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# The effect of supply and demand shocks on the non-market valuation of local public goods

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ABSTRACT. For local public goods, supply or demand shocks may create periods during which it is welfare enhancing for households to undertake spatial arbitrage by relocating residentially. We point out that the magnitude and direction of the average benefit estimate obtained during such a transition period is likely to vary systematically depending upon the magnitude of the shock, the level of transaction costs and the extent to which other affected goods are substitutes or complements. We test a subset of our model's predictions using cross-sectional data on household demand for improved municipal services in post-socialist Romania. Our preliminary empirical analysis suggests that there have been substantial gains in welfare resulting from spatial adjustment following the opening up of housing markets. Furthermore, our results indicate that benefit estimates for improved water services during the transition may be substantially higher than long-run estimates. This limited evidence supports our concern that economists may recommend *non-optimal* levels of long-run investment, regulation, or user fees if they are unaware of the implications of future readjustment to supply or demand shocks.

## 1. Introduction

Economists routinely assume that consumers are in a long-run equilibrium when estimating the demand for a local public good. However, periodically we observe significant demand and supply shocks to this equilibrium that entail lengthy periods of spatial readjustment. Significant shocks to the supply of or demand for local public goods may result from natural disasters (e.g., Hurricane Mitch), the implementation of large infrastructure projects (e.g., the Three Gorges Dam), new regulations (e.g., the California South Coast Air Quality Initiative), macro-economic shocks (e.g., the Asian Crisis), or wars (e.g., Bosnia). Whether these shocks increase, decrease, or simply redistribute consumption of a local public good, a readjustment period of unknown duration is likely to follow. During the period of readjustment households move from either a sub-optimal or super-optimal to an optimal level of consumption of the good. We focus on this process of readjustment to an optimal level of consumption because it is likely to lead to inter-temporal changes in the magnitude of benefit estimates for those goods that are affected by a shock.

In order to highlight the potential importance of such a shock for non-market valuation methods, we develop a simple theoretical framework and then evaluate some of its predictions using data from a study of

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demand for urban environmental services in post-socialist Romania. First, for households we develop a simple model of adjustment from rationed to optimal levels of consumption in which we consider the rate and direction of change in household willingness to pay (WTP) for an improvement in a quasi-fixed good. Second, we empirically test a subset of our theoretical predictions using stated preference data on demand for access to improved water service in Iasi, Romania following the 1989 Revolution.[1] Third, we identify improvements in stated preference methods that better identify and control for the effects of shocks when measuring welfare improvements associated with a change in a quasi-fixed good.

We begin by developing a simple model of the transition from rationed consumption to optimal consumption in order to characterize the effects of adjustment on households' willingness to pay or willingness to accept. We first examine how a shock to only one good in a bundle leads to the prediction that estimates of average WTP for an improvement in that good during the adjustment period are likely to overstate the long-run benefits of an improvement. Second, we consider how shocks to multiple goods and the subsequent adjustment are likely to affect household WTP. Using the results of Carson, Flores, and Hanemann (1998) we argue that during the adjustment period the average estimate of WTP for an improvement in one of the goods is likely to overstate long-run benefits if all other affected goods are Hicksian substitutes and income effects are small. In the absence of this assumption, however, we cannot make conclusive predictions about the average WTP estimate without knowing the exact demand relationships and the income effects associated with all of the goods affected by a shock.

Empirically, we examine household responses to a series of shocks in Iasi, Romania, which are exemplary of transitions throughout post-socialist countries in Eastern Europe and Central Asia. For these households, the transition from socialist to capitalist patterns of production and consumption has changed both the demand (due to declines in real income) and the supply (the spatial distribution) of local public goods. However, households in Iasi and other post-socialist cities could not *spatially adjust* to these shocks until the advent of functioning housing markets. We interpret the formation of housing markets as another type of supply shock in which a rationed household's choice set is suddenly expanded to contain both higher and lower levels of bundles of goods.[2]

Ideally, we would like to fully characterize the effects of this shock in Iasi, Romania on short-run and long-run WTP for an improvement by estimating: (1) past welfare gains from adjustment, (2) future welfare gains from adjustment, and (3) the duration of the adjustment period. However,

[1] In many post-socialist cities, a wide range of urban services such as hot and cold water service are provided either without a price or with a fixed price so that their consumption is non-exclusionary, giving them some of the properties of a local public good.

[2] As a result of shocks, households may be forced to consume either a sub-optimal level or a super-optimal level of the goods, corresponding to whether they would be better off if they could buy or sell some units of the good.

given that we only have cross-sectional data from a stated preference study, we limit our empirical analysis to hypotheses to show that households are adjusting in the expected manner and that there have been significant gains from past adjustment. Our first hypothesis is that residential re-sorting should significantly increase the allocative efficiency with which households consume local public goods. We test this by estimating the correlation coefficient for consumption levels of local public services and household income and by comparing these coefficient estimates for households who have relocated (e.g., readjusted) with those who have not. We show that for a suite of goods the correlation coefficients for households who have not moved are significantly lower than for those that have relocated.

Our second hypothesis is that those households who have the most to gain from an adjustment in consumption will relocate earliest. Empirically, we model the decision to relocate in the post-shock environment as a function of socio-economic characteristics to show that younger, richer, smaller, and better-educated households are most likely to readjust their consumption first. Third, although we cannot conclusively predict the sign, significance, or magnitude of the effect, intuitively we expect households, after relocating to their optimal location, to be willing to pay less, *ceteris paribus*, than households at a rationed level of consumption. We model willingness to pay by controlling for the endogeneity of the residential relocation decision using a simultaneous equation model. Our preliminary analysis suggests that WTP for improvements in hot and cold water services is 30–35 per cent lower for households who have readjusted as compared with those who have not, *ceteris paribus.*

Our goal in testing these hypotheses is to demonstrate the importance of identifying shocks so that economists will not recommend inappropriate levels of investment, regulation, or prices for public goods based on benefit estimates that capture the transient effects of rationing. Our empirical analysis of data from Iasi, Romania suggests that ignorance of the effects of the shock on benefit estimates would have led to the recommendation to over invest in and over price urban infrastructure in the long run. Furthermore, recognizing the limits of our empirical analysis, we discuss methodological improvements that better characterize shocks. Specifically, we describe how to improve the collection of cross-sectional data to better control for the endogeniety of the WTP and relocation decisions, the omission of variables on changes in substitute and complementary goods, and other issues.

This paper proceeds as follows. After providing a qualitative description of the shock and subsequent adjustment in Iasi, Romania, we review the relevant literature in section 2. In section 3, we develop a model of the transition and its effects on demand. In section 4, we consider empirical evidence, which suggests the transition has had, and will have, substantial effects on the magnitude and stability of willingness to pay estimates. Finally, in section 5, we discuss the implications of these findings for both future research and public policies.

**2. Background and related literature**

As in many large cities across post-socialist Europe and Asia, policy makers in Iasi, Romania have a new interest in understanding their residents demand for existing and improved local public goods and services.[3] The collapse of the socialist command and control system devolved responsibility for the provision and financing of these goods to municipalities, forcing them to determine optimal levels of investment and service provision and to develop new financing systems of user fees and taxes. This new quest to get the quantities and prices of public services 'right' has prompted a wave of non-market valuation studies with more likely to follow (Davis *et al.*, 1996; DeShazo, 1996; H.I.I.D., 1997; Cartwright, 1998).[4] But what have not been considered are the potential effects of recent supply and demand shocks on the long-run stability of these benefit estimates.

Households in Iasi have experienced three different types of shocks. First, there has been a demand shock due to a sudden reduction in real household income as employment in state-owned plants has fallen and capitalist production has been slow to start. Second, households have experienced a supply shock as the spatial distribution of local public goods has changed for two different reasons and in two different directions. As industrial production has fallen so have associated negative externalities, leading to reductions in air, water, soil, and noise pollution. However, publicly financed amenities such as education, crime prevention, transportation, and urban services (water supply, solid waste service, etc.) have also fallen as local financial resources have declined.

The third shock we consider is the expansion of a household's choice set of residential locations as a free housing market develops. As in many socialist countries, planners in Iasi assigned households to residential locations with the stated objective of minimizing a household's travel costs to work. (State housing was located next to industrial zones and tended to be uniform in quality and size.) Subsequent residential relocation was rare and typically proved extremely difficult, requiring government approval and reassignment. This assignment policy prevented households from choosing their optimal price–quantity bundle, forcing the majority of households to consume either super-optimal or sub-optimal levels of local public goods and services. For the remainder of the paper, we assume that household consumption is rationed *ex ante* as a result of either their initial assignment to a residential location or one of the many subsequent shocks.

In Iasi, we focused on public services for which households must pay a fixed price that is unrelated to the quality of the service and for which consumption is non-excludable. Commonly, households were charged a single price for a broad bundle of public services, including heating, hot and cold water, municipal waste disposal, building maintenance, and

[3] Iasi is a city of 500,000 inhabitants in Northeast Romania, which had an average monthly household income of $110 in 1995. See DeShazo 1996 for further details.

[4] Countries in which the benefits of improving quasi-fixed public goods are measured, using stated preference techniques, include Lithuania, Latvia, Poland, Romania, Ukraine, and Yugoslavia.

other services. While this price varied across neighborhoods or apartment buildings, its level generally bore no relationship to a household's level of consumption of these services. Moreover, since the early 1990s, the price of this bundle has risen considerably and become quite heterogeneous across buildings, while quality has declined across buildings.

Following the Revolution of 1989, households became free to choose any price–quantity bundle by moving to a corresponding residential location on the urban spatial menu. Gradually, administrative control over the assignment of housing was phased out; households were given property rights over their residences and were granted the freedom to relocate as they pleased. By late 1991, a nascent residential real estate market had developed, enabling a few households to sell and buy property. However, the absence of necessary complementary markets that provide mortgages, insurance, titles and legal services meant that the effective transaction cost of residential relocation remained very high. Furthermore, no new public housing has been provided since 1990 and local officials reported that less than 170 new units were built privately between 1992 and 1995 (DeShazo, 1996). Thus, although the feasible set of options for households had expanded, the global housing supply over the time period considered in this paper was effectively fixed.

It is extremely likely that households will further adjust to their greatly expanded choice set, although the timing of this adjustment is uncertain. A survey in 1995 revealed that only 12 per cent of households had relocated since the beginning of the real estate market in 1992. At the time of the survey, the majority of households appeared to be extremely poorly sorted—households in the bottom and top twentieth percentiles for income frequently lived in the same apartment building and often on the same floor. Indeed, a household's income and its consumption of local public services were *negatively* correlated as of 1995. As of 1992, a period of spatial arbitrage or adjustment appears to have begun. However, Iasi appears to have a long way to go before we see the patterns of residential sorting found in adjacent countries. The question that interests us is how estimates of demand for a local public good in Iasi are likely to be affected as households adjust their baseline consumption of this good and its related substitutes and complements.

### *2.1 Related literature*

To interpret the implications of this arbitrage process for the stability and validity of estimates of household willingness to pay, we draw on the literature concerned with rationing and consumer choice in spatial markets. We use the virtual price framework formalized by Neary and Roberts (1980) who developed the Slutsky equation analogue to fully characterize consumer demand under quantity rationing.[5] They identify the welfare, substitution, and income effects associated with a change in

[5] Chavas (1984) further generalized the work of Neary and Roberts. Deaton and Muellbauer (1980) lead a wave of empirical work on the effects of rationing in capitalist, transitional, and socialist economies, followed by Portes (1980), Ellis and Naughton (1990), and Wang and Chern (1992).

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the rationed good, which enables us to clarify how a change in the rationed good affects the welfare measures obtained from many non-market valuation methods. In addition, we draw on several strands of literature concerned with the efficient consumption of spatial amenities and spatial arbitrage (Tiebout, 1956; Koopmans and Beckmann, 1963).

Scholars in the hedonic literature have evaluated how well a hedonic price function, estimated before an improvement, predicts the welfare derived from that improvement *ex post*. The problem they document is that the improvement itself may induce households to adjust their location (consumption of the good) and, in doing so, change the slope of the non-linear hedonic price function—thus changing the implicit prices and associated quantities facing households. Specifically, Scotchmer (1986) and Bartik (1988), with extensions by Kanemoto (1988) and Palmquist (1988), show that a uniform improvement causes changes in the slope of the hedonic price function such that the marginal utility of an improvement diminishes once households have fully adjusted to that improvement. As a result, economists who use the 'old' hedonic price function to value the improvement may be overstating long-run benefits associated with the uniform improvements. Our analysis is based on the same insight; adjustments in a household's consumption of a good change their marginal and incremental value of an improvement in that good.

However, when the changes in the level of the good are not uniform across space (e.g., increasing in only select locations or moving in both directions at different locations) their impact on household WTP may not always be so clear. For example Polinsky and Shavel (1976) and Freeman (1979) consider changes in a small area open to migration. Perhaps the best evaluation detailing the impacts of an improvement on land rents may be found in Lind (1973) and Starrett (1981). These authors explicitly recognize the problem of how to infer the benefits of an improvement that changes rent gradients when adjustment is possible over a location that is not *directly* affected by the improvement.

When considering residential relocation in Romania, one other issue we must consider is how the benefit estimates for one quasi-fixed good may be affected by the changes in the consumption of other goods. Carson *et al.* (1998) describe the conditions under which changes in WTP for a good will also depend on changes in the levels or prices of related substitutes and complements. In our setting, moving to a new residence clearly entails changes in the consumption of other public and private goods. Their analysis, which we will discuss in detail, enables us to consider how changes in the consumption of related goods are likely to affect WTP for the good of interest. Similarly, Hoehn and Randall (1989) point out that benefit estimates for a project made independently of other improvement projects are likely to overstate the net benefits of the initial project. Hoehn (1991) later examined complementarity and substitution among goods and suggested that independent benefit estimation may either overstate or understate net benefits.

## 3. Theoretical framework

Initially, we assume that consumers choose from $m$ locations, each of

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which includes $Q$ goods, supplied in fixed quantities, and $X$ goods, for which consumption may vary at any time.[6] Consumer preferences over these goods are represented by a utility function $U(X,Q)$, where $j$ denotes the location (and levels) of the $Q$ goods. Consumers maximize $U(X,Q_j)$ with respect to $X$ and $Q$ subject to a budget constraint, $P_x X + P_j Q_j \leq y$, where $P_x$ and $P_j$ are the prices for the market goods and the quasi-fixed goods, respectively, and $y$ is the household's income.[7] In the vector $Q$, we let $q_i$ denote the quasi-fixed good of interest and $Q_{-i}$ denote the remaining quasi-fixed goods associated with a location.[8] Assuming the regularity conditions outlined in Diewert (1982) are satisfied, we may define the dual minimization problem in terms of an expenditure function and the Hicksian demand function such that $e(P,q_i,Q_{-i},U) = P \bullet X^h(P,q_i,Q_{-i},U)$.

Because we eventually characterize the welfare implications of a shock that changes the level of $Q$ at location $j$ from a household's optimal level to a rationed level, we adopt a virtual price framework. Virtual prices are defined by setting the marginal value of each good equal to the negative of the derivative of the expenditure with regard to each good

$$-\nabla_{qi} e(P,Q,U) = p_i^v(P,Q,U)$$

For a rationed level of the public good, the virtual price, $p_i^v(P,Q,U)$, is the price the consumer would have to face to be induced to purchase that rationed quantity. The virtual price depends on both changes in $q_i$ and $Q_{-i}$ and as in the standard framework may be used to measure changes in welfare. Maler (1974) and Lohman (1991) have shown that the WTP and WTA for a change in public goods may be represented as the integral of the virtual price over a change in the public good. As we discuss, virtual prices will enable us to characterize how a change in WTP for $q_i$ is affected by both a change in a household's ration of $q_i$ and changes in the rationed levels of other related goods in $Q_{-i}$.

*3.1 Shocks from equilibrium*

We assume that initially households choose their optimal location, $Q_j^*$, such that their consumption of the quasi-fixed goods is in a long-run equilibrium. That is, households choose a residential location, $j$, such that the marginal utility of $q_i$, $\nabla_i$, equals the price, $p_i$, which also equals the virtual price, $p_i^v$, of that good. Moreover, no other location, $k$, on the spatial menu has a welfare-improving level of $q_i$. For a given distribution of $Q$ over the $m$ locations, under these equilibrium conditions the population is deriving the maximum utility from these quasi-fixed goods.

[6] We assume that the quasi-fixed goods are collectively provided, but may not satisfy strict non-excludability and non-rivalry in consumption.

[7] The vector $P_j$ may represent either fixed prices or implicit marginal prices as defined by the hedonic property model for these quasi-fixed goods.

[8] We make no assumptions about, nor does our analysis depend on, the global optimality with which this quasi-fixed good is provided. We are primarily interested in the changes in efficiency with which a given supply of the good is consumed.

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Now imagine a shock to the supply of one public good, $q_i$. This shock could increase or decrease the level of $q_i$ at each of the $m$ locations or it may simply redistribute the pre-existing level of the good across the $m$ locations. In any case, consumers now face a new spatial choice set for $q_i$. Following such a shock we are likely to observe three possible outcomes, the first two of which represent rationed outcomes that are non-optimal:

| | |
|---|---|
| sub-optimal consumption | $q_i < x_i(P,M)$ and $p_i^v < p_i \Rightarrow \delta U/\delta q_i > 0$ |
| super-optimal consumption | $q_i > x_i(P,M)$ and $p_i^v > p_i \Rightarrow \delta U/\delta q_i < 0$ |
| optimal consumption | $q_i = x_i(P,M)$ and $p_i^v = p_i \Rightarrow \delta U/\delta q_i = 0$ |

As a result of the shock, the distribution of households over the spatial menu no longer maximizes the social benefits that may be derived from this new distribution of $q_i$. Under this new distribution of $q_i$, households may wish to undertake spatial arbitrage to either 'cash-out' of their current location (in the case of super-optimal consumption) or 'buy-up' (in the case of sub-optimal consumption).

If households are able to adjust instantaneously to arbitrage opportunities then the shock will not affect subsequent benefit estimates for the affected goods. However, we assume that spatial readjustment is *not* instantaneous, but rather progresses as a function of the level of relocation transaction costs. Furthermore, we assume that transaction costs, $C$, begin high and decline over the adjustment period, $s = C^1, \ldots, C^i, \ldots C^*$, where $C^*$ denotes the long-run level of transaction costs, which must be non-negative. In our setting of Eastern Europe and Central Asia this assumption is reasonable because the search and information costs as well as the legal (title), insurance and capital costs, which together comprise the transaction costs, are likely to decline as housing markets thicken. In the presence of transaction costs, the net benefits to a consumer of moving to location $k$ from $j$ are positive only if $|p_{ik}^v - p_{ik}| - C^i \geq |p_{ij}^v - p_{ij}|$—in other words, for the new location the welfare gains minus the transaction costs must be greater than the gains from the old location.[9] Over time as $C$ converges to $C^*$ we expect the total social welfare derived from the post-shock distribution of $q_i$ to converge to a maximum.

We are interested in the degree to which the adjustment process changes households' consumption levels of $q_i$ and the rate at which this adjustment occurs. The rate of adjustment depends upon the patterns of trade, which depend upon the magnitude and distribution of potential welfare gains and transaction costs. If the transaction costs faced by all households are uniform but declining then we expect consumers with the greatest potential gains to relocate first (i.e., those most constrained by either a sub-optimal or super-optimal assignment of $q_i$). However, empirically there is no reason to believe that the distribution of transaction costs is uniform across the population. The adjustment process is complete when transaction costs are in their long-run equilibrium and there are no households for which there are gains from trade: $C^* > |p_{ik}^v - p_{ik}|$.

[9] If $C^* > |p_{ik}^v - p_{ik}|$ then this transaction never occurs because equilibrium transaction costs do not make it welfare enhancing to relocate.

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*3.2 Evaluating the effects of post-shock adjustment on WTP*

Our research question is how does average household WTP for an improvement in a quasi-fixed good change during the adjustment period following a shock. If the shock affects *only* the good of interest then a household's WTP is measured by the difference $e(P,q_i^r,Q_{-i}^*,U) - e(P,q_i^1,Q_{-i}^*,U)$.[10] In this case we develop a simple model of adjustment from the short run (non-optimal levels) to the long run (optimal levels) to consider the effects on WTP of relaxing the ration. However, if the shock affects *multiple goods* then a household's WTP for the good is the difference $e(P,q_i^r,Q_{-i}^r,U) - e(P,q_i^1,Q_{-i}^1,U)$.[11] Under these conditions, our predictions about how WTP for $q_i$ will change depend upon specifying the Slutsky equation with regard to $Q_{-i}$ (i.e., the substitute and complementarity effects as well as the income effects).

*Shocks that affect a single good*

We begin with the case in which the shock only affects the distribution of $q_i$. Recall that $q_i$ is the good for which we wish to estimate the average WTP for an improvement from $q_i^0$ to $q_i^1$. During an adjustment to a shock, measuring WTP becomes tricky because some households are temporarily at their rationed level of consumption, $q_i^r$, while others are at the optimal level of consumption, $q_i^*$, given the post-shock choice set. At any point during the adjustment we can estimate (1) the average WTP for the $N^r$ households whose consumption is still rationed, (2) the average WTP for the $N^s$ households who have relocated to achieve their optimal consumption and (3) a 'hybrid' average WTP for the $N$ households in the entire sample, where $N = N^r + N^s$.

$$WTP^r = (\sum_{k=1}^{r} e_k(P,q_i^r,Q^r{}_{-i},U) - e_k(P,q_i^1,Q^r{}_{-i},U)/N^r$$

$$WTP^* = (\sum_{l=1}^{s} e_l(P,q_i^*,Q^*{}_{-i},U) - e_l(P,q^1{}_{-i},Q^*{}_{-i},U))/N^s$$

$$WTP^h = [(\sum_{k=1}^{r} e_k(P,q_i^r,Q^r{}_{-i},U) - e_k(P,q_i^1,Q^r{}_{-i},U) + (\sum_{l=1}^{S} e_l(P,q_i^*,Q^*{}_{-i},U) - e_l(P,q^1{}_{-i},Q^*{}_{-i}U))]/N$$

Over the course of the adjustment period, if the transaction costs $C$, go to zero in the long run then we should observe $WTP^h$ and $WTP^*$ converging. However, *ceritus paribus*, during the adjustment period it should be the case that

$$WTP^* \leq WTP^h \leq WTP^r$$

The estimate of average WTP for households at their optimal initial level of consumption will be lower than the hybrid estimate of average WTP which contains a mix of households, some with initially rationed levels of

[10] We could also evaluate the welfare change by evaluating the change in the virtual price, $p_i^v$, by taking the derivative of the expenditure function with regard to $q_i$.

[11] In this case, evaluating the welfare change requires evaluating how the virtual price, $p_i^v$, changes by taking the derivative of the expenditure function with regard to both $q_i$ and the elements of $Q_{-i}$ that have changed.

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consumption and others at initially optimal levels of consumption.[12] Furthermore, we can define the average gains from the past trade

$$WTP^* - WTP^r = \Pi \geq 0$$

which is the difference between the average of the two groups, *ceteris paribus*.

The intuition behind our argument can be illustrated by considering a simple world inhabited by two households which value the good differently; denote the WTP of the household with the higher value for the good $W^H(.)$ and that of the other household $W^L(.)$. In this world there is only one unit of a good to allocate. We wish to know how much each household is willing to pay for an increase from their initial level of consumption to two units of the good, denoted $W^H(2)$ and $W^L(2)$. How is our estimate of total (or average) WTP affected by a non-optimal versus optimal allocation of the one good? In the non-optimal world, the low-value consumer is given the only unit of the good. Summing the difference in the WTP of each we get $[W^L(1) - W^L(2)] + W^H(0) - W^H(2)]$. In an optimally allocated world, the high-value consumer is given the good. Summing the difference in the WTP of each in this case we get $[W^L(0) - W^L(2)] + [W^H(1) - W^H(2)]$. The total (or average) WTP for the households in the non-optimal world is greater than that in the optimally allocated world: $[(W^L(1) - W^L(2)) + (W^H(0) - W^H(2))] > [(W^L(0) - W^L(2)) + (W^H(1) - W^H(2))]$.[13]

What we learn from the above analysis is that the effect of the adjustment process on our estimate of average WTP depends upon the magnitude of the initial mis-allocation of $q_i$ induced by the shock and upon the level of and rate of change in the transaction costs. This yields predictions for both cross-sectional and time series analysis of WTP. First, the efficiency with which households consume affected goods should increase with residential relocation. Second, we have a somewhat obvious prediction that, *ceteris paribus*, the mean WTP of rationed households should be larger than that obtained for unrationed households: $WTP^r > WTP^*$. Third, inter-temporally, we should observe the average hybrid estimate, $WTP^h$, for an improvement decline throughout the adjustment period. Fourth, we should observe those households with the most to gain trade first.

*Shocks that affect multiple goods*

In the above analysis, we made the assumption that only one good was affected by a shock and that households relocated residentially so as to adjust their consumption of only that good. In the example of post-socialist shocks that we consider, it is likely that many quasi-fixed goods will be affected and equally likely that when households relocate residentially

[12] It is also true that this inequality will hold in the long run as long as the equilibrium transaction costs remain positive, $C^* > 0$.

[13] Furthermore, if we let these two households trade, moving them both from the short run in which the good is misallocated to the long run in which it is optimally allocated, societal willingness to pay for an improvement decreases by: $\Pi = W^L(1) - W^H(1) = [(W^L(1) - W^L(2)) + (W^H(0) - W^H(2))] - (W^L(0) - W^L(2)) + (W^H(1) - W^H(2))]$. This represents efficiency gains to future trade or, conversely, the societal dead-weight loss associated with the historical misallocation of the amenity.

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they will adjust their consumption of several of these goods simultaneously. Therefore we must consider how changing the price level of many related goods will affect the WTP for $q_i$. We draw on the analysis of Carson, Flores, and Hanemann (1998) who examine the global and local properties of preferences in order to explore the substitution and complementarity among goods. To consider how a change in one rationed good affects the value of the $q_i$ we begin with the Slutsky equation equivalent

$$\delta q_i/\delta p_{-i}^{v} = \delta q_i^{m}/\delta p_{-i}^{v} + \delta q_i^{m}/\delta y \bullet (q_{-i})$$

Where we let $q_{-i}$ and $p_{-i}^{v}$ represent another affected good and that good's virtual price. In proposition 1, Carson *et al.* (1998) show that this equation must equal zero in order for their WTP of $q_i$ to not be affected by a change in another good. In propositions 2 and 3, they go on to show that the conditions under which other goods will have no effect are highly restrictive and unlikely to hold in most settings.

An important question for our analysis is whether we can determine the sign of the expected change in WTP for $q_i$ if we identify the related goods as either substitutes or complements. Carson *et al.* (1998) go on to consider this question. After suggesting that most goods examined in valuation studies are likely to be Hicksian substitutes, they show that if all of the goods that improve are Hicksian substitutes with regard to $q_i$ then WTP for $q_i$ will be unambiguously non-increasing or in the case of strict Hicksian substitutes will be decreasing (proposition 4). More formally

$$(e(P,q_i^{0},Q_{-i}^{0},U) - e(P,q_i^{1},Q_{-i}^{0},U)) - (e(P,q_i^{0},Q_{-i}^{0},U) - e(P,q_i^{1},Q_{-i}^{1},U)) \geq 0$$

This implies that if the consumption of the other goods increase, the predictions about WTP for $q_i$ will be the same as those presented earlier. The implications are less conclusive for the scenario in which all the other goods that improve are Hicksian complements. In proposition 9, these authors show that if the consumption of only two other goods increases and these goods are (strict) Hicksian complements, then WTP for an increase in $q_i$ is non-increasing (decreasing). However, when the number of other complementary goods is greater than two, an increase in these goods may either increase or decrease the WTP for an increase in $q_i$.

In our setting, another case of interest is that in which the other goods are rationed *ex ante* but are chosen optimally upon residential relocation. Recall that in this case the physical distribution of these goods does not change but the efficiency with which households consume them improves. *Ceteris paribus*, this change may be expressed as the difference

$$(e(P,q_i^{r},Q_{-i}^{r},U) - e(P,q_i^{1},Q_{-i}^{r},U)) - (e(P,q_i^{*},Q_{-i}^{*},U) - e(P,q_i^{1},Q_{-i}^{*},U))$$

In this case if all goods are Hicksian substitutes then welfare-enhancing arbitrage should decrease WTP for $q_i$. If all other goods are complements (and there are more than two of them) then we cannot know conclusively what the effect will be on $q_i$.

## 4. Empirical analysis

In Iasi, Romania, we know that as households relocate, their consumption of water services and other goods changes. Furthermore, we will hypoth-

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esize, as well as provide preliminary evidence that the allocative efficiency of many of these goods is improving. However, while we suspect that the net effect of these welfare-enhancing adjustments in consumption will lead to a decline in average WTP, we cannot predict this conclusively. In addition, we must limit our hypothesis testing to those hypotheses that may be evaluated with standard cross-sectional stated preference survey data. Nonetheless, we can evaluate three hypotheses that highlight the importance of identifying and characterizing the effect of shocks on household WTP.

First, we hypothesize that these shocks have induced residential resorting, which should increase the allocative efficiency with which local public goods are consumed. Second, we hypothesize that households with the most to gain from such an adjustment should relocate earliest in the adjustment period. Third, we hypothesize an effect attributable to the adjustment period on household's WTP for water services. We intuitively expect the effect to be a decrease in WTP for an improvement in water services for those households who have moved although we cannot predict the sign, significance, or magnitude. To test these three hypotheses, we analyze survey data collected to assist municipal officials in evaluating the potential to finance capital-intensive projects through higher user fees and property taxes. These data were obtained from a random in-person survey of 1,218 households in the metropolitan area of Iasi in 1995. For each household, information was collected about: (1) current housing quality and location, (2) levels of municipal services, (3) when households last relocated, (4) socio-economic characteristics, and (5) households' WTP for improved municipal services such as hot and cold water.[14]

*4.1 Allocative efficiency in consumption and trading behavior*

Our first hypothesis is that the efficiency with which households consume local services will increase as households move from their rationed location to the location that achieves their optimal level of consumption. Ideally, we would compare households' preferred consumption with their actual consumption for those who have and have not relocated. Since we cannot observe household preferences, but assume that these local services are normal goods, we use a household's income as a rough proxy for its preferred level of consumption. Our measure of relative allocative efficiency in consumption is the degree of correlation between a household's income and its level of consumption of local services. We expect that as allocative efficiency increases so too will the degree of correlation between income and consumption of these goods. In table 1 we present the correlation coefficients for several local public goods and services. For households who have relocated, income is positively correlated with the level of hot and cold water services, district heating service, in-house heating service, and solid waste service. In contrast, for households who are still at their administratively assigned location, the correlation coefficient is either negative or close to zero for these municipal services, highlighting the extent of the misallocation of local public goods for the 88 per cent of the population that have not relocated.

[14] For a detailed discussion of the study, see the Romania Policy Brief Series (DeShazo, 1996).

Table 1. *A comparison of correlation coefficients: mobile versus immobile households since 1991*

| *Characteristic or service* | *1991–1995 Correlation with income* | |
|---|---|---|
| | *Relocated* | *Did not relocate* |
| Hours of cold water daily | 0.07 | −0.02 |
| Hours of hot water daily | 0.20[a] | −0.12 |
| Own heating source | 0.20[a] | −0.12 |
| Quality of solid waste service | 0.63[a] | −0.10 |
| No. of floors in building (Proxy for water services quality) | 0.14[a] | 0.07 |

*Note:* [a] Significantly different from zero at the 10 per cent level.

Our second hypothesis is that households with the largest potential gains from moving will relocate first. In theory, these are households for which $(|p_{ik}^{v} - p_{ij}| - C)$ is the largest. Ignoring transaction costs for a moment, the largest potential gains are likely to be associated with the highest or lowest income households at locations with the lowest or highest level of amenities. However, in Iasi the transaction costs appear to be asymmetrically distributed. Asymmetrical access to capital markets and information on the housing market and related legal procedures suggest that more educated, wealthier households with connections to the private sector will have relatively lower transaction costs and thus higher mobility rates. To evaluate who is trading in the early stages of this market, we use a probit model to characterize the decision to relocate between 1991, when the real estate market began, and 1995 when the survey data were collected. The dependent variable equals 1 if the household relocated and 0 otherwise. We explain this relocation decision as a function of several socio-economic characteristics of the household. We present the results of this analysis in the left-hand column of table 2. The socio-economic characteristics of mobile households reveal that relocation has been skewed toward the younger, smaller, more educated, and wealthier households.

If we look more closely at the relationship between income and mobility, we see that proportionally the very poor have engaged in slightly more relocation than have those in the middle class. Figure 1 shows that the percentage of households in the upper-most income quartile (15 per cent) and lower-most income quartile (9 per cent) are comparatively more likely to have relocated than those in the middle-income quartiles (7 per cent each). This comports with, but does not confirm, our conjecture that the first households to move are those who most desire to either 'cash out' in the case of poor households with super-optimal consumption or 'trade-up' in the case of wealthier households with sub-optimal consumption.

*4.2 Willingness to pay for improved water service*

Our third hypothesis is that the WTP for an improvement in water service will be affected, and may decrease *ceteris paribus*, as a result of adjustment to the newly available choice set. To evaluate this hypothesis, we analyze the data generated by the stated preference methods used to value

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Table 2. *Instrumental variable model*

| | *Probit (Relocation: 1991–1995)* | | *Second stage (Willingness to pay)* | |
|---|---|---|---|---|
| | *Coefficient* | *(t-statistic)* | *Coefficient* | *(t-statistic)* |
| Relocation dummy (1 = Yes, 0 = No) | | | −1,123 | (−3.7) |
| Income of head (in 50,000 lei) | 0.102 | (2.69) | 503 | (3.40) |
| Post-secondary education (1 = Yes, 0 = No) | 0.225 | (1.71) | 811 | (2.19) |
| Employed by private sector (1 = Yes, 0 = No) | 0.07 | (2.36) | | |
| No. of members employed | −0.209 | (−2.56) | | |
| Age of head | −0.049 | (−8.80) | −90 | (−6.35) |
| Household size | −0.127 | (2.81) | 92 | (1.89) |
| Hours of hot water service | | | −300 | (−1.42) |
| Number of floors in bldg. | | | 79 | (1.86) |
| Starting point bias | | | 125 | (0.11) |
| Quality of interview | | | 1,001 | (4.9) |
| Presence of listener | | | 20 | (0.01) |
| Sigma | | | 2.23 | (2.78) |
| Rho | | | 0.072 | (1.99) |
| Constant | 1.156 | (2.284) | 3,666 | (3.01) |
| *N* | 511 | | 511 | |

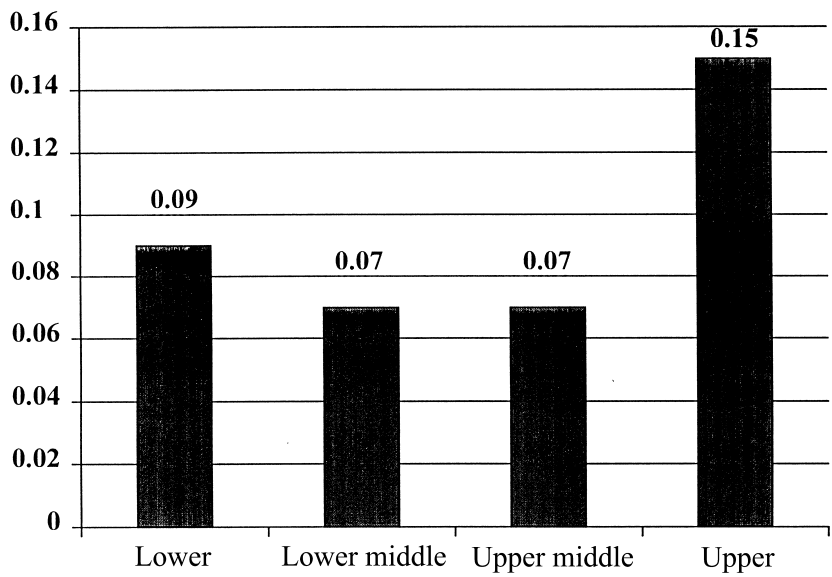


Figure 1. *Percentage of households who have relocated by income group*

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improvements in hot and cold water service in Iasi. We present the survey text for the stated preference question format in appendix A. Enumerators presented households with a scenario in which they would receive water service 24 hours per day, with adequate pressure, without discoloration or odor, and at an appropriate temperature in the case of hot water. In return, households would have to pay a higher monthly water bill. The elicitation format employed was a double-bounded referendum with an open-ended follow-up, enabling us to evaluate both discrete and continuous expressions of WTP.

At the time of the stated-preference study, there was a great deal of spatial variation in the quantity, quality, and cost of water-related services in Iasi. In 1995 the municipal government centrally supplied both hot and cold water on an average of 4 and 17 hours per day, respectively.[15] Nearly half of all households received hot water less than 2 hours per day, while 10 per cent of households enjoyed hot water at least 12 hours per day. Access to cold water, while more plentiful, was also heterogeneously distributed. Household expenditures on water-related services varied from 4 per cent to 11 per cent of monthly income as the utility raised the flat rate it charged neighborhoods. These variations in service quality and cost were due to differential spatial deficiencies in the production and distribution system across Iasi.

We assume that the amenity under consideration, water services, is important enough to be a factor in the residential choice of households. To evaluate this preliminary assumption, we examine households' rankings of the three public services most in need of improvement.[16] The frequency distribution of households' first choices is presented in figure 2. Over 38 per cent indicated that crime prevention was the most important service in need of improvement, while 25 per cent ranked public education first. However, 18 per cent ranked improved water services first, while 50 per cent of households ranked it as either the second or third most important. Furthermore, policies to improve water services were proposed by every candidate in the mayoral race in 1996.

Turning to evaluate how moving (or adjustment) to a welfare-improving location affects the average WTP for water, we compare households who are at rationed levels of both water services and other goods and services with households who are at their optimal levels of consumption for all goods. Our conjecture is that, *ceteris paribus*, households who have relocated will be willing to pay less for an improvement than those who have not relocated. Expressed in terms of the expenditure functions we expect

$$\left(\sum_{k=1}^{r} e_k(P,q_i^r,Q_{-}^r,U) - e_k(P,q_i^1,Q^r{}_{-i},U)/N^r\right) - \left(\sum_{l=1}^{s} e_l(P,q_i^*,Q^*{}_{-i},U) - e_l(P,q_{-i}^1,Q_{-i}^*,U)/N^s\right) = \Pi \leq 0$$

[15] While households may supply their own hot water in the future through the use of in-house devices and tanks, in 1995 less than 2 per cent had the ability to heat their own water aside from stovetop heating.

[16] The set of possible choices was determined during the pre-test and includes urban parks, noise pollution, air pollution, parking and public transportation, education, crime, water services, and solid waste services.

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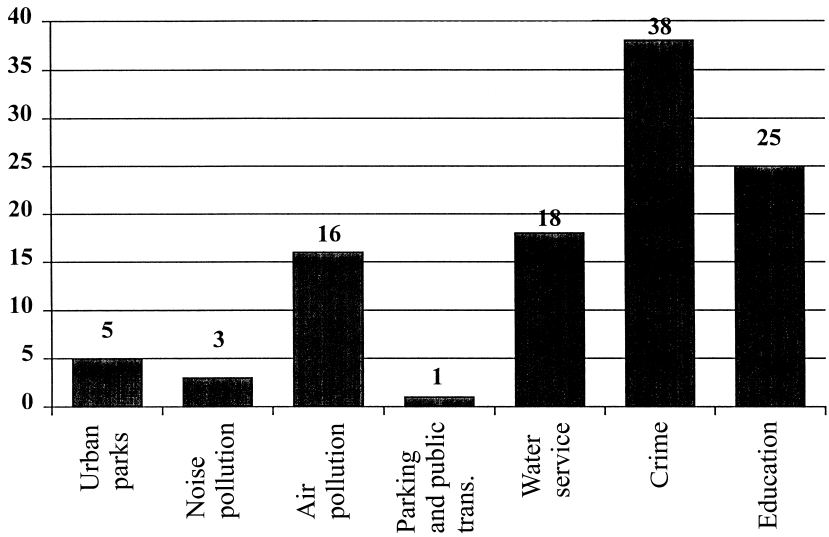


Figure 2. *Percentage of households who rated the local public good most in need of improvement*

*(Average WTP conditioned on* $q_i^r$ *and* $Q^r{}_{-i}$*) − (Average WTP conditioned on* $q_i^*$ *and* $Q^*{}_{-i}$*)*

Where Π is the average difference in WTP for $q_i^1$ between the two groups. Although the sign of the difference between these expenditures is technically indeterminate for the reasons discussed above, we believe that households who have relocated will be willing to pay less, *ceteris paribus*, because we believe that the substitution effects will dominate.

We specify a model of WTP for the improved services that will be estimated as a logistic regression, using the discrete responses, and an OLS regression, using the open-ended continuous responses. The model for the open-ended willingness to pay responses takes the form

$$WTP = \alpha + \beta_Z X_Z + \beta_\Pi Y_\Pi + \varepsilon$$

where α is a constant and $X_Z$ is a vector of variables including the current level of service, available substitutes, the level of the starting value for the discrete WTP questions, and demand shifters in the form of socio-economic variables (Cameron, 1988). The variable, ε, is the error term. We define a dummy variable, $Y_\Pi$, that distinguishes households at a rationed level of $q_i$ from those at their optimal levels so that

$$E(WTP \mid Y_\Pi = 0) = \alpha + \beta_1 X + \varepsilon = (\sum_{k=1}^{r} e_k(P,q_i^r,Q^r{}_{-i},U) - e_k(P,q_i^1,Q^r{}_{-i},U))/N^r$$

$$E(WTP \mid Y_\Pi = 1) = \alpha + \beta_1 X + \beta_\Pi Y_\Pi + \varepsilon = (\sum_{l=1}^{s} e_l(P,q_i^*,Q^*_{-i},U) = e_l(P,q_i^1,Q^*_{-i},U))/N^s$$

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Table 3. *Model of household determinants of WTP for water services (Dependent variable = discrete and continuous willingness to pay)*

| *Independent variable* | *Logistic hot water* *Coeff.* | *(z-stat.)* | *Logistic cold water* *Coeff.* | *(z-stat.)* | *OLS hot water* *Coeff* | *(t.stat.)* | *OLS cold water* *Coeff.* | *(t-stat.)* |
|---|---|---|---|---|---|---|---|---|
| Relocation dummy | −0.36 | (−3.12) | −0.27 | (−1.76) | −1,019 | (−2.3) | −2,104 | (−1.97) |
| Income of head (50,000 lei increments) | 0.10 | (2.42) | 0.17 | (3.2) | 497 | (3.27) | 1,250 | −(3.2) |
| Post-secondary educ. (1 = yes; 0 = no) | 0.20 | (2.12) | 0.16 | (1.96) | 808 | (2.10) | 503 | (1.96) |
| Age of head (years) | −0.03 | (−4.28) | −0.12 | (−6.96) | −0.94 | (−7.55) | −100 | (−6.96) |
| Employed by private sector (1 = yes; 0 = no) | 0.55 | (3.15) | 0.36 | (1.99) | 1,225 | (2.86) | 1,090 | (1.99) |
| Hours of water service | −0.45 | (−1.32) | −0.03 | (−0.69) | −301 | (−1.32) | −507 | (−0.69) |
| No. of floors in bldg. | 0.01 | (0.11) | — | — | 77 | (1.80) | — | — |
| Starting point dummy | — | — | — | — | 120 | (0.03) | 204 | (0.80) |
| Log of threshold value | 0.73 | (1.92) | 0.56 | (1.95) | — | — | — | — |
| Quality of interview (ranked 1–3) | 0.43 | (4.34) | 0.36 | (3.01) | 1,107 | (4.95) | 932 | (3.01) |
| Presence of a listener (1 = yes; 0 = no) | 0.04 | (0.36) | 0.01 | (0.01) | 21 | (0.01) | 3 | (0.01) |
| Constant | −7.3 | (−2.24) | −8.6 | (−3.26) | 3,671 | (3.71) | 7,054 | (3.26) |
| | Pseudo $R^2 = 0.11$ | | Pseudo $R^2 = 0.09$ | | $R^2 = 0.21$ | | $R^2 = 0.19$ | |
| | $N = 1{,}120$ | | $N = 530$ | | $N = 1{,}120$ | | $N = 530$ | |

The estimate of $\beta_{\Pi}$ measures the average difference in WTP between these two groups; the interpretation of this dummy variable is equivalent to the value of $\Pi$ as presented above.

Preliminary results for hot and cold water are presented in table 3 based on both the initial discrete bids and the open-ended follow-up questions. Before interpreting the effect of relocation it will be useful to know that the mean WTP estimated from the discrete referendum question is 3,332 lei and 7,201 lei per family per month for hot and cold water, respectively.[17] The mean WTP obtained from the open-ended question was 3,200 and 6,900 lei per month, respectively.[18] The coefficient on the relocation dummy, $\beta_{\Pi}$, is negative and significant across both functional forms and types of service. For households who had relocated, the logistic regression reveals a reduction in WTP of 1,234 lei and 1,904 lei or 37 per cent and 26 per cent on average for hot and cold water, while for the OLS regression the reduction was 1,019 lei and 2,104 lei or 32 per cent and 29 per cent on average.

However, it is reasonable to suspect that $Y_{\Pi}$ may be correlated with the error term, $\varepsilon$, implying that $\beta_{\Pi}$ may be endogenous and not be consistently estimated. The probability that a household relocated is likely to be a function of the WTP for (or to forego) an improved amenity. A Hausman test

[17] In 1995, US$1 was equal to 2,000 Romanian lei.

[18] For a complete discussion of the specification of these models, see DeShazo (1996).

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of the exogeneity of the relocation dummy is rejected at the 5 per cent level for both the hot and cold water models; the t-statistic for the fitted value relocation dummy was 3.69 and 1.98 respectively. To control for this endogeneity, we employ a treatment effects model of selection (Barnow, Cain, and Goldberger, 1980; Greene, 1998: 716 and Maddala, 1983: 263–4), which simultaneously models the household's decision to relocate and its WTP for hot water. To the WTP model, we add a probit model of the decision to relocate to control for selection effects. This model takes the form

$$Y_{\Pi} = \alpha + \beta_Z X_Z + \beta_E X_E + \varepsilon_1$$
$$WTP = \alpha + \beta_Z X_Z + \beta_{\Pi} Y_{\Pi} + \varepsilon_2$$

Where $Y_D = 1$ if the household has relocated since 1991 and is equal to zero otherwise. The error terms, $\varepsilon_1$ and $\varepsilon_2$, are distributed bivariate normal with standard deviations $\sigma_1$ and $\sigma_2$ (which are normalized to one), while the correlation across the error terms is measured by ρ (see Greene (1998: 716) for estimation details).[19]

The exogenous variables, $\beta_E$, we use in the probit model are: (1) whether or not the head of the household is employed by the private sector and (2) the number of family members employed in any occupation, which is highly correlated with a household's decision to relocate, but is not correlated with a household's WTP for hot water. Employment in the private sector appears to offer the household access to new information particularly on the nascent capital market as well as the real estate and related markets. The total number of household members employed appears to make finding a suitable new home more difficult. This is because of the logistical challenge of finding not only a unit with more than the average number of rooms (3.2) to accommodate a larger household, but also of finding a location that does not increase the sum of the household's travel costs.

We present the results of the simultaneous equation model in table 2. We see that, for hot water, our estimate of $\beta_{\Pi}$ changes from 1,109 to 1,132 lei (from 32 to 34 per cent). This parameter is robust in a wide range of model specifications, changing most significantly with the omission of household income. The estimated correlation between the error terms of these two models is 0.07 and is significant at the 10 per cent level, suggesting that the correction for endogeneity was appropriate.

*4.3 Caveats and future refinements*

Our empirical efforts to characterize the effects of a shock on WTP could be significantly improved by (1) better estimating $\beta_{\Pi}$ in a cross-sectional analysis or (2) collecting inter-temporal data that would help characterize additional dimensions of the shock. There are several reasons why our estimates of $\beta_{\Pi}$ may not be consistent. First, even with the correction for endogeneity, we suspect our estimate of $\beta_{\Pi}$ may be an underestimate of

[19] A second way of correcting for the endogeneity associated with the relocation variable is to employ a two-stage least squares approach; regress $Y_{\Pi}$ on exogenous and other variables to obtain the fitted value for $Y_{\Pi}$. Then include this fitted value in the WTP equation (Maddala, 1983: chapter 9).

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potential efficiency gains. Recall that we made the assumption that a household that had relocated moved precisely to its equilibrium location. However, given the thinness of the real estate market in Iasi, relocation may only imply a move toward, but not the achievement of, the household's optimal level of consumption. Under existing conditions, it would not be surprising to observe these households relocating *again* in the future, especially as the supply of new homes increases; this simplifying assumption may lead to a downward bias in this parameter estimate. Second, we have not controlled for the changes in the other goods, $Q_{-i}$, for those households that have relocated. The effect on $\beta_{\text{II}}$ will depend upon whether these goods are complements or substitutes and the magnitude of these changes. Third, we cannot be sure that unobserved heterogeneity is not affecting our parameter estimate.

Some of these concerns could have been addressed by collecting additional information about households, their consumption and their decision to move or not. For households who did relocate, obtaining additional information on past and present levels of consumption of local public goods/services, their transaction costs, their motives for moving, and the constraints they faced would have been helpful. This information may also provide additional instrumental variables with which to control for endogeneity. In many cases, the level of these goods may be correlated with the household's decision to relocate, but not with their *ex post* demand for improvements in services at their new location. For households who have not moved, it would have proven useful to determine whether they planned to relocate, if not, why and, if so, what constraints and transaction costs households felt they would encounter.

## 5. Discussion

By moving beyond a cross-sectional analysis, we could potentially have done more than estimate the past gains from adjustment to the shock. By extending the data collection to time series or even panel data approaches we could better characterize the time path of the transition and its likely effect on future estimates of benefits. Although more costly, this would enable researchers to better model the rate of adjustment and the magnitude of welfare gains associated with different stages of the adjustment period. Indeed, it is worth noting that accelerating the adjustment process improves the utility derived from the existing distribution of all quasi-fixed goods. Indeed, it may be the case that improving households' ability to adjust their consumption to the optimal level for the given spatial distribution may generate larger welfare gains than incremental improvements in the goods while spatial adjustment remains encumbered by thin markets.

Despite the uncertainty about the magnitude of the adjustment period, the range of evidence that we have presented suggests that a spatial transition is occurring and will affect the stability of measured welfare estimates. By describing the effects of spatial arbitrage on demand estimates we sought to improve the reliability of valuation methods in these transitional situations. We seek to caution economists and policy makers when using valuation information obtained before, during, and

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after significant demand or supply shocks. Accounting for this process is likely to remain important for the next decade in many parts of post-socialist Europe and Asia. Other significant policy interventions such as large infrastructure projects, new regulatory regimes or natural disasters may produce similar periods of disequilibria in the spatial market for local public services.

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## Appendix A: A description of willingness to pay questions used in Iasi, Romania

*Introduction to bidding games for improved services*

Now, I would like to find out how much your household would be willing to pay for water meters and improvements in the water services you receive.

I shall describe in detail the improvements in the service to you and then ask whether you would be willing to subscribe to these improved services at a specific price. You shall have to answer YES or NO to these questions.

It is in your best interest to indicate the price you are really willing to pay. If you mention an artificially low price, you run the risk of not obtaining the service. If you mention an artificially high price, you might actually have to pay it. The best strategy is to indicate your real willingness to pay.

Every household has different needs and financial resources. Please respond to the questions on the basis of your own needs and finances. Also, consider whether your family has more important things on which to spend its money.

Do you have any questions about what I have just said?

*Apartments: Willingness to pay for improved hot water*

You have indicated that you receive hot water less than 24 hours a day and that water pressure is sometimes low.

I am going to ask you a series of questions about how much you and your family would be willing to pay each month for improved *hot water* service. In order to cover the costs of improving the system RAT and RAJAC may have to increase the price of the water supply.

When responding you should assume that you will be billed *only* for the water your family uses.

By improved hot water service, we mean you will receive *hot water* 24 hours a day, every day of the week, all year around. Water pressure will be satisfactory. The temperature of the hot water will be carefully regulated so that it is neither too hot nor too cold.

1. Would you and your family be willing to pay a *total* hot water bill of 10,000 lei each month for improved hot water service?
   _____ YES—SKIP TO Q.3
   _____ NO—CONTINUE
2. Would you and your family be willing to pay a *total* hot water bill of 8,000 lei (or 7,000 lei) each month for improved hot water service?
   _____ YES _____ NO
   ENUMERATORS: CONTINUE TO Q.3!
3. What is the maximum bill for improved hot water service you and your family would be willing to pay each month? _____ lei

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