trouvées entre les effets d'interaction liés aux études et aux infrastructures de transport, d'une part, et aux salaires, d'autre part. Malgré un rôle comparable du contexte régional pour les hommes et pour les femmes, il y a des différences de genre dans les associations entre les caractéristiques socioculturelles et des infrastructures et l'emploi.

1. Empirical rationale: Infrastructure in the nexus of Culture, Development and Gender

This paper analyses the nexus of transport infrastructure, paid employment and the interaction effects of human and physical capital whilst accounting for gender differences in Turkey. As such it seeks to contribute to and extend the literature on the implications of

transport infrastructure investments on regional and local development. Despite the multitude of studies that found a positive impact of transport investments on output, productivity and costs of production during 1989-2009, long-term economic benefits of investment in transport infrastructure have been widely criticized mainly due to significant variations in the results (Bhatta and Drennan, 2003 and Goetz, 2011). Labour market spillovers are deemed particularly important to realise the economic growth impacts of investments, which was comprehensively analysed over the last decade (Demetriades and Mamuneas, 2000; Berechman, *et al*., 2006; Rice, Venables and Patacchini, 2006; Graham, 2007). Extending the findings of these studies, others (e.g. Banister and Berechman, 2001; Goetz, 2011) emphasise that labour market spillovers, and eventually economic development implications of transport investments, are *conditional* on complementary factors including human capital development. In fact, human capital development was found to have a stronger positive impact on regional growth in the European Union (EU) than that of physical infrastructure in well-connected regions (Crescenzi and Rodríguez-Pose, 2012). It has therefore been suggested that investments in transport infrastructure are a necessary, but not sufficient, condition for economic development in some regions and that such investments are neither a necessary nor sufficient condition in other, already well-developed regions (Banister and Berechman, 2001; Goetz, 2011).

Development is however not limited to material wellbeing; social equity aspects should also be considered if it is to bring overall wellbeing. The provision of the direct and indirect benefits of infrastructural development facilitates other basic needs, including access to education and to labour markets. How certain groups of individuals benefit (or not) from the investments can be encompassed within a broad definition of wellbeing. The consideration of equity impacts of infrastructure investments (particularly with respect to gender, age, and ethnicity) points to the significance of *social and cultural contexts* as well as

the political institutions such as structural reforms and social policy (see, for instance, McQuaid, et al., 2001 on gender and class; Esfahani and Ramíres, 2003 on political institutions; Sánchez, et al. 2003 on ethnicity; Leck, et al. 2008 on economic inequalities).

Gender has been recognised as a particularly important social category in the context of mobility and transport as it functions as one of primary axes along which levels of mobility and access are differentiated (Law, 1999; Hanson, 2010). It is believed that the failure to produce transport policies and provision that meet women's needs exacerbates social exclusion mainly because conventional planning places disproportionate constraints on women's take-up of employment and other opportunities ignoring the nature of trips women usually make (Hamilton, 2001). In today's world, alternative forms of communication are suggested to ameliorate time poverty of women due to multiple tasks in the household and at work places (Grieco, 2011). The dynamics between transport infrastructure development and labour markets are complicated further because the benefits of increased accessibility to employment are gendered. For instance, accessibility impacts of and the types of jobs created by increased large transport infrastructure projects are likely to differ for men and women.

The nexus of gender and mobility has been examined in a variety of ways. Numerous studies have investigated how women's commuting patterns differ from men's as well as differences in commuting among women and how these are structured by income, ethnicity, spatial location, and so on. (e.g. Grieco, et al. 1989; Hanson and Pratt, 1995; Turner and Fouracre, 1995; Tran and Schlyter, 2010). The most relevant findings of this vast literature for the purposes of the present study is that home-work interdependencies and the sectoral and regional shifts of jobs for women as a result of industrialisation are key to understanding why mobility patterns are being gendered and how these differences are important for local economic development. In this respect, the earlier studies on the UK by Massey (1995) and

Hanson and Pratt (1989) shed useful insights on how local labour markets are transformed through gendered division of labour.

More recently the relation between gender and transport has been studied using the lens of the mobilities paradigm in the social sciences (Uteng and Cresswell, 2008) and this has shown that gender and access to opportunities cannot be reduced to commuting and socio-spatial mapping of regions. So, it is clear that an even broader lens is required to understand how gender is implicated in the complex nexus of wider benefits of transport and culture (Law, 1999; Hanson, 2010), which is reflected in the empirical studies that take into account personal capacities and opportunities – in this case, of women – which can be significantly affected by the social, cultural and political structures they live in (see, for instance, Uteng 2009 on immigrant women in Norway). Overall, it has been acknowledged that 'gender' should be utilized as a theoretical concept (Buiten 2007).

Although such local geographies of participation and gendered mobilities are ignored in the gender and development literature, which is mainly nation-centric, the consideration of broader economic effects of development on women, which are claimed to be negative following the work of Boserup (1970), is inevitable. The studies following Boserup (1970) brought culture into the explanation of economic growth patterns and the distribution of its benefits (e.g. Fernandez, 2007; Fernandez and Fogli, 2009). There are several studies on Turkey that argue that household roles and other local social norms have acted as a constraint on women finding jobs in cities (e.g. Tansel, 2001; Aran, et al., 2009). Yet, such statistical studies usually ignore the nested structure of the sample they use, i.e. the embedding of women in regions, and eventually the importance of space (Stucky et al., 2007). As a result, transport and commuting has not been considered except for the use of transport as an occupational sector in the macro analyses of female employment in Turkey (e.g. Günlük-Şenesen and Şenesen, 2011). The studies that make use of multilevel modelling in explaining the contextual

effects on female employment, on the other hand, ignore the physical infrastructural characteristics of the regions and districts (e.g. Ward and Dale, 1992; Spierings, Verloo, and Smits, 2008).

Bringing together the conceptual implications of the literatures on transport on economic development, gender and mobility and gender and development, this paper examines the association between transport infrastructure endowment and improvements and paid employment whilst considering existing social and cultural conditions in Turkey. Specifically, the analysis asks to what extent the individual and regional variation in female and male paid employment are associated with social and cultural contexts including the inequality in household roles and physical infrastructural characteristics of the regions. It also investigates the association between the cross-level interaction effect of education and transport infrastructure development and male and female paid employment, whilst controlling for such cultural factors as household roles and participation in cultural activities. The latter investigation helps to illustrate the interactions between individual and household attributes and regional infrastructure whilst the consideration of cultural attributes at the regional level renders the importance of sociocultural contextuality more evident in questioning the development implications of transport infrastructure. Significantly lower levels of female labour force participation (FLFP) than male labour force participation (MLFP) and the increasing transport infrastructure investment in the country in the last decade make Turkey a useful case study.

The remainder of the paper starts by introducing the empirical setting of the analysis, followed by a discussion of the data used for the empirical analysis: a multi-level statistical model will be created to account for individual and household, and regional characteristics, which is then extended by integrating the cross-level interaction effects between transport and education. It is concluded that considerable part of the variation in paid employment is at

regional scale and the role of regional context is roughly the same for men and women. Moreover, it is found that transport infrastructure is associated with paid employment at different levels of education, and these associations vary for men and women depending on the types of infrastructure. In the concluding section, the policy implications are discussed as well as pointing out the broader conceptual and methodological recommendations for future research.

2. Empirical Context

The FLFP rate in Turkey is around 28% – a very low figure compared to OECD and EU-15 averages of 61% and 65, respectively (OECD, 2011). The difference between the labour force participation of women and men is striking: since 1990s, the difference has ranged between 43% and 50% (see Figure 1).

[FIGURE 1]

Several explanations have been offered to explain the decreasing FLFP rates and the differences between the FLFP and MLFP rates in the country until 2010 (see Aran, *et al.*, 2009 for a broad overview). Initially, the phase of declining FLFP rate in Turkey was similar to those experienced in many countries exposed to rapid urbanization and industrialisation. Together with the improvements and increase in the road transport infrastructure, the immense rise in migration to cities has not been met by job opportunities available in large cities (Biçerli and Gündoğan, 2009). However, this was only the starting point. Besides the lack of jobs for all in the cities, the negative link between urbanization and female employment meant that women were not able to fulfil their dual roles (home and work) in urban areas. The reasons for this include unequal divisions of labour in the household and

relatively low levels of female educational attainment, mainly determined by the socio-cultural structure (Taymaz, 2010). Moreover, working in an urban area requires interacting with nonfamily members as opposed to working in family businesses/farms in rural areas, where women usually work with other family members; this may not be acceptable for conservative societies (Göksel, 2010).

Meanwhile, the last decade has witnessed massive investments in transport infrastructure. Public and private investment in transport increased by approximately 66 % between 1998 and 2010 and it accounts for around 24 % of the total fixed capital investment (as of 2010) (Ministry of Development of the Republic of Turkey - Development, 2010). Currently, the total length of highways stands at around 62,000km, and the length of village roads at around 350,000km. Given the striking gender differences in the labour market and the increased levels of spending on transport infrastructure, Turkey acts as a useful case-study to explore the interconnectedness of gender, transport and development in the context of labour markets. Against this empirical setting, the analysis seeks to investigate how differences between regions in female and male paid employment differ after controlling for individual, household, physical and sociocultural factors. The analysis also sheds light on the association between the cross-level effect of education and transport infrastructure endowment and investment controlling for other individual socio-economic and cultural factors.

3. Data and Methodology

In this paper, two datasets are used: the 2009 Labour Force Survey (LFS) and the 2006 Family Structure Survey (FSS), both of which were conducted by TURKSTAT, as well as information on the stock and investment in road transport infrastructure obtained from the General Directorate of Highways of Turkey. The 2009 LFS covers 503,329 individuals from 135,891 households. 366,273 of the sample are older than 15, constituting the working age

population. Household LFSs in Turkey have been conducted annually since 1988, and they are the main data source on the labour market situation of the country from the supply side. The 2006 FSS, on the other hand, covers a smaller number of people, 14,379 individuals. The survey consists of questions that indicate family structure, domestic problems, lifestyle and tendencies related to the families in Turkey. The questions include for example 'Why do you think women should not work?' and 'To what extent does religion play a role in your choice of clothing?'

The data obtained and constructed by the datasets show similar characteristics. The means and standard deviation of the main characteristics of the data used are given in Table 2. Age and education are given as groups. For every age group, the median of the interval is assigned, while education is calculated as the number of years spent in education. The number of girls and boys represent the number of children (aged below 15) in the household.

[TABLE 1]

Both datasets cover data at NUTS-I and NUTS-II levels. In order to pool the data together, the NUTS-I level of data is used (Figure 2).

[FIGURE 2]

The analysis is carried out separately for men and women to account for gender differences. It is important to point out that TURKSTAT defines labour force participation rate as the ratio of the labour force, which comprises all employed (both paid and unpaid family workers) and unemployed, to non-institutional working age population[i]. The dependent variable of this study takes the form of a binary response variable: whether or not the woman/man is in the paid employment or not in 2009.

There are three road transport infrastructure indicators used in the analysis: length of motorways, annual change in road transport investment between 2003 and 2009, and length of

provincial roads at city level; all normalized to land area. They were all grouped into NUTS-1 regions to pool with the 2006 FSS and 2009 LFS. The number of secondary schools in the regions was obtained from the Development Indicators Statistics provided by TURKSTAT.

A principal component analysis (PCA) has been carried out using the 2006 FSS to form four indices of social and cultural contexts at the regional level (NUTS-I level): inequality in household division of labour towards women, men's power in decision-making within the household, religious beliefs, and participation in cultural activities. The PCA is a multivariate statistical analysis technique that provides data reduction by using the variance/covariance matrix of a variable set with a linear combination of these variables. The analysis allows us to merge the questions indicating personal perceptions in the 2006 FSS into certain indicators used in the model. The principal scores are computed from the original variables using the coefficients found by the PCA.

Data from the 2009 LFS were augmented with the variables created on the basis of the 2006 FSS and information on regions' infrastructural characteristics, and then used to construct a multilevel binomial logistic regression model[ii]. Multilevel modelling is particularly useful given the focus of the analysis on between-region and within-region variance and how these variances differ, which cannot be explicated by fixed effects ordinary least square (logistic) regression analysis. Multilevel modelling allows us to explore to what extent the regional context plays a role in regional variance in paid employment for men and women. Besides, deriving conclusions for individuals from regional level regressions ignores the variability across individual level units. It could well be that there are different associations between regional variables and individual and household level factors. Ignoring that it is actually the individuals who act results in ecological fallacy (Robinson, 1950, cited in Snijders and Bosker, 1999). Similarly, only looking at individual level variables entails the risk of atomistic fallacy, which arises when regional level information is drawn from

individual level variables. The relationship that holds at individual level does not necessarily hold at regional level. Finally, including regional level variables in a model with individuals as the unit of individuals inflates the standard errors of the regional level variables and treats cross-level interactions incorrectly (Snijders and Bosker, 1999).

Explicitly, the multilevel models used in this study ask the following questions in the context of Turkey:

(1) Do differences between regions in female / male employment remain after controlling for individual and household attributes?

(2) How much of the variation in female and male paid employment is due to regional differences after controlling for individual and household attributes, and social, physical and cultural contexts?

(3) How does the association between education and paid employment change according to transport infrastructure endowment and investment, controlling for other socio-economic and cultural factors?

Figure 3 illustrates the variables examined at individual and household, and regional level.

[FIGURE 3]

Regional Level (NUTS-1)

Social and cultural conditions are introduced into the analysis by means of four indices formed from the questions used in the 2006 FSS.

- The first index indicates the *inequality in household division of labour*, mainly biased towards women. Seven questions are used to form the index. These questions include information on who does the following tasks in the household: ironing, washing, dishwashing, and sewing, tea service in the evenings, tidying up the house during the day, making the table for dinner and cooking. Dummies are formed that take the value 1 if the

work is done by the woman in the household, and 0 otherwise. The more unequal the division of tasks towards women in the household, the higher the value the index takes. Tea service in the evening is specific to traditional Turkish families, where all the members of the family gather and a member of the household serves tea. Although it is usually assumed to be women's task, the allocation of the task in dual earner families should give a good indication of the inequality in the division of labour in the household.

- The second index is called the *religious beliefs* index, indicating the role of religion in women's everyday lives. The 2006 FSS includes seven questions on whether the individuals consider religious values when deciding on their relationships with their partners and neighbours, their choice of friends, their choice of clothing, their food and drink, and lastly job choice and voting. Dummies are formed that take the value 1 if religion plays a determining role on these aspects, and 0 otherwise. The higher the index is, the stronger religious beliefs individuals have. Unlike using dummy variables for different ethnicities, religions and ideologies, which make assumptions regarding the lifestyles of individuals belonging to a certain group, these questions are a good indicator of the role of religion in the everyday lives of the women concerned.
- The third index is called the *decision power of men in the household* index. The 2006 FSS includes seven questions on who makes the decisions on the following matters: choice of house, house planning, choice of friends, relationships with neighbours and friends, issues relating to children, shopping and entertainment and holiday planning. There is no significant difference between whether women or men alone take these decisions except for the choice of house and the house planning. In 30.6% of the households, men alone decide on the former, whereas for 44.4% of the households, the latter is determined by women alone. Dummies are formed that take the value 1 if the decisions on these issues

are made by men alone, and 0 otherwise. The higher the index is, the stronger the men's decision power is in the household.

- Last index is formed from three questions in the survey that indicate *the participation of the individuals in cultural activities* including the activities carried out with their families: whether the family members often go out for dinner together, whether they see films and plays together and whether the women themselves have been to cinema in the past year. The results of the survey indicate that 84.3% of the families in Turkey never see films and plays together, while only 5.5% of them go out for dinner together. The survey also includes questions on whether the household members visit the other family members, friends and relatives together. However, the PCA analysis shows that they are not correlated with the above indicators and the intellectual activities that are done with the family members and by women themselves, which also indicates the presence of a level of economic capital to be able to carry out these activities, are more important for the purposes of this paper.

In order to transfer these indices to the 2009 LFS, the means of the indices are taken. Following Göksel's (2010) use of the same survey, the following equation is used:

$$I_{ijkl} = \sum a_{ijkl} / N_{ijkl}$$

where i, j, k, and l represent sex, cohort, region and urban, respectively. For inequality in the household division of labour, it is assumed that women/men in certain age cohorts in a certain region in an urban area have the same value for the index, which is the mean of the indices calculated from the 2006 FSS (Göksel, 2010). Similarly, the other indices are transferred accounting for gender, age, urban and regional factors.

Additions to the transport infrastructure stock and enhanced transport services improve accessibility, which leads to positive economic externalities, employment and factor productivity in particular (Banister and Wright, 2005). In order to represent the transport infrastructure development of a region, a specific proxy for both the stock of transport infrastructure (infrastructure endowment) and the annual additional investment (further investment) in the region are used (Crescenzi and Rodríguez-Pose, 2012). The former is proxied by the length of motorways per land area (km of road / km^2 of land area), while the latter is proxied by its annual change between 2003 and 2009 (Canning and Pedroni, 2004).

These measures are in line with the existing studies that use physical extent of the system and the monetary investment in the region to indicate transport infrastructure (Goetz, 2011). The physical extent of the system used to indicate both the stock and the variation in the transport infrastructure may be subject to criticism as it does not correct for quality, but monetary investment in infrastructure, as an alternative indicator of transport infrastructure investment, may be misleading – this type of investment does not always result in an increase in capital stock (Pritchett, 1996). Moreover, since the focus is on wider accessibility to benefits rather than direct transport benefits, the indicator's capacity to capture directly the impact of better accessibility makes it an appropriate proxy (Crescenzi and Rodríguez-Pose, 2012).

Road transport infrastructure (motorways and provincial roads) has been preferred over other modes of transport, because the former is more dominant in Turkey for mobility of both goods and people, and therefore likely to have larger effects on the spatial allocation of production, and hence wider transport benefits (Puga, 2002). On a contextual scale, it was the start of the motorway development (the transition from rail investment to highway investment in the 1950s), which led to higher levels of urbanization, resulting in lower FLFP in Turkey (Tansel, 2001). The glossary compiled by the General Directorate of Highways of the

Republic of Turkey makes a distinction between defining motorways and provincial roads by implying that provincial roads are used as an indicator of within-province accessibility. Pal (2010) also points out the distinction between motorways and provincial roads in terms of providing different levels of accessibility when including them as determinants of an economic outcome. Transport infrastructure investment, which is indicated by the average annual change in road transport infrastructure investment between 2003 and 2009, includes investment in motorways, the construction of divided highways, road improvements and asphalt roads. All transport infrastructure variables are normalized to region size (km^2).

Lastly, the number of secondary schools in the region is included as an accessibility to education indicator to observe the comparative impacts of social infrastructural and physical infrastructural goods (Pal, 2010).

The Individual and Household Level

Individual and household characteristics include *age*, *education*, proxied by the number of years spent in education, natural logarithm of the *non-labour income (husband income for females)* and *number of girls and boys in the household*.

The final data sample for women consist of 68,367 married women aged between 25 and 47, and is used to construct a multilevel binomial logit model. For men, the final dataset consists of 36,548 married men aged between 25 and 47. The study considers only married individuals so as to capture the impact of all the variables described above. Household roles, family structure and the social environment are most observable with married women, who are assumed to have commitments to their families. Furthermore, based on Tansel's (2001) suggestions that the main reasons for the declining trends may be the increases in enrolment rates at all levels of schooling and on-going structural changes in retirement schemes, only married women/men aged between 25 and 47 are considered as they are likely to have completed their education but are still far from retirement (Fernandez and Fogli, 2009).

4. Multilevel Binomial Logistic Regression Analysis

The results of the multilevel binomial regression are presented in Tables 2 and 3. Table 2 includes an intercept-only model and two random intercept models for married men and women separately. Intercept-only model already shows the divergent trends for men and women. The odds of women having a paid job for an 'average' region are estimated as exp (-1.585) = 0.205, and the corresponding probability is 0.205/(1+0.205) = 0.17. This figure increases to around 0.94 for men. The between-region variance in the log-odds of having a paid job is significant for both men and women. This means that the considerable part of the variation in paid employment is at the regional scale but the role of the regional context is roughly comparable for men and women. The variance partition coefficient estimated from the variance estimates in the intercept-only model indicates that no less than 11.01% of the variation is attributable to regional characteristics, including compositional and contextual effects (Table 2). This figure is 11.27% for male employment. The compositional effects are attributable to differences in group composition, which are the characteristics of the individuals and households of which the groups are comprised, while regional level variables or properties result in contextual differences. Because individuals living in the regions differ in terms of socio-economic and social and cultural characteristics, the individual and household explanatory variables (i.e. compositional characteristics) should be controlled for. In the first random intercept model, where only individual and household attributes are included, and the variance in female employment at regional level decreases to 5.95%, while the variance for male employment decreases to 5.19%. This figure isolates the contextual part of the regional variation. Adding contextual effects to the random intercept model reduces the regional variation of female employment to 2.35%. The variation for men goes down to 1.7%. The fact that the regional variation is still significant, at 5%, implies that there are other

contextual effects that explain the difference between regions in addition to transport infrastructure, the number of secondary schools and social and cultural factors.

Before explaining what these findings mean for the aims of this paper, it should be noted that the dominance of the individual and household level was expected. The large difference in the number of units of analysis at individual and household, and regional levels partly explains the unequal size of the variance parameters (Schwanen, 2003). Nevertheless, the regional variation where urbanization, individual socio-economic and social and cultural characteristics are controlled for is still crucial for the purposes of the present study. So far, the key finding is that the contextual variation is about half of the total regional variation and its share is only slightly larger for women than for men. Therefore, in answering (1), it can already be concluded that regional differences in paid employment for both men and women remain after controlling for individual and household characteristics. That the regional differences including socio-cultural contexts, urbanization and physical infrastructure accounts for around half of the variation addresses (2). Before going into the analysis related to the question (3), given the rationale of this paper, it is important to discuss what constitutes the regional variation according to the findings.

[TABLE 2]

Looking at the separate impacts of the contextual effects, there exist statistically significant positive association between female paid employment and the length of provincial roads. However, no definitive conclusion can be drawn from the available information due to factors including the economic development levels associated with different types of transport infrastructure stock. The social infrastructural and social and cultural characteristics of the regions are significantly associated with levels of working women and men. The results

illustrate that the degree to which women carries greater responsibility for housework in the household is negatively associated with women's participation in paid labour force, while there exists no relationship between this index and male paid employment. The participation of individuals from both sexes in cultural activities is positively associated with paid employment. Amongst the individual and household variables, education is positively associated with female and male paid employment as expected.

So far, it has been assumed that the association between explanatory variables and paid employment do not change within regions. It may, however, be that how individual level variables, such as education, influence paid employment may depend on and interact with factors at the regional scale, including transport infrastructure indicators. Multilevel analysis allows for the possibility of such 'cross-level interactions' and we have tested for such interactions between individual education on the one hand and the stock of motorways and transport infrastructure investment on the other. There are two reasons to look at the cross-level interactions with education. First, education is found to be one of the most significant determinants of female employment in Turkey (e.g. Dayıoğlu and Kırdar, 2009) as confirmed with the positive statistical association between education and paid employment for both men and women (Table 2). Second, human capital development (as indicated by educational attainment) is pointed out as a crucial complementary factor to increase the effectiveness of physical capital including transport infrastructure, and it is even found to be more important in bringing regional development (Banister and Berechman, 2001; Markusen, 2008; Crescenzi and Rodríguez-Pose, 2012). Therefore, understanding how the association between education and paid employment changes given the physical infrastructural goods and vice versa as pointed by the question (3) is important for elucidating how these factors influence each other in the context of labour markets. Table 3 shows the estimates from this cross-level interaction model for women and men. Because there are no significant changes in the impact of the

other explanatory variables, the fixed model including all individual, household and contextual effects, is not included in the table.

[TABLE 3]

In the model, education is a categorical variable with three classes reflecting common levels of educational attainment in Turkey: primary school education (including secondary school education), high school education and university education. To start with, the cross-level interaction impact of transport infrastructure investment and education on female paid employment are found to be negative, while the cross-level interaction effect of transport infrastructure investment and high school education on male employment is positive. What is interesting here for the purposes of this study is that there actually is an association between the two. The negative association in the case of female paid employment could well be due to low levels of educational attainment in the under-developed regions in which there have been high levels of investment in the last six years in Turkey (Development, 2010). Therefore, conclusive implications cannot be deduced from this. Moreover, the inclusion of annual change in transport infrastructure investment in the model does not change the statistical significance of the length of motorways and provincial roads stock considerably. Therefore, the interactions terms for transport infrastructure investment are not included in the tables.

For women, the regression coefficients for the cross-level interaction between education and some of the transport infrastructure stock variables are statistically significant at the 95% confidence level. Their statistical significance implies that the impact of education is associated with different levels of transport infrastructure variables and vice versa. However, these interaction terms cannot be interpreted separately from the main effects of the length of motorways, provincial roads and education. The main effect of motorways is negative but insignificant, while the level of education is positively associated with the

likelihood of women having a paid job. Accordingly, the statistically significant positive interaction effect of high school education and motorways should be interpreted to say that the association between the length of motorways and paid employment is less negative for higher educated married women. Alternatively, but equally, it could be said that the association between having high school education and paid employment is stronger as there are more motorways in the region of residence. Similarly, the association between provincial roads and female paid employment is also significant when considered with educational attainment. In contrast with the contextual effects of the length of motorways, both the main contextual effect of the length of provincial roads and the interaction effects are statistically significant for women. However, while the main effects of provincial roads and education are positive, the interaction effects are negative. This could be interpreted to say that the association between the length of provincial roads and paid employment is less positive among women with higher levels of education. Alternatively, the association between paid employment and education is weaker as there are more provincial roads in the region of residence.

The results are different for male paid employment (Table 3). In contrast to women, the main effect of the motorways stock becomes statistically insignificant when cross-level interaction effects are added to the model while the positive association between educational attainment and male paid employment remains to be statistically significant. This could imply that the overall association between the length of motorways and male paid employment is mainly due to large proportion of educated men in regions with good links to the rest of the country. The positive cross-level interaction effect of the length of provincial roads and high school education and the negative but insignificant main effect of provincial roads may imply that the association between provincial accessibility and male employment is less negative in regions, where men are better educated. Alternatively, but equally, it could be said that the

association between high school education and male paid employment is stronger as there are more provincial roads in the region of residence.

In terms of gender differences and similarities, the main observation is that that the male paid employment in Turkey is not necessarily associated with the length of motorways and while the opposite holds for women with high school education but not with university education. This finding can be explained by the visible trend that well educated women (i.e. women with university education) usually have upper nonmanual jobs located in cities, for which they do not have direct relationship with either accessibility or the provision of jobs generated from the transport sector. Overall, this is consistent with the relatively higher rate of females with university education holding managerial positions in Turkey (Gündüz-Hosgör and Smits, 2006). Moreover, the association between provincial accessibility and female paid employment becomes weaker as women are better educated, whereas provincial accessibility becomes significant and less negative for better-educated married men. The main similarity is that the employment status of married men and women with university education are not necessarily associated with country-wide accessibility and or jobs induced as a result of motorways.

5. Implications

The initial assumption made in the study was clear: in order to assess the external economies of transport infrastructure, all other socio-economic and social and cultural factors should be considered when observing aggregate trends. The reasoning of the study was based on the equity considerations that emphasise social and cultural conditions and the studies arguing for the existence of necessary conditions for transport infrastructure to bring about economic development. The use of multilevel regression analysis gave us a more nuanced view of regional, individual and household characteristics, indicating how these two could be related.

Empirically, it was shown that considerable part of the variation in paid employment is at the regional scale but the role of the regional context is roughly comparable for men and women. Moreover, the contextual variation is about half of the total regional variation and its share is only slightly larger for women than for men. The cross-level interaction effects show that there actually exist statistically significant associations between the cross-level interaction effect of educational attainment and transport infrastructure and (male and female) paid employment. However, because the causality between the paid employment and the explanatory variables is not accounted for, one should be cautious when interpreting the effect of the cross-level interaction between the infrastructure endowment and education. The results may well be explained by the previous growth pattern in the regions which are endowed with infrastructure; the enhanced local infrastructural endowment may have made infrastructure a factor that accompanies the process of labour market development, rather than being one of its engines.

Despite the lack of a causality test (therefore not being able to account for time effects) the investigation shows how the association between education and paid employment changes according to transport infrastructure endowment and investment, controlling for other socio-economic and cultural factors. On the whole, it can be concluded that most of transport infrastructure stock is associated with employment as long as human capital development, i.e. education, are taken into account. The women with university education were found not to be associated with increased country-wide accessibility in terms of taking up paid employment opportunities. Provincial accessibility was found to be more positively associated with lower educated women. These trends change for men: while the association between provincial accessibility and male paid employment becomes stronger and less negative, there exists no association between country-wide accessibility and paid employment for married men with university education. Therefore, these results should be interpreted to highlight the relative

importance of different levels of education in planning scale and types of transport infrastructure investments and the associated gender differences. Specifically, the significant correlations between education and different types of infrastructure differing among women and men call for more detailed analysis of the ex-ante policy analysis in infrastructure development to determine, for instance, whether lower educated women are spatially constricted or not as implied in the cross-level interaction tests in this analysis.

Overall, the analysis has shown that local economic returns can be entangled within gender, educational level and types of infrastructure built. This is something international development organisations should carefully consider when recommending one-size-fits-all macro-level strategies in the context of transport and economic development (e.g. World Bank, 2009). At a national level, it is observed that development plans in Turkey lack the consideration of these cross-sector and social equity impacts, particularly in the context of transport. The five-year development plans put in place since 1960s have maintained the dominance of road transport infrastructure investment. The environmental concerns first appeared in the Seventh Development Plan (1996-2001); the Eighth Development Plan (2001-2005) included the concept of sustainability for the first time in the history of the development policy in Turkey (Babalık, 2007 cited in Kartal, 2007). However, the motivation was solely about energy dependency and did not include any reference to the social equity aspects of transport and individuals' wellbeing with respect to physical accessibility (Kartal, 2007). Needless to say, the current development plan of the Government of Turkey (Ninth Development Plan for 2007-2013) does not include any social elements, particularly gender issues, in the context of wider benefits of transport either.

Given the significantly low levels of female paid employment, which stands out amongst those in OECD countries, the Turkish regional development policy could greatly benefit from consideration of the association between country-wide and within-province

accessibility and educational attainment in the social and cultural contexts. The results highlight the importance of regional context for female paid employment. Accordingly, the emphasis on single development issues particularly in the context of transport investments and female employment should be replaced by an integrated development planning approach accounting for infrastructure types, gender and cultural context.

The conceptual and methodological contributions of the paper should be discussed within the context of Turkey and similar emerging market economies. The main message of the paper is to highlight the importance of social and cultural contexts and the complementarity effects amongst regional economic variables including human and physical capital in the debate surrounding transport infrastructure on local and regional development. This is demonstrated through three-fold empirical contributions the study has made to the existing literature in the context of Turkey. First, the study confirms the different levels of association between social obligations and female and male employment and stresses the importance of the degree to which women carries greater responsibility for housework in the household in terms of taking up employment opportunities. This was particularly important as to integrate the cultural aspect in the gender and transport literature into the investigation of the economic growth impacts of transport infrastructure development. Second, by demonstrating that the associations between physical infrastructure and employment become statistically significant when considered with education, the complementarity argument that the impacts of transport infrastructure cannot be isolated from other social characteristics including human capital development is illustrated. Specifically, by providing a multilevel perspective, a distinction has been made between individual and regional level attributes involving the impact of cross-level interactions. As a result, the main message for future research in the context of Turkey is that the association between transport infrastructure

development and female employment should be assessed by considering non-economic factors and cross-level interaction effects.

Finally, it was shown that the nature of multilevel modelling requires more detailed data to avoid potential endogeneity problems. It is important to note that because the model uses two datasets collected in different years, 2006 HSS and 2009 LFS, it is assumed that the perceptions of the people have not changed over three years. This is likely to hold as most of the indices are based on cultural attributes and are therefore persistent over the long term. However, the model would greatly benefit from carrying out the same analysis with the upcoming 2011 FSS or any other longitudinal datasets that include the same variables to examine whether the associations do in fact remain the same. Given that these interactions are dynamic in nature, as evidenced by the economic historical investigation of railroads and waterways (Lakshmanan, 2011); the study could be advanced by bringing in a time perspective including regional spillovers over time and the dynamics of migration.

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EC	European Commission
EU	European Union
FLFP	Female Labour Force Participation
HSS	Household Structure Survey
KM	kilometre
LFS	Labour Force Survey
MLFP	Male Labour Force Participation
NUTS-I	Nomenclature of Territorial Units for Statistics (covers 12 regions in Turkey)
NUTS-II	Nomenclature of Territorial Units for Statistics (covers 26 regions of Turkey)
OECD	The Organization for Economic Cooperation and Development
PCA	Principal Component Analysis
TURKSTAT	Turkish Statistical Institute

Appendix A. Abbreviations

Appendix B. Definitions of labour force and employment status (TURKSTAT)

Non-institutional population	comprises all the population excluding the residents of dormitories of universities, orphanage, rest homes for elderly persons, special hospitals, prisons and military barracks etc.
Non-institutional working age population	indicates the population 15 years of age and over within the non-institutional civilian population.
Labour force	comprises all employed persons and all unemployed.
Labour force participation rate	indicates the ratio of the labour force to non-institutional working age population.
Employment	comprises all the non-institutional working age population who are included in the "persons at work" and "not at work" described below. Persons at work: Persons economically active during the reference period for at least one hour as a regular employee, casual employee, and employer, self-employed or unpaid family worker. Persons not at work: All self-employed and employers who have a job but not at work in the reference week for various reasons are considered as employed.

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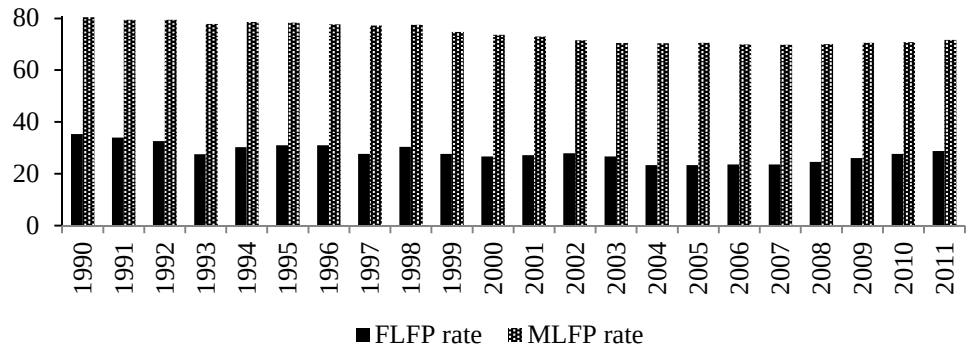
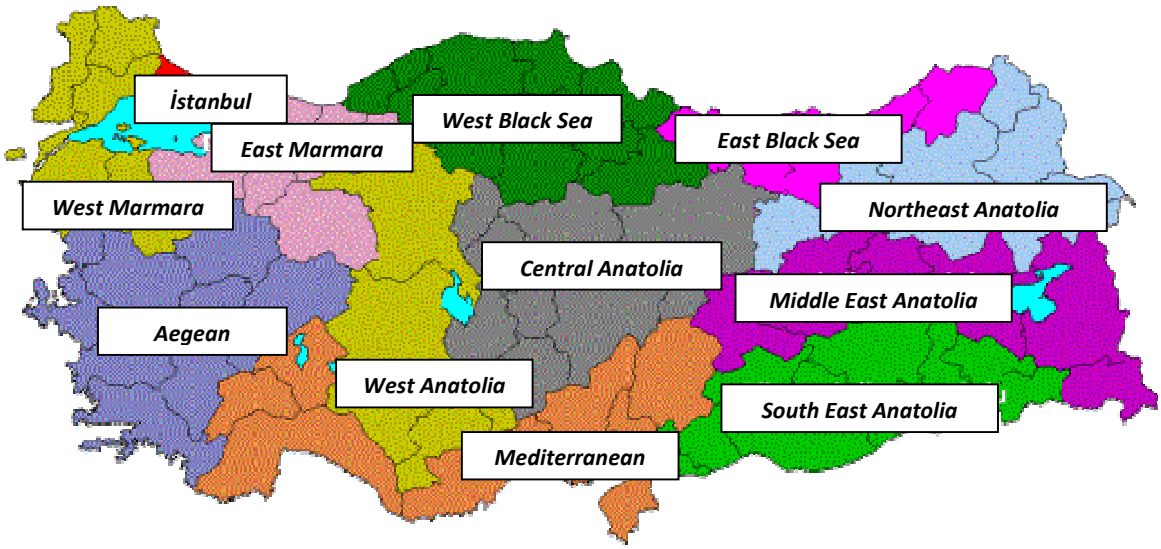
FIGURES

Figure 1: FLFP and MLFP rates in Turkey 1990-2011



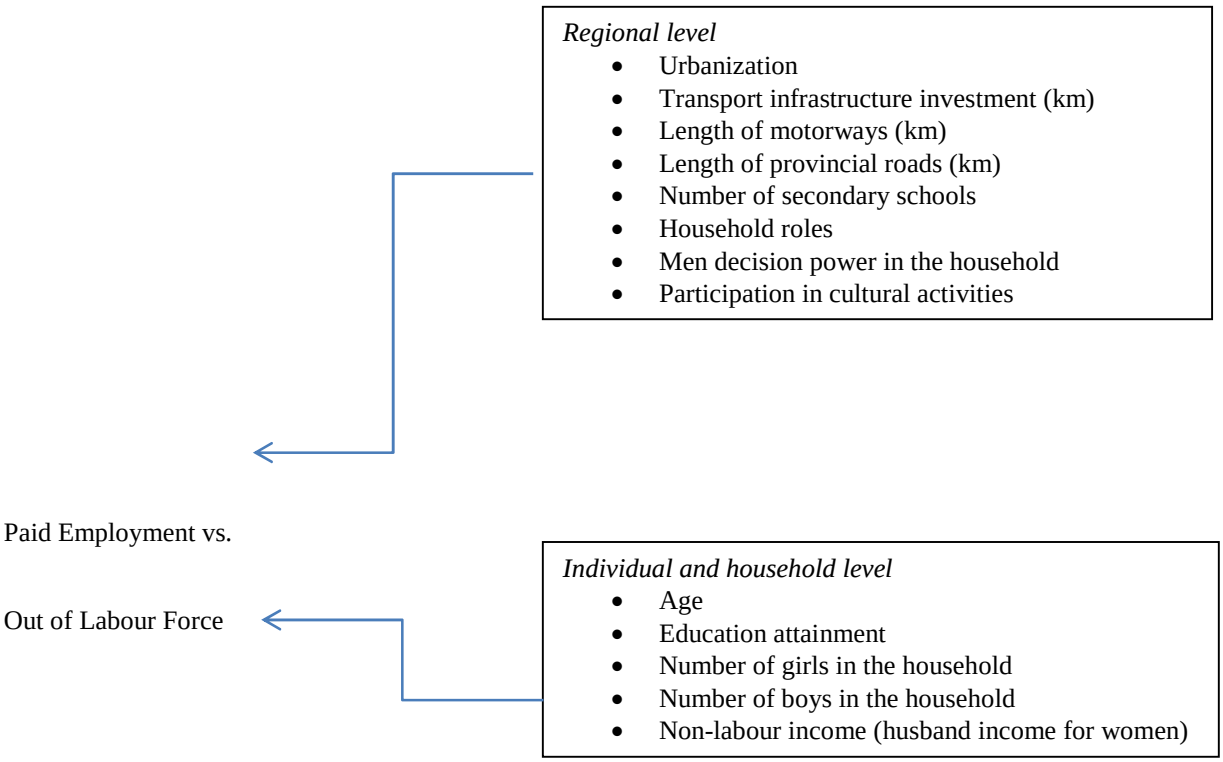
Source: Turkish Statistical Institute

Figure 2: Map of Regions of Turkey at NUTS-I Level



Source: Republic of Turkey Ministry of Development

Figure 3: Levels of Analysis



TABLES

Table 1: Comparison of the Datasets – Female and Male

DATASET	WOMEN				MEN			
	2006 FSS*		2009 LFS**		2006 FSS*		2009 LFS**	
Variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	34.01	5.000	36.71	6.916	33.79	4.996	35.20	5.359
Education	5.85	4.525	5.80	4.030	7.75	3.778	8.07	4.092
Urban	0.61	0.489	0.72	0.450	0.60	0.489	0.72	.448
No. of girls	1.39	1.206	0.78	0.969	1.25	1.145	0.87	.972
No. of boys	1.48	1.273	0.81	0.931	1.38	1.076	0.93	.937

Source: Author's calculations

*The final 2006 FSS used in this analysis covers only married women / men aged 25-47.

**The final 2009 LFS used in this analysis covers only married women / men aged 25-47.

Table 2: Multilevel binomial regression analysis – Female and Male Employment

	Intercept-only model				Random intercept model				Random intercept model			
	Women		Men		Women		Men		Women		Men	
	Log	t-stat	Log	t-stat	Log odds	t-stat	Log	t-stat	Log odds	t-stat	Log	t-stat
Fixed Part												
Intercept	-1.585	-8.57	2.702	14.4	-1.748	-13.2	2.901	16.67	-1.368	-14.1	2.882	22.5
Age					-0.015	-5.0	-0.039	-9.75	-0.012	-6.0	-0.031	-6.4
Education					0.197	65.7	0.155	25.8	0.205	68.3	0.143	23.8
No. of girls					-0.127	-9.07	0.015	0.72	-0.144	-10.3	0.032	1.52
No. of boys					-0.122	-8.13	-0.071	-3.23	-0.141	-9.4	-0.042	-1.91
Non-labour income					-0.007	0.4	0.034	3.4	0.012	0.71	0.027	2.7
Urbanization (Level 2)									-0.598	-11.7	0.271	2.2
HH. roles (Level 2)									-0.562	-12.8	-0.012	-0.14
Rel. beliefs (Level 2)									-0.102	-1.55	-0.252	-2.15
Men. dec. power (Level 2)									0.217	4.62	-0.453	-5.27
Part. cult. act (Level 2)									0.333	4.9	0.412	2.11
M. ways (Level 2)									0.141	0.19	1.217	2.12

Prov. roads (Level 2)									0.644	2.18	-0.321	-1.12
Trans. inv. change (Level 2)									-0.543	-0.7	0.474	0.76
Secondary schools (Level 2)									-0.026	-0.74	0	0
Random Part												
Level 1 - individual												
Variance intercept	1.000				1.000				1.000			
Level 2 - region												
Variance intercept	0.407	2.45	0.418	2.40	0.208	2.42	0.355	2.40	0.079	2.39	0.057	2.19
Variance partition coefficient	11.01%		11.27%		5.95%		5.19%		2.35%		1.9%	

Number of cases at regional level: 12

Number of cases at individual level (Women): 68,367

Number of cases at individual level (Men): 36,548

Abbreviations for the indicators:

HH roles: Inequality in household roles

Rel. beliefs: Religious beliefs

Men. dec. power: Men's decision power in the household

Part cult. act: Participation in cultural activities

M.ways: Motorways

Prov. roads: Provincial roads

Trans. inv. change: Transport investment change

Table 3: Cross-section coefficients of Multilevel Regression on Female and Male Employment in Turkey

	Men		Women	
	Log odds	t-stat	Log odds	t-stat
Mways	-0.051	-0.05	-0.379	-0.4
PSE X Mways	0.1465	1.674	0.591	1.950
HSE X Mways	1.715	1.597	0.829	2.543
UE X Mways	-0.668	-0.706	-0.094	-0.255
Prov.	-0.730	-1.7	1.220	3.34
PSE X Prov.	0.401	1.480	-0.558	-6.4
HSE X Prov.	0.744	2.163	-0.802	-8.18
UE X Prov.	0.499	1.574	-0.784	-6.426
TII	0.452	0.734	-0.481	-0.52
PSE	1.007	10.276	0.257	5.977
HSE	1.585	12.580	0.893	18.225
UE	2.161	18.314	3.191	56.982
Variance intercept	0.055	2.115	0.117	2.388
Variance partition coefficient	16.44%		3.43%	

PSE = Primary school education

HSE = High school education

Mways = Motorways

Prov. = Provincial roads

TII = Transport infrastructure investment

[i] Please refer to Appendix B for further details.

[ii] MLWin is used for the multi-level analysis.