Cities and Specialization: Evidence from South Asia*

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Abstract

There are several theories of why cities exist. Many revert around agglomeration externalities driven by returns to specialization. Using survey data from Nepal, we test these theories by examining the relationship between proximity to urban centers and the organization of labor. We show that wards located in and near cities have more diversified and more market oriented activities. This suggests the presence of returns to specialization which are harnessed through the market. Wage work, work away from home, and unemployment are more prevalent in and around cities. These effects are felt up to four hours of travel time from large cities. We also find evidence of a weak relationship between city size and firm size. Urban specialization, however, does not extend to household chores. Urbanization is associated with lower female labor market participation and with a more pronounced specialization of women either in market-related activites or in strictly home-based chores.

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1. Introduction

Since Adam Smith's comment about specialization being driven by the extent of the market, economists think of cities as resulting primarily from a combination of returns to specialization, market size, and agglomeration effects (e.g. Henderson 1988, Dicken & LLoyd 1990, Ades & Glaeser 1999, Fujita, Krugman & Venables 1999). From a historical perspective, manufacturing is thought to have played a central role in the formation of large cities because of returns to scale and linkages with specific segments of the service sector (e.g. Myrdal 1957, Hirschman 1958, Maddison 1982).

Similar processes need not account for Third World cities where the proliferation of microenterprises supplying identical goods and services is striking. There are few large production units, suggesting that returns to scale are not captured (e.g. ILO 1980, Fafchamps 1994). The GDP share of manufacturing in a typical developing country is small, even in large cities. This stands in contrast with developed country cities which mushroomed with industrialization. Given the limited level of technological development, skill specificity is low, and labor market externalities are expected to be low as well. Finally, since microenterprises do not purchase financial, warehousing, or marketing services, there is little specialization in the provision of industrial services.

Taking together, these simple observations cast some doubt on the idea that Third World cities are driven by returns to specialization. An alternative theory emphasizes the redistribution of surplus from the country side to an urban elite. In his study of pre-industrial societies, Braudel (1986) gives several examples of what he calls 'princely cities', such as ancient Rome, Imperial Beijing, Ottoman Istambul, and Vijayanagar in South India. All these cities reached a very large size without industrializing.[1] Judging by historical records, they had many features similar to

[1] There are other theories as well. Rural market towns, for instance, can be explained without reference to

present-day Third World cities, such as a large number of small traders and artisans and little focus on manufacturing.

The distinction between these two sets of theories has deep policy implications. Endogenous growth theory emphasizes the role of diversification and specialization in the development process (e.g. Romer 1990, Aghion & Howitt 1992, Rodriguez-Clare 1996, Fafchamps 1997). If urbanization is necessary to capture returns from specialization, then it may be a prerequisite for growth and is to be welcomed. If, in contrast, Third World cities are an artificial by-product of bloated bureaucracies, urbanization is parasitic and should be combatted.

Although cities have been extensively studied in developed countries (e.g. Jacobs 1969, Henderson 1974, Glaeser, Kallal, Sheinkman & Shleifer 1992), there is surprisingly little empirical work in developing countries, especially at the disaggregated level. This paper is an effort to fill this vacuum. We focus on two sets of related issues: the extent of specialization at the household and local level, and the form that specialization takes, i.e., through the market or within firms. We also discuss the marketization of domestic chores. The empirical analysis uses a detailed household labor survey from Nepal. The choice of Nepal as a study country is appropriate because, given the mountainous terrain, proximity to cities – measured in travel time – varies dramatically across space. As discussed in Jacoby (2000), the layout of the population is simple compared to other, more densely populated regions of the world. These features enable us to tease out of the data the effect of town proximity on the organization of work.

Regarding specialization, we find that proximity to large urban centers is associated both with more specialization at the individual and household level and more diversification at the local level. In contrast, households living in isolated areas tend to divide their time among a

returns to specialization: a small number of crafts and services would naturally gravitate around the rural market simply to economize on transport costs (e.g. von Thunen 1966, Fafchamps & Helms 1996). This phenomenon, however, cannot explain large cities.

large number of distinct activities. In spite of this, the local economy itself is less diversified. These results are consistent with claims that the concentration of population in cities favors the division of labor through the market (e.g. Jacobs 1984, Ades & Glaeser 1999, Ellison & Glaeser 1997, Glaeser et al. 1992). The unambiguous relationship between urbanization and increased specialization does not carry over to household chores. While households living close to cities allocate less time to chores such as fetching water and firewood – presumably because they purchase them from public providers – they allocate more time to cooking, cleaning, and shopping.

One important contribution of this paper is to show that specialization effects are not limited to cities themselves but spill over to neighboring towns and villages. Cities do not 'steal' non-farm jobs away from surrounding areas, quite the contrary: towns and villages close to a large urban center tend to enjoy a more diversified local economy. The reach of cities is also broader than often thought: their effect is felt up to three to four hours of travel time away.

Proximity to urban centers is associated with a higher proportion of wage employment and hierarchical workers. Much of this relationship, however, is due to differences in sectoral mix – cities emphasize sectors of activity where wage work is more prevalent and hierarchical workers more needed. Within sectors, we only find weak evidence of an association between proximity to cities and either wage work or hierarchies. Firm size and the prevalence of wage employment also affect employment strategies and the nature of unemployment and the behavior of the unemployed therefore vary with proximity to cities. These finding are consistent with standard models of urban unemployment in poor countries (e.g. Lewis 1954, Harris & Todaro 1970, Basu 1997).

2. Conceptual Framework

There are several theories of why cities exist (Dicken & LLoyd 1990). Some, like Braudel's concept of 'princely cities', view cities as the result of a political economy process whereby a 'prince' channels surplus to a geographically concentrated elite. The geographical concentration of purchasing power may affect the sectoral structure of production because of income or relative price effects – city dwellers may demand more luxury crafts, for instance. But princely cities need not exhibit returns to scale or to specialization. Such cities are costly to maintain – if only because of congestion – so that, once the prince's power vanishes, the city shrinks or disappears. New technology (e.g., higher buildings, public transportation) may enable modern princely cities to grow larger than in pre-industrial times without necessarily changing their fundamental nature. Other explanations for the existence of cities revert around the presence of agglomeration externalities: cities exist because certain types of economic activity benefit from being close to each other (e.g. Jacobs 1984, Henderson 1988, Henderson 1994).

Whether cities are of the first or second type is important for economic policy. Because of congestion, princely cities are inefficient. Output and welfare could be expanded by spreading purchasing power and factors of production over a larger area. In contrast, cities based on agglomeration externalities need not be inefficient if gains from externalities compensate losses from congestion. The purpose of this paper is to throw some light on this question by looking for telltale signs of agglomeration externalities.

We know very little about the type of agglomeration externalities that are most relevant for developing countries today. One source of agglomeration externalities is increasing returns to firm size. By definition, cities concentrate people. To the extent that a larger market enables larger firms to operate, one would expect firm size to increase with proximity to large urban centers. A corollary is that wage employment – a prerequisite for a large firm size – should also

increase with proximity to cities. This should be true not only in aggregate, but also within each sector of economic activity.

A second possible source of agglomeration externalities is returns to specialization. The idea is that geographical proximity enables individuals to specialize in the production of specific goods and services (Becker & Murphy 1992). They no longer have to be self-sufficient in a whole range of items they consume, but can focus on the few activities they are good at, and rely on the market for their other consumption and input needs. Specialization should therefore increase close to urban centers, and with it the diversity of goods and services produced. A further implication is that reliance on the market should increase with proximity to cities (Fafchamps & Shilpi 2002). Urban households should therefore produce fewer things themselves, and spend less time on chores such as fetching water, repairing the house, processing food products, and the like.

An increased division of labor through specialization can take two forms: across firms and within firms. Specialization across firms is associated with increased reliance on the market: people specialize in a single commodity or skill that they sell to others. Specialization within firms is best exemplified by Adam Smith's parable of the pin factory. It is associated with larger firm size and therefore an increased reliance of wage employment. Larger firms mean a more hierarchical organization of production, with some workers specializing in the monitoring of other workers. The circulation of information within large firms is also more problematic, hence the need for accounts, internal reports, and the like (Aoki 1988). We would expect these features to yield a different occupational structure, with more workers defining themselves as managers and clerks – those we call hierarchical workers for the purpose of this paper.[2]

A rigorous treatment of agglomeration externalities is beyond the scope of this paper and

[2] This is a simplification since many hierarchical workers also have specific skills. The proportion of hierarchical workers is very small in all sectors, precluding a breakdown of hierarchical workers into various sub-categories.

has been covered elsewhere – see for instance Fujita, Krugman & Venables (1999), Henderson (1988), and Dicken & LLoyd (1990). The theory predicts a systematic relationship between market size, firm size, specialization at the individual level, and diversification at the economy level. Larger economies are expected to be more market oriented – agents purchase goods from the market instead of producing them themselves – but also to have larger firms because of returns to scale. In contrast, agents operating in smaller economies are more diversified because they produce more goods themselves. For a more rigorous treatment of these issues, the reader may refer to Brueckner (1987)'s discussion of urban equilibria.

We expect self-sufficient producers to underreport the range of activities they are involved in. This is because some unspecialized activities take too little time to be noticed, or are combined with other activities. For instance, transporting purchased consumer goods from the nearest town to the village is typically not counted as a separate activity if it is self-provided. But it is recorded as a distinct activity if the respondent is a specialized agent, e.g., a village shopkeeper. For this reason, we expect larger economies to have a more diverse set of reported activities, i.e., to be more diversified. This is so even though individual agents are less diversified. Testing these implications and the proposition above is the object of the remainder of the paper.

3. Data

Home to the Everest, Nepal is located nearly entirely at the foot of the Himalaya mountains. It is largely rural, with 86% of its 21 million inhabitants living in villages or towns of less than 10,000 people. In the early 1990's, Kathmandu, the capital city and largest urban center, had a population of around half a million people.[3] At the last publicized census, there were only 34 cities and towns of 10,000 inhabitants or more. Given the mountainous terrain, communications

[3] 421,000 inhabitants in 1991. Current estimates put the 2000 Kathmandu population level at around 1 million. A population census was conducted in 2001 but the results are not yet available.

are difficult within Nepal. People living in the remote Northern part of Nepal must trek for many hours by foot or bullock cart before reaching the nearest road. Nepal thus offers a perfect testing ground to examine the effect of proximity to cities on specialization.

The data we use come from the Nepal Labor Force Survey (NLFS) of 1998/99. The data were collected by the Central Bureau of Statistics of Nepal (CBS). The questionnaire and survey methodology were designed in collaboration with the International Labor Organization, drawing from survey experience in similar countries (Government of Nepal 1999).[4]

Geographical coverage is extensive. The survey covers 14,355 urban and rural households spread among 719 villages or 'wards' distributed over 73 of the 75 districts of the country. Wards are administratively classified as urban and rural on the basis of their sectoral specialization relative to neighboring wards. Rural wards are those that emphasize agriculture; urban wards are those that do not. Some urban wards are located in moderately large cities; most belong to small towns and district-level administrative centers. By design, half of the surveyed wards were selected in areas classified as 'urban'; the other half were selected in rural areas. Urban areas are thus overrepresented in the sample, a feature that suits our purpose perfectly. Since the administrative classification of a ward is endogenous to the very process we seek to understand, we generally ignore it.

Twenty households were selected at random in each ward and employment-related information was collected on each household member except small children (i.e., below the age of 5). There are some 74,622 individuals identified in the sample. We focus on the 45,422 of them who

[4] As far as we know, the NLFS has not been used by other researchers, apart from the above mentioned ILO/CBS report. This is a strength to the extent that the work presented here is less subject to data mining bias. But it is also a weakness because the validity and reliability of NLFS have not been tested by other researchers. The reader will find comfort in the fact that, three years prior to the NLFS, the Central Bureau of Statistics of Nepal conducted a Living Standard Measurement Survey (the Nepalese Living Standard Survey or NLSS). The results from this earlier survey can easily be compared with similar LSMS surveys in other countries. This comparison suggests that the work done by CBS is of high quality. This is also the opinion of the World Bank staff in Katmandu.

are aged 14 and above and for whom employment data were collected.[5] Information is available not only on employment by sector and occupation, but also on household chores, subsistence activities, and unemployment. Two different recall periods were used – one week and one year. Our analysis is based on annual data whenever possible. Information on income is available only for the 26% of the sample whose main employment is wage work.

Table 1 summarizes respondents' answer to the question 'What is your main activity?'. Categories have been aggregated for presentation purposes. Farming is the main activity of 62% of the sample. Manufacturing – including handicrafts – accounts for less than 10% of the sample. Trade and trade related activities such as hotels/restaurants and transport together account for over 12% of the sample. Services account for the rest.

Respondents were asked to describe how much time they worked over the seven days preceding the survey. They were also asked to distribute their hours of work into 16 different activities which can be divided into three categories: market work, that is, work done primarily or exclusively for the market; what we call subsistence-related work, which may in part be for the market but is largely for self-consumption; and household chores, which are not for the market. Table 2 summarizes this information.

The overwhelming majority of those surveyed work in one way or another. On average, total work represents 47 hours per week. Women work more than men but most of their work time is devoted to a variety of household chores. In contrast, men allocate most of their work time to market and subsistence-related activities. Wage work represents one quarter of all male work, agriculture over one third, and non-farm self-employment close to one fifth.

Respondents were also asked to describe their employment and job search experience during the 12 months preceding the survey. Information from this part of the questionnaire is summa-

[5] 2527 household members have no employment data, probably because they were absent at the time of the survey.

rized in Table 3. In case of multiple activities, we focus on the main activity of the respondent. A breakdown by sector is provided. To economize space in the Table, we have combined similar sectors together – agriculture with domestic services, manufacturing with construction, and trade with hotel/restaurants and transport.

Results show that wage work is not equally prevalent in all sectors. Employment in the public service sector – which include health and education – is primarily salaried. In contrast, self-employment is the norm in agriculture and, to a lesser extent, in trade and trade-related sectors such as transport and hotel/restaurants The data shows that sectors with a high proportion of wage employment are also those in which workers are least likely to work from home.

The occupational structure of the labor force can be used to identify individuals involved in managerial or administrative tasks. The presence of such workers can be viewed as an index of hierarchization in the production process. The data show that the extent of hierarchical production varies dramatically across sectors: while close to one forth of those employed in private or public services are in management or administration, figures are much lower for all the other sectors – and close to zero in agriculture.

The next panel presents the information available on firm (or organization) size. In Nepal most employment is found is very small enterprises. The overwhelming majority of surveyed individuals work in firms without employees – e.g., microenterprises. This is true in all sectors except in personal and public services. In personal services, close to half the sample works in firms or organizations with at least one employee. In the public service sector, work in large organization is the norm because health and education workers, who constitute the bulk of public service workers, work for the government. The data also suggest that private firms are small. The only large employer is the government.

The bottom panel of Table 3 displays unemployment levels for the entire sample and by

sector. An individual whose previous main occupation was in a given sector is defined as unemployed in that sector. Unemployment is divided among those who actively searched for a job in the month preceding the survey, and those who did not. The two categories are roughly equivalent, except that search unemployment is less frequent in agriculture. Men are more likely to be looking for work than women. Unemployment is lowest in public services, probably because most workers in that sector are civil servant and are thus less likely to be laid off.

We complement these LFS data with information about urban population in Nepal using the 1991 population census. For our purpose, a town is defined as a settlement of more than 10,000 inhabitants. There were 34 such towns in 1991. We first compute the distance between each of the 719 surveyed ward and each of these towns. Distances are normally taken along existing roads, except when roads do not exist, in which case we calculate the shortest arc distance to the nearest road, and then the distance to various cities along the road.[6] Distances are then converted into travel time using available information about trucking and walking speeds along various types of roads in Nepal.[7] Off the road travel is assumed to take place by foot – a reasonable assumption for Nepal given the nature of the terrain.

Available information on distance to towns is summarized in Table 4. Certain wards classified as urban for the purpose of sampling are not large enough to qualify as town according to our definition. The average distance from surveyed wards to the nearest town is around 3 hours,

[6] This is a very time consuming process that requires a combination of various techniques. e.g., visual inspection of maps, statistical information on road grades, calculation of arc distances, comparisons across various measurements to identify shortest distances, etc. The assistance of Jyotsna Puri (GIS lab, Department of Research of the World Bank) was essential to the success of this operation.

[7] Travel speeds are calculated for various terrains and types of road. Assumed travel times are as follows, in km/hour:

	Highway	Provincial road	Secondary road	Off road
Terai	60	35	10	5
Siwalik	51	29.75	8.5	4.25
Middle mountain	42	24.5	7	3.5
High mountain	36	21	6	3
High Himalayas	30	17.5	5	2.5

These figures were obtained through discussion with various transportation experts and South Asia operations staff at the World Bank. Travel on highways and provincial roads is assumed to take place by truck; travel on secondary roads is assumed to be by cart.

with large differences across wards. Around 30% of surveyed wards are located either within towns or very close to towns. A little over half the surveyed households live at most two hours travel away from a town or city; the median distance is 1 hour and 35 minutes. Compared to more nationally representative surveys (Fafchamps & Shilpi 2002), this sample is slightly more urban in the sense that more sample households live in or new towns than in the country as a whole. However, there also are many households living far from towns and cities in the sample, a reflection of the mountainous and isolated nature of much of Nepal. A quarter of surveyed individuals are located more than 4 hours travel time from the nearest town; five percent are more than 10 hours away. The extent of this variation makes it easier to identify the effect of distance on economic activity. It is the main reason why Nepal was chosen.

4. Empirical Estimation

We are interested not only in testing the effect of proximity to cities on specialization, but also in identifying the reach of cities, that is, the distance over which the effect of proximity can be felt. To this purpose, we opt for a non-parametric approach and conduct empirical estimation as follows. Consider a measure of specialization y_i for individual i. Urban population residing at various distances h from household i is denoted $\{p_i(h)\}$. We want to test the effect of city proximity on variable y_i. This relationship is expected be non-linear, with unknown inflection points. It can therefore be written:

$$y_i = \int_0^H g(h)p_i(h)dh + \beta z_i + u_i \tag{4.1}$$

where z_i is a vector of regional dummies and u_i is an error term. A similar approach is adopted by Chomitz & Gray (1996) in their analysis of land use in Belize. Estimating function $g(.)$ non-parametrically provides a simple way of testing various hypotheses about the effect of location.

In addition, the estimated shape of the fitted $g(.)$ function provides useful information about the reach of cities.

The fact that function $g(.)$ is multiplied by population $p_i(h)$ and the presence of censoring in the dependent variable make estimation by conventional non-parametric techniques difficult. To turn the above equation into an estimable regression model, we discretize functions $g(.)$:

$$y_i = \sum_{h=1}^{H} \gamma_h P_i^h + \beta z_i + u_i \tag{4.2}$$

where P_i^h is the urban population residing within, say, h and $h-1$ hours of travel from household i, i.e., $P_i^h == \int_{h-1}^{h} p_i(s)ds$. Parameter H is chosen large enough that proximity effects die out, that is, such that $g(H) \simeq 0$.

To construct these P_i^h variables for $h = 1, ..., H$ hours, we combine information on distance to towns with data on population in these towns. The resulting variables give the urban population at various time distances from each ward. Consequently, they only vary from ward to ward. The variables are organized as follows. Suppose that a ward i is 3 hours away from the nearest town, which has a population of 30,000. The next nearest town is 7 hours away and has a population of 100,000. In this case we have, for each household in the ward, $\{P_i^1; ...; P_i^{10}\} =$ 0;0; 30,000;0 0;0; 100,000;0,0,0. Table 5 summarizes our constructed P_i^h variables. The average surveyed ward has an urban population of 74,000 inhabitants located within an hour of travel time. The median, however, is zero. In the regression analysis, population is measured in millions.

Estimation efficiency can be improved by requiring that the estimated γ_h parameters generate a smooth approximation for function $g(.)$. One such method is the so-called roughness penalty method suggested by Good & Gaskins (1971) and Silverman (1982). In the case of ordinary

least squares, the estimator is obtained by minimizing:

$$\sum_{i=1}^{T}[y_i - \sum_{h=1}^{H}\gamma_h P_i^h - \beta z_i]^2 + \sum_{h=2}^{H-1}\lambda^2[(\gamma_{h+1} - \gamma_h) - (\gamma_h - \gamma_{h-1})]^2 \tag{4.3}$$

where T is sample size and λ is a penalty parameter.[8]

In the analysis that follows, various measures of specialization are used, some of which are limited dependent variables. In case y_i is dichotomous so that OLS is inappropriate, the sum of squared residuals in equation (4.3) can be replaced with the required likelihood function.[9] The penalty parameter λ must be adjusted accordingly. When the estimating function is a likelihood function (and provided some other conditions are satisfied), Silverman (1984) has shown that the roughness penalty approach yields a kernel estimator. The purpose of the rest of the paper is to estimate the above model using data on Nepal. In all regressions, four regional dummies and two agro-ecological dummies z_i are included as regressors to control for geographical factors not due to proximity to cities.[10] Coefficients estimates are not reported here since they are not the focus of our analysis. All reported standard errors are robust (White) standard errors corrected for possible correlation within survey clusters.

Before proceding with the analysis, we must correct for the possible endogeneity of urban population and travel time. It is indeed conceivable that towns are larger whenever they produce more things. Observing that wards located to large towns are more diversified could then be the result of reverse causation. The same reasoning applies to road construction: public authorities

[8] These estimates of the γ's can easily be obtained using the regular OLS command by adding $H-2$ artificial observations at the end of the sample such that dependent variable and regressors are zero, except for $P_n^{n-T-1} = \lambda$, $P_n^{n-T} = -2\lambda$, and $P_n^{n-T+1} = \lambda$ for $n = T+1$ to $T+H-2$.

We experimented with bootstrapped standard errors. In our case, given the large sample size and the low penalty parameters used in the estimation, bootstrapped confidence intervals are indistinguishable from the OLS or tobit reported estimates.

[9] The linear regression model is used for censored dependent variables. This approach is justified since what we are interested in is the effect of distance to towns on $E[y]$.

[10] The five regions are Eastern, Central, Western, Mid-western, and Far Western. The three agro-ecological zones are Mountain, Hills, and Terai.

might be more inclined to build roads to farming areas that specialize in specific commercial crops. Since travel is faster on roads, this would result in specialized rural area being closer to towns in terms of travel time.

To address these concerns, we instrument city population and travel time as follows.[11] Predicted urban population is obtained by regressing the log of actual population on physical characteristics of the district in which the town is located: the log of its size in square kilometers; the log of its arable land area; the log of the distance to the nearest river; its mean elevation; the standard deviation of the elevation within the district; and a dummy if the district is the mountainous part of the country. By limiting our instruments to physical features, we minimize the risk of that instruments are themselves endogenous. [12] Size is included because larger district can hold more people. Arable land area proxies for food production potential. Distance to the nearest river proxies for accessibility, as roads often follow valleys. Elevation controls for climate: towns are less likely at higher elevations. The standard deviation of elevation is a measure of roughness in the terrain; towns are more likely in flat districts. The mountain dummy is included for the same reason. Regression results are presented in Appendix 1. The R^2 of the regression is 0.27. Regressors in general have the expected sign but are multicollinear (mean VIF of 8.7), which explains why regressors are not individually significant.[13] Since we are only interested in predicting population, multicollinearity does not matter.[14]

[11] We should point out, however, that we obtain very similar qualitative results whether we instrument population and distance or not. Results are also insensitive to the choice of instruments. The results presented here use a conservative list of instruments least suspect of endogeneity. We also obtain similar qualitative results if we use the 1971 population census instead of 1991 figures.

[12] We also experimented with a longer list of instruments, including area of irrigated land and the like. This results in a better fit for town population but the rest of the analysis is unaffected. Additional regressors are omitted in the analysis presented here to minimize the risk of endogeneity and overfitting.

[13] The Variance Inflation Factor or VIF is an informal check for the presence of multicollinearity among regressors. A VIF value of 10 or above is considered a symptom of high multicollinearity.

[14] One referee also raised the possibility that urban workers have more human capital than rural workers and thus higher returns to specialization. This, by itself, may trigger more specialization in cities even in the absence of agglomeration externalities. This possibility should be kept in mind when interpreting the results. Of course, it is also conceivable that cities attract better educated workers precisely because they need them for more specialized tasks and in larger firms. Disentangling the respective effects of human capital and agglomeration effects is left

Travel time between a ward and a town is instrumented using foot travel time as well as physical characteristics of the ward and town: size of the district; arable land; mean elevation; distance from the nearest river (available only for the town); standard deviation of elevation; and regional dummies (East-West). Foot travel time is computed using iso-elevation curves to account for the mountainous nature of the terrain. The regression is estimated in log form. Results are presented in Appendix 2. As expected, foot distance is the major determinant of travel time. Other regressors are significant as well and usually have the expected sign. The R^2 of the regression is 0.84. Population variables P_i^h used in the subsequent analysis are constructed using predicted urban population and travel time instead of actual values.[15] As it turns out, results are virtually identical to those obtained with actual values, suggesting that endogeneity of town population and road construction is not a source of bias in these data.

4.1. Sectoral division of labor

To get a sense of what the spatial division of labor looks like, we begin by examining the sectoral composition of employment as a function of proximity to cities. For individuals covered in the survey, information was collected on the sector of their main occupation. This sector is coded using the two-digit International Standard Industrial Classification (ISIC), yielding 56 distinct sectors of activity. Some of these sectors are tiny; others, such as subsistence agriculture, include the majority of the sample.

We begin by grouping sectors into broad categories such as agriculture, manufacturing, and the like. Estimates of the γ_h's are reported graphically in Figure 1, together with the asymptotic 95% confidence interval. Not surprisingly, results show a strong increase in agricultural

for future research.

[15] Standard errors are not corrected for the use of predicted regressors. Doing so would be extremely difficult given the way in which regressors are constructed. The fact that instrumented and unininstrumented results are very similar suggest that inference is very unlikely to be affected.

emphasis as one moves away from towns, but at distances of less than three hours of travel time other activities tend to predominate. Employment in all non-farm sectors decreases slowly with distance from towns, but the effect is hardly significant for private services.

In terms of sectoral division of labor, the reach of towns extends further than we had anticipated. Most areas located within one to three hours of large cities are classified as rural, yet they display a specialization pattern comparable to that of neighboring urban areas. It does not appear, therefore, that cities 'steal' non-farm jobs from neighboring villages. Similar results are reported in Fafchamps & Shilpi (2002). It is, however, possible that the proximity effect evidenced in Figure 1 is due to an urban hierarchy phenomenon: large cities may be surrounded by satellite towns that serve as relay with the countryside. Figure 1 may thus be picking a satellite town effect.

4.2. Individual and local specialization

Having clarified what the general pattern of activity looks like, we examine the extent of individual and local specialization. We begin by constructing a simple specialization index as follows. Let n_{ij} denote the number of hours of work spent on activity j by individual i and let $N_i \equiv \sum_{j=1}^{M} n_{ij}$. Then the specialization index S_i is defined as:

$$S_i \equiv \frac{\sum_{j=1}^{M} n_{ij}^2}{N_i^2}$$

The index is basically a Simpson index. With complete specialization, the index takes the value 1: individual i allocates all of his or her time to a single activity. With perfect diversification – equal time spent on each activity – the index takes the value $1/N_i$. The index is insensitive to size effects or choice of unit – i.e., it does not change if all n_{ij}'s are multiplied by the same constant.

Index S_i was computed for each surveyed individual using data on hours spent working in each of seven different production activities – wage work, non-farm self-employment, agriculture, construction, food processing, handicrafts, and other work. Average values for S_i are 0.94 for men and 0.92 for women if we exclude household chores; 0.80 and 0.42 if we include them. We thus see that most individuals specialize in a single market or subsistence-related activity but are usually involved in household chores as well. When chores are included in the index, women appear more diversified than men. This is in part because chores are finely defined in the questionnaire.

Estimates of the γ_h's for the specialization index are reported graphically in Figure 2a.[16] Household chores are excluded as they are discussed below. Results show that individuals residing close to large population centers have a higher specialization index, meaning that they are more focused on a few productive activities.

This finding might be due to the fact that individuals within a household specialize more near towns albeit households remain equally diversified. To verify this possibility, we construct a similar index at the household – rather than individual – level and repeat the procedure. The results, not shown here for the sake of space, are virtually identical. Both sets of results indicate that the effect of proximity is felt up to four hours travel time away from urban areas, which is a longer distance than we expected. Cities shape more of the surrounding rural areas than is typically recognized.

Next we construct a similar index for wards and reestimate the γ_h coefficients. The average indices are 0.27 and 0.52 with and without household chores, respectively. Results, shown on Figure 2b, display the opposite pattern: wards located in and near cities are more diversified.[17]

[16] Because of heavy censoring, we use a tobit estimator for this regression. To control for possible correlation of errors within wards, we use a ward-level random effect tobit.

[17] For each ward, the specialization index measures the extent of specialization among 20 randomly selected households. Given that the same number of households is surveyed in each ward irrespective of ward population,

We repeat the analysis with another, more detailed way of measuring diversification at the ward level. By definition an individual has a single main occupation, so that an individual specialization index by occupation cannot be computed. But we can use the 56 ISIC codes to construct a more precise measure of economic specialization at the ward level. The ward specialization index is computed as:

$$S_k \equiv \frac{\sum_{j=1}^{M} p_{kj}^2}{P_k^2}$$

with p_{kj} is the number of sampled working individuals in ward k whose main activity is activity j and P_k is the total number of sampled working individuals in ward k. If all surveyed individuals in a ward have the same main occupation (e.g., farming), the index takes value 1.

The average of this index across all wards is 0.26. Since farming is the main activity of over 60% of the sample, we also compute a non-farm occupation diversity index for each ward. Its average value is 0.47. Regression results are presented in Figures 3a and 3b. Figure 3a includes all sectors; Figure 3b excludes agriculture. Both Figures show a strong upward trend, indicating that wards located in or near cities are more diversified in general and have a larger portfolio of non-farm activities. The effect of urban proximity is felt up to four hours of travel time.

4.3. Division of labor and household chores

We then investigate whether specialization carries over to household chores. We expect that many activities described as household chores in rural areas are taken over by market providers in cities. Firewood and water are good examples of commodities that are typically self-provided in villages but purchased from specialized suppliers in towns and cities. Similar principles can apply to other household chores: home cooking can be replaced by restaurants and pre-cooked foods;

we do not have to worry about population size affecting the ward specialization index.

the time spent cleaning the house cleaning can shortened by purchasing household appliances or hiring outside help; etc (Becker 1965).

Whether or not specialization carries over to household chores depends on other factors as well. The physical size of homes, for instance, is likely to be smaller in cities because land prices are higher. Consequently, we would expect households to spend less time cleaning their home, in which case it may not be necessary to rely on market providers. Urban households are also likely to have higher incomes. To the extent that good food and a clean home have a high income elasticity, one would expect urban dwellers to spend more resources on cooking and cleaning. If, at the same time, wages are higher in urban areas so that domestic help is more expensive, urban households may decide to self-provide cooking and cleaning.

We already saw that employment in hotel/restaurants and domestic services is more prevalent in and around cities. We now investigate whether this is sufficient to reduce the time spent on household chores. Each surveyed individual was asked to detail the number of hours spent in 16 categories of activities during the seven days preceding the survey. These 16 activities can be divided into three groups: predominantly market-oriented activities (wage work, non-farm self-employment, and handicrafts); activities pursued partly for the market, partly for self-subsistence (agriculture, food processing, construction and repairs, and miscellaneous work); and predominantly self-subsistence activities (cooking, cleaning, minor repairs, shopping, caring for the old, childcare, fetching water, collecting firewood, and volunteer community services). The third category is what we call household chores. We focus on the share of total work time reported in each of these activities and groups of activities.

Wage work and non-farm self-employment display a strong urban proximity effect. This effect tapers off around four hours away from large cities. The results are not shown graphically for lack of space. Agricultural and food processing work increases strongly with distance from

cities. Other market and subsistence activities do not display strong proximity effects but they represent only a small proportion of total work. In contrast, strong proximity effects are found in household chores (Figure 4). As anticipated, the share of work-time spent fetching water and firewood increases rapidly with distance from cities. The same pattern applies to time allocated to minor repairs and childcare. We also see that the share of time spent shopping drops dramatically with distance. This confirms that reliance on self-subsistence increases with distance from cities (Fafchamps & Shilpi 2002).

Results for cooking and cleaning, however, do not fit this pattern: the share of total work time spent on these two activities is much larger close to cities.[18] Together, the effect of cleaning and cooking is so strong that the share of household chores in total work is larger in and around cities (last panel of Figure 4). Although market specialization applies to some household chores such as water and firewood provision, it does not extend to more 'bourgeois' chores such as cooking and cleaning. For these chores, self-provision absorbs an increasing share of total work time as proximity to cities rises. This result may be due to a high income elasticity for home food and a clean house coupled with a female wage effect. This issue deserves more research.

Since cooking and cleaning are also activities most subject to gender casting, urbanization turns out to be associated with a sharper distinction of gender roles. Further analysis (Figure 5) indicates that urban women tend to specialize more than their rural counterparts, and that they specialize primarily in household chores. Urban women also spend more time in market-related activities, principally small businesses. In contrast, they spend much less time in subsistence activities such as farming. As a result, women's share of unpaid work in total work tends to decrease with proximity to cities. These findings present a mixed picture regarding the effect of town proximity on women. They suggest that, for a small percentage of women, town

[18] The same pattern is obtained if shopping is excluded from the list of household chores.

proximity is associated with more market-related work – wage employment, small businesses – and hence more financial independence. For many women, however, it is synonymous with less work outside the home and more emphasis on household chores. These findings thus contradict the perception that 'traditional ideas' and 'backwardness' are to blame for allocating household chores to women. If anything, women spend more time working in and around the home in urban areas. These issues deserve more research.

4.4. Wage employment, firm size, and hierarchies

Specialization may take two forms: through the market or within firms (Williamson 1985). So far we have examined specialization through the market. We now investigate whether specialization is also related to increased firm size. The first indicator we use is the proportion of wage employment in total employment. Surveyed individual were asked to describe their employment status in their main job. We divide the sample between salaried and self-employed workers.[19] Urban population is our measure of market size.

Results show a strong relationship between proximity to cities and wage employment (last panel of Figure 6). The cut-off distance again is four hours of travel time. This constitutes preliminary evidence that town proximity is associated with larger firm size. Wage employment is closely related with work outside the home: 87% of the self-employed work in or around the home while 89% of wage workers work outside the home. The difference is strongly significant. Regressed on distance to cities, work outside the home also displays a strong proximity effect. To the extent that larger firm size requires assembling many individuals and equipment under a common roof, work outside the home is another indicator that firm size increases with town proximity.

[19] Employers are put in the same category as wage worker since they rely on salaried labor. They represent a very small proportion of the sampled population, however, so that they do not really affect results.

These effects might, however, be due to differences in the sector mix. Wage employment is indeed more prevalent in certain sectors than others (Table 3). To investigate this possibility, we reestimate Figure 6 for each of 5 broadly defined sectors. Results, shown in the first five panels of Figures 6, show a negative relationship between distance and wage employment in four of the five sectors. The effect, however, is only significant for agriculture. This suggests that much of the relationship between cities and wage employment is due to sectoral effects. In the public services sector, wage employment actually increases with distance from towns and cities. This is probably due to the fact that, in cities, there exist small-scale private providers of health and education while, in rural areas, these tasks are predominantly performed by government employees.

The respective role of wage and self-employment indicates whether people work in microentreprises or in larger firms, but it does not make any further distinction by firm size. Respondents were asked how many regular paid employees were employed at their place of work. Data were collected as categories – no paid employees, 1 to 4, 5 to 9, and 10 or more. Ordered probit regressions applied to the data uncover a strong proximity effect: firms are larger in the proximity of cities (last panel of Figure 7). But the effect is again much weaker within individual sectors. As for Figure 6, the effect is only significant for agriculture. Public services again display the opposite pattern.

Finally, we seek clues about the existence of hierarchies in the occupational structure of the sample. Large firms require managers and administrative personnel to supervise their workers and ensure the circulation and preservation of information within the firm. Figure 8 shows that respondents are more likely to describe themselves as managers or clerks if they work close to cities. The shape of the relationship is reminiscent of Figures 6 and 7, confirming the association with firm size. Within sector, however, the relationship between urban proximity and

hierarchical occupations is loose and mostly non-significant, except for agriculture and trade.

Taken together, these results indicate that cities have larger firms because they harbor more activity in sectors where firms are large. Within sectors, firm size is only weakly associated with distance to and size of urban markets.

4.5. Unemployment, labor supply, and labor market participation

The urban and peri-urban emphasis on wage employment has implications on the nature of unemployment and the behavior of the unemployed. The availability of wage work should encourage an explicit search for wage employment. In contrast, if the primary mode of employment is self-employment, searching for a job is irrelevant. Unemployed individuals must instead search for the means to initiate self-employment – land, bullocks, trade skills, or start-up capital. The form that unemployment takes is thus expected to take a different form depending on the relative importance of wage employment – and thus on the proximity to cities. Proximity to wage employment may also change people's perceptions. Individuals not looking for work may nevertheless declare themselves as unemployed if they think that they might one day be faced with a wage employment offer.

Respondents were asked whether they 'wanted to work more' and whether they 'looked for work' in the month preceding the interview. We treat responses to the first question as a measure of unemployment (or underemployment), and responses to the second question as indicative of job search. Using these data, we construct two variables: search unemployment (those looking for a job), and non-search unemployment (those unemployed who did not look for a job). Regression results are summarized in Figure 9. As anticipated, we find a strong relationship between city size and search unemployment. But, contrary to our expectation, the relationship between non-search unemployment and proximity to city is equal in significance and

magnitude. Results nevertheless confirm that unemployment is more prevalent close to large cities.

It is instructive to compare unemployment to labor supply. Respondents were asked how many days they were working or available for work in the 12 months preceding the survey.[20] We use this information as our measure of labor supply. Results show a dramatic increase in labor supply as one moves away from urban areas (Figure 10c). In other words, unemployment is higher in and near cities, but labor market participation is lower.

This result, however, masks a sharp difference between male and female labor supply: while male labor supply shows a mild increase with distance, female labor supply sharply drops in the vicinity of urban centers (Figures 10a and 10b – note the difference in the scale of the graph). This again reflects the channeling of female labor towards home-based chores.

5. Conclusion

We have examined the relationship between proximity to cities and specialization. We found that individuals living close to large urban centers are more specialized while the local economy is less specialized. These results are consistent with the presence of returns to specialization. They are precisely what one would expect if the concentration of population in and near cities favors the division of labor. Cities exist presumably thanks to some kind of agglomeration effect. What our results suggest is that specialization and the ensuing division of labor are one likely source of agglomeration effect. These findings are similar to those reached by Jacobs (1984), Glaeser et al. (1992), Ades & Glaeser (1999), and Ellison & Glaeser (1997) for other parts of the world. Our work demonstrates that these principles apply to poor countries as well, in spite of circumstantial evidence to the contrary – e.g., large number of microenterprises

[20] To minimize recall bias, the information was individually collected for each of the 12 months preceding the interview and subsequently combined.

in Third World cities. It also shows that specialization effects extend beyond the immediate boundary of cities themselves and affect surrounding villages and towns. Proximity to cities favors rural diversification. Taken together, these results suggest that cities are not necessarily bad for development.

The results presented here indicate that urban and peri-urban areas have more wage workers, larger firms, and a more hierarchical organization of production. Much of this relationship, however, is due to differences in sectoral mix – cities emphasize sectors of activity where wage work is more prevalent and hierarchical workers more needed. We also find evidence of increasing returns due to market size within sectors, but the magnitude of the effect is much smaller and often non-significant. The distinction is important because it is often believed that the geographical distribution of firm size is primarily a consequence of firm-specific returns to market size (e.g. Bain 1956, Sherer 1973, Pryor 1972). Our analysis suggests instead that firm size depends primarily on sector – and thus on technology. Cities have more wage work mainly because the sectors of activity that are found there are composed of firms whose technology favors large size and a hierarchical mode of organization.

Firm size and the prevalence of wage employment also affect employment strategies. If wage jobs are easier to find in and around cities, urban residents who are unemployed or underemployed are more likely to search for wage employment instead of engaging in self-employment. Because search takes time, we expect active job search to be concentrated in and around cities. This is confirmed by the data: unemployed individuals searching for a (wage) job are predominantly located close to towns and cities. In contrast, there is no relationship between proximity to cities and the number of unemployed individuals *not* searching for a job. The nature of unemployment and the behavior of the unemployed therefore vary with proximity to cities. These finding are consistent with standard models of urban unemployment in poor countries (e.g.

Lewis 1954, Harris & Todaro 1970, Basu 1997).

Our analysis also brings to light the fact that specialization does not extend to all household chores. While households living close to cities allocate less time to chores such as fetching water and firewood – presumably because they purchase them from public providers – they allocate more time to cooking, cleaning, and shopping. As far as shopping is concerned, this finding is consistent with the marketization of the urban economy. In contrast, the increased time spent cooking and cleaning represents a move away from the market. It probably reflects an increased demand for better meals and a cleaner house, without a proportional increase in the marketization of domestic services (e.g., through restaurants, domestic servants, and the like).

This has implications for the gender division of labor. For a small percentage of women, proximity to cities means more market-related work in the form of wage employment and small businesses. But in general, town proximity is associated with lower female labor market participation and a more pronounced specialization of women in strictly home-based chores. This suggests that towns favors a shift in preferences towards a more 'bourgeois' life-style. Since we do not have information on income, we cannot tell whether this only reflects a high income elasticity for home cooked meals and a clean home, or whether living in towns affects preferences independently from income. But it is proximity to towns, not isolation or backwardness, that decreases female work outside the home and favors a sharper division of labor between men and women. Urban women who work are an exception: increased specialization in and and around cities makes them more financially independent as less emphasis is put on unpaid work on the family farm.

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Table 1. Sectoral Distribution — Main Activity

	Number	%
Agriculture	22740	62.0%
Manufacturing	3510	9.6%
Construction	1461	4.0%
Trade	2961	8.1%
Restaurants and hotels	907	2.5%
Transport	806	2.2%
Private services	1072	2.9%
Public services	1945	5.3%
Domestic services	1263	3.4%
Number of observations	36665	

Based on answers to the question 'What is your main activity?'

Table 2. Labor Supply and Type of Work
(based on a one week recall questions)

Labor supply	**All**	**Male**	**Female**
Percentage who work	89.9%	86.5%	93.2%
Hours of work per week	47	42	51
Number of observations	45422	22116	23306
Of those who work:			
A. Market work			
Wage job	14.7%	25.5%	5.3%
Non-farm self-employment	11.8%	18.8%	5.7%
Handicrafts	0.7%	0.5%	0.9%
Total:	27.3%	44.8%	11.8%
B. Subsistence-related work			
Agriculture	33.6%	37.2%	30.4%
Food processing	1.0%	0.4%	1.4%
Construction	0.6%	1.0%	0.2%
Other work	0.4%	0.5%	0.4%
Total:	35.6%	39.1%	32.5%
C. Chores			
Cooking	13.9%	2.5%	23.9%
Cleaning	9.0%	2.4%	14.9%
Minor repairs	0.8%	0.6%	1.0%
Shopping	2.9%	4.3%	1.7%
Care for the old	0.5%	0.5%	0.5%
Childcare	6.8%	3.2%	9.9%
Volunteer community service	0.4%	0.7%	0.1%
Water collection	1.1%	0.6%	1.6%
Firewood collection	1.7%	1.4%	2.1%
Total:	37.2%	16.2%	55.7%
Number of observations	40837	19122	21715

Based on answers to the question 'What did you do over the last week?'.

Table 3. Sample characteristics

	All	Agriculture	Manuf. & contruction	Trade & transport	Personal services	Public services	Male	Female
A. Wage employment								
% in wage employment	26.0%	10.7%	60.4%	25.9%	67.3%	95.1%	36.1%	14.5%
B. Location of work								
% who work away from home	31.3%	11.1%	62.9%	63.1%	86.3%	95.0%	43.6%	17.9%
Number of valid observations	35083	22639	4861	4583	1057	1940	18573	16510
C. Hierarchy:								
% in managerial or clerical position	2.9%	0.1%	3.9%	2.8%	23.6%	24.2%	4.7%	1.0%
Number of valid observations	36667	24003	4971	4674	1072	1945	19195	17472
D. Firm size:								
No employee	88.7%	98.2%	77.5%	85.2%	52.7%	9.8%	82.4%	95.4%
One to four employees	3.6%	1.2%	8.9%	11.3%	10.4%	1.7%	5.5%	1.6%
Five to nine employees	0.6%	0.1%	2.8%	1.1%	1.2%	0.9%	1.0%	0.3%
Ten or more employees	7.1%	0.5%	10.9%	2.3%	35.7%	87.6%	11.2%	2.8%
Number of valid observations	32613	22332	3714	4125	824	1618	16783	15830
E. Unemployment:								
% who searched for a job last year	3.8%	2.2%	3.9%	1.9%	3.7%	1.2%	4.1%	2.3%
% who did not search for a job	4.1%	3.7%	3.3%	1.3%	3.4%	1.0%	3.3%	3.5%
Unemployment rate (*)	8.0%	6.1%	7.8%	2.7%	5.5%	1.6%	8.3%	7.7%
Number of valid observations	37503	23914	4952	4665	1071	1943	19549	17954

(*) Time available for work/(work time+time available for work)

Based on questions relative to employment and unemployment over the 12 months preceding the survey.
Headings A, B, C, and D report the percentage of employed adults in the various categories.
Heading E refers to the percentage of unemployed in the active population, that is, among those employed plus unemployed.
We distinguish between those who actively looked for a job over the last 12 months from those who did not.
The breakdown by sector depends on the primary sector of activity declared by the respondent.

Table 4. Distance from Nearest City

	Wards		Individuals	
At most one hour	202	29.7%	13460	31.9%
One to two hours	169	24.9%	10266	24.3%
Two to three hours	80	11.8%	4598	10.9%
Three to four hours	68	10.0%	4146	9.8%
Four to five hours	39	5.7%	2387	5.6%
Five to six hours	37	5.4%	2246	5.3%
Six to seven hours	23	3.4%	1365	3.2%
Seven to eight hours	8	1.2%	496	1.2%
Eight to nine hours	12	1.8%	720	1.7%
Nine to ten hours	9	1.3%	560	1.3%
Ten to eleven hours	5	0.7%	304	0.7%
Eleven to twelve hours	5	0.7%	317	0.8%
Twelve to thirteen hours	6	0.9%	385	0.9%
More than thirteen hours	16	2.4%	1008	2.4%
Number of observations	679		42258	

Table 5. Proximity to Urban Population
(population expressed in thousands)

Travel time category:	Mean	Median	Minimum	Maximum
Up to one hour	26	0	0	197
One to two hours	27	0	0	221
Two to three hours	22	8	0	221
Three to four hours	20	0	0	244
Four to five hours	22	7	0	236
Five to six hours	28	14	0	236
Six to seven hours	36	17	0	245
Seven to eight hours	26	9	0	274
Eight to nine hours	22	6	0	228

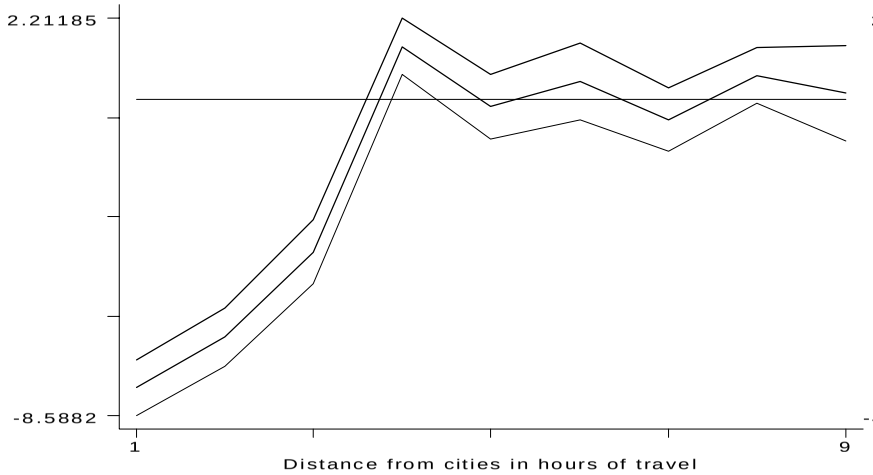

Figure 1a. Urban wards only

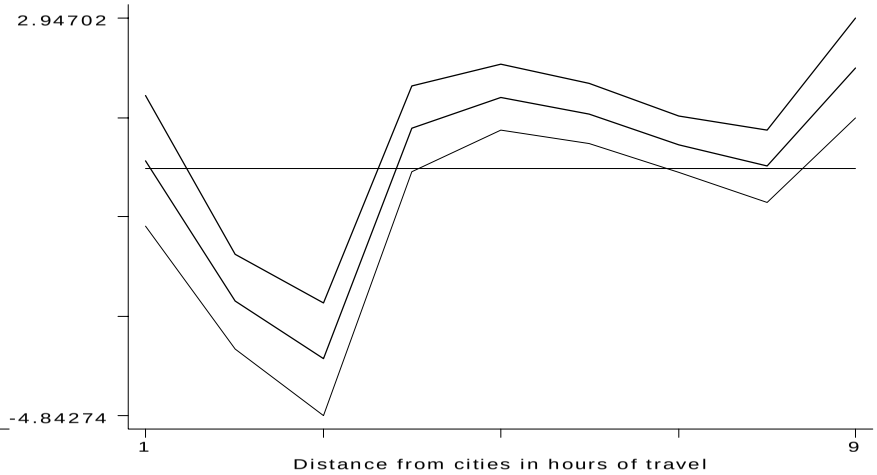

Figure 1b. Rural wards only

Figure 1. Agricultural employment in urban and rural wards

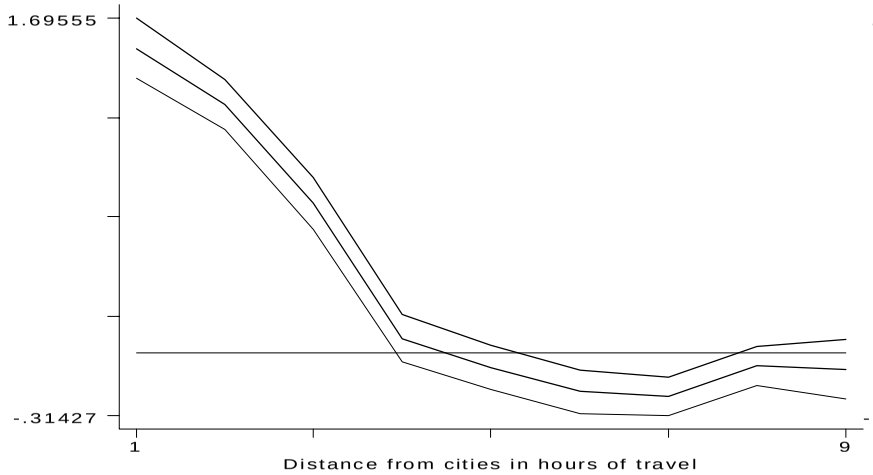

Figure 2a. Individual specialization index

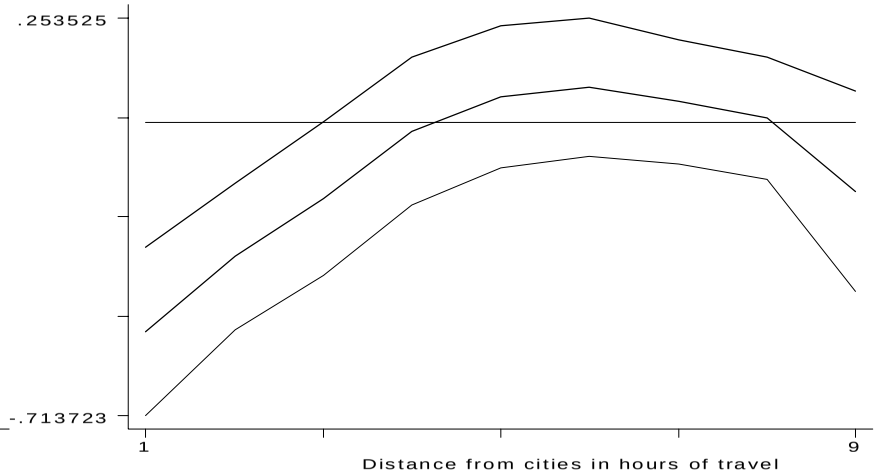

Figure 2b. Ward specialization index

Figure 2. Specialization index

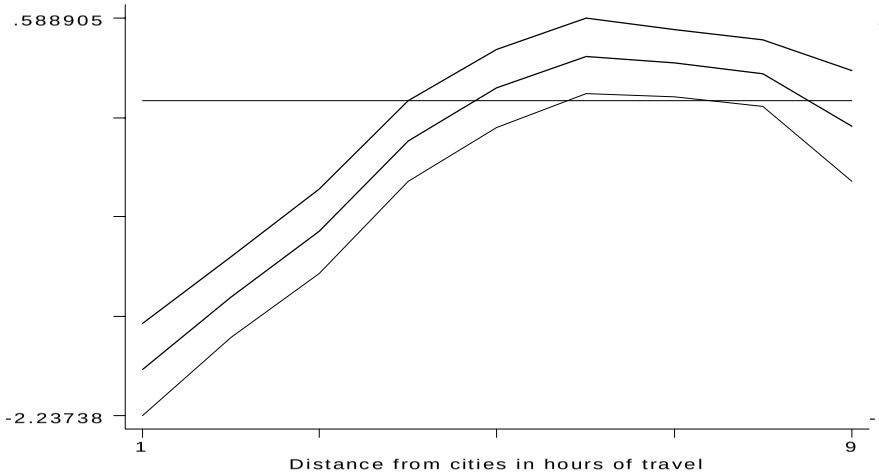

Figure 3a. Including agriculture

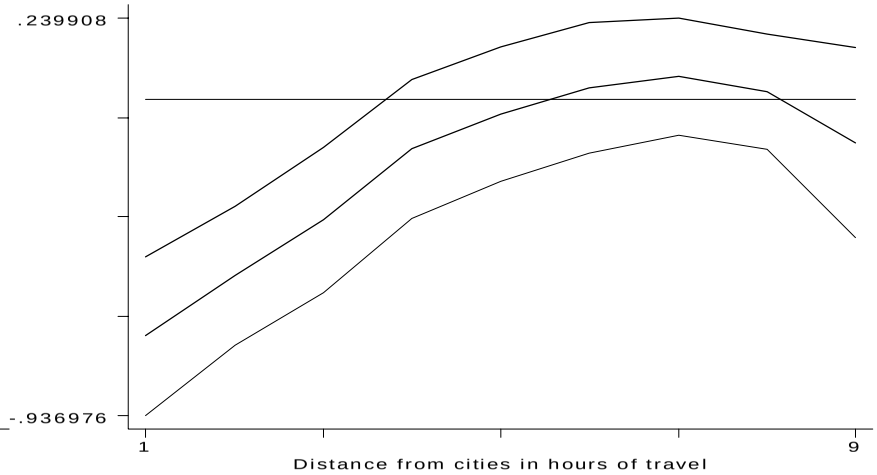

Figure 3b. Excluding agriculture

Figure 3. Occupational diversity in wards

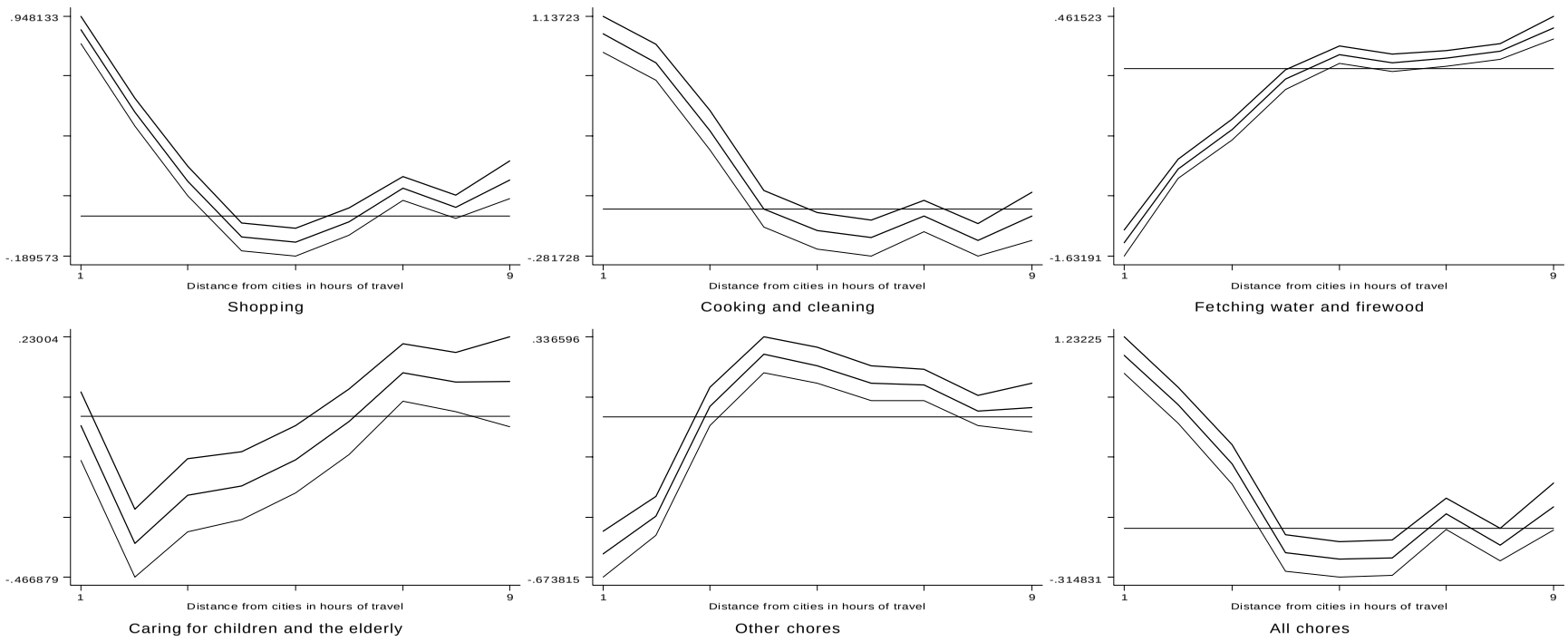

Figure 4. Household chores

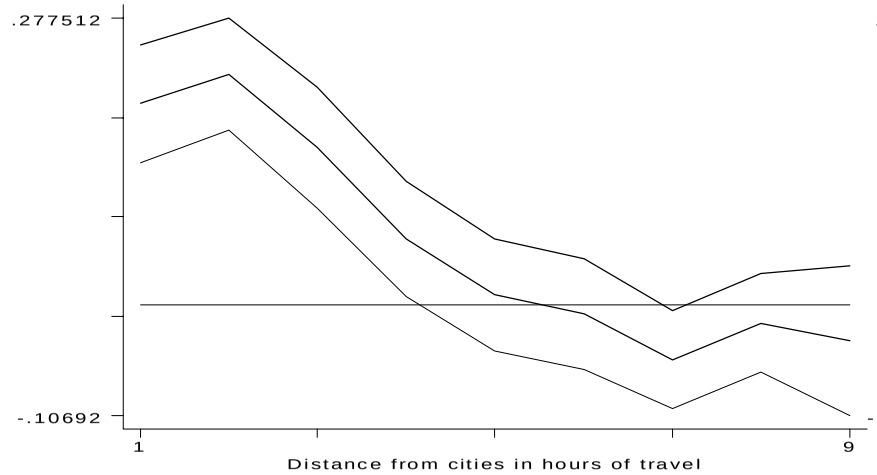

Figure 5a. Individual specialization index

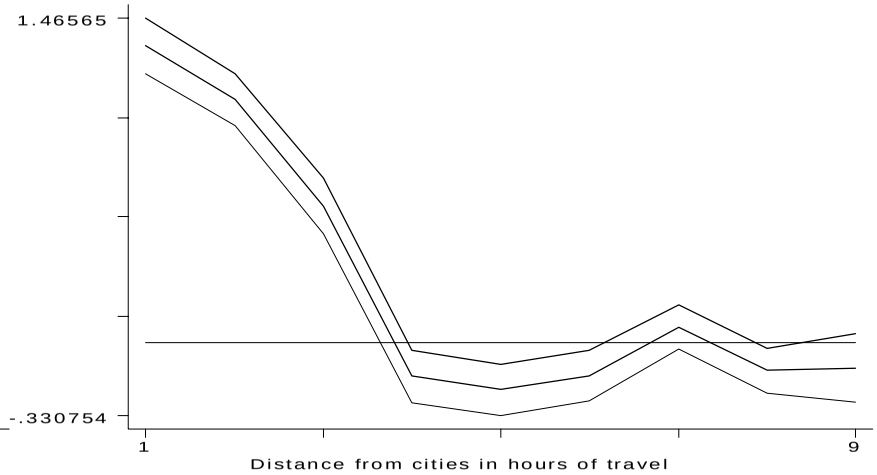

Figure 5b. Share of chores in total work

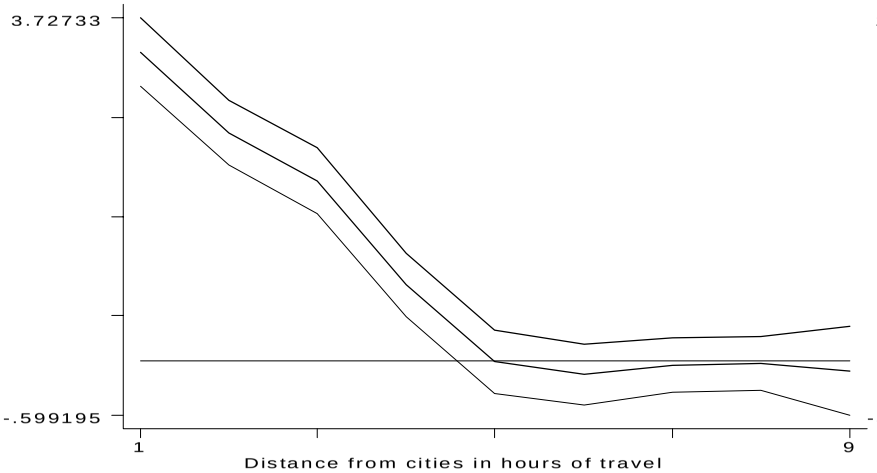

Figure 5c. Share of market work in total work

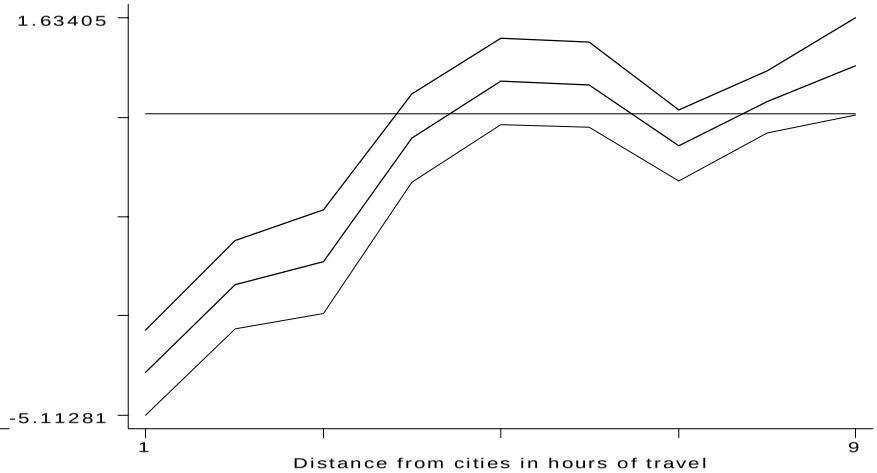

Figure 5d. Unpaid work

Figure 5. Female specialization

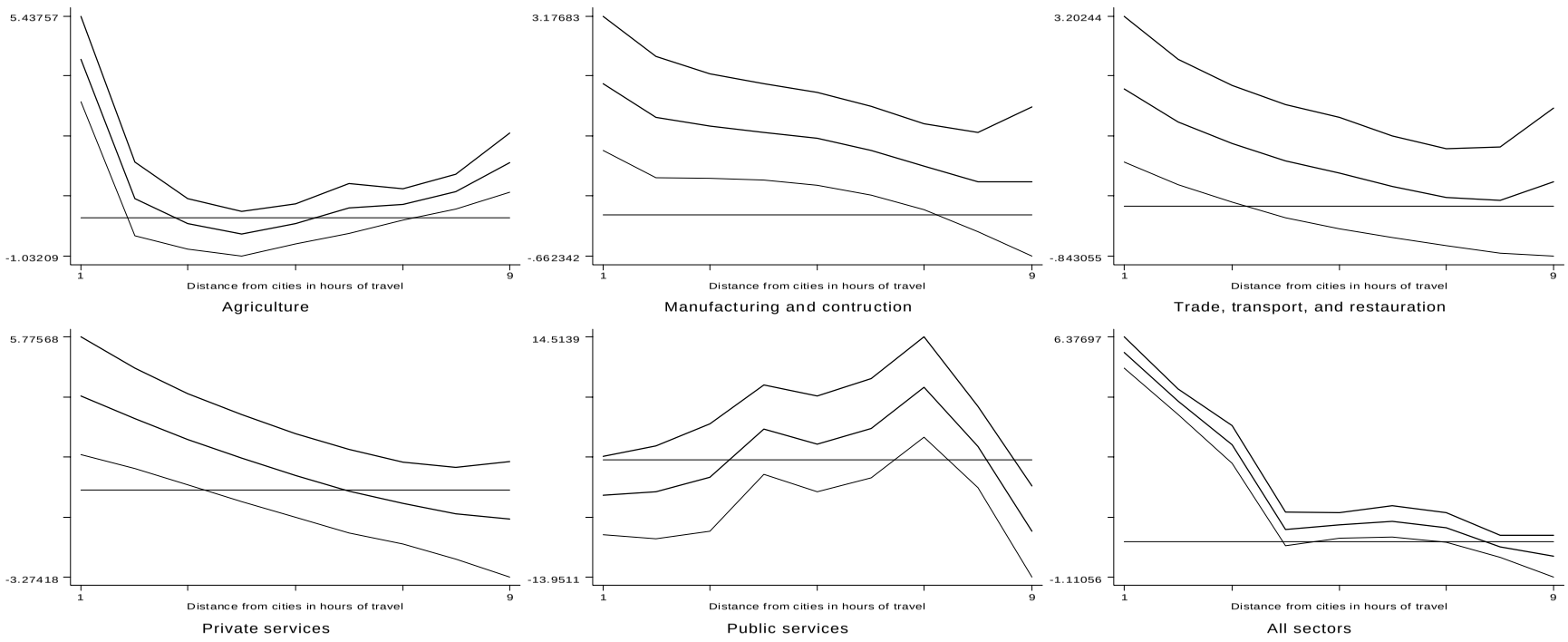

Figure 6. Share of wage employment

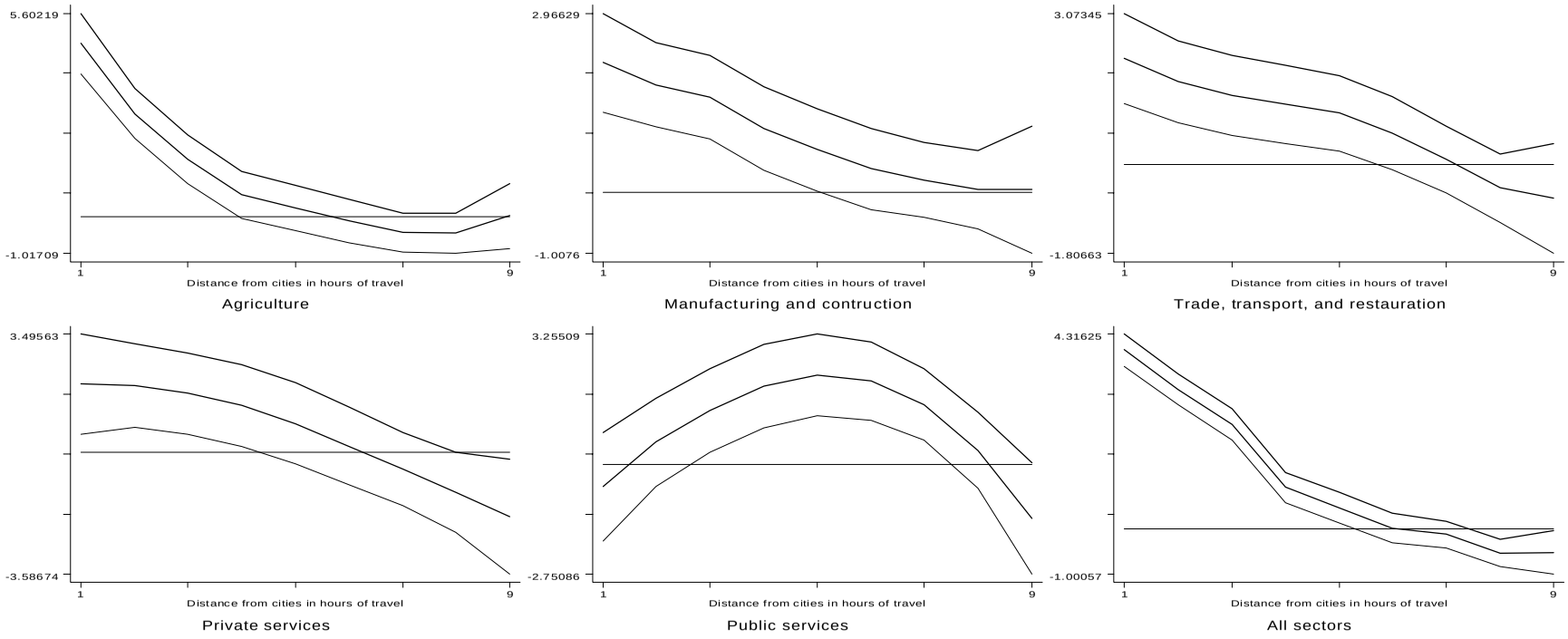

Figure 7. Firm size

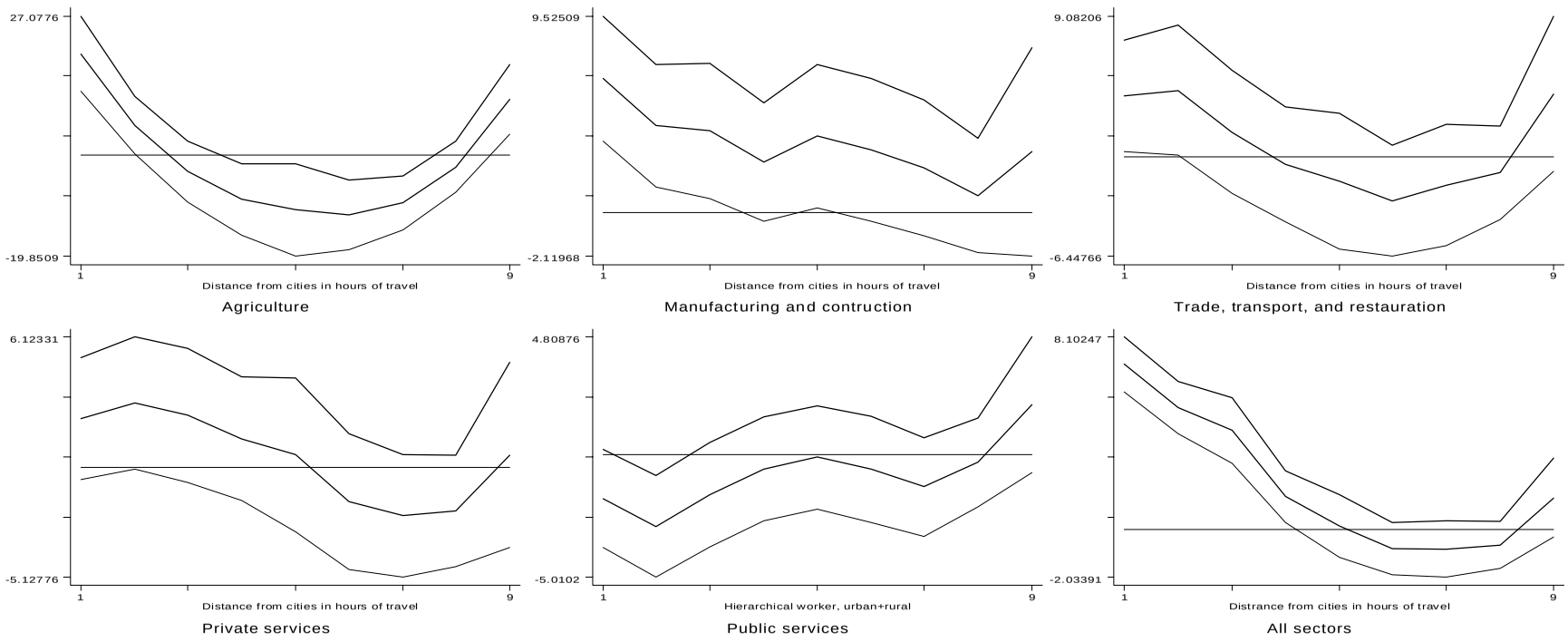

Figure 8. Share of managers and clerks in employment

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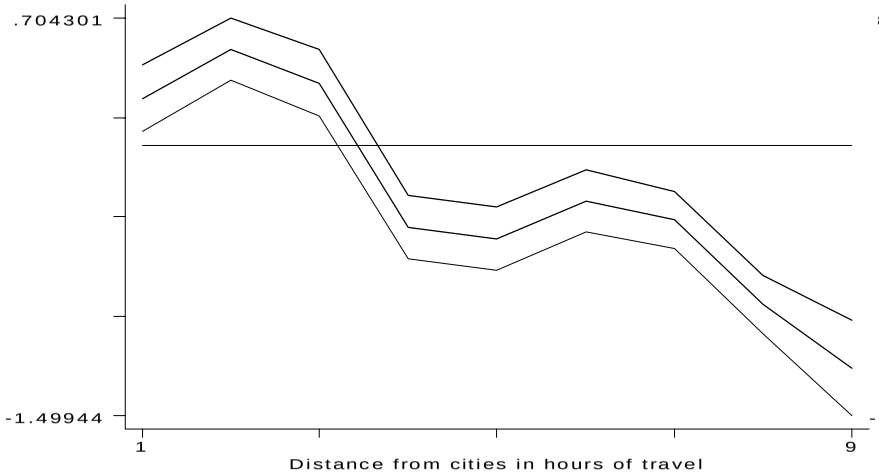

Figure 9a. Unemployment rate

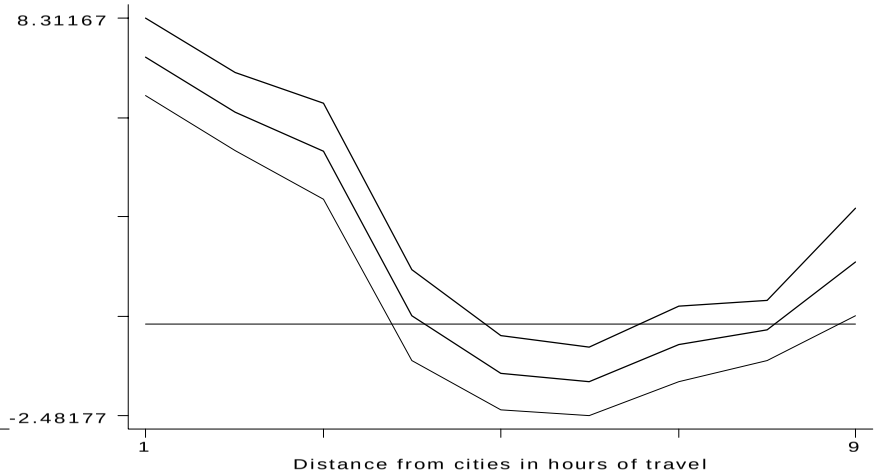

Figure 9b. Search unemployment

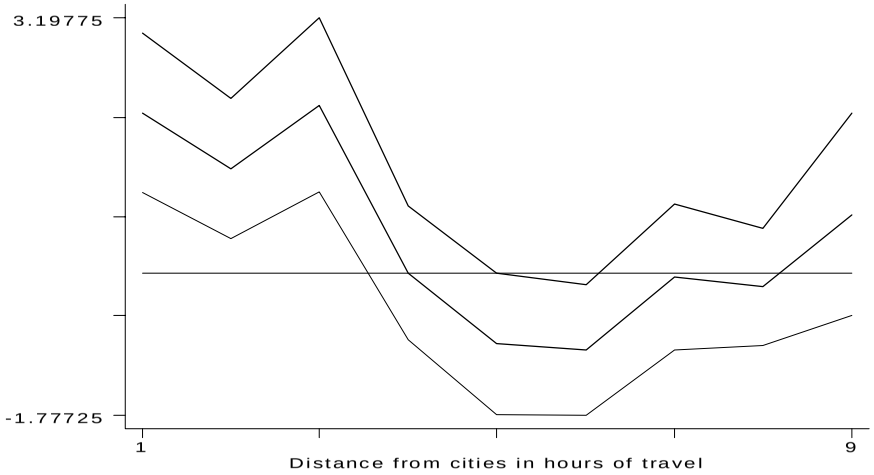

Figure 9c. Non-search unemployment

Figure 9. Unemployment

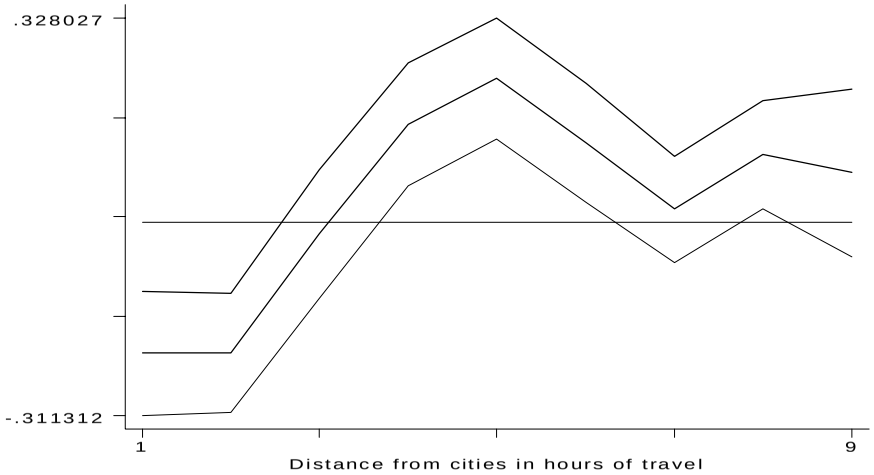

Figure 10a. Males only

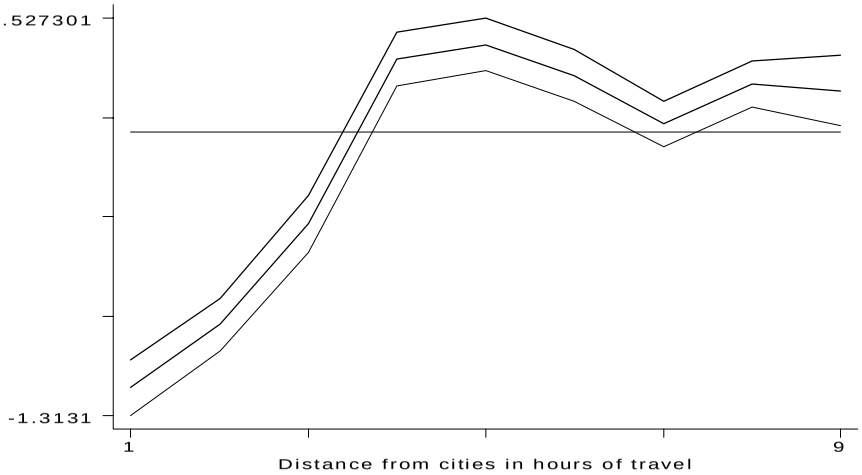

Figure 10b. Females only

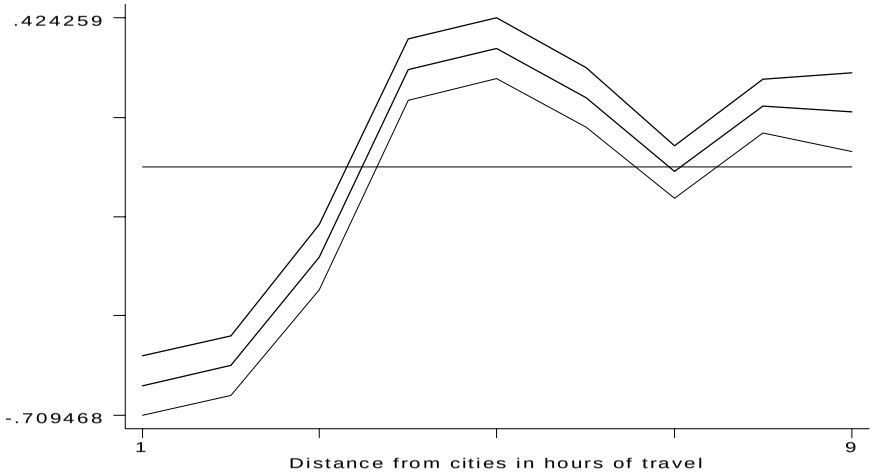

Figure 10c. All individuals

Figure 10. Labor supply