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Abstract

The existence of compensating differentials in Russian labor and housing markets is examined using data from the Russian Longitudinal Monitoring Survey (RLMS) augmented by city and regional-specific characteristics from other sources. While Russia is undergoing transition to a market economy, we find ample evidence that compensating differentials for location-specific amenities exist in the labor and housing markets. Our estimated wage and housing value equations suggest that workers are compensated for differences in climate, environmental conditions, ethnic conflicts, crime rates, and health conditions, after controlling for worker characteristics, occupation, industry, and economic conditions, and various housing characteristics. Moreover, we find evidence that these compensating differentials exist even after controlling for the regional pay differences ("regional coefficients") used by the Russian government to compensate workers for living in regions that are designated as less desirable. We rank 953 Russian cities by quality of life as measured by a group of eleven amenities. Sizable variation in the estimated quality of life across cities exists. The highest ranked cities tend to be in relatively warm areas and areas in the western, European part of the country. In addition, our quality of life index is positively correlated with net migration into a region, suggesting workers are attracted to amenity-rich locations. Overall, we find that sufficient market equilibrium exists and a model of compensating differentials with controls for disequilibrium yields useful information about values of location-specific amenities and quality of life in this large transition economy.

JEL Classification: D5, H4, J3, J6, P2, P3, Q2, R1, R2

Key words: compensating differentials, equilibrium, hedonic, quality of life, amenities, implicit prices, labor market, housing market, transition, Russia

1. Introduction

Market economies tend to generate compensating differentials in housing and labor markets for location specific amenities. These local amenities include climate, which is natural, urban conditions, which are produced, and environmental quality, which is partly natural and partly produced. In markets that are functioning smoothly, compensating differentials are a basic tool for understanding the consequences of movements of people and businesses across regions and cities. Compensating differentials are also used to estimate the values people place on goods that are not typically sold in markets and to measure quality of life across geographic locations. In Western economies such as in the United States, there have been several studies that estimate compensating differentials in labor and housing markets and which rank areas by quality of life and many more related studies. The recent review of this literature by Gyourko, Kahn, and Tracy (1999) offers a critical synthesis of more than 70 books, articles, and papers.

A related and potentially important use of the estimates of the values of amenities is as shadow prices for amenities that are not typically included in national income accounts. Construction of an index that is more comprehensive than Net National Product, such as Nordhaus and Tobin' (1972) Measure of Economic Welfare, requires monetary values of the nonmarket goods and services. Green accounting requires monetary values of measures of environmental and natural resource services.[1] Considerable interest in green accounting exists in the U.S. and, in fact, around the world; see Nordhaus (2000) and Heal and Kriström (forthcoming). If compensating differentials can be estimated for transition economies, the prospect for successful implementation of green accounting is more promising for more of the world. In order to use a compensating differentials approach, sufficient equilibrium must exist whether or not the market economy is in transition.

Compensating differentials represent an equilibrium adjustment mechanism in housing and labor markets that matches consumers/workers and firms with different preferences and production technologies. Even in a mature, market economy such as in the U. S. one might be skeptical of the usefulness of this equilibrium model. A major study by Greenwood, Hunt, Rickman, and Treyz (1991) tests for spatial equilibrium. Greenwood et al. assess the reasonableness of the equilibrium assumption used to estimate compensating differentials and quality of life indices in the following way. They model net migration into an area as a function of the net present value of potential earnings in the area and the amenities in the area – both relative to what is available in other areas. They estimate an equilibrium relative income for each area as the level at which no net migration would occur for that area. By comparing the actual income to

[1] As discussed in Heal and Kriström (forthcoming) other approaches such as defensive expenditures and politically determined willingness to pay are candidates for estimating the monetary values of amenities. Stated preference approaches can be used to estimate the value of amenities. Hoehn and Randall (2002) provide a state of the art example and Carson (2001) provides an overview of contingent valuation. An unexplored, alternative approach

the estimated equilibrium income, they find little evidence of disequilibrium for the period 1971-1988 in the U.S. They find that classification of areas that are amenity-rich and amenity-poor and comparing them with estimates from quality of life index values from the Blomquist, Berger, and Hoehn (1988) study yields only minor classification differences.

Gyourko, Kahn, and Tracy (1999) provide a reminder of the crucial nature of this underlying equilibrium assumption of the compensating differentials framework. Our study examines whether sufficient market equilibrium exists to generate compensating differentials in a transition economy, and if they exist, what they imply about geographic variation in quality of life as measured by location specific amenities.[2]

Surely any concern about equilibrium is magnified if a compensating differentials framework is applied to an economy making a transition from central government planning to a decentralized market system. The basic question is whether or not compensating differentials are generated in a transition economy. Are the market forces strong enough to produce observable wage and housing price differences across regions that are related to differences in location specific amenities? This paper applies a compensating differential framework to estimate a wage and housing hedonic equations, amenity values, and a quality of life index for the largest country in

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would be to make inferences from extended surveys of happiness that have been applied to macroeconomic conditions, see di Tella, MacCulloch and Oswald (2001).

[2]Total utility for individuals is comprehensive and depends on at least the consumption of marketed goods and services, goods produced within the household, as well as the bundle amenities that is available in the areas where

transition, Russia. To our knowledge no one has attempted a systematic analysis of compensating differentials for location specific amenities and quality of life for a transition economy.

Few would question the challenge given the change in Russia induced by the transition that began more than a decade ago. Fischer and Sahay (2000) describe Russia's promising start with privatization and stabilization in the early and mid 1990s. However, this period was followed fiscal problems that resulted in financial collapse in 1998 and the lowest level of output since the transition began. The ratio of real Gross Domestic Product in 1999 to that in 1989 was only 0.59; see Fischer and Sahay (2000, p.3). Adjustments in the labor and housing markets are not likely to be smooth and quick.

Among transition economies, Russia offers a unique opportunity to examine compensation for location-specific amenities. Heterogeneity in location-specific amenities across the Russian Federation is one reason that Russia is a good transition economy for our study. Russia is a large country that stretches across 11 time zones. Figure 1 provides a map of the Russian Federation and its 89 oblasts, republics, and krays, or regions. Important for our analysis is the fact that there is wide variation in the distribution of amenities across regions. For example, Figure 1 illustrates the substantial variation in crime rates across regions in Russia. This kind of variation

the individuals live and work. Quality of life, as defined in this paper in equation 5 below, is the value to allows us to examine any wage and housing price differences, holding constant nonamenity factors affecting wages and housing prices. Existence of compensating differentials allows valuation of quality of life in Russian cities as well as estimation the amount of influence of central government planners through "regional coefficients" they used to adjust wages.

2. An Equilibrium Model of Wages, Rents, and Amenities

The fundamental framework for analyzing compensating differentials and quality of life was developed by Rosen (1979) and Roback (1982). In this framework consumer/workers with similar preferences and firms with similar production technologies face different location specific amenity bundles across geographic areas. In spatial equilibrium, so that there is no incentive to move, differences in wages and/or housing prices develop to require payments for locating in amenity rich areas and provide compensation for locating in amenity poor areas. Applications with heterogeneous individuals have led to including nonlocation characteristics of workers and houses as control variables. The full implicit price of a specified amenity is the sum of the housing price differential and the negative of the wage differential. In Blomquist, Berger, and Hoehn (1988), we expand this framework to incorporate agglomeration

households of a bundle of amenities in an area, not a measure of total utility.

effects and use this form of the implicit price of amenities. We find capitalization of the value of local amenities into local labor markets and housing markets.

In this paper we analyze cities. As in Blomquist, Berger, and Hoehn (1988), households derive utility from consumption of a composite good, local housing, and local amenities. A household gets access to the amenities of the k^{th} city through purchase of housing h_k in that city, where $k = 1 \ldots n$ and n is the number of cities. Both the composite good and housing are purchased out of labor earnings. Households are endowed with one unit of labor each that they sell to local firms and earn a wage w_k. All income is labor income and labor is homogeneous. In city k, household well-being is

$$v^k = v^k (w_k; p_k; a_k), \quad (1)$$

where $v^k(.)$ is the indirect utility function, p_k is the price of housing in city k, and a_k is an index of local amenities. The price of the composite good is fixed and suppressed. Wages increase utility, $\partial v^k/\partial w_k > 0$, and the price of housing decreases utility, $\partial v^k/\partial p_k < 0$. An increase in the amenity index will increase utility if a is an amenity for consumer/workers, $\partial v^k/\partial a_k > 0$, decrease utility if a is a disamenity for consumer/workers, $\partial v^k/\partial a_k < 0$, and have no effect on utility if a is not an amenity factor.

Firms produce the composite good by combining capital and local labor and production technology is constant returns to scale. Let the prices of the composite good and capital be fixed by international markets, and further let the wages and prices be normalized on the price of the composite good. Set the price of the composite good equal to one. In city k, unit production costs are

$$c^k = c^k\,(w_k;\, a_k), \tag{2}$$

where c^k is the unit cost function for a firm and the price of capital is left implicit. By Sheppard's lemma a firm's demand for labor is $\partial c^k/\partial w_k > 0$. If a is a production amenity, then costs are lower, $\partial c^k/\partial a_k < 0$. If a is a production disamenity, then costs are higher, $\partial c^k/\partial a_k > 0$. Costs are unaffected if a is not a production amenity factor. Because we do not observe urban sub-areas or regions, we do not consider variation of amenities within cities or agglomeration affects which spillover jurisdictions within an urban area.

Equilibrium results from sufficient movement of households and firms among cities so that wages and housing prices clear the labor and housing markets. Spatial equilibrium implies that households in all cities experience a common level of utility, u^0, and unit production costs are equal to the unit production price. For any city, the set of wages and housing prices that sustains an equilibrium satisfies the system of equations

$$u^0 = v^k\,(w_k;\, p_k;\, a_k); \tag{3a}$$

$$1 = c^k\,(w_k;\, a_k). \tag{3b}$$

Equilibrium differentials for wages and housing prices can be used to compute implicit prices of the amenities, f_k. By taking the total differential of equation 3a and rearranging, the implicit price of an amenity can be found, $f_k = (\partial v^k/\partial a_k) / (\partial v^k/\partial w_k)$. For amenity a_k the full implicit price is

$$f_k = h_k\,(\mathrm{d}p_k/\mathrm{d}a_k) - \mathrm{d}w_k/\mathrm{d}a_k, \quad (4)$$

where h_k is the quantity of housing purchased by a household in city k, $(\mathrm{d}p_k/\mathrm{d}a_k)$ is the equilibrium housing price differential and $(\mathrm{d}w_k/\mathrm{d}a_k)$ is the equilibrium wage differential. The full implicit price is combination of the effect in the housing market and the effect in the labor market. Comparative static analysis of such a model shows that the signs of the housing price and wage differentials depend on the effect of the amenity factor on households and the effect of the amenity factor on firms. A pure consumption amenity, that does not have an effect on firms, is expected to have a full implicit price that is positive. It is the weighted sum of the differentials in the housing market and labor market that is expected to be positive. It is not necessary that both the housing prices are higher and the wages are lower in cities that are rich in the consumption amenity. The quality of life index (QOLI) for any city k is

$$\mathrm{QOLI}_k = \Sigma_i f_i\, a_{ki} \qquad k = 1, \ldots, 953. \quad (5)$$

QOLI is the sum of the endowments of the i amenities in city k where each amenity is weighted by its estimated full implicit price based on the wage and housing price differentials. As such, the QOLI is an estimate of the total compensation or payments for the amenities in city k made through the housing and labor markets.[3]

[3] For small variations in the typical amenity bundle the difference in the QOLI index approximates the value households place on the amenities. Tim Bartik has suggested an alternative to the Rosen, linearized approach that is used in this paper. The alternative would measure the combined wage and housing price differential associated with the change in amenities city to city using the wage and housing hedonic functions. Values from such a nonlinear index would be more closely related to willingness to pay suitable for benefit cost analysis. He also suggests that this alternative may not yield greatly different values for amenity bundles given the semilog specification we use in estimation of the wage and housing equations.

Although the equilibrium assumptions of the model may make one wonder about how appropriate this framework is for a transition economy, the concept of compensating differentials is not a foreign concept in Russia. Government planners have faced preferences for cities that are rich in amenities and have responded by offering inducements for working in less desirable areas. Soviet policy included the "efficient and socially necessary" allocation of labor across regions. The goal of that policy was attracting workers to locations with unfavorable climate and environment. Soviet channels of worker reallocation involved planned distribution of graduates, organized recruitments to the "bad" regions, regional compensating wage differentials, housing subsidies, paid moving expenses and other government actions. Russia has kept the system of government regional wage coefficients for public workers. These regional wage coefficients provide different levels of compensation for government workers depending on the location of the job. As can be seen from Figure 2 that shows the coefficients by region for the year 2000, the compensation for public workers is greater for areas to the north and to the east in Russia where climate is harsher. The value of the regional wage coefficient ranges from 1.0 (no compensation) in central Russia to 3.0 (triple the base wage) in Siberian Chukotka, in northeastern Russia near the Bering Straight.

The Russian housing market is less developed and the transactions costs associated with housing purchases and housing exchanges between cities are high.

There are some indications that market forces played a role in the allocation of housing as far back as 1992, the last year of the official administrative allocation system for housing, but the evidence is mixed, see Buckley and Gurenko (1998). However, there is some evidence that even in this environment, compensating differentials for location-specific amenities can develop. Kolstad, Gorbacheva, Khaleeva, and Shcherbich (1998) use data on apartment rents in Moscow and find that environmental quality is associated with higher rents holding constant the characteristics of the apartment. Another potential problem is that Soviet policy involved moving restrictions through the system of "propiska," official permits in the place of residence. Soviet policy is no longer Russian policy as transition occurs, but "propiska" is still an issue in two major cities, Moscow and St. Petersburg.

The fact that compensation for working in areas that are amenity poor is not new makes it more likely that Russian markets generate compensating differentials. Markets will not be limited to climate differences, however, but will consider whatever consumer/workers and firms deem important. The presence of government wage coefficients does not change the theory, but we can test to see if their presence has any impact on wages and housing prices. We can determine if compensation exists for amenities even after controlling for the regional wage coefficients. In addition, we can examine whether the regional wage coefficients are related to just climate or also to any other amenity variables. Finally, we will be able to compare quality of life rankings that emerge from our market analysis based on compensating differentials with rankings implicit in the government's policy tool, the regional wage coefficients

3. Russian Markets, Amenities, and Data

For the purpose of this study, several data sources are combined into unique linked city-household-employee data that contain detailed information on workers, houses, and city characteristics. The primary data for this study are drawn from the 9th round of the Russian Longitudinal Monitoring Survey (RLMS). The RLMS is a household panel survey based on the first national probability sample drawn in the Russian Federation. Rounds 1 through 4 were conducted in 1992 and 1993 using a sample of over ten thousand individuals (Phase I). A new sample (Phase II) was drawn for Round 5 in 1994. This second sample was used subsequently in 1995, 1996, 1998 and 2000.

Only the 9th round of the RLMS conducted between October and December 2000 contains data on individual housing prices. Therefore, we use only Round 9 of the RLMS in the estimation of our wage and hedonic models and identify implicit amenity prices using inter-city variation in the RLMS.[4] There were 9,704 individuals who

[4] While we cannot use panel estimation in the housing equation estimation using the RLMS, we could use panel data for the estimation of the wage equation. We choose not to use data from multiple years to exploit the panel nature of the data for several reasons. First, prices of amenities may be changing over time and it would be difficult to properly account for this in a short panel. Further, if one wanted to do fixed-effect estimation to control for person specific fixed effects, the variation in the quantities of the various amenities may not vary sufficiently over time to allow for identification. And even if there were sufficient variation, it is not clear that one would want to include individual fixed effects, because these fixed effects may themselves capture part of the compensation for amenities

completed the adult (age 14 and over) questionnaire in the 9th round. These individuals come from 39 cities and 158 locations in 32 different oblasts, or regions, in the Russian Federation. The number of employed individuals was 4,508, and we base our wage analysis on a sample of 2,551 employed adults in the 9th round who have complete information on wages, hours worked, demographic characteristics, occupation, and industry and reside in cities. We base our housing value analysis on a sample of 2,215 households living in cities.

The RLMS provides several individual characteristics such as gender, years of schooling, actual labor market experience, job tenure, marital status, usual monthly hours of work, and average monthly wages. Based on information provided by most working respondents on their job, we were also able to get detailed occupation and industry codes. Data quality can be a concern in any country, but for transition economies variance in data quality is high. A crucial variable in our hedonic model is the market wage. Earlier rounds of Phase II of the RLMS (1994-1996) contain only information on wages actually paid during the previous month. Actual earnings are problematic as a measure of equilibrium wages in Russia given that many Russian workers have wage arrears (60 percent of RLMS employees reported wage arrears in 1998) and that some actual earnings observations contain several months of back pay while others contain no pay for the current month. Instead, we use the worker's

in the labor market, especially if unobservably similar workers tend to choose locations with similar amenity contractual wage, (natural log of) the average monthly wages at the worker's primary job. This wage information was specifically elicited from respondents in the 9th round of the survey. As discussed by Earle and Sabirianova (2002), the contractual wage circumvents the wage arrears problem and represents the best available wage measure for our study.

Data on housing prices also present a challenge. The RLMS variable for the price of housing is (natural log of) owner reported, market house value.[5] Values reported by owners are reliable in the U.S., except for a tendency of owners who have recently purchased their houses to report values slightly higher than other evidence indicates their houses are worth; see Kiel and Zabel (1999). We assume the same to be the case in Russia. What we know that is different is that a substantial share of Russian households did not report housing values, perhaps because as of yet there is not a general knowledge of market prices due to relatively few transactions in any given area. To correct for any bias in house prices caused by differences between the owners who report and owners who do not report, we estimate a selection equation for reporting.

The city-level data on amenities and economic conditions come from the Annual Registries of 1080 Russian cities. The city registries contain information from the

bundles. In this case, part of the compensating differential is imbedded in the fixed effects rather than in the estimated implicit amenity prices.

[5] At an earlier stage of our research, only data on average housing prices per square meter across urban areas in each region were available. Given that constraint we estimated only a wage equation controlling for an estimated housing premium for each region following Stover and Leven (1992) and in a second specification controlling for the level of housing prices in the region following Henderson (1982). With the availability of more complete housing data

reports of municipalities submitted to the Russian Statistical Office (Goskomstat) for the period 1994-1999. The data allow us to exploit a variety of relevant city characteristics including total air pollution, amount of sulfur fall-out, effluent of dirty sewage, phone lines, number of physicians, crime rate, share of loss making firms, employment, migration, and development of public transportation. We base our analysis on a sample of 953 cities with complete information on these characteristics. Most variables are taken for the year preceding the individual survey, 1999. For some variables such as pollution, crime rate, and employment change (those with significant missing values, higher measurement error, and stronger time-series fluctuations) we use annual averages for the 1994-1999 period.

Some data are not available at the city-level and we use regional variables that come from the 2000 Goskomstat Regional Yearbook, the Practical Science Database, and regional risk indices. These variables include climate variables, the morbidity rate, and an index of ethnic and political risk. The latter variable from a study by Matiyasevich et al. (1998) is included because of its high relevance for the quality of life in Russia. The integrated index of ethnic and political risk is comprised of historic conflicts in international relations, religious confession homogeneity, tendency to sovereignty on the national level, emigration of non-native population, historical growth of Cossack settlements, and mass presence of refugees. It ranges from 0 in Kostroma oblast (a

for 2000, especially the value of individual houses, we use the more complete model with both wage and housing region in Central Russia) to 9.388 in the Republic of Dagestan in Northern Caucasus. The highest values are given to regions that are close to Chechnya areas of conflicts. We can see if compensating differences are generated in the areas that are close to actual and potential wars, ethnic conflicts, and terrorism.

Previous studies have shown the importance of commuting time in analyzing the quality of life. The complication is that data on average commuting time is not available for cities outside the RLMS data or for the year 2000. Therefore we estimated commuting time equations using Rounds 5-8 (1994-1996, 1998) of the RLMS. Commuting time in hours per week was expressed as a function of demographics (gender, age, and schooling), passengers per capita, and city-level variables measuring the local public transportation system such as types of public transportation, route length, and number of public vehicles. These results are shown in Appendix 2. For comparability purposes, we obtained predicted values for commuting time across all 953 cities in the full sample using the public transportation and passenger congestion variables.[6]

Table 1 contains the full list of variables used in our analysis, and the descriptions and sources of the variables. These variables were chosen because climate, public services, and environmental quality are theoretically relevant, previous studies

price equations to estimate the compensating differentials in both markets.

[6] By not including the demographic variables, we are evaluating the predicted commuting time at a constant set of demographics across cities. The mean values of the demographic variables multiplied by their estimated

of market economies have found them to be important, they are important determinants of the QOL in Russia, and they are the variables for which data are available.

Gyourko and Tracy (1991) enrich the model of wages, rents, and amenities by broadening the scope of amenities beyond natural amenities such as climate to include amenities that are locally produced. They explicitly incorporate the local fiscal environment, i.e. publicly provided services and taxes in their model and find substantial wage differentials as compensation for amenity differences in their analysis of U.S. cities. As Gyourko, Kahn and Tracy (1999) show, omitting property taxes will make full implicit prices biased towards more capitalization of locally produced goods into wages and less into housing prices. We have some produced amenities as measured by crime rate, phone lines, commuting time, number of physicians, whether the city is a regional capital, and risk of ethnic unrest and some partly publicly produced amenities such as air pollution and water pollution. However, the property taxes paid by Russian households amount to the insignificant portion of the local budget. This will reduce the size of the bias that is due to the omitted property taxes in our model.

Another possible modification to the model of wages, rents, and amenities is to include the consumption of private, locally produced goods excluding housing.

coefficients in the commuting time equation is subsumed into the constant terms of the estimated wage and housing

Gabriel, Mattey and Wascher (2003) incorporate nonhousing, local goods and demonstrate that the compensating differential in the price of local consumption goods becomes a third component of the full price of amenities. They find that the estimates of full implicit prices of some amenities are different when they are based on the three differentials rather than only wages and housing prices. Overall, however, their rankings for the 50 (U.S.) states for the period between 1981 and 1990 based on QOLI with two differentials and their augmented QOLI with three differentials had a Spearman rank correlation equal to 0.9. We rely on this overall similarity for Russia because we do not have data for prices of local consumption goods excluding housing. As an alternative to our basic specification we do try adding a regional-level variable that measures the minimum income needed for subsistence. The level of subsistence is highly correlated with consumer prices and excludes housing prices.

Recently, Gabriel and Rosenthal (forthcoming) develop the model of wages, rents, and amenities model further to estimate the "quality of the business environment," i.e., the value of location specific amenities to firms. For a pure consumption amenity, they start with the fact that housing (land) prices and wages are both costs to firms and show that to get a measure of the value of the amenity to firms, the compensating wage differential is added to (not subtracted from) the housing price differential. They use the value to firms along with the value to consumer/workers to

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hedonic equations.

analyze migration and the growth and composition of 37 cities in the U.S. over the period 1977-1995. We focus on the location decisions and quality of life of consumer/workers rather than firms, and therefore use the more traditional formulation of Rosen (1979) and Roback (1982) using data from the RLMS, city registries, and other available Russian sources.

4. Estimated Implicit Prices, Government Regional Policy, and Quality of Life

4.A. Labor and Housing Markets and Implicit Prices

We begin our analysis by estimating a log wage equation as a function of individual characteristics, location amenities, and controls for labor market disequilibrium. Because our model assumes that workers are homogenous, the implied equilibrium wage equation would include only location amenities. However, empirically we must control for worker heterogeneity, so we include a series of individual characteristics. Similarly, our model assumes that the labor market is in equilibrium. In order to control empirically for potential disequilibrium situations, we also include measures of annual employment change and the local share of firms making losses.

As in all of the statistical estimates reported in the paper, we use the STATA software package. Robust standard errors from the Huber-White estimator are used to calculate standard errors with clustering by RLMS secondary sample districts similar to

U.S. zip codes. The wage equation results are reported in Table 2, along with means, standard deviations, and minimums and maximums of the variables used in the estimation. The estimates in Table 2 are performed without RLMS sample weights. The weights include many of the same variables we already include in our model, so any gain will be mostly from improved efficiency. However, we already employ the Huber-White estimator to produce robust standard errors and account for a general form of heteroscedasticity. Later in the paper, we compare the quality of life rankings that we obtain using the estimates reported with those obtained using sample weights.

In general, the results for the individual characteristics are quite consistent with what one would find for a typical "Mincer" earnings equation. There are positive returns to schooling, and quadratic experience-earnings and tenure-earnings profiles. The estimated returns to schooling are below typical recent estimates for Russia and other transition economies (see Sabirianova Peter, 2003) since we have more extensive set of individual and location controls which are positively correlated with years of schooling. Without occupation dummies and amenity variables, the estimated returns to schooling would fall in the same range as those typically obtained in the U.S.[7] and would be higher than those reported by Brainerd (1998) for 1993-94, using a different Russian data source, monthly cross-section household surveys conducted by the All-Russian Center for Public Opinion Research. Our estimated experience and tenure profiles are slightly more concave than the experience profiles reported by Brainerd (1998), perhaps because we use actual rather than potential years of experience. These profiles are flatter and less concave than those typically estimated in the U.S.

The wage effects of the 11 amenity variables are mostly statistically significant (except for air pollution) and in all cases have the expected sign if all compensation were through the labor market. Of course, the theoretical model makes clear that it is the full compensation through both the housing and labor markets that ultimately matters for determining quality of life differences. The 11 amenity variables are jointly significant; the F-value is 21.23.

The disequilibrium variables suggest that in areas in which firms are making losses, wages are lower, but that increased employment is positively related to wages. The two disequilibrium variables are jointly significant in the determination of wages (F-value is 33.52), suggesting it is important to include these controls in our hedonic model of Russian wage determination.[8]

Next, we turn to the estimation of the housing hedonic model. One additional complication in estimating the housing hedonic using the RLMS data is that a significant number of respondents did not report a housing value. Therefore, we specify a Heckman maximum likelihood selection model with two equations: an

[7] See Barron, Berger, and Black (1997) and Card (1999) for some typical cross-section estimates using Census and Current Population data.
[8] Such controls for disequilibrium forces have also been used in wage and housing hedonics using U.S. data; see, for example, Berger and Blomquist (1992).

equation explaining whether a respondent reports a housing value and a second equation in which the log of housing value is a function of housing characteristics, location amenities, disequilibrium variables, and the inverse Mills ratio. The model is identified by including demographic characteristics of the respondent in the selection equation such as gender, age dummies, level of education, and computer skills. Thus identification of the model does not rest solely on the nonlinearity of the model, as is sometimes the case. Demographic characteristics that are included into the selection equation may be correlated with knowledge of the housing market and thus the propensity to report a housing value. In fact, we do find that older respondents and less educated individuals, who may have less knowledge of the housing market, are less likely to report a housing value. Those with computer skills are more likely to report a housing value. In the housing hedonic, the estimated inverse Mills ratio (λ) has a negative and significant estimated coefficient. This implies that holding housing characteristics, location amenities, and disequilibrium conditions constant, a random person from the population would report a higher housing value than those who actually report. This result suggests that non-reporters would be overly optimistic about the value of their housing unit, perhaps because of inadequate information about the true nature of the housing market. There are a limited number of housing characteristics available in the RLMS data and the variables that are statistically significant have the expected sign. The 11 amenity variables are jointly significant (chi^2

value is 280.41) and while some have the unexpected sign if all compensation came through the housing market, it is the total compensation through both markets that matters. The two disequilibrium variables are individually and jointly significant (chi^2 value is 86.49). Larger employment decline and higher shares of firms losing money are associated with lower housing prices.

In Table 4, we combine the estimated wage and housing price differentials into annual full implicit prices per household using Eq. 4 at the mean wage, number of workers, and housing value of the sample, assuming a 7.85 percent annual depreciation rate on housing.[9] This involves multiplying the negative of the estimated parameter estimate in the log wage equation by the mean wage to convert the estimated effect into rubles and then multiplying by 12 and 2.63 full-time equivalent workers per household to convert to annual household compensation in the labor market. The labor market compensation is added to the housing market compensation which is simply the housing market estimated parameter multiplied by the mean housing value to convert to rubles, and by 0.0785 to get an imputed annual housing expenditure. A negative full implicit price means that a characteristic is a disamenity while a positive price is an amenity.

[9] This is the rate used by Blomquist, Berger, and Hoehn (1988).

The implicit prices are all of the expected sign and all but commuting time are statistically significant at the 10 percent level or higher.[10] Phone lines, number of physicians, and location in a capital city are amenities and the remaining variables are disamenities. The full implicit prices are expressed in thousands of rubles per year. In order to get a better idea of the amount of compensation involved given the different scaling of the units of the different amenities, the last column of Table 4 shows the compensation required for one standard deviation change in the amenity or disamenity from its mean value.

The last column shows the amount in thousands of rubles that the average Russian household would be willing to pay for one standard deviation increase in the quantity of local amenities and would be willing to accept for one standard deviation increase in the quantity of local disamenities.[11] One standard deviation changes in climate (heating degree days), air pollution, and crime produce the largest implicit annual compensation in the housing and labor markets; the amounts are 7,839, 8,050, and 8,602 rubles respectively. These compensation amounts are sizable compared to a mean monthly salary of 1,928 rubles or an annual salary of 23,134 rubles. For a one standard deviation improvement in climate (as measured by heating degree days), the

[10] The standard errors on the full implicit prices are obtained by taking a linear combination of the standard errors in the wage and housing price hedonic equations, with the same weights as those used to calculate the full implicit price. This is the same approach used by Blomquist, Berger, and Hoehn (1988). The full implicit price on the capital city dummy is calculated using the transformation proposed by Halvorsen and Palmquist (1980).

[11] Of course, the hedonic estimates are only strictly valid for small changes in the quantities of amenities and disamenities. However, the vehicle of considering one standard deviation changes has been used often in the literature to illustrate the relative sizes of the implicit compensations for various amenities.

typical household would be willing to pay 34 percent of a typical worker's salary or 13 percent of a typical household's annual earnings.

We are now in a position to calculate quality of life indexes using the full implicit prices reported in Table 4. It is straightforward to generate quality of life indexes for the 39 cities included in the RLMS data for which complete data are available. The full implicit prices in Table 4 are simply used to weight the quantities of the bundle of amenities in each city to produce a quality of life index. Using the full implicit prices in Table 4 along with administrative data on amenities by city we are also able to generate quality of life indexes for 953 cities in the Russian Federation. Given that the RLMS cities are fairly representative of cities throughout Russia it is appropriate to generate QOLI's for all cities using the parameter estimates obtained from the RLMS data.[12]

4.B. Government Regional Wage Coefficients and Implicit Market Prices

Our initial formulation of the wage and housing price hedonic model omitted the government regional wage coefficient. However, the government regional wage coefficients were designed to compensate for regional climate differences. It is interesting to determine how much compensation for location amenities exists in Russian wage and housing markets after controlling for the regional wage coefficients

[12] Appendix 1 provides a comparison of the amenity levels in the 39 RLMS cities with the full sample of 953 cities. There are insignificant differences in the mean values of climate variables, air and water pollution, morbidity rate, ethnic-political risk, and regional wage coefficients. At the same time t-test reveals statistical differences at the 5 percent level in the mean values of phone lines, number of doctors, commuting time, capital city, and crime rate.

or whether the market compensation replicates the kind of compensation that was in place even during the Soviet period.[13]

Table 5 shows the wage differentials after including the government regional wage coefficient variable. As expected, this variable is highly significant: areas with higher values for the regional wage coefficient (worse climates) have higher wages. In addition, the "heating degree day" variable becomes statistically insignificant. Somewhat surprisingly, several other amenity variables become statistically insignificant in the wage hedonic. However, the amenities are still jointly statistically significant (F-value of 9.39). So while the presence of the government wage coefficient reduces the remaining compensation through the labor market, it does not eliminate it.

Table 5 also shows the housing hedonic estimates after including the government regional wage coefficient variable. The pattern is not as clear as for the wage equation, nor should we expect it to be. The government regional wage coefficients were designed to reflect compensation in the labor market, not the housing market. Some of the estimated amenity coefficients become insignificant after the introduction of the government wage coefficient, others become significant. However, the amenities are still jointly significant (chi^2 value of 263.90). While some of the compensation generated by the market duplicates compensation reflected in the government regional wage coefficients, there is clearly a significant amount of additional market compensation

[13] The government regional wage coefficients used in this paper are apparently very similar in magnitude to those

taking place. The government regional wage coefficients and our original quality of life index have a simple correlation coefficient of -0.4167 for the full sample of 953 cities, which illustrates that though they are related, they are not measuring the same thing.

4.C. Quality of Life across Russian Cities

We calculate the quality of life index values using the full implicit prices in Table 4 for 953 cities in the Russian Federation. Table 6 shows these QOLI values for the top 20 cities, regional centers, and the bottom 20 cities. A complete ranking of all 953 cities is available upon request. The index values are denominated in thousands of year 2000 rubles per year. The estimated minimum QOLI value is added to each index value so that all index values are positive and the lowest QOLI value is zero. The index values are most easily interpreted when comparing cities with one another. Comparing the first and sixth cities in Table 6, residents in Stavropol, the first ranked city, annually pay 6 thousand rubles through lower wages and higher housing prices for the basket of local amenities there relative to the basket of local amenities available in Astrahan, the sixth ranked city. The range in the quality of life index across the 953 cities is 253,000 rubles, several times the average annual wage. This variation is a much larger than the variation found by Blomquist, Berger, and Hoehn (1988) across their sample of 253 U.S. counties, perhaps reflecting the greater variability in the basket of amenities in Russia relative to the U.S.

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used during the Soviet period.

Moscow is 50th and St. Petersburg is 177th in our ranking. These rankings appear low given that there is excess demand for available residence permits or "propiskas" in these two cities, suggesting that they are desirable places to live. This localized disequilibrium for Moscow and St. Petersburg makes it difficult for us to get true quality of life rankings for these two cities. First, the rationing of residence permits means that housing prices will not get bid up high enough and labor supply will not increase and wages will not be bid down enough to reflect quality of life in these two cities. However, this problem should not be a very large one for our wage and housing parameter estimates since Moscow and St. Petersburg together only makes up a small portion of the full RLMS sample. However, the ranking for Moscow and St. Petersburg are still problematic under the system of rationed residence permits if their attractiveness is unique and cannot be accounted for by typical variables in quality of life indexes. In this case, an appropriate strategy would be to include dummy variables for Moscow and St. Petersburg, but the system of residence permits would prevent us from estimating the full values of the unique amenities in those two cities. We have estimated the wage and housing equations with dummy variables for Moscow and St. Petersburg and find, as reported in Table 7, that the QOL ranking with our base ranking is quite high, 0.99.

Figure 3 provides a graphical depiction of the quality of life index values by region. The regional values are population-weighted values of the QOLI values for the cities in the region. As such, they represent a regional urban average of quality of life. In general, regions with cities with higher quality of life appear to be in the southern and European region of Russia. In order to illustrate the degree of variation in quality of life within a single region, Figure 4 shows city-by-city QOLI values for the Sverdlosk region in the Urals. Within the Sverdlosk region, the QOLI varies from a low of 177 thousand rubles per year in Sysert, ranked 928, to a high of 226 thousand rubles per year in the capital of Yekaterinburg, ranked 139.

We have also calculated alternative QOLIs to check the sensitivity and robustness of our original ranking. Table 7 reports correlations of these alternative indexes and the resulting rankings with our original index and ranking (Table 6). Rows 1 and 2 show correlations with QOLIs after controlling for the government regional wage coefficient. These correlations range from 0.9100 for the 39 RLMS cities to 0.9557 for the full sample of 953 cities. Rankings with dummy variables for Moscow and St. Petersburg, a set of alternative amenity variables described in Table 5, inclusion of the cost of subsistence level in each city, observations weighted by RLMS weights, wages actually received last month, and without a selection equation for housing all are highly correlated with the ranking using our base hedonic equations.

Gyourko, Kahn, and Tracy (1999) argue that if the "observed amenities model" is used, as in this paper, then it should be compared to the "group effects model" under the assumption that errors due to unaccounted unobservables in wage and housing price equations are caused primarily by omitted amenities rather than omitted worker or house characteristics. Gyourko and Tracy (1991) find that group effects can matter for specific amenity values and can matter in rankings too because the standard errors on the QOLI values can be large. Gabriel, Mattey, and Wascher (2003) use an observed amenities model and compare it to a group fixed effects model for the 50 states and find there is not much difference in the rankings (the Spearman rank correlation is 0.8).

Given these previous studies, it is worth comparing the rankings that would be obtained from a group effects model from those that we obtain from our observed amenity model. It is only possible to estimate city fixed effects for the 39 cities in the RLMS sample and not for the other cities in the full city sample. We restrict our comparisons to these 39 cities. Another complication is that our two disequilibrium variables vary only city to city and thus drop out of city fixed effect model. We pursue two different options. In the first, we simply correlate our quality of life index with estimated city fixed effects, realizing that the fixed effects also contain the effects of the disequilibrium variables. In this case, the correlation coefficient is 0.4663 and the Spearman rank correlation coefficient is 0.5656. In the second option, we recalculate the quality of life index to include the two disequilibrium variables and correlate the revised index with the city fixed effects. The resulting correlation coefficients increase to 0.6389 and 0.7014 confirming the importance of accounting for disequilibrium in the case of Russia. While these correlations are lower than the one obtained by Gabriel, Mattey, and Wascher (2003), it does show that the alternative sets of rankings are fairly highly related to one another. We would not expect the correlation to be one because variables such as building age, housing condition, and outside space are not included in the housing price equation due to unavailability. This matters because differences in these housing structure characteristics erroneously will be attributed to differences in quality of life using the group effects approach. In addition, our comparison points to the fact that a pure comparison is not possible using our models because of the presence of variables to control for disequilibrium forces in the housing and labor markets.

5. Migration and Quality of Life

Despite the nature of transition from central planning to a market economy in Russia, we have substantial evidence that equilibrium exists. The estimated wage and housing price equations show that wages depend on worker and job characteristics and housing price depend on house characteristics in expected ways. Location specific amenities generate compensating differentials in both wages and housing prices. This result is consistent with the prediction of the equilibrium framework. These results come from equations that partly control for disequilibrium by including two variables in our equations, city annual employment change and share of firms in the city that are making losses.

Migration is important in the equilibrium framework in that migration of some consumer/workers and firms is necessary to achieve spatial equilibrium. Migration is a real phenomenon in the transition economy of Russia. Andrienko and Guriev (2003) analyze gross region-to-region migration flows in Russia. They report that total officially registered internal migration is approximately 2 percent per year during the 1990s. This migration rate is considerably lower than the migration rates of developed, market economies.[14] Their analysis of migration flows during the period 1990-1999 shows that job opportunities matter, and that climate and local public goods matter as well. This finding gives more credibility to our estimates of amenity compensating differentials in Russian in that migration is occurring and is influenced by location specific amenities.

Our calculations from the Annual Registries of Russian Cities show higher level of internal migration in Russia. During the 1994-1999 period, at least 3 percent annual changes in population due to migration are estimated for 73.3 percent of the cities, at least 5 percent annual changes for 56.6 percent of the cities, and at least 10 percent annual changes for 27.7 percent of the cities. Even these rates, however, are lower than the migration rates of developed, market economies.

The existence of migration does not necessarily imply disequilibrium. Life cycle motivation for migration can be thought of as an equilibrium phenomenon. As

[14] The official data used by Andrienko and Guriev (2001) may well understate the actual amount of migration in

households experience anticipated changes in income, they will anticipate relocating to areas that offer a bundle of amenities that more closely matches their new demands. As households anticipate changing their participation in the labor market, say through retirement, they will relocate to areas that more closely match their demands; see Linneman and Graves (1983) and Gyourko, Kahn, and Tracy (1999). Thus, migration can be related to equilibrium differences in quality of life as shown by Berger and Blomquist (1992) using U.S. data. Similarly, Brown (1997) provides some evidence that aggregate region-to-region migration in Russia is related to air pollution and temperatures, which are components of typical quality of life indexes. In the last two rows of Table 7, we show that our quality of life index is positively correlated with net migration into Russian cities. In other words, cities with higher measured quality of life attract more in migration, consistent with equilibrium movement toward high quality of life areas.

6. Conclusions

This paper uses data from the Russian Longitudinal Monitoring Survey (RLMS) and administrative sources to examine compensating differentials for location-specific amenities in the labor and housing markets. We find that there is compensation generated in labor and housing markets for differences in amenities across cities in

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Russia. Almost half of the respondents in the RLMS report that they have lived for 6 consecutive months or more in

Russia. This result may be surprising given the relatively recent transition to a market economy. However, our results suggest that even nascent market economies are capable of generating compensating differentials. Our results are consistent with available evidence on region-to-region migration in Russia. While migration rates in Russia are below those in developed, market economies, they do appear to be sensitive to amenity variation across regions. Apparently the migration that does occur is enough to generate inter-city variation in wages and housing prices due to inter-city variation in amenities. The estimated wage and housing premiums are used to calculate a quality of life index across 953 cities in the Russian Federation for the year 2000, the year for which we have complete data. In general, quality of life is higher in cities in southern and European areas of Russia.

Perhaps one of the reasons that market generated compensating differences have appeared relatively quickly in Russia is that there was a long history of government mandated compensating differentials mostly reflecting climate differences in the Soviet era. These government regional wage differences have remained in the public sector. We find that after controlling for these mandated differences in the public sector, we still are able to estimate compensating differentials and generate quality of life measures. Thus, while government planners have been able to dictate some compensation for quality of life differences, there are still substantial compensating

a different location since age 14.

differentials on top of the government regional wage differentials. This important result of market forces is readily observable in a country such as Russia in which the transition to a market is far from complete. The many difficulties that Russia has experienced have not been enough to prevent market compensation for a broad array of amenities from taking hold in labor and housing markets.

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Table 1: Variables and Data Sources

Variable Name	*Variable Description*	*Source*
	Housing model variables	
Main regression		
Log of housing prices	Log of housing market value, rubles	RLMS2000
Living space	Living space (rooms) in square meters	RLMS2000
Share of non-living space	Share of non-living space (kitchen, bathroom, hall, etc.) in the total housing space	RLMS2000
Privatized housing	1 if housing is privatized; 0 otherwise	RLMS2000
Central heating	1 if central heating system; 0 otherwise	RLMS2000
Central water supply	1 if central water supply; 0 otherwise	RLMS2000
Hot water supply	1 if hot water supply; 0 otherwise	RLMS2000
Piped gas	1 if piped gas; 0 otherwise	RLMS2000
Central sewerage	1 if central sewerage system; 0 otherwise	RLMS2000
Home phone	1 if family has phone; 0 otherwise	RLMS2000
Additional variables in the selection probit equation		
Reported housing value	1 if respondent reported the approximate market value of housing; 0 otherwise	RLMS2000
Female	1 if female; 0 if male	RLMS2000
Age categories	Five age categories: 15-24; 25-34; 35-44; 45-54; 55+ (omitted)	RLMS2000
Education categories	Five education categories: elementary (omitted); secondary, vocational; technical; university	RLMS2000
Computer skills	1 if respondent has ever used a computer; 0 otherwise	RLMS2000

Table 1: Variables and Data Sources (continued)

Variable Name	*Variable Description*	*Source*
	Wage model variables	
Log of monthly wages	Log of average monthly wages at the primary job, rubles	RLMS2000
Log of monthly hours	Log of usual hours of work per month at the primary job	RLMS2000
Female	1 if female; 0 if male	RLMS2000
Married	1 if now married; 0 otherwise	RLMS2000
Years of schooling	Highest year of school attended	RLMS2000
Actual experience	Years of actual labor market experience	RLMS2000
Experience squared	Years of actual labor market experience squared	RLMS2000
Tenure	Years of work at the same enterprise	RLMS2000
Tenure squared	Years of work at the same enterprise squared	RLMS2000
Industry dummy variables	15 industry dummies include energy and fuel industry; metallurgy and chemicals; machine-building; wood processing; light and food industries; agriculture (omitted); transportation and communications; construction; trade; finance and commerce; municipal utilities; health; education, culture, and art; public administration; and other industries	RLMS2000
Occupation dummy variables	8 occupation dummies include officials and managers; professionals; associate professionals and technicians; clerks; service workers; craft workers; operators and assemblers; military specialist; elementary occupations (omitted)	RLMS2000

Table 1: Variables and Data Sources (continued)

Variable Name	*Variable Description*	*Source*
	City-level variables	
City (municipal) amenities		
Air pollution	Air pollution, tons per Ha, 1994-1999 average	GKSCITY
Sulfur fall-out	Fall-out of sulfurous anhydride, tons per Ha, 1994-1999 average	GKSCITY
Water pollution	Effluent of dirty sewage, thousands cubic m per Ha, 1994-1999 average	GKSCITY
Total phone lines	Number of phone lines per capita, 1999	GKSCITY
Home phone lines	Number of home phone lines per capita, 1999	GKSCITY
Doctors	Number of physicians per 100 population, 1999	GKSCITY
Commuting time	Predicted commuting time (calculated by the authors from the estimated commuting time equation)	Authors
Crime rate	Number of registered crimes per 1,000 population, 1994-1999 average	GKSCITY
Capital city	1 if central city of a region; 0 otherwise	Authors
City disequilibrium variables		
Share of loss-making firms	Share of loss-making firms, 1999	GKSCITY
Employment change	Annual employment change, percent, 1994-1999 average	GKSCITY
Average mobility change	Annual change in population due to migration per 1,000 population, 1994-1999 average	GKSCITY
	Regional-level variables	
Regional amenities		
Temperature in warm period	Sum of temperature in warm period, >10 C	PSD
Heating degree days (cold)	Sum of heating degree days, <0 C	PSD
Total precipitation	Sum of precipitation in warm and cold periods, mm	PSD
Precipitation in cold period	Sum of precipitation in cold period, mm	PSD
Morbidity rate	Morbidity rate or number of illnesses per capita, 1999	GKS2000
Ethnic and political risk	Index for ethnic and political risk, 1998: integrated index comprised of historic conflicts in inter-national relations, confession homogeneity, tendency to sovereignty on the national level, emigration of non-native population, historical growth of Cossack settlements, and mass presence of refugees	RISK1998
Level of subsistence	Minimum amount needed for subsistence, thousand rubles per month, 1999	GKS2000
Regional wage coefficients	Regional compensating wage coefficients enforced by the government	

Table 1: Variables and Data Sources (continued)

Variable Name	*Variable Description*	*Source*
	Commuting time equation variables	
Commuting time	Weekly hours of commuting from/to work, 1994-1996, 1998	RLMS9498
Female	1 if female; 0 if male	RLMS9498
Years of schooling	Highest year of school attended	RLMS9498
Age	Years	RLMS9498
Available public transportation	1 if city has only buses; 2 if city has also trams and/or trolley buses; 3 if city has subway; 1994-1996, 1998	GKSCITY
Route length	Average length of a route, km, 1994-1996, 1998	GKSCITY
Number of public vehicles	Number of buses, trams and trolley buses per 1,000 population, 1994-1996, 1998	GKSCITY
Number of passengers	Annual sum of passengers per capita, 1994-1996, 1998	GKSCITY

Sources:
RLMS2000 – 9th round of the Russian Longitudinal Monitoring Survey, conducted in October-December 2000
RLMS9498 – 5-8th rounds of the Russian Longitudinal Monitoring Survey, conducted in 1994-1996 and 1998
GKS2000 – Goskomstat, Regions of Russia 2000, Moscow: Goskomstat, 2000
GKSCITY – Goskomstat Database, Annual Registries of Russian Cities, 1994-1999
PSD – Practical Science Database
RISK – Matiyasevich T., et al. "Russia: Regional Risk Rating," Vienna: Bank Austria AG, 1998
Regional wage coefficients are provided by the deputy parliament group on social policy

Table 2: Wage Equation with Amenities, RLMS Cities, 2000

OLS with Clustering	*Coeff.*	*t*	*Mean*	*Std. Dev.*	*Min*	*Max*
Dependent Variable						
Log of monthly wages			7.222	0.814	3.40	11.51
For reference: monthly wages, rubles			1928	2626	30	100000
Human Capital Characteristics						
Log of monthly hours	0.415	7.00	5.103	0.316	1.39	6.33
Female	-0.357	-12.47	0.535	0.499	0	1
Married	0.035	1.22	0.668	0.471	0	1
Years of schooling	0.063	8.98	12.289	2.325	3	18
Actual experience	0.021	5.39	20.259	12.364	0	59
Experience squared / 100	-0.049	-6.05	5.632	5.698	0	34.81
Tenure	0.008	2.26	7.942	9.097	0	58.75
Tenure squared / 100	-0.013	-1.20	1.458	3.065	0	34.52
Occupations						
Officials and managers	0.444	4.64	0.041	0.199	0	1
Professionals	0.431	6.76	0.180	0.385	0	1
Associate professionals	0.258	4.53	0.191	0.393	0	1
Clerks	0.184	3.23	0.071	0.256	0	1
Service workers	-0.019	-0.31	0.097	0.296	0	1
Craft workers	0.265	4.89	0.187	0.390	0	1
Operators/assemblers	0.306	5.40	0.152	0.359	0	1
Military specialists	0.002	0.01	0.015	0.121	0	1
Amenities/Disamenities						
Heating degree days / 100 (cold)	0.417	3.77	1.432	0.225	0.81	1.85
Total precipitation / 100	0.054	2.68	5.339	1.389	3.29	8.21
Air pollution	0.006	1.11	2.812	3.061	0.15	13.04
Water pollution	0.019	5.74	6.063	7.072	0.0001	27.36
Home phone lines	-0.859	-3.79	0.194	0.091	0.07	0.71
Doctors	-0.436	-3.46	0.621	0.247	0.21	1.12
Commuting time	0.223	3.30	4.519	0.434	3.70	5.38
Crime rate	0.010	3.56	20.928	7.728	8.21	42.87
Morbidity rate	0.695	3.56	0.735	0.101	0.52	0.94
Capital city	-0.190	-2.32	0.601	0.490	0	1
Ethnic-political risk	0.046	4.03	1.696	1.726	0.17	8.92
Disequilibrium Variables						
Share of loss-making firms	-1.879	-6.98	0.336	0.089	0.12	0.57
Employment change	2.133	2.60	-0.032	0.030	-0.12	0.02
Constant	1.994	3.91				

N = 2551 F(43, 285) = 60.43 R^2 = 0.477

F-test for eleven amenities/disamenities: F(11, 285) = 21.23

F-test for two disequilibrium variables: F(2, 285) = 33.52

Notes: Dependent variable is log of average monthly wages (in rubles); 15 industry dummies are included but not shown here; elementary occupations are omitted; t-statistics are defined with robust clustered standard errors allowing for correlation within sample districts. Sample is restricted to employees residing in cities.

Table 3: Housing Value Equation with Amenities, RLMS Cities, 2000
(Heckman ML Model with Sample Selection and Clustering)

Main Regression	*Coeff.*	*z*	*Mean*	*Std. Dev.*	*Min*	*Max*
Dependent Variable						
Log of housing market value			12.064	0.800	8.01	14.73
For reference: house values, rubles			236461	229006	3000	2500000
Housing Characteristics						
Living space	0.019	4.06	33.093	15.000	6	330
Share of non-living space	0.723	2.39	0.356	0.113	0	0.83
Privatized housing	-0.033	-0.81	0.645	0.479	0	1
Central heating	-0.030	-0.23	0.876	0.329	0	1
Central water supply	0.127	0.95	0.917	0.276	0	1
Hot water supply	0.211	3.42	0.710	0.454	0	1
Piped gas	0.191	2.35	0.876	0.329	0	1
Central sewerage	0.108	0.76	0.858	0.350	0	1
Home phone	0.194	4.31	0.594	0.491	0	1
Amenities/Disamenities						
Heating degree days / 100 (cold)	-0.220	-1.29	1.433	0.246	0.81	1.85
Total precipitation / 100	0.012	0.41	5.130	1.336	3.29	8.21
Air pollution	-0.016	-2.12	2.894	3.234	0.15	13.04
Water pollution	0.036	6.24	5.145	6.362	0.0001	27.36
Home phone lines	0.026	0.08	0.185	0.081	0.07	0.71
Doctors	-0.471	-2.46	0.605	0.247	0.21	1.12
Commuting time	0.612	5.83	4.489	0.414	3.70	5.38
Crime rate	0.003	0.80	21.234	7.639	8.21	42.87
Morbidity rate	0.574	2.09	0.730	0.103	0.52	0.94
Capital city	-0.111	-0.89	0.581	0.494	0	1
Ethnic-political risk	0.050	3.16	1.713	1.618	0.17	8.92
Disequilibrium Variables						
Share of loss-making firms	-2.676	-6.82	0.344	0.091	0.12	0.57
Employment change	1.208	0.97	-0.031	0.030	-0.12	0.02
λ	-0.610	-11.08				
Constant	8.972	14.90				

N = 2215; censored obs. = 775; uncensored obs. =1440 (non-missing reports on housing value);

Wald $Chi^2(22)$ = 643.92

Chi^2-test for eleven amenities/disamenities: $chi^2(22)$ = 280.41

Chi^2-test for two disequilibrium variables: $chi^2(4)$ = 86.49

Note: Summary statistics is given for 1440 uncensored observations.

Table 3: Housing Value Equation (continued)

Selection Equation	*Coeff.*	*z*	*Mean*	*Std. Dev.*	*Min*	*Max*
Characteristics of the Reference Person in a Household						
Female	0.048	0.63	0.874	0.332	0	1
Age 15-24	0.253	1.84	0.047	0.211	0	1
25-34	0.430	4.18	0.140	0.347	0	1
35-44	0.130	1.75	0.213	0.410	0	1
45-54	0.166	2.57	0.225	0.418	0	1
Level of education						
Secondary school	0.119	1.56	0.194	0.396	0	1
Vocation school	0.117	1.30	0.099	0.299	0	1
Technical school	0.198	2.89	0.276	0.447	0	1
University	0.285	3.71	0.240	0.427	0	1
Computer skills	0.293	4.53	0.247	0.432	0	1
Housing Characteristics						
Living space	0.012	2.32	32.544	13.825	6	330
Share of non-living space	1.115	2.80	0.355	0.112	0	0.83
Privatized housing	0.121	1.83	0.621	0.485	0	1
Central heating	-0.049	-0.27	0.877	0.329	0	1
Central water supply	0.157	0.87	0.909	0.287	0	1
Hot water supply	-0.118	-1.17	0.704	0.457	0	1
Piped gas	-0.036	-0.31	0.875	0.330	0	1
Central sewerage	-0.087	-0.52	0.855	0.352	0	1
Home phone	-0.029	-0.40	0.601	0.490	0	1
Amenities/Disamenities						
Heating degree days / 100 (cold)	0.406	1.52	1.421	0.230	0.81	1.85
Total precipitation / 100	-0.065	-1.41	5.300	1.373	3.29	8.21
Air pollution	0.013	0.99	2.724	3.038	0.15	13.04
Water pollution	-0.010	-0.96	5.726	6.788	0.0001	27.36
Home phone lines	-0.787	-1.59	0.194	0.090	0.07	0.71
Doctors	-0.238	-0.92	0.618	0.245	0.21	1.12
Commuting time	-0.231	-1.67	4.528	0.440	3.70	5.38
Crime rate	0.000	0.06	20.691	7.601	8.21	42.87
Morbidity rate	-1.136	-2.52	0.734	0.101	0.52	0.94
Capital city	0.173	0.93	0.591	0.492	0	1
Ethnic-political risk	-0.002	-0.06	1.691	1.672	0.17	8.92
Disequilibrium Variables						
Share of loss-making firms	0.193	0.36	0.338	0.089	0.12	0.57
Employment change	2.973	1.78	-0.033	0.031	-0.12	0.02
Constant	1.128	1.30				

Notes: Dependent variable is log of housing market value, rubles; sample size is restricted to households-occupants of own houses living in cities; t-statistics are defined with robust clustered standard errors allowing for correlation within sample districts. Omitted categories are age 55+; and elementary school. Summary statistics is given for 2215 total observations.

Table 4: Implicit Prices for Amenities in Russian Cities, Base Specification, 2000

Amenities	*Wage Differential*		*Housing Value Differential*		*Full Implicit Price*		*QOLI Changes*
	Coeff.	***t***	***Coeff.***	***t***	***Coeff.***	***t***	
Heating degree days / 100	0.417	3.77	-0.220	-1.29	-29.452	-8.26	-7.839
Total precipitation / 100	0.054	2.68	0.012	0.41	-3.077	-4.56	-4.856
Air pollution	0.006	1.11	-0.016	-2.12	-0.663	-3.29	-8.050
Water pollution	0.019	5.74	0.036	6.24	-0.515	-5.20	-3.663
Home phone lines	-0.859	-3.79	0.026	0.08	52.728	7.02	4.505
Doctors	-0.436	-3.46	-0.471	-2.46	17.806	4.32	2.926
Commuting time	0.223	3.30	0.612	5.83	-2.229	-1.03	-0.749
Crime rate	0.010	3.56	0.003	0.80	-0.544	-5.86	-8.602
Morbidity rate	0.695	3.56	0.574	2.09	-31.610	-4.67	-3.638
Capital city	-0.190	-2.32	-0.111	-0.89	9.484	3.58	2.404
Ethnic-political risk	0.046	4.03	0.050	3.16	-1.877	-4.66	-3.803

Notes:

- QOLI changes show changes in the mean value of quality of life index in response to one standard deviation increase in the amount of corresponding amenity.
- Robust (location clustering) standard errors are in parentheses.
- Full implicit prices are estimated at the mean of housing values and wages.
- The number of workers per household is measured in full-time equivalent units as a ratio of total working hours of all household members to the average hours in the sample.
- Average number of full-time workers per household is 2.63.
- Interest rate is 7.85%.
- Mean wages is 1927.8 rubles per month.
- Mean housing value is 236,461 rubles.

Table 5: Implicit Prices for Amenities in Russian Cities, Alternative Specifications, 2000

Amenities and Disequilibrium Variables	*Wage Differential (OLS)*		*Housing Value Differential (Heckman ML)*		*Full Implicit Price*	
	Coeff.	*t*	*Coeff.*	*t*	*Coeff.*	*t*
A. Specification with government regional wage coefficients						
Heating degree days / 100 (cold)	0.059	0.52	-0.530	-2.64	-13.447	-4.18
Total precipitation / 100	0.041	2.27	0.000	-0.01	-2.524	-4.48
Air pollution	0.002	0.40	-0.016	-2.30	-0.430	-2.32
Water pollution	0.012	3.82	0.030	4.65	-0.194	-2.54
Home phone lines	-0.259	-1.08	0.586	1.62	26.617	3.37
Doctors	-0.356	-2.95	-0.404	-2.17	14.141	3.65
Commuting time	0.225	3.09	0.608	5.63	-2.388	-0.99
Crime rate	0.002	0.73	-0.002	-0.47	-0.172	-1.63
Morbidity rate	0.380	2.02	0.386	1.34	-15.942	-2.60
Capital city	-0.179	-2.12	-0.083	-0.65	9.352	3.39
Ethnic-political risk	0.028	2.36	0.033	2.07	-1.070	-2.56
Share of loss-making firms	-1.811	-7.34	-2.553	-6.94	…	…
Employment change	1.603	2.13	0.662	0.54	…	…
Regional wage coefficients	**0.536**	**5.49**	**0.426**	**3.28**	…	…
Test for 11 amenities/disamenities	F(11, 285)=9.39		Chi²(22) = 263.90			
Test for 2 disequilibrium variables	F(2, 285)=32.56		Chi²(4) = 80.31			
Test for 2 climate variables	F(2, 285)=2.92		Chi²(4) = 9.48			
	N = 2551		N = 2215			
	R^2 = 0.499		Wald Chi²(23)=671.4			
B. Specification with alternative amenity variables						
Temperature in warm period / 100	-0.017	-2.91	0.004	0.63	1.100	4.87
Precipitation in cold period / 100	0.180	2.73	0.061	0.60	-9.828	-4.62
Sulfur fall-out	0.074	2.33	0.007	0.19	-4.344	-3.59
Water pollution	0.020	7.37	0.036	7.85	-0.558	-6.85
Total phone lines	-0.897	-4.30	0.042	0.12	55.346	8.70
Doctors	-0.303	-2.65	-0.360	-2.02	11.757	3.23
Commuting time	0.222	3.15	0.616	5.47	-2.044	-0.94
Crime rate	0.012	3.44	0.004	0.98	-0.620	-5.18
Morbidity rate	0.759	3.47	0.499	1.66	-36.937	-4.79
Capital city	-0.194	-2.32	-0.167	-1.31	8.702	3.18
Ethnic-political risk	0.029	2.87	0.061	4.32	-0.639	-1.79
Share of loss-making firms	-1.919	-6.18	-2.751	-7.13	…	…
Employment change	3.190	3.49	1.151	0.88	…	…
	N = 2551		N=2215			
	R^2 = 0.478		Wald Chi²(23)=855.5			

Notes: t-statistics are defined with robust clustered standard errors allowing for correlation within sample districts. Summary statistics for alternative amenity variables is provided in Appendix 1. Both specifications also include the same set of human capital and housing characteristics as Tables 2 and 3. Full implicit prices are estimated at the mean of housing values and wages. Sample is restricted to respondents residing in cities.

Table 6: Ranking of Selected Cities among 953 Russian Cities by Quality of Life Index of 11 Amenities, 2000 Thousand Rubles

Rank	*City Name*	*Region Name*	*City QOLI*	*Region QOLI*
		Top 20 Cities		
1	Stavropol[1]	Stavropol'skiy kray	253	239
2	Voronezh[1]	Voronezhskaya oblast	250	246
3	Grajvoron	Belgorodskaya oblast	249	233
4	Lermontov	Stavropol'skiy kray	249	239
5	Elista[1]	Kalmykiya-Khal'mg Tangch	247	242
6	Astrahan[1]	Astrakhanskaya oblast	247	244
7	Korocha	Belgorodskaya oblast	247	233
8	Novohopersk	Voronezhskaya oblast	245	246
9	Essentuki	Stavropol'skiy kray	245	239
10	Kislovodsk	Stavropol'skiy kray	244	239
11	Volgograd[1]	Volgogradskaya oblast	244	238
12	Semiluki	Voronezhskaya oblast	243	246
13	Zheleznovodsk	Stavropol'skiy kray	242	239
14	Rostov-na-Donu[1]	Rostovskaya oblast	242	229
15	Sudzha	Kurskaya oblast	242	232
16	Krasnoslobodsk	Respublika Mordoviya	241	237
17	Saratov[1]	Saratovskaya oblast	241	230
18	Ryazan[1]	Ryazanskaya oblast	241	236
19	Novovoronezh	Voronezhskaya oblast	241	246
20	Gorodische	Penzenskaya oblast	240	233
[1]Regional centers				
		Regional Centers		
22	Saransk	Respublika Mordoviya	239	237
23	Belgorod	Belgorodskaya oblast	238	233
24	Tambov	Tambovskaya oblast	238	227
28	Penza	Penzenskaya oblast	237	233
30	Blagoveschensk	Amurskaya oblast	237	221
33	Izhevsk	Udmurtskaya Respublika	237	227
34	Kursk	Kurskaya oblast	236	232
37	Cheboksary	Chuvashskaya Respublika	236	229
43	Ul'yanovsk	Ul'yanovskaya oblast	235	233
45	Orenburg	Orenburgskaya oblast	235	222
46	Vologoda	Vologodskaya oblast	234	217
48	Nizhnij Novgorod	Nizhegorodskaya oblast	234	225
49	Kostroma	Kostromskaya oblast	234	228
50	Moscow	Moscow	234	228
53	Kemerovo	Kemerovskaya oblast	234	215
60	Krasnodar	Krasnodarskiy kray	233	220
63	Kirov	Kirovskaya oblast	233	233
64	Tula	Tul'skaya oblast	233	227
70	Samara	Samarskaya oblast	232	224

74	Joshkar-Ola	Respublika Mariy-El	231	228
77	Mahachkala	Respublika Dagestan	231	221
80	Orel	Orlovskaya oblast	230	226
83	Novosibirsk	Novosibirskaya oblast	229	224
90	Ivanovo	Ivanovskaya oblast	229	226
92	Chelyabinsk	Chelyabinskaya oblast	229	216
99	Birobidzhan	Yevreyskaya avtonomnaya oblast	228	225
110	Pskov	Pskovskaya oblast	228	218
113	Smolensk	Smolenskaya oblast	227	223
119	Nazran'	Ingushskaya Respublika	227	220
134	Bryansk	Bryanskaya oblast	226	222
135	Tomsk	Tomskaya oblast	226	221
139	Ekaterinburg	Sverdlovskaya oblast	226	212
140	Kaluga	Kaluzhskaya oblast	226	222
144	Omsk	Omskaya oblast	225	225
149	Vladimir	Vladimirskaya oblast	225	214
160	Kazan'	Respublika Tatarstan	224	211
171	Barnaul	Altayskiy kray	224	213
177	St. Petersburg	St. Petersburg	223	220
185	Tver'	Tverskaya oblast	223	213
204	Chita	Chitinskaya oblast	221	215
208	Lipetsk	Lipetskaya oblast	221	220
224	Arhangel'sk	Arkhangel'skaya oblast	220	210
242	Ufa	Respublika Bashkortostan	220	209
280	Vladikavkaz	Respublika Severnaya Osetiya	218	213
303	Petropavlovsk-Kamchatskij	Kamchatskaya oblast	217	214
304	Novgorod	Novgorodskaya oblast	217	210
306	Perm'	Permskaya oblast	217	207
309	Yaroslavl'	Yaroslavskaya oblast	217	211
326	Kurgan	Kurganskaya oblast	216	213
339	Irkutsk	Irkutskaya oblast	216	201
362	Nal'chik	Kabardino-Balkarskaya Resp.	215	211
372	Majkop	Respublika Adygeya	215	215
442	Murmansk	Murmanskaya oblast	212	197
447	Tyumen'	Tyumenskaya oblast	212	209
454	Yuzhno-Sahalinsk	Sakhalinskaya oblast	211	201
488	Kaliningrad	Kaliningradskaya oblast	210	202
506	Petrozavodsk	Respublika Kareliya	209	194
526	Anadyr'	Chukotskiy avtonomnyy okrug	208	208
544	Magadan	Magadanskaya oblast	207	206
567	Krasnoyarsk	Krasnoyarskiy kray	206	176
573	Habarovsk	Khabarovskiy kray	206	200
591	Vladivostok	Primorskiy kray	206	203
613	Kyzyl	Respublika Tyva	204	199
617	Syktyvkar	Respublika Komi	204	194
796	Ulan-Ude	Respublika Buryatiya	196	189

823	Yakutsk	Respublika Sakha(Yakutiya)	194	190
856	Cherkessk	Karachayevo-Cherkesskaya Resp.	192	189
		Bottom 20 Cities		
934	Neman	Kaliningradskaya oblast	174	202
935	Udachnyj	Respublika Sakha(Yakutiya)	173	190
936	Olonets	Respublika Kareliya	173	194
937	Babushkin	Respublika Buryatiya	172	189
938	Kostomuksha	Respublika Kareliya	171	194
939	Segezha	Respublika Kareliya	170	194
940	Kovdor	Murmanskaya oblast	170	197
941	Priozersk	Leningradskaya oblast	169	220
942	Cherdyn'	Permskaya oblast	168	207
943	Zaozernyj	Krasnoyarskiy kray	163	176
944	Usol'e	Permskaya oblast	162	207
945	Pudozh	Respublika Kareliya	161	194
946	Krasnoznamensk	Kaliningradskaya oblast	155	202
947	Kondopoga	Respublika Kareliya	151	194
948	Pravdinsk	Kaliningradskaya oblast	133	202
949	Myshkin	Yaroslavskaya oblast	111	211
950	Gusinoozersk	Respublika Buryatiya	92	189
951	Artemovsk	Krasnoyarskiy kray	89	176
952	Zapolyarnyj	Murmanskaya oblast	28	197
953	Noril'sk	Krasnoyarskiy kray	0	176

Table 7: Ranking Sensitivity Analysis

	Correlation between QOLI Values	*Spearman's Correlation between Rankings*
Alternative QOLI Rankings:		
1. With government regional wage coefficients (all 953 cities)	0.9557	0.9445
2. With government regional wage coefficients (39 RLMS cities)	0.9100	0.8998
3. With Moscow and St. Petersburg included as a dummy variable (all 953 cities)	0.9892	0.9906
4. With alternative amenity variables described in Table 5 (all 953 cities)	0.8428	0.8700
5. With the level of subsistence (all 953 cities) (Mean=0.148; Std.Dev.=0.043)	0.9910	0.9880
6. With survey weights (all 953 cities)	0.9999	0.9999
7. With wages actually received last month in the OLS wage equation (all 953 cities)	0.9740	0.9640
8. Based on the one stage OLS housing equation (without sample selection, all 953 cities)	0.9938	0.9929
9. With city fixed effects (39 RLMS cities, amenities only)	0.4663	0.5656
10. With city fixed effects (39 RLMS cities, amenities plus disequilibrium variables)	0.6389	0.7014
Government Regional Wage Coefficients		
1. All 953 cities	-0.4167	-0.5322
2. 39 RLMS cities	-0.6636	-0.6231
Mobility Change		
1. Average mobility change in 1994-1999 (all 953 cities) (Mean=3.112; Std.Dev.=8.767)	0.2894	0.2422
2. Average mobility change in 1998-1999 (all 953 cities) (Mean=0.678; Std.Dev.=9.234)	0.2655	0.2030

Note: The table shows the coefficients of correlation between the base QOLI values (shown in Table 6) and alternative QOLI values. The table also contains the coefficients of correlation between the base QOLI values and government regional wage coefficients and between the base QOLI values and the change in city mobility. Average mobility change is defined as an average annual change in population due to migration per 1,000 city residents. Mean value and standard deviation for average mobility change and the level of subsistence are shown in parentheses.

Appendix 1: Sample Mean Comparison Tests

Variables	*Sample of 953 Cities*		*Sample of 39 RLMS Cities*		*Two-Sample t Test*	*P-value*
	Mean	*Std.Dev.*	*Mean*	*Std.Dev.*		
Heating degree days /100 (cold)	1.428	0.266	1.415	0.212	0.363	0.719
Temperature in warm period /100	20.387	6.024	20.626	4.792	-0.302	0.764
Total precipitation /100	5.428	1.524	5.596	1.449	-0.711	0.481
Precipitation in cold period /100	1.422	0.559	1.425	0.435	-0.044	0.965
Air pollution	2.696	12.733	2.170	2.650	0.889	0.376
Sulfur fall-out	1.056	10.761	0.483	0.785	1.545	0.123
Water pollution	2.802	7.232	5.136	6.483	-2.193	0.034
Total phone lines	0.202	0.092	0.246	0.128	-2.125	0.040
Home phone lines	0.162	0.076	0.199	0.106	-2.161	0.037
Doctors	0.392	0.169	0.552	0.249	-3.971	0.000
Commuting time	4.094	0.354	4.356	0.440	-3.667	0.001
Crime rate	23.901	15.428	20.140	8.793	2.517	0.015
Morbidity rate	0.698	0.119	0.711	0.107	-0.749	0.458
Capital city	0.079	0.269	0.385	0.493	-3.853	0.000
Ethnic-political risk	1.650	2.158	1.514	1.497	0.543	0.590
Government regional wage coefficients	0.430	0.153	0.321	0.102	1.112	0.272

Note: t-statistics show the results of two-sample t test with unequal variances on the equality of means.

Appendix 2: Commuting Time Equation, RLMS Cities, 1994-1996, 1998

OLS	*Coeff.*	*t*	*Mean*	*Std. Dev.*	*Min*	*Max*
Dependent variable – Hours of commuting time per week			5.185	4.492	0	75
Female	-0.792	-9.44	0.508	0.500	0	1
Age	-0.005	-1.29	39.455	12.100	14	82
Years of schooling	0.065	3.83	12.015	2.587	0	18
Available public transportation						
Only buses (omitted)			0.361	0.480	0	1
Trams and trolley buses	0.729	5.87	0.458	0.498	0	1
Subway	1.128	5.96	0.181	0.385	0	1
Route length	0.032	1.99	10.193	2.603	4.58	23.60
Number of passengers / 100	0.043	1.69	4.525	2.892	0.04	11.26
Number of public vehicles	-0.417	-2.55	0.920	0.355	0.08	1.68
Constant	3.856	11.72				

N=11322 $F(11, 11310) = 22.92$ $R^2 = 0.024$

Notes: Year dummies are included for three of the four years; t-statistics are defined with robust standard errors. The sample is limited to the 39 cities included in the RLMS for the years in which the commuting question was asked.

Figure 1: Crime Rate per 100,000 People by Region in the Russian Federation, 1999

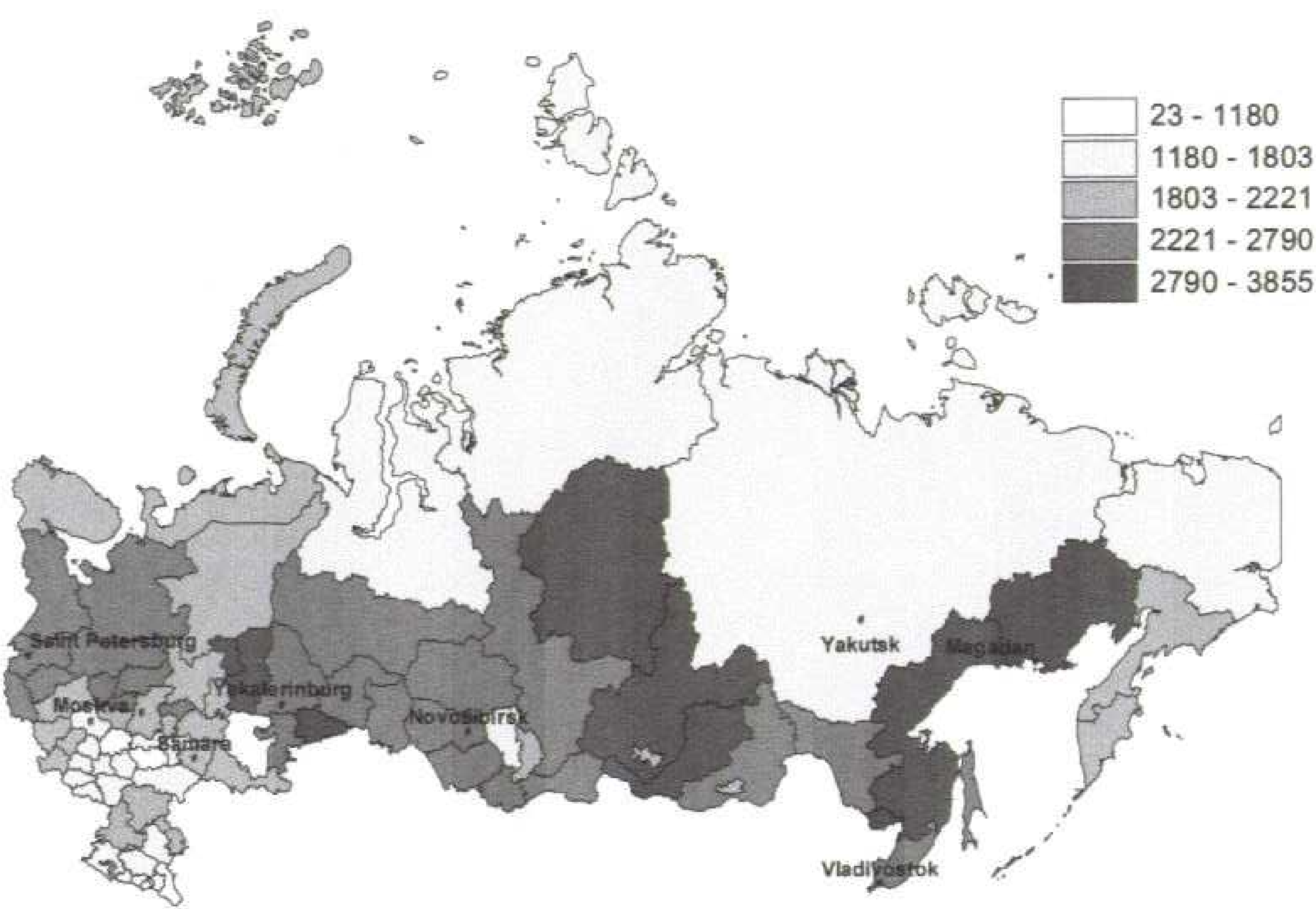


Figure 2: Government Regional Wage Coefficients, 2000

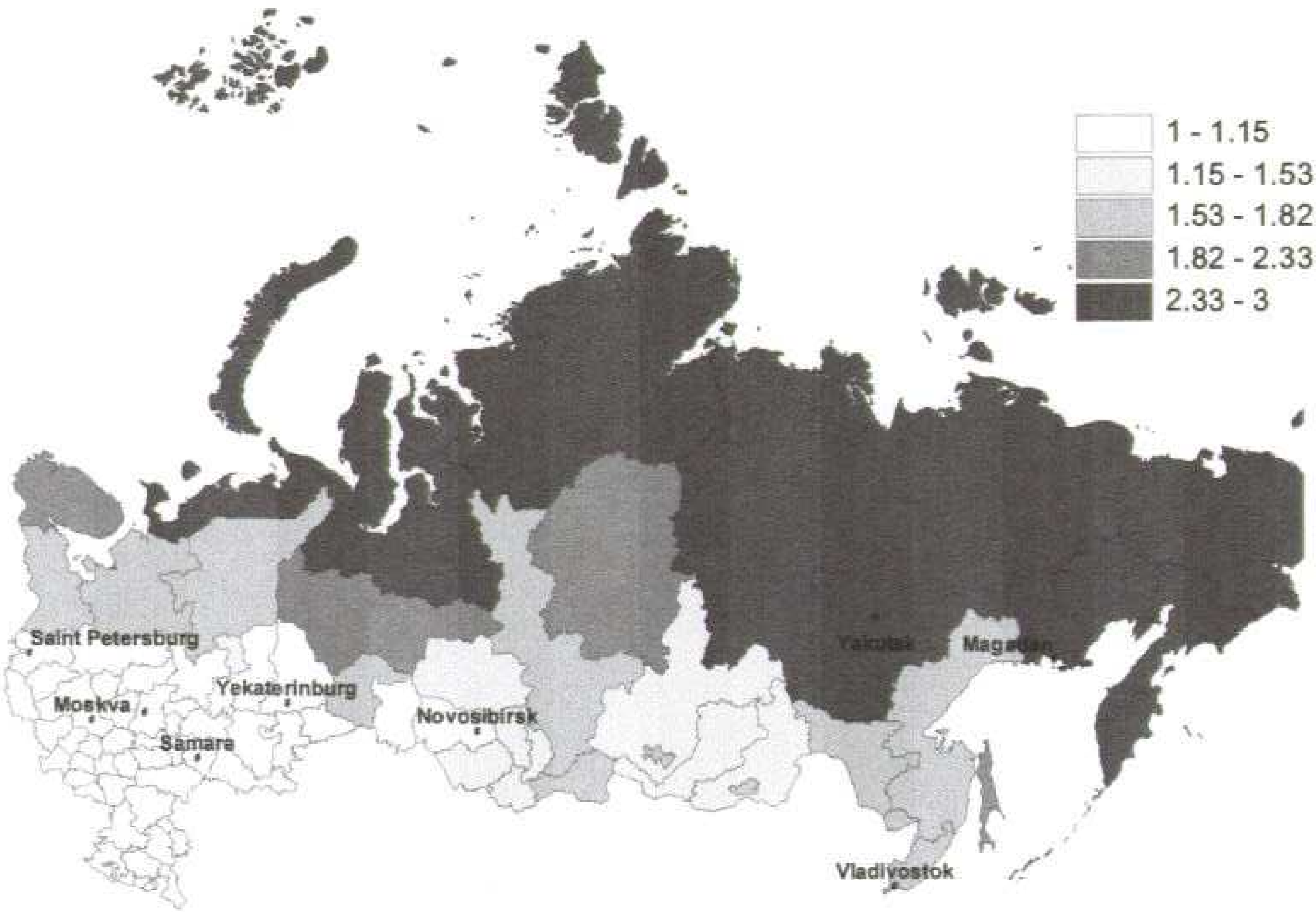


Figure 3: Quality of Life Index Values by Region in the Russian Federation, 2000

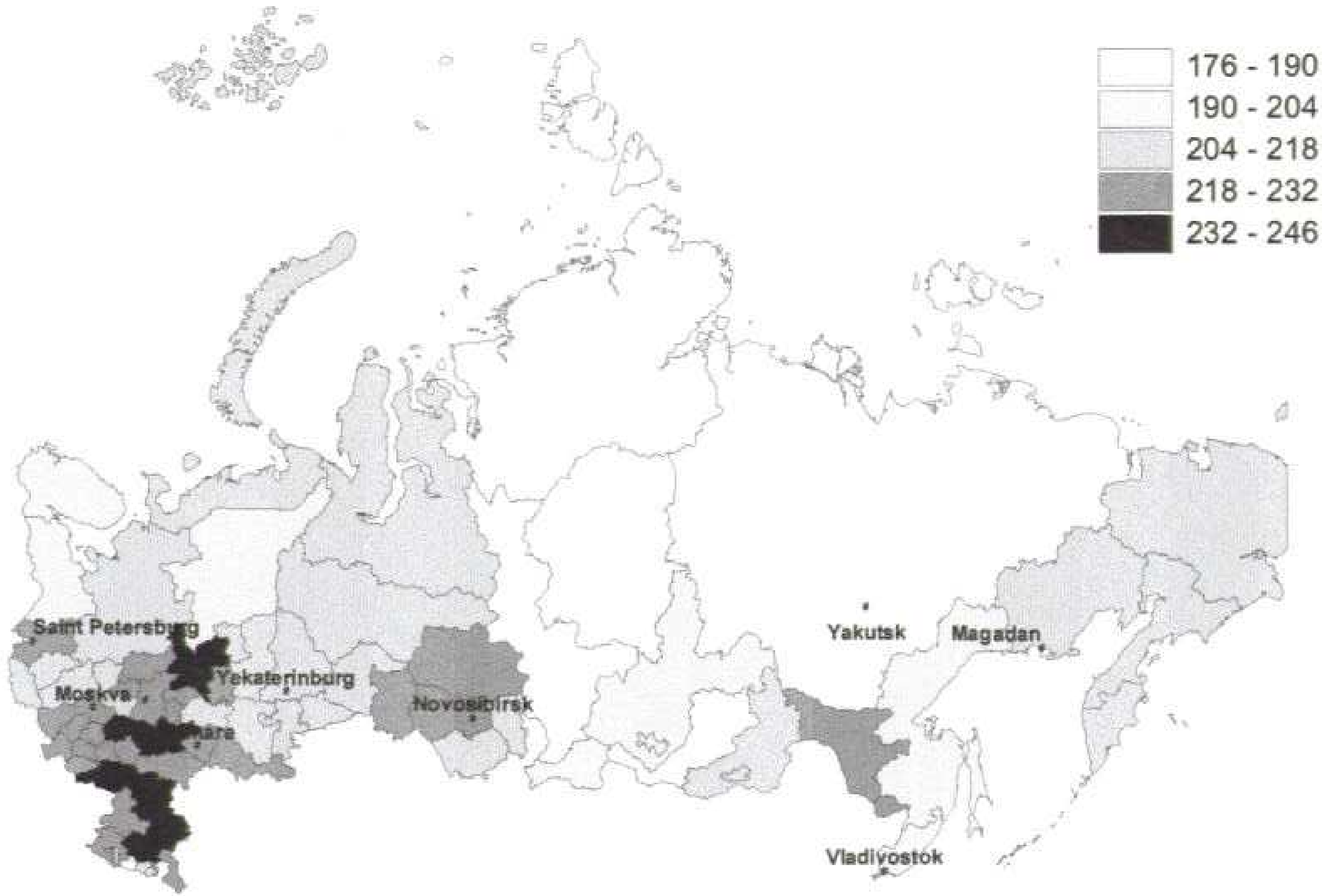
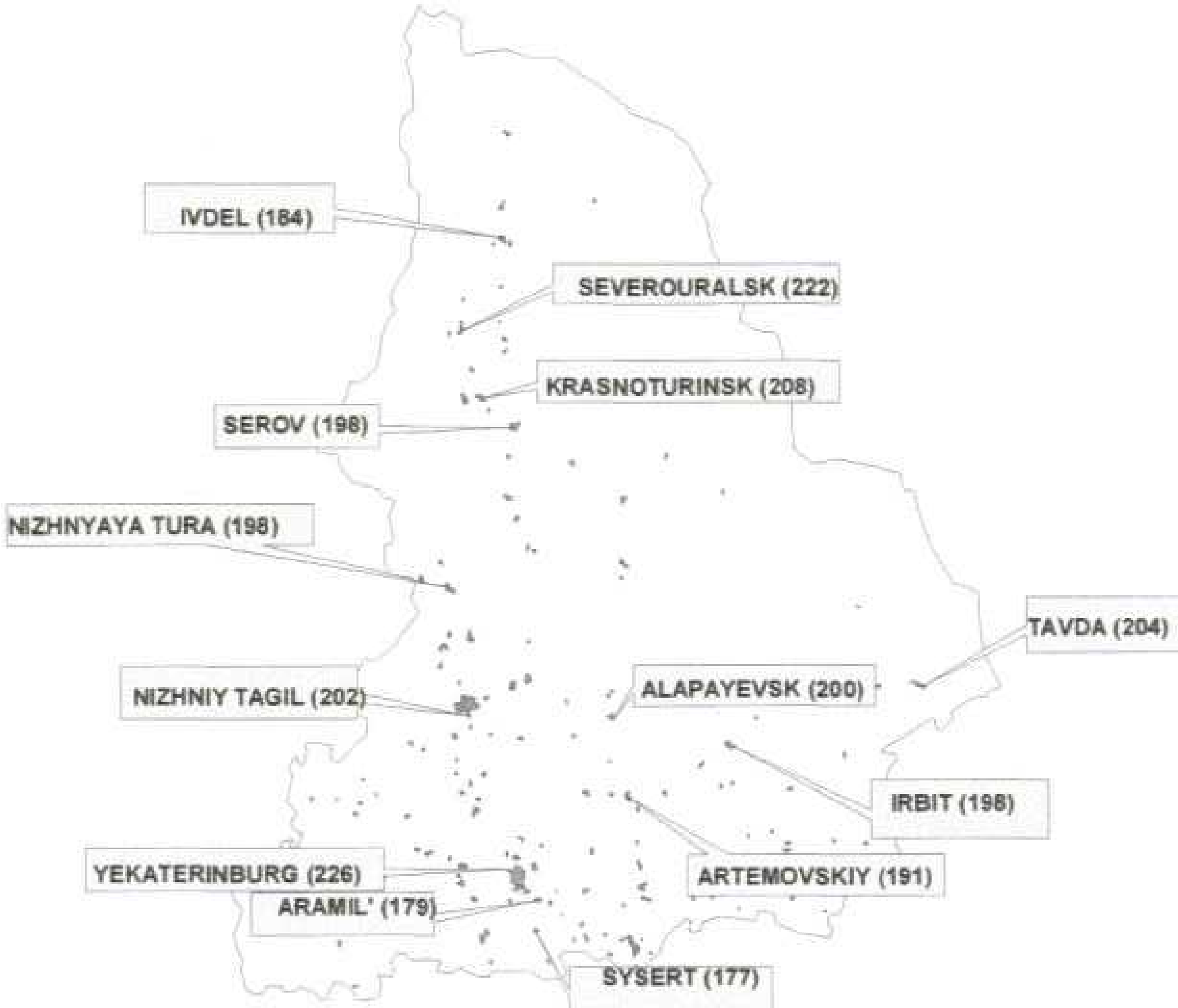


Figure 4: Quality of Life Index Values by City in the Sverdlovsk Region of the Russian Federation, 2000



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