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Effects of Basic Elder Pension on Self-Assessed Health: Fixed-Effect Ordered Logit with Time-Varying Parameters*

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Abstract We examine the effects of the Basic Elder Pension (BEP) in Korea on self-assessed health for the elderly of age 65 or higher, using two wave Korean panel data. As there could be innately healthy/optimistic individuals, it is important to allow for time-constant individual effects possibly related to regressors, which is, however, difficult as the dependent variable takes on four ordered categories. To overcome this difficulty, we transform the ordered discrete response into binary, and apply Panel Conditional Logit Estimator (PCLE) to the binary model. Since there are three ways to transform four ordered categories into binary, we obtain three PCLE's in total. To impose the restriction that the same parameters are estimated in those PCLE's, we use minimum distance estimator. We find that BEP has a small positive effect that is significant: 100% increment in BEP would result in an increment of 3–7% of 'one standard deviation of the latent continuous health propensity'. Finding a small effect might be natural, as improving health for the elderly would be a hard thing to do.

Keywords pension, self-assessed health, panel ordered logit, minimum distance estimation

JEL Classification C33, C35, I12, J14, H55

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1. INTRODUCTION

The Basic Elder Pension (BEP) in Korea is one of the most important sources for the Korean elderly income. Whereas the National Pension in Korea is conditional on participating in the pension scheme for a certain duration, BEP is provided based only on one's wealth and income on or after age 65. BEP was introduced in 2008 for those with income in the bottom 60% among the elderly of age 65 or higher; in January 2009, it was expanded to cover the bottom 70%. The eligibility is based on the "recognized amount of income" that is essentially monthly income plus 'the converted amount of assets to monthly income (using annual interest rate of 5%)'. When eligible, the elder receives about $95 per month on average as of 2013 if single, and about $150 if with a spouse of age greater than 65. These are rather small amounts, given the current price level in Korea.

BEP was designed to support elders suffering from financial burdens. It has been, however, subject to some criticisms such as paying to residents in rich areas with no "tangible income". The opponents claim that it is hardly the best way to address the elderly poverty problem by trying to cover too many elders, given that the income inequality is severe among the elderly.

It would be ideal to assess the full impact of BEP on the welfare of the elderly, but this would not be easy, and thus this paper sets a modest goal of *finding the effect of BEP on self-assessed health that takes on four ordered categories* (0,1,2 and 3). For this, we use panel data from the Korea Welfare Panel Study for years 2007 and 2008; 2007 is just before the treatment (BEP), and 2008 is just after. Since the Korean government plans to further expand BEP, finding its effects on various dimensions of the welfare of the elderly matters much, with health being probably the most important part.

For the related literature, Nahm and Lim (2008) and Kang and Choi (2010) examined macroeconomic index changes before and after BEP. Kim and Jeong (2012) used the Korean Retirement and Income Study for years 2006–2008 to find that BEP increased polarization in income. As for ordered health state in health economics and econometrics, see Borghesi and Vercelli (2012), Carro and Traferri (2013), Green *et al.* (2013) and the references therein.

In finding the effect of BEP on self-assessed health using panel data, it is likely that some people are innately healthy or optimistic than others to report relatively better health, and such innate factors are likely related to regressors affecting health. Due to this possibility, the so-called 'fixed-effect' models are preferred to 'random-effect' models. Unfortunately, there is no fixed-effect estimator for ordered discrete responses (ODR), although Panel Conditional Logit

Estimator (PCLE) is a well-known fixed-effect estimator for binary responses.

To allow for fixed effects that is to be handled by PCLE, we collapse the four-category ODR into binary in three different ways: 0 to 0 and (1,2,3) to 1, (0,1) to 0 and (2,3) to 1, and (0,1,2) to 0 and 3 to 1. This gives three sets of estimates for the same parameters—an over-identifying restriction—and we use minimum distance estimator (MDE) to combine the three sets of estimates; MDE also has a built-in test statistic for the over-identifying restriction. See Lee (2002) for this estimation procedure for panel ODR and some GAUSS programs; see also Lee (2010) for a review on MDE.

The rest of this paper is organized as follows. Section 2 describes our panel ODR model and the two-stage estimation procedure. Section 3 explains the data to do some preliminary data analysis. Section 4 presents the main empirical results. Finally, Section 5 concludes. Whereas our empirical contribution is in finding the effects of BEP on self-assessed health, our methodological contribution is in showing what is identified and how the estimation is to be done allowing for time-varying parameters in the above scenario of applying PCLE and then MDE for panel ODR.

2. MODEL AND ESTIMATOR

Let the response variable on health state for person i at time t be y_{it} taking on four ordered categories: very unhealthy (0), unhealthy (1), average (2) and healthy (3). Originally in our data, there was an extra category 'very healthy', but its proportion was less than 2%. Hence, we merged this into the 'healthy' category. Also the category order that was in reverse in the original data has been changed so that a higher number means a better health.

For two-wave panel data with N individuals, consider a latent continuous 'health propensity' y_{it}^* obeying a linear model:

$$y_{it}^* = \alpha_t + x_{it}'\beta_t + \delta_i + u_{it}, \quad i = 1, ..., N \text{ and } t = 1, 2$$

where α_t is a time-varying intercept, x_{it} is a regressor vector (1 not included in x_{it}), β_t is the time-varying slope parameter, δ_i is a time-constant error (i.e., 'unit-specific effect'), and u_{it} is a time-varying error. In the panel data literature, usually only the intercept is specified to be time-varying and is called the 'time-effect', but we allow the slope to change as well, as there is no good prior reason to restrict time variation only to the intercept.

The observed four-category ODR y_{it} is

$$y_{it} = \sum_{r=1}^{3} 1\,[y_{it}^{*} \geq \gamma_{rt}] = \sum_{r=1}^{3} 1\,[\alpha_t + x_{it}'\beta_t + \delta_i + u_{it} \geq \gamma_{rt}]$$

where γ_{rt}'s are unknown thresholds that are allowed to time-vary as α_t is so. That is, y_{it} takes on $r = 0,1,2,3$ such that

$$y_{it} = r \quad \text{if } \gamma_{rt} \leq y_{it}^{*} < \gamma_{r+1,t} \qquad \text{where } -\infty = \gamma_{0t} < \gamma_{1t} < \gamma_{2t} < \gamma_{3t} < \gamma_{4t} = \infty.$$

Assuming that

$$(u_{i1}, u_{i2}) \text{ are iid logistic } \left(P(u_{it} \leq a) = \frac{\exp(a)}{1+\exp(a)}\ \forall a\right) \text{ and } (u_{i1}, u_{i2}) \amalg (\delta_i, x_{i1}, x_{i2})$$

we obtain a 'panel ordered logit' model. But, as well known, there is no 'fixed-effect' estimator for panel ODR, i.e., no estimator being able to allow for an arbitrary relation between δ_i and x_{it}'s by removing δ_i from the model. One way to overcome this shortcoming is the following *two-stage procedure*.

First, we turn the four-category ODR into a binary response in three ways:

$$1[\alpha_t - \gamma_{jt} + x_{it}'\beta_t + \delta_i + u_{it} \geq 0], \quad j = 1,2,3$$

to which PCLE can be applied that is a well-known 'fixed-effect' estimator for panel binary responses (see the review of Lee 2013 and the references therein). When PCLE is applied, what appears in each PCLE regression function is the first difference of the left-hand side over periods 1 and 2:

$$1[\Delta\alpha_2 - \Delta\gamma_{j2} + x_{i2}'\beta_2 - x_{i1}'\beta_1 + \Delta u_{i2} \geq 0], \quad j = 1,2,3 \qquad (\mathrm{M}_0)$$
$$\text{where} \quad \Delta\alpha_2 \equiv \alpha_2 - \alpha_1, \quad \Delta\gamma_{j2} \equiv \gamma_{j2} - \gamma_{j1}, \quad \Delta u_{i2} \equiv u_{i2} - u_{i1}.$$

Time-constant regressors c_i with slope β_{ct} should appear in the form $c_i'\Delta\beta_{c2}$ in M_0, although this point is not explicit. If only $\alpha_t - \gamma_{jt}$ is time-varying while β_t is time-constant—this would be the typical specification in practice—we get, with c_i dropping out,

$$1[\Delta\alpha_2 - \Delta\gamma_{j2} + \Delta x_{i2}'\beta + \Delta u_{i2} \geq 0], \quad j = 1,2,3 \qquad \text{where } \Delta x_{i2} \equiv x_{i2} - x_{i1}. \quad (\mathrm{M}_1)$$

The main parameter of interest is the slope for BEP that shows the effect of one-unit increase in BEP on health that is measured relative to one standard deviation (SD) of u_{it} (i.e., of y_{it}^{*}). For instance, if $\beta_{BEP} = 0.5$ and BEP is in

$\ln(payout)$, then 100% increment of BEP payout results in the increment of '0.5 times one $SD(u_{it})$'. In general, an increase/decrease of one $SD(u_{it})$ is fairly rare in ODR and binary response models. That is, since $SD(u_{it}) \simeq 1.8$ for the logistic distribution, a slope of absolute magnitude greater than 1.8 is rare; for probit, a slope of absolute magnitude greater than 1 is rare, as $SD(u_{it}) = 1$ in the $N(0,1)$ distribution.

Second, for both models M_0 to M_1, the three intercepts differ due to the different conversion points to binary (at 0, at 1 and at 2, respectively), whereas the slopes are the same. Hence, to come up with a single set of slope estimates, we use MDE. Define $\psi_j \equiv \Delta\alpha_2 - \Delta\gamma_{j2}$ and

$$\begin{aligned} \text{three PCLE parameters} \quad &: \quad \gamma_1 \equiv (\psi_1, \zeta_1')', \quad \gamma_2 \equiv (\psi_2, \zeta_2')', \quad \gamma_3 \equiv (\psi_3, \zeta_3')'; \\ \text{MDE parameter} \quad &: \quad \gamma \equiv (\psi_1, \psi_2, \psi_3, \zeta')' \end{aligned}$$

where ζ_j equals $(\beta_2', -\beta_1')'$ in M_0 and β in M_1. These parameters satisfy the restriction

$$\begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \end{bmatrix} = R\gamma \text{ with } R \equiv \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & I \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & I \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & I \end{bmatrix} \iff \begin{bmatrix} \psi_1 \\ \zeta_1 \\ \psi_2 \\ \zeta_2 \\ \psi_3 \\ \zeta_3 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & I \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & I \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & I \end{bmatrix} \begin{bmatrix} \psi_1 \\ \psi_2 \\ \psi_3 \\ \zeta \end{bmatrix}$$

where the dimension of the identity matrix I is the same as the row dimension of ζ_j.

Using these restrictions with γ_j's replaced by its PCLE $\hat{\gamma}_j$'s, the MDE g_{mde} for γ is

$$\begin{aligned} & g_{mde} \equiv (R'W_N^{-1}R)^{-1}R'W_N^{-1}\hat{\gamma}_{123} \quad \text{where} \\ & \hat{\gamma}_{123} \equiv (\hat{\gamma}_1', \hat{\gamma}_2', \hat{\gamma}_3')', \quad W_N \equiv \tfrac{1}{N}\textstyle\sum_i \hat{\eta}_i\hat{\eta}_i', \quad \hat{\eta}_i \equiv (\hat{\eta}_{i1}', \hat{\eta}_{i2}', \hat{\eta}_{i3}')' \to^p \eta_i \equiv (\eta_{i1}', \eta_{i2}', \eta_{i3}')', \\ & \eta_{ij} \equiv (\frac{1}{N}\sum_i s_{ij}s_{ij}')^{-1}s_{ij}' \quad \text{and } s_{ij} \text{ is the PCLE score function, } j = 1,2,3. \end{aligned}$$

It also holds that, with '$\rightsquigarrow$' denoting convergence in distribution,

$$\begin{aligned} & N^{1/2}(g_{mde} - \gamma) \rightsquigarrow N\{0,\ (R'W^{-1}R)^{-1}\} \quad \text{where } W = E(\eta\eta'); \\ & \tau_N \equiv N(\hat{\gamma}_{123} - Rg_{mde})'W_N^{-1}(\hat{\gamma}_{123} - Rg_{mde}) \rightsquigarrow \chi^2_{\dim(\hat{\gamma}_{123}) - \dim(\gamma)}. \end{aligned}$$

The test statistic τ_N is an over-identification test statistic for '$H_0 : \zeta_1 = \zeta_2 = \zeta_3$' that is analogous to the well-known GMM over-identification test; τ_N can serve as an omnibus model specification test.

3. DATA AND PRELIMINARY ANALYSIS

With BEP starting in January 2008, Our data is from the Korea Welfare Panel Study for years 2007 (just before BEP) and 2008 (just after). Initially, there were 6314 households, and we extracted balanced panel data ($N = 2092$) with (i) only the households whose head is 65 years of age or older in 2008, (ii) no household head change over 2007 and 2008, and (iii) no non-response in the variables to be used. Although the observation unit is a household, certain variables are for the household head only: self-assessed health y, age, the number of visits to doctors, and the number of hospitalization days.

Table 1 describes the response variable, and Table 2 describes the regressors. Although there should be many variables relevant for health, all time-constant variables except age are removed in PCLE as their slopes are time-constant; age is still kept in the model as it is an important variable for individual data analysis. In Table 2, the variables for household head have their names starting with 'Head'; all the other variables are for household.

One possible confounder in analyzing the BEP's effect is the other welfare programs such as the 'subsistence assurance program' and the 'medical assistance program'. The eligibility conditions for those programs are partly based on variables unavailable in our data, as well as on income and asset that are available in our data. Hence those program variables cannot be controlled fully, which can cause an omitted variable bias. But, whereas BEP started in 2008, those programs started long before. Since the participation status in those programs is unlikely to change much year to year, those welfare program variables would drop out of the differenced model M_0 or M_1, or at least be much diminished in their presence.

As BEP started in 2008, BEP amount in 2007 is zero. Annual income (net of the BEP amount) and the total asset (including financial asset and real estate) as well as BEP are all in 10,000 Korean Won (about \$10) turned into the 2010 level using the consumer price index. All monetary variables will be used in logarithm for our empirical analysis below. Since $\ln BEP$ is used, its coefficient corresponds to the proportional change in BEP, but BEP was zero in 2007 and this makes any proportional change to be zero. To avoid this complication, we will add 1 to BEP before ln is taken so that $BEP = 1$ ($\Longleftrightarrow \ln BEP = 0$) in 2007.

Suppose that age_{it}, not the time-constant age in 2008, appears in the model. Then it would appear for PCLE in the form

$$\Delta(\beta_{age,2}age_2) = \beta_{age,2} \times age_2 - \beta_{age,1} \times age_1$$
$$= (\beta_{age,1} + \Delta\beta_{age,2})age_2 - \beta_{age,1} \times (age_2 - 1) = \Delta\beta_{age,2} \times age_2 + \beta_{age,1}.$$

Table 1: Household Head Self-Assessed Health

	2007 # obs. (%)	2008 # obs. (%)
Healthy	459 (21.9)	426 (20.4)
Average	570 (27.2)	589 (28.2)
Unhealthy	891 (42.6)	924 (44.2)
Very unhealthy	172 (8.2)	153 (7.3)

Table 2: Regressors

	2007				2008			
Variable	Mean	(SD)	Min	Max	Mean	(SD)	Min	Max
Head Age in 2008	72.7	(5.8)	65	97	73.7	(5.7)	66	98
BEP (in 10,000)	0	(0)	0	0	73.2	(62.9)	0	635.8
Income (in 10,000)	1,468	(1,407)	7.8	17,630	1,557	(1,482)	107	15,406
Asset (in 10,000)	7,916	(20,398)	0	323,359	8,573	(22,925)	0	343,303
Head # doctor visits	28.8	(36.0)	0	312	29.7	(36.9)	0	312
Head # hospital days	4.2	(14.5)	0	300	5.9	(20.5)	0	320

Hence, using age_2 (i.e., age in 2008), we get to estimate $\Delta\beta_{age,2}$ as its slope, with $\beta_{age,1}$ absorbed by the intercept; note that using age in 2008 is equivalent to using the time-constant birth year (times minus one).

Table 2 shows that the average BEP amount in 2008 is 732,000 Won, which is only about 4.5% of the average income, 16.18 million Won. But, among those who received BEP in 2008 (1422 households that are 68% of the sample), the average BEP amount is 1.1 million Won that is 9% of the average income, 12.05 million Won. Hence, receiving BEP in 2008 means 9% increase in income, which is substantial. Bear in mind that our sample is for households whose head age is 65 or above, and consequently, income and asset are much lower than those for all ages, 32.63 million and 32.57 million for income in 2007 and 2008, and 100.54 million and 109.63 million for assets.

Two variables representing health care usage are in the regressors: the annual number of visits to doctors (28-30 times on average) and the annual number of hospitalization days (4-6 times). For the all-age sample, the number of doctor visits and hospitalization days are much lower (17 and 0.2, respectively). The two regressors are potentially endogenous for at least two reasons. One is the simultaneity that health care usage affects health, which in turn affects health care usage. The other is a common factor problem: there might be an unobserved

Table 3: Changes in Variables

Variables	Mean	SD	Min	Max
y	-0.013	0.96	-3	3
Income	88.4	796	-5,837	7,106
Asset	658	16,081	-160,699	242,751
Head # doctor visits	0.88	40.2	-280	298
Head # hospital days	1.67	21.6	-300	320

individual heterogeneity that affects both y and health care usage; e.g., a high concern for health may lead to a better health and a more frequent health care use. Our estimator cannot deal with the simultaneity problem as this requires instruments that we do not have, but the common factor problem is dealt with by our estimator so long as the common factor is captured by δ.

Table 3 presents the changes in y and x, as the changes give the explanatory power to PCLE. Although y's average change is small, the standard deviation is not. Also the changes in the other regressors are not small either.

4. MAIN EMPIRICAL ANALYSIS

The main estimation results for PCLE and MDE are in Tables 4 and 5. A MDE slope estimate can be viewed as a weighted average of the three corresponding PCLE slopes. Whereas Table 4 allows only the slope for age in 2008 and the 'intercept minus threshold' to time-vary, Table 5 presents the fully time-varying PCLE's and MDE. The empirical findings in Tables 4 and 5, however, do not differ much for $\ln(\text{BEP})$, and the Wald test for reducing Table 5 to Table 4 is not rejected. We will thus base our empirical interpretations mainly on Table 4 using the more parsimonious model.

The key variable BEP has a small, but significant, effect of size 0.060: 100% increase in BEP leads to the increment of $0.060/1.8 = 0.033$ times $SD(u_{it})$. In the first PCLE, the effect is almost twice higher ($0.11/1.8 = 0.061$), suggesting that the BEP effect is relatively higher for those with poor health. Somewhat surprisingly, income does not matter, whereas asset does in Tables 4 and 5. This may be because 1% increase in asset is equivalent to almost 5% increase in income, as asset is about 5 times greater than income in Table 2. The MDE over-identification tests do not reject the models in Tables 4 and 5.

Table 4′ in the appendix is the same as Table 4 except that $\{\ln(\text{Income})\}^2$ and $\{\ln(\text{Asset})\}^2$ are used additionally to better reflect the potential nonlinear effects

Table 4: PCLE and MDE (t-value in (·); * & ** for significance at 10 & 5%)

	0 v. 1,2,3	0,1 v. 2,3	0,1,2 v. 3	MDE
Intercept ψ_1	1.18 (0.71)			0.76 (0.86)
Intercept ψ_2		0.72 (0.68)		0.53 (0.63)
Intercept ψ_3			-0.61 (-0.44)	0.49 (0.58)
Age in 2008	-0.017 (-0.81)	-0.012 (-0.84)	-0.006 (0.31)	-0.010 (-0.85)
ln(*BEP*)	*0.11* (1.65)*	*0.055 (1.47)*	*0.030 (0.68)*	*0.060** (2.02)*
ln(Income)	-0.14 (-0.57)	0.19 (1.22)	0.13 (0.57)	0.039 (0.31)
ln(Asset)	0.010 (0.201)	0.083** (2.51)	0.13** (2.43)	0.076** (2.79)
# doctor visits	-0.002 (-0.813)	-0.010** (-4.89)	-0.011** (-3.56)	-0.007** (-4.50)
# hospital days	-0.016** (-4.52)	-0.020** (-5.01)	-0.036** (-4.25)	-0.017** (-6.70)
Over-ID test:	test stat. 18.2 with p-value 0.11			

Table 5: Fully Time-Varying PCLE & MDE

	0 v. 1,2,3	0,1 v. 2,3	0,1,2 v. 3	MDE
Intercept ψ_1	1.71 (0.58)			0.19 (0.14)
Intercept ψ_2		0.50 (0.30)		0.008 (0.006)
Intercept ψ_3			-2.55 (01.20)	-0.022 (-0.016)
Age in 2008	-0.014 (-0.58)	-0.013 (-0.82)	0.011 (0.54)	-0.009 (-0.75)
ln(*BEP*)	*0.134* (1.84)*	*0.045 (1.11)*	*0.031 (0.60)*	*0.060* (1.83)*
ln(Income)	0.116 (-0.45)	-0.17 (-0.99)	-0.004 (-0.018)	-0.018 (-0.13)
	-0.35 (-1.12)	0.23 (1.30)	0.29 (1.17)	0.088 (0.60)
ln(Asset)	-0.030 (-0.50)	-0.10** (-2.60)	-0.16** (-2.61)	-0.081** (-2.53)
	0.067 (1.12)	0.065*(1.70)	0.091 (1.62)	0.068** (2.20)
# doctor visits	0.004 (1.09)	0.011** (4.44)	0.011** (3.27)	0.008** (4.26)
	-0.001 (-0.17)	-0.010** (-3.72)	-0.011** (-2.86)	-0.007** (-3.26)
# hospital days	0.021** (2.18)	0.021** (3.30)	0.034** (3.63)	0.022** (4.11)
	-0.013** (-3.61)	-0.019** (-4.05)	-0.038** (-2.55)	-0.015** (-5.45)
Over-ID test:	test stat. 23.2 with p-value 0.278			

of income and asset. Table 5′ in the appendix is the same as Table 5, again, except that $\{\ln(\text{Income})\}^2$ and $\{\ln(\text{Asset})\}^2$ are used additionally. In Tables 4′ and 5′, the t-values are somewhat lower due to the multicollinearity problem introduced by the squared variables; otherwise, little difference for $\ln(\text{BEP})$ from Tables 4 and 5.

In Tables 4 and 5, the two health care usage variables are highly significant with negative effects. Since using health care services is expected to improve health, the negative effects are likely to be either the bias due to the ignored simultaneity (i.e., the reverse causality of y reducing the health care use) or the health care usage variables representing an unobserved poor health indicator to result in negative slopes. Since we allow the unobserved individual effect δ, the latter interpretation does not necessarily invalidate Tables 4 and 5, but the former does. Hence we removed the two health care usage variables in Tables 6 and 7 in the appendix. This, however, poses a dilemma: remove the variables to identify only the 'reduced form' parameters as the removed variables are presumably substituted out, or keep them to incur the endogeneity bias. Fortunately, Tables 6 and 7 in the appendix show that the main finding for $\ln(\text{BEP})$ does not differ much from Tables 4 and 5 (and 4′ and 5′).

5. CONCLUSION

In this paper, we estimated the effect of the Basic Elder Pension (BEP) in Korea on self-assessed health state of the elderly of age 65 or higher using two-wave Korean panel data, where the health state is measured in four ordered categories. In terms of the methodological contribution, we used panel conditional logit estimator (PCLE) for binary responses after transforming the four categories into binary in three different ways, and then applied minimum distance estimation to obtain a single set of estimates from the three sets of PCLE estimates. This two-stage procedure allowed a time-constant individual effect related to regressors in an arbitrary fashion; also, we allowed parameters to time-vary for more generality. For the empirical contribution, we found that BEP has a small, but significant, effect on health: 100% increment in BEP leads to an increment of 3-7% of one health-propensity SD, where health propensity is the latent continuous health variable behind the observed four category health.

APPENDIX

Table 4′: PCLE and MDE (t-value in (·); * and ** for significance at 10 & 5%)

	0 v. 1,2,3	0,1 v. 2,3	0,1,2 v. 3	MDE
Intercept ψ_1	1.49 (0.89)			0.74.(0.84)
Intercept ψ_2		0.79 (0.74)		0.52 (0.61)
Intercept ψ_3			-0.61 (-0.43)	0.47 (0.56)
Age in 2008	-0.022 (-0.99)	-0.013 (-0.90)	0.006 (0.314)	-0.010 (-0.82)
ln(*BEP*)	*0.106** *(1.62)*	*0.057 (1.51)*	*0.028 (0.63)*	*0.058** *(1.95)*
ln(Income)	4.70 (1.56)	0.81 (0.90)	1.63 (0.82)	0.99 (1.21)
ln(Income)^2	-0.37 (-1.60)	-0.046 (-0.67)	-0.105 (-0.76)	-0.070 (-1.13)
ln(Asset)	0.12 (1.00)	0.053 (0.68)	0.11 (1.01)	0.071 (1.13)
ln(Asset)^2	-0.014 (-1.03)	0.003 (0.42)	0.001 (0.13)	0.001 (0.10)
# doctor visits	-0.002 (-0.80)	-0.01**(-4.88)	-0.011** (-3.58)	-0.007** (-4.49)
# hospital days	-0.015** (-4.33)	-0.02** (-4.96)	-0.036** (-4.26)	-0.016** (-6.41)
Over-ID test:	test stat. 21.2 with p-value 0.169			

Table 5′: Fully Time-Varying PCLE and MDE

	0 v. 1,2,3	0,1 v. 2,3	0,1,2 v. 3	MDE
Intercept ψ_1	6.64 (0.45)			-2.19 (-0.44)
Intercept ψ_2		-2.08 (-0.37)		-2.37 (-0.47)
Intercept ψ_3			-13.69 (-1.49)	-2.40 (-0.48)
Age in 2008	-0.019 (-0.78)	-0.013 (-0.82)	0.013 (0.63)	-0.01 (-0.78)
ln(*BEP*)	0.11 *(1.48)*	*0.034 (0.81)*	*0.032 (0.60)*	*0.043 (1.26)*
ln(Income)	-4.37 (-1.33)	-0.59 (-0.55)	-0.65 (-0.25)	-0.84 (-0.87)
	2.66 (0.62)	1.20 (0.73)	3.96 (1.53)	1.43 (0.98)
ln(Income)^2	0.34 (1.35)	0.033 (0.41)	0.047 (0.27)	0.061 (0.85)
	-0.23 (-0.73)	-0.068 (-0.58)	-0.25 (-1.43)	-0.094 (-0.91)
ln(Asset)	0.040 (0.25)	0.080 (0.78)	-0.17 (-1.10)	0.058 (0.71)
	0.27 (1.76)	0.16* (1.66)	0.068 (0.54)	0.17** (2.20)
ln(Asset)^2	0.002 (0.12)	-0.016 (-1.66)	0.001 (0.046)	-0.012 (-1.56)
	-0.024 (-1.48)	-0.008 (-0.81)	0.001 (0.12)	-0.009 (-1.20)
# doctor visits	0.003 (0.98)	0.01** (4.27)	0.011** (3.20)	0.008** (4.07)
	-0.001 (-0.32)	-0.01** (-3.68)	-0.011** (-2.79)	-0.007** (-3.29)
# hospital days	0.020* (1.93)	0.022** (3.43)	0.034** (3.57)	0.022** (3.95)
	-0.0130** (-3.50)	-0.019** (-4.14)	-0.040** (-2.67)	-0.015** (-5.29)
Over-ID test:	test stat. 26.37 with p-value 0.553			

Table 6: PCLE and MDE (No Health Care Usage Variables)

	0 v. 1,2,3	0,1 v. 2,3	0,1,2 v. 3	MDE
Intercept ψ_1	1.48 (0.92)			1.15 (1.35)
Intercept ψ_2		1.11 (1.09)		0.99 (1.19)
Intercept ψ_3			-0.046 (-0.036)	0.90 (1.10)
Age in 2008	-0.022 (-1.05)	-0.019 (-1.33)	-0.003 (-0.15)	-0.017 (-1.47)
ln(*BEP*)	*0.101* (1.65)*	*0.073** (2.05)*	*0.045 (1.05)*	*0.069** (2.39)*
ln(Income)	-0.29 (-1.31)	0.077 (0.50)	0.034 (0.16)	-0.039 (0.32)
ln(Asset)	0.021 (0.41)	0.078** (2.42)	0.13** (2.71)	0.078** (2.88)
Over-ID test:	test stat. 6.56 with p-value 0.585			

Table 7: Fully Time-Varying PCLE and MDE (No Health Care Usage Variables)

	0 v. 1,2,3	0,1 v. 2,3	0,1,2 v. 3	MDE
Intercept ψ_1	3.35 (1.24)			1.21 (0.93)
Intercept ψ_2		1.46 (0.92)		1.06 (0.82)
Intercept ψ_3			-1.38 (-0.71)	1.00 (0.77)
Age in 2008	-0.022 (-1.01)	-0.021 (-1.41)	0.000 (-0.001)	-0.017 (-1.43)
ln(*BEP*)	*0.12* (1.70)*	*0.058 (1.46)*	*0.038 (0.79)*	*0.061* (1.89)*
ln(Income)	0.20 (0.84)	-0.081 (-0.49)	0.058 (0.25)	0.031 (0.24)
	-0.56* (-1.92)	0.088 (0.50)	0.17 (0.72)	-0.026 (-0.18)
ln(Asset)	0.026 (0.44)	-0.096** (-2.63)	-0.17** (-2.98)	-0.086** (-2.75)
	0.071* (1.23)	0.061* (1.64)	0.098* (1.85)	0.071** (2.33)
Over-ID test:	test stat. 13.75 with p-value 0.317			

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