Determinants of the Living Arrangement of the Elderly: The Role of Housing Market[*]

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INTRODUCTION

Research on determinants of living arrangements of the elderly has focused primary the individuals and family characteristics, exploring the demographic and economic changes as well as cultural and health factors. Often, the attention has centered in the change in the availability of offspring due to fertility decline (Agree 1993), the rising income among the elderly due to social security and other social transfers, and changes in tastes as the cause for the rise in the independent living arrangements of the elderly (Michael, Fuchs, and Scott 1980; Costa 1997; McGarry and Schoeni 2000, Engelhardt et al. 2000).

A much less considered dimension is the effect of local housing markets. Housing costs along with the income represent a constraint to the choice of living arrangements and are important economic factors that influence the decision maker to live alone or to coreside with children. In other words, the cost of housing might represent the major expense and may challenge an older person's ability to maintain an independent dwelling

The purpose of this article is to fill in some gaps in the way demographers and sociologist traditionally approached determinants of living arrangements of elderly persons by considering the effect of housing market on living arrangements decisions.

Brazil, the country considered here, has undergone to major social security reform in 1988 and it is one of the few nations in developing countries which provide universal pension coverage for the elderly in both urban and rural areas. Using the Brazilian National Household Data (PNAD) before and after the social security reform, this research provides an opportunity to examine how increase in income from transfer programs would shape the choices of elderly living arrangements and how this choice is constrained by the local housing market.

BACKGROUND

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This section describes briefly the Brazilian Social Security Reform in 1988.

SOCIAL SECURITY REFORM IN BRAZIL

In the early 1990's, reform in the social security system dramatically expanded the pension coverage. The 1988 Constitution led to parity in pension eligibility between rural and urban workers as well as to increases in the minimum benefits[1]. Rural pensions are essentially non-contributory and a minimum of one times the minimum wage are paid to rural workers aged 60 years or above, regardless of their household income or the position in the household. As a consequence, elderly, both in urban and rural areas, saw a substantial increase in their non-labor incomes.

The results of the reform may be seen in table 1. Table 1 illustrates the effect of the reform on the individual level, showing the proportion of the elderly receiving social security in Latin America. In contrast to other Latin American countries, in Brazil, more than two thirds of the elderly receive a pension in urban areas. In rural areas, it is the only country in Latin America where almost three-quarters of the elderly receive a pension. Figure 1 illustrates the effect of the implementation of these policies n the well-being of the elderly. Before the reform, more than half of the elderly had an income below the minimum wage. After the reform, this proportion decreased dramatically to 15 per cent. Consistently, the poverty rate among elderly is lower than average population in Brazil and it is the lowest among Latin America countries (Gill, Packard and Yermo, 2004).

DATA, MEASURES AND METHODS OF ANALYSIS

DATA

I use the Brazilian National Household Survey (PNAD). PNAD is an annual household survey that investigates characteristics of the rural and urban population such as education, work status, income, home ownership and household composition. The survey contains individual and household information. The sample size is about 100,000 households units and approximately 350,000 individuals. These households were

[1] The actual implementation was established by Approval of Ordinal Law in July, 1991. However for bureaucratic reasons, the process was only completed by the end of 1992

distributed in 112,434 census sectors in 793 municipalities. For this study, the sample is restricted to those age 60 and older for both men and women.

The last year for which the survey data are available before the reform is 1987. After the reform, 1998 data was chosen because there was a health and morbidity supplement available in that year. For older ages, health plays an important role in the determinants of living arrangements. It is known from previous studies that poor health status and disability decrease the likelihood of living independently at older ages and increase the likelihood for co-residence (Mutchler and Burr 1991; Soldo and Agree 1988).

In this study, the living arrangements of the elderly are measured by classifying the individuals according to their relationship to the household head. Therefore, it is classified in three categories: 1) living alone (or with spouse only); 2) child in house (elderly householder, living with or without a spouse, sharing a house with at least one adult child); 3) in child's house (elderly person who lives with or without spouse in the household headed by non-elderly relative). This classification is useful to determine the authority and dependence among the members within the household. Moreover, household headship is "strongly related to the flow of resources in intergenerational households" (Mutchler and Burr, pg. 540)

The sample is divided by marital status and by sex because living arrangements present great variation among married and unmarried elderly and there is a difference in marital status depending on the sex.

METHODS OF ANALYSIS

TWO STEP APPROACH: CALCULATION OF HOUSING COST INDEX AND MULTINOMIAL LOGIT MODEL

The goal of this paper is to investigate the covariates that may influence the choice of living arrangements, looking especially at the effect of social security benefits and the local housing costs. This is accomplished by employing two steps approach. In the first step, I estimate a hedonic regression with dummies for each metropolitan and non metropolitan area that will provide an estimate for local housing market. The dependent

variable is the log of the monthly rent price of dwellings as a function of its characteristics and area dummies. The area dummies in these regressions indicate how much or less an individual in some areas must pay for a dwelling with the same attributes. I use the data from 1987 and 1998 Pnad. The scope is the urban areas, primarily the states where the metropolitan areas are located. I applied only for urban areas because of the absence of rental market in rural areas. The ten metropolitan areas in Brazil are: Belém (Pará), Fortaleza (Ceará), Recife (Pernambuco), Salvador (Bahia), Rio de Janeiro ((Rio de Janeiro), Belo Horizonte (Minas Gerais), São Paulo (São Paulo), Curitiba (Paraná), Porto Alegre (Rio Grande do Sul) and Brasília (Federal District).

I use rent as proxy for property value in the absence of information on market price. In economic theory, house is classified as durable good, and rent can be seen as "the present value of the flow of income derived from the ownership of the house" (Morais and Cruz, 2003). Therefore, "rent should maintain a direct relationship with property value, justifying its use in the hedonic price regression" (Morais and Cruz, 2003).

The equation which relates the rent to other variables is:

$$\ln R = \beta X + \delta Z + \varepsilon$$

where R is a vector of rents, X is the explanatory variables corresponding to the physical attributes of the dwelling, Z is the area dummies, and ε is the stochastic residual[2].

The variables considered for the attributes of the house are: quality of physical structure, measured as the quality of the housing materials for wall, roof and floor; size of dwelling, measured as number of bedrooms; urban infrastructure service, measured as water, sewerage and garbage collection. I also use dummies for each MA, and non-metropolitan areas in the state where the MA are located, to capture the characteristics of local housing market. Belo Horizonte was used for the comparison.

The results are shown in the table 2 for the two periods -1987 and 1998. The rent was in logarithm form.

For the 1987 and 1998 sample, Sao Paulo MA had the higher rent than any other MAs in both periods. This results means that for the same quality of house and urban

[2] I tested linear and log-linear form. The function form that best fits is the log-linear form. It had a smaller SSE than the linear and its R^2 adjusted was 0.46 for 1987 data and 0.59 for 1998 data.

service, inhabitants of Sao Paulo pay more rent. The results are consistent with the construction cost meter square data from IBGE (1997).

One can argue that instead of using hedonic price model, it would be preferable to use simply the area-specific mean rental price. However, housing price may vary widely across the areas depending on the attributes or characteristics of the house (size, age of dwelling, construction materials used, such as wooden floor, marble bathroom, etc.) and its location. Therefore, the hedonic price would give a better indicator of the housing price level in each location than area-specific rental price.

To compare hedonic regression results with mean rental price, I did a scatter plot of hedonic measures against rental values, for 1987 and 1998 (see Figure 2). In order to compare the estimates, I took the exponent of the hedonic regression estimates and then normalized it to be 100 for Belo Horizonte. I deflated and normalize the mean rental price and took as the reference Belo Horizonte with a 100 index value. The figure A1 shows that both hedonic and mean rental price have a strong association, but differ in important ways. For example, Belém MA, Pará and Pernambuco have higher indices for hedonic estimates than mean rent in 1987. One possible explanation is that the sample selection in the Pnad for these areas might have some bias. The housing in these places might have better quality and access to urban services.

In conclusion, hedonic model is preferable to mean rental price because it control for housing characteristics which can vary widely across different areas

MULTINOMIAL LOGIT MODEL

In the second step of analysis, the dummy variables for each area from hedonic regression are then used as an indicator of the housing price. Since they are in log terms, I take the exponent. Then, I use the multinomial logit model to estimate the likelihood of whether an elderly live alone (LA), child in house (CIH) or in child's house (CH) as a function of individual socio-demographic characteristics and housing prices.

The theoretical framework used is the rational choice model. The choice model is derived from the utility maximization hypotheses. The hypothesis assumes that individual agents choose from among the available alternatives in order to maximize their utility and

that distribution of choices made in the population is a refection in part of the distribution of individual preferences (McFadden, 1981). In this case, the individual chooses the living arrangement which yields the highest possible utility among the three options: living alone (LA), child in house (CIH) and in child's house (CH).

Thus, given the *j* possible outcomes, the probability that an elderly will be observed in the *jth* living arrangement is given by:

$$P(Y = j) = \frac{\exp(X\beta j)}{\sum_{k=1}^{3} \exp(X\beta k)}$$

where *j*=1 (LA), 2 (CIH), or 3(CH). The reference category of the response variable was CIH.

The multinomial logit model makes the assumption known as the independence of irrelevant alternatives (IIA). There are two tests for the IIA assumption. One is the Hausman test and the other is the Small-Hsiao test[3]. I have performed both tests, and both of them confirmed the IIA hypothesis.

The matrix X contains the individual specific demographic variables such as sex, age, race/color, education; and regional variables (geographic macro-regions). The variables health status and kin availability were included for the 1998 sample.

The matrix X also contains the measurement of Social Security benefits defined as: 1) a dummy variable for receipt of positive benefits, which include old age, disability, length of service and survivor's benefits; 2) a continuous variable measuring the real monthly value of old age, disability, length of service and survivor's benefits.

I my model, I did not include income that was broader than social security income because some components of non-social security income may be endogenous. That is, if an elderly has no option to coresidence, he may work in order to increase his income or he may use his savings and/or assets to make the ends meet. In other words, "decisions about post-retirement hours of labor supply and post-retirement of decumulation of assets are likely determined jointly with living arrangements decisions" (Engelhardt, G et al. ,2002).

[3] Long, J. and Freese, J. (2006). Regression Models for Categorical Dependent Variables Using Stata. Texas: Stata Press

The variables sex, race, health, receipt of social security, and geographic macro regions were transformed into categorical variables. The variable age is used in linear and square form. The variables years of schooling, and social security income are used as continuous variables. For married elderly, the social security income was the couple's social security income.

I fit a model in which data from both periods -1987 and 1998 – are pooled together. In this case, the covariate representing the reference year is included and the social security income was deflated. The year dummy controls for unobservable changes over time (1987 is the reference year).

Results

The Social Security is the most extensive social policy for well being of the elderly in Brazil and it constitutes the major single source of income for 53% of the population aged 60 and over (Wajnman et al., 1999). After the Social Security reform in 1988, which adopted the universal coverage, the levels of benefits became relatively high and generous.

The descriptive analysis (table 3) show that the percentage of married elderly in LA rose from 33.0% to 38.0% between 1987 and 1998. This increase in LA has been mirrored by a decline in CH from 65.0 % to 61.3 %, and by decline in CIH from 2.0% to 1.4%. The rise in the proportion of the married elderly living alone (LA) was due to a decline in the proportion of those living with a child in elderly house (CIH) and by those in the child's house (CH). The percentage of single women in LA rose from 27.2% to 30.0%, those in CH rose from 39.4% to 45.6%, while those in CIH declined from 33.4% to 24.4%. The percentage of single men in LA also rose from 37.2% to 41.2%, those in CIH had no much variation form 35.8% to 35.3%, while those in CH declined from 27.5% to 23.0%.

The aim of this paper is to analyze the causes of this change and assess the impact of the social security reform and housing costs on the elderly living arrangements.

Table 4 contains the multinomial regression results for married, unmarried women and unmarried men

Table 1: Percentage of Elderly who Receive Pension and/or Survivor Benefits in Latin America

	Urban Areas	Rural Areas
Argentina (1997)	67.4	n/a
Bolivia (1997)	26.3	3.6
Brazil (1996)	**61.8**	**74.9**
Chile (1996)	61.3	48.4
Colombia (1997)	20.3	8.5
Costa Rica (1997)	39.4	18.7
Ecuador (1997)	17.1	n/a
Honduras (1997)	8.1	1.8
Mexico (1996)	23.2	7.5
Nicaragua (1997)	16.8	n/a
Panama (1997)	47.6	18.8
Paraguay (1996)	21.4	n/a
Dominican Republic(1997)	15.7	6.4
Uruguay (1997)	81.3	n/a

Venezuela (1997)	10.8	n/a

Source: Comission Economica para America Latina y el Caribe – CEPA

Figure 1: Income Distribution Among Older Persons, Expressed as Multiple of the Minimum Wage in Each Year

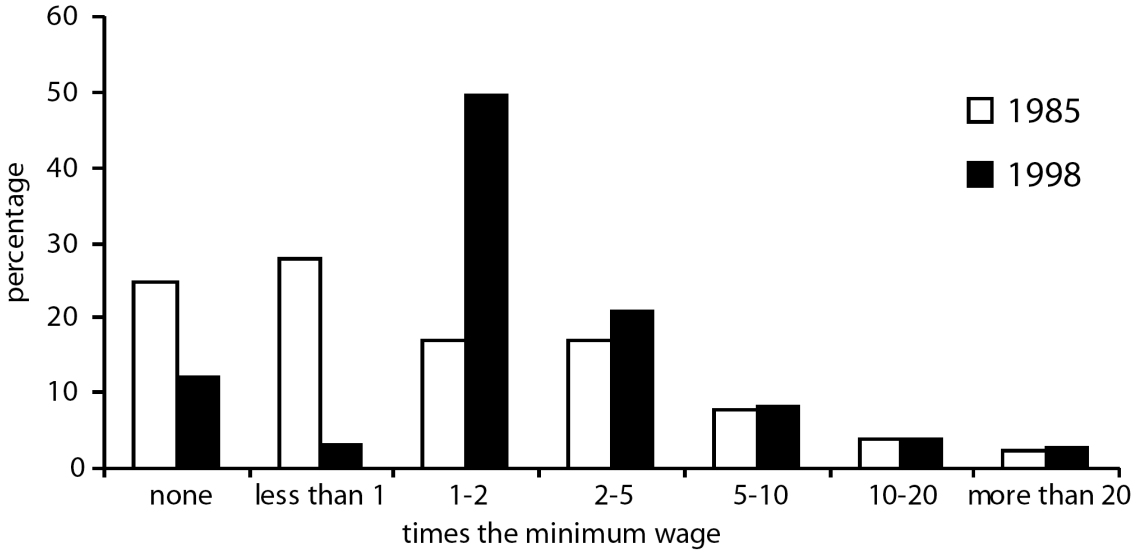

Table 2:Hedonic Price Estimated from Microdata (Dependent variable: ln rent), 1987-1998

Attributtes	1987	1998
total rooms	0.2192	0.1893
	[49.49]***	[65.47]***
masonry	0.463	0.37
	[6.72]***	[4.43]***
woodwall	0.1063	-0.0092
	[1.47]	[0.11]
roof	0.0587	0.0432
	[0.72]	[0.71]
water	0.1534	0.2056
	[4.67]***	[8.24]***
bath	0.0496	0.1639
	[1.83]*	[5.04]***
sewerage	0.4441	0.4729
	[17.31]***	[25.15]***
septic	0.19	0.3918
	[7.01]***	[16.98]***
fossa		0.1364
		[5.59]***
garbage	0.3596	0.3314
	[14.29]***	[9.14]***
floor	0.3563	
	[5.15]***	
Belem	0.3438	0.3498
	[6.50]***	[7.42]***
Fortaleza	-0.3217	-0.1276
	[6.62]***	[3.94]***
Recife	-0.3533	-0.0451
	[7.98]***	[1.41]
Salvador	-0.086	-0.092
	[1.85]*	[2.78]***
Rio de Janeiro	-0.0755	0.2882
MA		
	[2.01]**	[10.71]***
Sao Paulo MA	0.3977	0.4984
	[11.14]***	[19.39]***
Curitiba	0.2344	0.1512
	[4.72]***	[4.32]***
Porto Alegre	0.2721	0.2758
	[6.15]***	[8.22]***
Brasilia	0.4699	0.2566
	[9.90]***	[8.21]***
Para	0.2355	-0.2339
	[3.28]***	[4.46]***
Ceara	-0.7582	-0.9319
	[9.04]***	[19.08]***
Pernambuco	-0.6988	-0.7953
	[10.23]***	[18.86]***
Bahia	-0.3307	-0.7004
	[5.08]***	[17.06]***
Minas Gerais	-0.3084	-0.5482

	[7.48]***	[20.78]***
Rio de Janeiro	-0.3258	-0.1587
	[5.03]***	[4.49]***
Sao Paulo	0.0586	-0.0738
	[1.57]	[2.82]***
Parana	0.1112	-0.3313
	[1.98]**	[9.55]***
Rio Grande do Sul	0.0801	-0.1628
	[1.32]	[4.55]***
Constant	2.1543	3.0482
	[19.14]***	[27.60]***
Observations	10700	9067
R-squared	0.46	0.59

Absolute value of t statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 2: Scatter Plot of Hedonic Index vs. Rental for 1987 and 1998

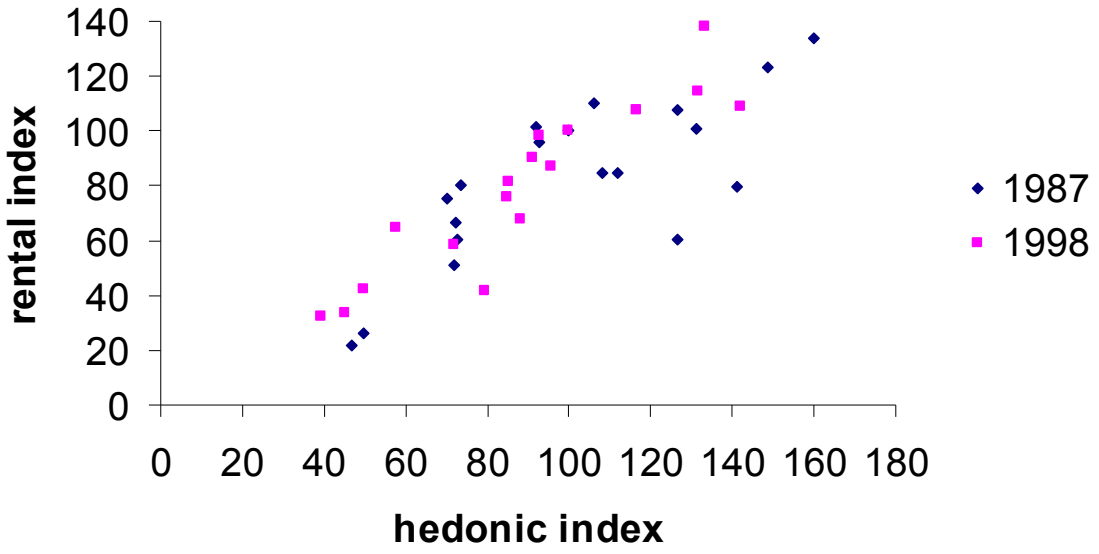

Table 3: Distribution of Elderly by Living Arrangements, 1987-1998

	1987				1998			
		Married	Single			Married	Single	
	Total	Couple	Men	Women	Total	Couple	Men	Women
Living Alone	30.33	32.95	37.24	27.17	34.43	37.33	41.15	30.00
Child in House	55.04	65.04	35.25	39.40	54.71	61.25	35.82	45.61
In child's house	14.63	2.01	27.51	33.43	10.86	1.41	23.04	24.39
Total	100.0	100.0	100.0	100.0	100.0	100.6	100.0	100.0

Source: 1987-1998 PNAD

Table 4: Estimated Coefficients from Multinomial Logit Model of Living Arrangements of Elderly by Marital Status and Urban Residence, 1987-1998.

	Married Elderly				Unmarried Elderly Women				Unmarried Elderly Men			
	Living Alone		In Child's House		Living Alone		In Child's House		Living Alone		In Child's House	
	Coef	Exp(B)	Coef	Exp(B)	Coef	Exp(B)	Coef	Exp(B)	Coef	Exp(B)	Coef	Exp(B)
sex	0.529	1.6972	0.6726	1.9593								
	[13.41]***	[13.41]***	[4.48]***	[4.48]***								
age	0.1764	1.1929	0.4051	1.4995	0.1299	1.1388	0.3859	1.4709	0.1504	1.1623	0.142	1.1525
	[3.62]***	[3.62]***	[2.68]***	[2.68]***	[2.74]***	[2.74]***	[7.82]***	[7.82]***	[1.60]	[1.60]	[1.41]	[1.41]
age square	-0.0008	0.9992	-0.0019	0.9981	-0.0006	0.9994	-0.0022	0.9978	-0.001	0.999	-0.0007	0.9993
	[2.47]**	[2.47]**	[1.86]*	[1.86]*	[2.00]**	[2.00]**	[6.75]***	[6.75]***	[1.56]	[1.56]	[0.98]	[0.98]
white	0.3746	1.4545	0.3642	1.4394	0.4944	1.6395	0.6604	1.9355	0.0324	1.033	0.236	1.2662
	[4.87]***	[4.87]***	[1.27]	[1.27]	[5.43]***	[5.43]***	[7.04]***	[7.04]***	[0.19]	[0.19]	[1.16]	[1.16]
yellow	0.1668	1.1816	0.6936	2.0009	0.3018	1.3523	1.1444	3.1405	-0.9189	0.3989	-0.3597	0.6979
	[0.90]	[0.90]	[1.33]	[1.33]	[0.86]	[0.86]	[3.82]***	[3.82]***	[1.46]	[1.46]	[0.58]	[0.58]
pardo	0.0695	1.072	-0.3647	0.6944	0.0686	1.071	0.3163	1.372	-0.1879	0.8287	0.0639	1.066
	[0.85]	[0.85]	[1.13]	[1.13]	[0.70]	[0.70]	[3.20]***	[3.20]***	[1.08]	[1.08]	[0.30]	[0.30]
schooling	0.0762	1.0792	-0.0116	0.9884	0.1702	1.1856	-0.1034	0.9017	0.0943	1.0988	-0.0319	0.9686
	[4.01]***	[4.01]***	[0.16]	[0.16]	[6.32]***	[6.32]***	[3.48]***	[3.48]***	[1.78]*	[1.78]*	[0.50]	[0.50]
North	-0.3524	0.703	-0.0772	0.9257	-0.3893	0.6775	-0.1149	0.8915	-0.0184	0.9818	0.1499	1.1618
	[3.35]***	[3.35]***	[0.23]	[0.23]	[2.99]***	[2.99]***	[1.02]	[1.02]	[0.09]	[0.09]	[0.65]	[0.65]
Southeast	0.6309	1.8793	0.1198	1.1273	0.2691	1.3088	0.0022	1.0022	0.1982	1.2192	0.0248	1.0251
	[12.42]***	[12.42]***	[0.57]	[0.57]	[4.20]***	[4.20]***	[0.03]	[0.03]	[1.62]	[1.62]	[0.17]	[0.17]
South	0.9814	2.6682	0.8259	2.284	0.551	1.7349	0.2103	1.234	0.4921	1.6358	0.2982	1.3474
	[16.45]***	[16.45]***	[3.77]***	[3.77]***	[6.98]***	[6.98]***	[2.55]**	[2.55]**	[3.12]***	[3.12]***	[1.62]	[1.62]
Center-west	0.1408	1.1512	-0.4448	0.6409	-0.7624	0.4665	-0.049	0.9522	0.4373	1.5485	0.901	2.462
	[1.01]	[1.01]	[0.72]	[0.72]	[3.60]***	[3.60]***	[0.31]	[0.31]	[1.09]	[1.09]	[2.20]**	[2.20]**
Receipt of Social Security	**0.2236**	**1.2506**	0.108	1.1141	0.1193	1.1267	**-0.4564**	**0.6336**	-0.1352	0.8735	-0.1646	0.8483
	[5.17]***	[5.17]***	[0.64]	[0.64]	[1.59]	[1.59]	[6.58]***	[6.58]***	[1.01]	[1.01]	[1.02]	[1.02]
Social Security Income	**0.0168**	**1.0169**	-0.1035	0.9017	0.0017	1.0017	**-0.058**	**0.9436**	-0.0101	0.99	**-0.0843**	**0.9191**
	[4.57]***	[4.57]***	[4.32]***	[4.32]***	[0.26]	[0.26]	[5.91]***	[5.91]***	[0.77]	[0.77]	[3.92]***	[3.92]***
Housing	-0.0002	0.9998	**0.0673**	**1.0696**	-0.0019	0.9981	**0.0281**	**1.0285**	**-0.0256**	**0.9747**	**0.0207**	**1.0209**
	[0.07]	[0.07]	[5.20]***	[5.20]***	[0.40]	[0.40]	[5.78]***	[5.78]***	[2.86]***	[2.86]***	[1.98]**	[1.98]**
Year	0.0088	1.0088	-1.0713	0.3426	-0.106	0.8994	-0.7063	0.4934	0.3416	1.4071	-0.3226	0.7242
	[0.16]	[0.16]	[4.68]***	[4.68]***	[1.38]	[1.38]	[8.70]***	[8.70]***	[2.44]**	[2.44]**	[1.93]*	[1.93]*
Constant	-10.0052		-23.3876		-7.2704		-16.3075		-5.5443		-7.2253	

	[5.82]***	[4.24]***	[4.19]***	[9.00]***	[1.62]	[1.94]*
Observations	15989	15989	10852	10852	2580	2580

Absolute value of z statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%