Estimates of the mobility of Mental Health: results based on a binary health measure and Irish micro-data

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SUMMARY
Most existing analyses of mobility and threshold levels concentrate on the ever-growing literature on income mobility. Our paper takes these analyses and applies them to Irish health data in an attempt to quantify the level of mobility in and between different mental health states. Using the eight waves of the Living in Ireland Survey, we estimate a Two-Part Model of transitions into and out of good and bad mental health as well as changes in the level mental health from the previous health state. Our measure of mental health is the 12-item version of the General Health Questionnaire (GHQ), which detects minor psychiatric disorders among respondents. From this we construct a threshold level, below which a respondent is mentally healthy and above which they are mentally ill. The main conclusion is that individuals with a higher income or higher level of education are more likely to have a better self-rated, physical, mental, and social health. Women are often in worse health than men. Finally, it is possible to identify three subgroups which, generally speaking, are in a more precarious position, i.e. women, the unemployed, and sick or disabled people.

1. INTRODUCTION

Mental illness is associated with large costs to individuals and society. According to the World Health Organization's 2005 report, *The Economics of Mental Health in Europe*, "We cannot afford not to invest in mental health. The economic costs to society of mental health problems are enormous, with one cautious estimate from the International Labour Organization putting them at between 3% and 4% of gross national product in the Member States of the European Union." The economic costs of mental health problems are substantial, and most of the economic costs are incurred outside the healthcare system, in contrast to other health issues.

In January 2006, the Irish government "A Vision for Change" was launched. A Vision for Change details a comprehensive model of mental health service provision for Ireland. However, in order for this model to be effective, we need to prevent a broad-brush approach being used and target those groups that are deemed most at risk of developing mental illness. Mental illness prevention programmes are more effective when they are targeted at groups of individuals who are most at risk of developing severe mental health problems and who suffer from prolonged periods of ill-health or are more likely to have multiple episodes of mental health problems.

In this paper we attempt to quantify the amount of mental illness in Ireland between 1994 and 2001. To do this we use a mental health threshold level, above which a person is mentally ill. We are concerned with identifying the fundamental determinants that cause an individual to cross the threshold and go from being mentally healthy to being mentally unhealthy and vice versa. We are concerned with answering the following question:

- What events increase individuals' likelihood of entering and exiting mental illness?

Most existing analyses of threshold levels concentrate on the ever-growing literature on income mobility (see e.g.: Prais, 1955; Bartholomew, 1967; Shorrocks, 1978; Atkinson, 1983 and more recently Jarvis & Jenkins, 1998; Gardiner & Hills, 1999 and Bradbury & Katz, 2002, among others). In this paper we take these analyses and attempt to quantify the level of mobility in mental health using Irish data. The particular level of mental health we are interested in is the crossing of the threshold level of mental health.

For our dependent variable we take a discrete measure of mental health, which can take values from 0 to 36. From this we construct a binary variable, whereby an individual scores 1 if they are above the mental health threshold (i.e., mentally ill) and 0 if they are below (healthy). Here, we are only interested in mobility whereby the threshold is crossed, i.e., whether an individual goes from good mental health to bad mental health or vice versa. We are not interested in whether an individual moves between further sub-states, e.g., movements from good mental health to excellent mental health or bad to very bad mental health. The availability of longitudinal datasets makes it possible to supplement snapshots of health status with studies of health dynamics. This is apparent from recent studies on health and mobility in countries where longitudinal data is available.[1]

The paper is organised as follows: Section 2 discusses the Irish Health Care System and outlines the history of Mental Health in Ireland. It also briefly introduces the variable we use to measure mental health and gives a review of how the threshold level was chosen although this is extended in Section 3. Section 3 introduces the data used in the analysis and gives further information on the dependent variable. Section 4 presents the econometric model and discusses the methodology in detail. Section 5 presents the results and Section 6 concludes.

[1] See Hauck & Rice, 2004 and Contoyannis *et al.,* 2004 for Britain and Buckley *et al.,* 2004 for Canada

2. MENTAL HEALTH IN IRELAND

Mental healthcare services in Ireland have traditionally been institutional in nature. Services have catered primarily for a long-stay population and in many cases there has been a very high rate of relapse leading to a culture of maintenance rather than recovery. With the publication of *Planning for the Future* (1984) service provision has changed from an institutional model to one that is community and home based. It proposed that residential based care would be for a much shorter period of time. This policy has rolled out slowly since 1984 and the present situation is that Ireland has a mix of traditional institutional care and community and home based services.

Mental disorders are the leading cause of disability (lost years of productive life) in the North America, Europe and, increasingly, in the world (NAMI, 2006). According to the National Alliance on Mental Illness, by 2020 major depressive illness will be the leading cause of disability in the world for women and children. Without treatment the consequences of mental illness for the individual and society are staggering: unnecessary disability, unemployment, substance abuse, homelessness, inappropriate incarceration, suicide and wasted lives; the NAMI estimates that the economic cost of untreated mental illness is more than 100 billion dollars each year in the United States.

Depression and anxiety disorders are the most common mental illnesses. Depression causes people to lose pleasure from daily life, can complicate other medical conditions, and can even be serious enough to lead to suicide. It is one of the health problems most likely to cause workers to miss work (Kessler *et al.* 2001), and costs $44 billion per year to the US economy in lost productivity (Greenberg *et al*., 1993, Hall & Wise, 1995). Episodes of mental illness can come and go throughout a person's life. Some people experience their mental illness only once and then fully recover. Even though patients attach nearly as much importance to their mental health as to their physical health (Sherbourne *et al.*, 1999), unfortunately, only about half of those affected by mental illness receive treatment.

In a 2005 Irish study, carried out for the support and advocacy group Mental Health Ireland (MHI), depression has emerged as the most common condition experienced by patients with mental illness in Ireland. The study has also found that over two-thirds of

Irish people have direct experience of people with mental illness; mainly in the extended family (35%) and among friends and acquaintances (23%). Of those people with direct experience of mental illness, 52% identified depression as the most common factor. Ten per cent of those surveyed admitted to personally experiencing mental illness, with 75% of these respondents saying depression was the most common condition.

3. DATA

3.1 Living in Ireland Survey

We use 8 waves of data from the Living in Ireland Survey (LII). The LII is a longitudinal survey of households and individuals conducted by the Economic and Social Research Institute (ESRI) each year from 1994 up to 2001. It formed the Irish Component of the European Community Household Panel (ECHP). Where possible each adult (17+) in the household was interviewed, and the sample design aimed to produce a nationally representative sample of those living in private households. The same individuals are re-interviewed in successive waves and, if they split off from their original households, are also re-interviewed along with all adult members of their new households. The size of the initial sample was substantially augmented in 2000, since there had been significant drop-out or attrition of those in the original sample. Table 1 summarises the wave-on-wave response rates, from Wave 1 to Wave 8. For a detailed description of the survey, response rates etc. see Whelan *et al* 2003. Since its initiation in 1994 the Living in Ireland Survey has provided the data for a considerable range of research studies on topics such as poverty, income inequality, the labour market and social inclusion (see for example Nolan, O'Connell and Whelan, 2001).

3.2 Non-response and Attrition Bias

Table 2 shows how the sample size and composition evolves across the waves of the LII. The table, which gives figures for men and women separately, shows the number of observations that are available at each wave and the corresponding number of drop-outs and re-joiners between waves. These are expressed as wave-on-wave survival and attrition rates. The survival rate is the percentage of original sample members remaining at wave *t*. The attrition rate is the percentage of the number of drop-outs between waves *t* and *t-1* to the number of observations at *t-1*. The raw attrition rate excludes re-joiners, while the net drop-out rate includes them. Attrition rates are highest between waves 1 and 2, with the

rate tending to decline over time, until wave 6 when it increases before declining again for the remainder of the waves.

A British study, by Hauck and Rice (2004), reported the average rate of attrition over eleven waves of the BHPS to be 41%. The average rate of attrition over eight years in our data is 61%. This rate is approx. 20% higher than the rate reported by Hauck and Rice for the BHPS. This is in keeping with a report by Rendtel *et al* (2004) in which they look at attrition rates for each country in the ECHP. They find considerable differences across countries. Their results show that the ECHP is most affected by attrition in Ireland where the remaining part of respondents dropped to 46%. For the UK BHPS and the German-SOEP, they find the highest overall response rates across the EU (about 76 and 79% respectively).

A basic premise long recognised in health economics literature is that supply and demand do not interact in the health care sector in the conventional manner described by microeconomic theory of the operation of markets. Health is determined by many factors among which medical care is only one. These factors include social class, work environment, employment status, income, housing-conditions, heating, education, diet and lifestyle.

The Grossman model is concerned with how individuals allocate their resources to produce health. The model goes beyond traditional demand analysis and has been extremely influential in health economics. It utilises the idea of the individual as a producer of health (not simply a consumer) by removing the artificial separation of consumption and production. As a producer of health the individual buys market inputs (medical care, food, clothing), and combines them with their own time to produce services that increase their utility. Grossman's model also introduces the idea of investing in human capital (health and education) to improve outcomes in both the market (work) and non-market (household) sectors

Demand for health care is a derived demand, arising from the utility associated with health status and the impact of health care on that status. Thus:

Utility = U (Health Status (Health Care), Other Commodities),

where,

Health Status = f(x)

In this paper the type of health status we are concerned with is mental health status. This is measured by GHQ and the x's are a set of individual and household specific variables.

3.3 Dependent Variable

The measure of self-reported mental health used in this paper is the General Health Questionnaire (GHQ). The GHQ is a measure of current mental health and since its development by Goldberg in the 1970s it has been extensively used in different settings and different cultures. This questionnaire was originally developed to detect minor psychiatric disorders among respondents in community settings and included 60 questions. In the present study, an abbreviated version of the questionnaire, the GHQ-12, was adopted to provide a general measure of psychological well-being. This abbreviated version consisted of only 12 items, each of which described a condition or an aspect of mental health status. Subjects were asked to indicate whether they had experienced the condition more or less than usual over the past one month. Lower score indicated better psychological well-being.

The subjects are asked questions on concentration, sleep loss due to worry, perception of role, capability in decision making, whether constantly under strain, perception of problems in overcoming difficulties, enjoyment of day-to-day activities, ability to face problems, loss of confidence, self-worth, general happiness and whether suffering depression. The GHQ questions are formulated in a way such that respondents are more inclined to take their own previous health states as a comparison when responding to the questions. Each question is rated on a four-point scale (less than usual, no more than usual, rather more than usual, or much more than usual); and in this paper the GHQ questions were coded using the Likert scoring method (0-1-2-3, 0 being the best score). This ordinal coding has therefore resulted in an overall scale that ranged from 0 (least distressed) to 36 (most distressed).

Although the GHQ-12 is a relatively crude measure of psychological morbidity, it has been shown to have acceptable sensitivity and specificity in identifying probable psychiatric cases (Goldberg & Williams, 1988) and a limited number of items from the GHQ has been shown to be sufficient to measure morbidity in large-scale population

surveys (Tennant, 1977; Radovanovic and Eric, 1983; Banks et al 1980; Banks, 1983; Mari and Williams, 1985; Harding and Sewel, 1992 and Jacobsen *et al.*, 1995). According to a large number of validation studies respondents scoring over a certain threshold value are likely to be experiencing certain psychological problems or are potential "cases" that would profit from psychological intervention. It is recommended that the mean GHQ score for the whole population of respondents provide a rough guide to the best cut-off threshold (Goldberg *et al.*, 1998).

In this paper we only consider those people who are mentally healthy when joining the sample, and use the mean GHQ score (GHQ=9.98) as our threshold value. Since this value is a non-integer, we round it off to the nearest integer, i.e., GHQ Threshold=10. If respondents score 10 or above they are deemed mentally ill. Because we have longitudinal data we are able to quantify the number of times a respondent crosses the threshold (from healthy to unhealthy and vice versa) over the course of the study (1994-2001). We limit this to the first four transitions, as the sample size for those who make more than four transitions becomes very small and we are concerned that there is not much information to be gained from examining these "serial crossers". We also examine the key determinants that cause a person to cross the threshold. Since our GHQ score is a non-negative integer between 0 and 36 we also use count data models to examine the size of the change in GHQ score that leads to an individual crossing a threshold. Table 3 displays the population split by the number of transitions they make and gives the percentage of people in each group by each of the explanatory variables. Figure 1 shows a graphical representation of this table.

3.4 Explanatory Variables

As well as the usual socioeconomic variables (age, gender, education etc.), we want to include other measures of health status so that not only do we have a measure of mental health but we also have measures of general and physical health and we can determine how these, impact on GHQ score. Kaplan et al. (1989) has noted that each of these measures was `guided by the WHO definition of health status: "Health is a complete state of physical, mental and social well-being and not merely absence of disease"' (Kaplan et al. 1989, p. S31). Part of this broader approach to measuring health is to ask people to assess the state of their own health. Subjective health assessment has become a critically important component of contemporary health research (Albrecht 1994), which some argue

is as reliable as, and perhaps even more reliable than, biomedical measures (Epstein 1990). A commonly used global question (and one which is asked in the Living in Ireland Survey) asks: 'In general, how good would you say your health is very good / good / fair / poor / very poor?' It is from this question that we derive our self-assessed health (SAH) categories.

We also include a measure of physical health albeit a crude measure. The individual reports whether they are hampered in their daily activities, by any chronic physical or mental health problem, illness or disability. If they say that they are hampered, the interviewer then reports whether or not the respondent is usually confined to bed, a wheelchair user, has other mobility problems or has no mobility problems. From the answers to these questions we construct a variable which takes a value of one if the individual is usually confined to bed, a wheelchair user or has other mobility problems and zero otherwise. One could argue that subjective health is affected by physical health, however a recent study by Oswald and Powdthavee (2006) shows, using longitudinal data, that people who become disabled go on to exhibit marked recovery in mental wellbeing, although adaptation to severe disability is partial not complete. Table 4 provides variable names and definitions.

Ireland's health care system is a complex mix of public and private care. Under existing eligibility arrangements almost 28% of the population are eligible for the full range of public, primary, and hospital services, free of charge through the General Medical Services (GMS). This eligibility for a medical card is means tested. Also approximately 50% of the population avail of care in private hospitals through the purchase of voluntary private health insurance. In 2003 a study revealed that of those with a medical card approximately 16% had purchased medical insurance (Health Insurance Authority). As a result of this health system we can also include a number of medical-cover status variables, Medical Card Holder, Insurance Policy Holder, Both Medical Card and Insurance Policy Holder and No Medical Cover.

4. ECONOMETRIC MODEL AND ESTIMATION METHODS

We are essentially concerned with answering two questions. First, what are the key determinants that cause an individual to cross the threshold from being mentally healthy

to being mentally unhealthy? Second, what are the key factors that determine the number of GHQ units moved by an individual that crosses the threshold? Therefore two equations need to be estimated:

Making a transition =	**f (Gender, Age, Income, Education, Marital Status, Labour Force Status, Health Status…..(1)**
Number if GHQ Units Moved =	**f (Gender, Age, Income, Education, Marital Status, Labour Force Status, Health Status..…(2)**

When modelling health care the data on the outcome variable is often characterised by a large number of zeros. The data in this paper are no different. Referring back to table 3 we can see that over 43% of our sample did not cross the threshold and therefore we have many zeros in the dependent variable of equation (1). The dependent variable for equation (2) is a discrete variable with values from 0 to 36. Although these equations need to be estimated separately, estimating equation (2) for individual *i* is conditional on that person making a transition in the first place, i.e. conditional on the probability that Y>0 in equation (1). The most common model used in the literature to analyse this kind of data is a two-part model. An alternative model to use would be a Heckman Selection model. There has been some debate in the literature as to which model is more appropriate for describing health care expenditures[2]. However Heckman estimates are quite poor when there is no valid exclusion restriction. Since no valid exclusion restrictions exist in our dataset, the two-part model is the more appropriate model to use for the purposes of this paper.

The origin of the two-part model can be traced back at least to Goldberger (1964), who labels it the twin linear probability approach. Cragg (1971) who appears to be the first to use the term 'two-part model', discusses several of its variants. In this model two stages are distinguished: whether the individual crosses the threshold or not and how many units they move given that they have crossed. The level of actual observed positive units moved are modelled directly, rather than potential units moved. Two-part (and more generally

[2] See for example Toro-Vizcarronndo and Wallace (1968), Duan et al (1983), Leung and Yu (1996) and more recently Dow and Norton (2003) for further discussion.

multi-part) models are described in Wooldridge (2002) and used in Duan, Manning, Morris, and Newhouse (1983) to analyze individuals' medical expenditures.

The two-part model focuses on actual outcomes. In this framework a zero is truly a zero and what this model allows us to explore is whether there is a latent expected number of units moved which might have been observed under certain circumstances. Assuming that the errors in equations (1) and (2) are not correlated allows us to run the two-part model, as identification is not an issue.

The Probit Regression Model

As making a transition between health states is a binary outcome a probit regression model is estimated for each transition, with the five health indicators as covariates, in addition to a range of demographic and socio-economic controls. Rather than reporting the probit coefficients which only provide informative about the sign and the effect of the variable, the tables report the marginal effects. In a probit model it is assumed that the probability of a "success" (y>0) is:

$$\Pr[y > 0 \mid X] = \Phi(X\beta_1, \varepsilon_1) \quad \text{.....(3)}$$

The estimated marginal effect of a small change in the i^{th} (continuous) variable in X on the probability of a success is:

$$\frac{\partial P(y > 0)}{\partial X_i} = \hat{\beta}_i . f(\hat{\beta} X) \quad \text{.....(4)}$$

where $\hat{\beta}$ are the maximum likelihood estimates of β and $f(.)$ is the normal density function[3]. Since this varies from observation to observation, the convention is either to evaluate at particular values of the X's (such as the means) or to estimate at all observations and then take the mean of the marginal effects. The latter is obviously computationally more intensive. In many cases the two approaches yield very similar

[3]The extension to where the X variable is discrete (e.g. a dummy variable) is straightforward.

results. This paper presents marginal effects at the means[4]. The standard errors reported are robust and adjusted for intra-group correlation.

Count Data Models

The second part of the model involved modelling the size of the movement in GHQ score between periods. The OLS regression equation for this is:

$$\mathrm{E}[y \mid y > 0, X] = X\beta_3 + \mathrm{E}[\varepsilon_3 \mid y > 0, X] \quad \text{.....(5)}$$

Since the size of movement in GHQ score between periods is a non-negative integer, this variable can be treated as a count. Using the ordinary least squares (OLS) method for event count data results in biased, inefficient, and inconsistent estimates (Long 1997). Thus, researchers have developed various nonlinear models that are based on the Poisson distribution and negative binomial distribution

Count data often follow a Poisson distribution, so some type of Poisson analysis might be appropriate. The Poisson model assumes that the mean and variance of the errors are equal. However from Table 5 we see that the variance of the dependent variable is nearly always at least twice as large as the mean. The distribution of the size of jump is displaying signs of over dispersion, that is, greater variance than might be expected in a Poisson distribution. Poisson regression can be followed up with the Stata *poisgof* command, which tests the Poisson goodness-of-fit. From the same table we can see that the value of the chi-square is extremely large in every transition. This large value for chi-square in the *poisgof* is another indicator that the Poisson distribution is not a good choice. Negative binomial regression is often more appropriate in cases of over dispersion.

The negative binomial distribution is a form of the Poisson distribution in which the distribution's parameter is itself considered a random variable. The variation of this parameter can account for a variance of the data that is higher than the mean. While the poisson model was defined in terms of the parameter alpha, the negative binomial estimates ln(alpha). This is done because estimating ln(alpha) forces the estimated alpha to be positive. Marginal effects (instead of negative binomial coefficients) are reported and the standard errors are based on robust standard error estimates that control for the clustering of observations on the person identifier.

4 Using the "dprobit" routine in Stata 9.

5. RESULTS

Table 6 presents the two-part model whereby the first part is the marginal effects of the probit model and the second part displays the negative binomial estimates of the size of the movement in GHQ score by transition.

First Part

The probit model is estimated in order to determine the probability that a respondent will cross the health threshold. In this model we include information on gender, income, education and labour force status as well as self-reported health status and type of health cover. As can be seen from Table 6, only a few of the explanatory variables are significant. Being male reduces the probability of making an initial transition from healthy to unhealthy by 1.8%. However, gender doesn't have any significant effect for later transitions. Age has a highly significant effect on the probability of making an initial transition with the effect getting weaker and less significant the more transitions one makes. However, the coefficient on age squared is negative which tells us while the probability of making a transition is positive, this probability increases at a decreasing rate.

An increase in the number of children in the household decreases the probability of becoming healthy again if a respondent has become unhealthy previously. Surprisingly an increase in income or being retired increases the probability of becoming unhealthy. Lower education levels are associated with becoming unhealthy and staying there over all transitions. Interestingly those with 3rd level education have a high probability of becoming unhealthy again and staying there if they have a history of becoming unhealthy in the past.

Being a homemaker has a large positive effect on the probability of becoming healthy again after crossing the threshold in the first instance. Surprisingly for those homemakers who go on to make a fourth transition, there is a large significant negative effect on the probability of becoming healthy again. There is a similar pattern with those who never married although the magnitude and significance is not as strong.

Our self reported health variables have predominately significant effects on the probability of crossing a health threshold. Having bad or very bad self reported healthy

unsurprisingly has a large significant effect of becoming unhealthy and staying unhealthy. Being physically disabled has a similar effect although the significance declines after the second transition. Being a medical card holder is associated with an increase in the probability of becoming unhealthy for both the first and third transitions. Having medical insurance as well as a medical cover has a strong positive effect on the probability of becoming unhealthy in the first instance, however the significance declines after this. Having no medical cover increases the probability of becoming unhealthy and staying unhealthy although none of the results display any great significance.

Since income and education, and income and labour force status are highly correlated we include interaction dummies for these variables. For those with lower education status, an extra unit of income decreases the probability of making a transition for healthy to unhealthy and increases the probability of making a transition back to healthy after becoming unhealthy, although this effect is only significant for those making a transition from healthy to unhealthy. For those retired individuals, having an extra unit of income consistently reduces the probability of crossing the threshold in any direction, although this effect is only significant for the first two transitions.

Second-Part

Table 6 also presents the results for the expected number of GHQ units moved. As discussed above these results are obtained via a Negative Binomial Regression Model. The regressions are restricted to those individuals who to cross the threshold (in either direction) and the number of GHQ units are calculated for each individual as the difference between GHQ score in the period the transition occurs and GHQ score in the previous period.

From the table we can see that unsurprisingly the health and age variables tend to have the greatest impact on the expected number of units moved. Having bad general and physical health, having a medical card or having no medical cover increases the expected number of units moved when making a transition from good mental health to bad mental health. There is a similar pattern for those who make a second transition (from bad health back to good health). Being a medical card holder with insurance reduces the expected number of units moved over all transitions although this is significant in the second transition.

Being male also reduces the number of GHQ units moved over all transitions although this is no significant for those who make four transitions. Age also has a significant effect on the expected number of GHQ units moved when making the transition from unhealthy to healthy.

Being retired and having a leaving certificate, consistently reduces the expected number of GHQ units moved across all transitions although this is only significant for those making a third transition from healthy to unhealthy.

Being unemployed and being in further education has a large positive significant effect on the expected number of GHQ units moved for those making a second transition back to healthy again. We also see some significance in the results for the marital status variables. Those that are divorced or separated have higher expected number of GHQ units moved for the first transition relative to those that are married. Being widowed is associated with a greater number of GHQ units moved for those who make a second transition. For those making a fourth transition, being widowed is associated with a lower number of GHQ units moved and never been married is associated with a higher number of GHQ units moved.

6. DISCUSSION & CONCLUSIONS

Mental health is an area that is under-researched and that would benefit greatly from the input of health economists. Mental health problems are among the most common forms of ill health. They place a heavy burden on individuals, their families and friends and the community at large. They also impose substantial economic costs on a country's health service and society as a whole. In order for mental illness prevention programs to be most effective we must first identify those groups of people that are most at risk of becoming mentally ill and of suffering from periods of ill-health.

Using a two-part model and Irish micro-data, this paper examines the association between socioeconomic status and levels and changes in mental health. In particular we take analysis of mobility stimulated by applications in income and poverty studies. We examine the key determinants that cause a person to cross a threshold level of mental health. This is done using two-parts; first part is to examine the probability of making a transition and the second part is to examine the size of the change in GHQ score that leads

to an individual crossing a threshold. In common with other studies of mental health in the UK and the US, we find socio-economic status and gender are significant and important determinants of the levels of mental health. In addition, to our knowledge, no other study uses a threshold level of mental health to study the mobility in and out of health states in Ireland.

We present the statistical characteristics of people who experience poor mental health and conduct a two-part analysis of the links between indicators of mental health and several socio-economic outcomes. We find that people with the highest probability of becoming mentally ill are likely to be older, female, and less educated. These people are also more likely to be in bad general and physical health and have medical cards. However, we do find an income effect for those in low education and those who have retired, although the magnitude of the effect isn't substantial.

We also find that those with the largest expected number of GHQ units moved are the people mentioned above as well as those that have no medical cover and those who are divorced or separated. Males make smaller moves than females. Also those with higher levels of education and those who are retired make smaller moves. Interestingly while those with medical cards have high expected number of units moved the opposite is the case for those who have insurance as well as medical cards.

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TABLES

Table 1: Individual and Household response rates each wave

	1994	1995	1996	1997	1998	1999	2000 Original	2000 New	2000 Total	2001
Households										
Completed Households	4048	3584	3174	2945	2729	2378	1952	1515	3467	2865
Non-Response	3038	794	624	390	394	464	414	114	1560	797
Total Households	7086	4378	3980	3335	3123	2842	2366	2661	5027	3662
Household Response Rate	57%	82%	84%	88%	87%	84%	83%	57%	69%	78%
Non-Sample	166	98	125	119	94	83	77	159	236	78
Individuals										
N. in Completed Households	14585	12576	10889	9952	9000	7721	6276	5174	11450	9131
. . followed from first wave	N/A	12117	10241	9154	8139	6908	5530	0	5530	4820
. . new since last wave	N/A	459	648	798	861	813	746	5174	5920	4311
Eligible for Individual Interview (*)	10418	9048	7902	7255	6620	5719	4745	3952	8697	6996
Number individuals Interviewed	9904	8531	7488	6868	6324	5451	4529	3527	8056	6521
% Individual interviews completed	95%	94%	95%	95%	96%	95%	95%	89%	93%	93%

Note: * in completed Households

SOURCE: "Monitoring Poverty Trends in Ireland: Results from the 2001 Living in Ireland Survey", Whelan et al, Policy Research Series No.51, ESRI, 2003.

Table 2. GHQ sample size, drop outs, rejoinders and attrition by wave and previous period health status

Wave	No. Indiv.	Drop outs	Re-joiners	New Joiners	Raw attrition (%)	Net attrition (%)	Mean	Survival rate (%)
All Data								
1	8583						10.41	
2	7100	2320	0	837	27.03	17.28	9.98	82.72
3	6225	1360	70	415	19.15	12.32	10.12	71.56
4	5666	1010	122	329	16.22	8.98	10.04	65.13
5	5274	797	119	286	14.07	6.92	9.80	60.63
6	4439	1138	125	178	21.58	15.83	9.60	51.03
7	3690	1066	148	169	24.01	16.87	9.65	42.42
8	3328	638	148	128	17.29	9.81	9.52	38.26
Men								
1	4103						9.95	
2	3384	1163	0	444	28.35	17.52	9.47	81.39
3	2938	701	39	216	20.72	13.18	9.56	70.66
4	2681	506	72	177	17.22	8.75	9.55	64.48
5	2444	440	68	135	16.41	8.84	9.46	58.78
6	2035	571	76	86	23.36	16.73	9.18	48.94
7	1683	522	86	84	25.65	17.30	9.31	40.48
8	1515	322	91	63	19.13	9.98	9.07	36.44
Women								
1	4480						10.83	
2	3716	1157	0	393	25.83	17.05	10.43	81.83
3	3287	659	31	199	17.73	11.54	10.62	72.38
4	2985	504	50	152	15.33	9.19	10.48	65.73
5	2830	357	51	151	11.96	5.19	10.10	62.32
6	2404	567	49	92	20.04	15.05	9.95	52.94
7	2007	544	62	85	22.63	16.51	9.94	44.20
8	1813	316	57	65	15.74	9.67	9.89	39.93

Table 3: Sample split by Number of Transitions made: Percentage of Population in each cohort

	No Transitions	One Transition	Two Transitons	Three Transitions	Four Transitions	Five Transitions	Six Transitions
All	43.77%	18.48%	19.71%	9.16%	6.52%	1.80%	0.57%
Male	54.00%	47.67%	46.26%	39.11%	53.39%	46.26%	32.77%
Female	46.00%	52.33%	53.74%	60.89%	46.61%	53.74%	67.23%
Irish	97.95%	98.15%	98.46%	98.16%	98.38%	95.72%	89.92%
Non-Irish	2.05%	1.85%	1.54%	1.84%	1.62%	4.28%	10.08%
No Qualifications	19.16%	33.57%	22.69%	32.07%	33.11%	35.29%	37.82%
Junior Cert	25.58%	23.42%	24.35%	28.77%	23.53%	20.59%	21.85%
Leaving Cert	33.52%	25.92%	29.76%	22.05%	20.50%	23.53%	15.97%
3rd Level	21.74%	17.10%	23.20%	17.11%	22.86%	20.59%	24.37%
Employed	59.96%	48.14%	58.38%	48.77%	53.32%	54.01%	42.02%
Unemployed	3.97%	4.92%	2.95%	3.46%	5.90%	2.41%	0.00%
Retired	7.69%	12.91%	7.73%	9.24%	13.13%	9.09%	11.76%
Home maker	15.46%	24.98%	24.30%	34.70%	24.04%	28.61%	44.54%
Further Education	12.44%	8.01%	5.90%	2.15%	3.02%	3.48%	0.00%
LFS Other	0.49%	1.04%	0.73%	1.68%	0.59%	2.41%	1.68%
Married	51.39%	62.27%	64.41%	64.36%	73.67%	72.73%	77.31%
Divorced/Separated	1.10%	1.14%	0.98%	1.68%	2.14%	0.27%	7.56%
Widowed	2.92%	6.51%	4.78%	7.51%	2.36%	4.81%	8.40%
Never Married	44.59%	30.08%	29.84%	26.46%	21.83%	22.19%	6.72%
V.Good/Good or Fair SAH	99.66%	97.32%	99.66%	98.90%	99.71%	98.40%	98.32%
Bad / V.Bad SAH	0.34%	2.68%	0.34%	1.10%	0.29%	1.60%	1.68%
Physical Disability	5.13%	14.21%	8.12%	12.44%	8.19%	12.83%	15.97%
No Disability	94.87%	85.79%	91.88%	87.56%	91.81%	87.17%	84.03%
Medical Card Holder	18.09%	29.46%	20.05%	32.23%	21.76%	34.76%	31.09%
Medical Insurance	47.90%	39.42%	49.16%	38.22%	44.91%	44.39%	54.62%
Med Card + Insurance	1.26%	1.82%	1.90%	1.94%	3.17%	0.80%	4.20%
No Medical Cover	32.75%	29.30%	28.89%	27.61%	30.16%	20.05%	10.08%
N	**9,103**	**3,843**	**4,099**	**1,905**	**1,356**	**347**	**119**

Figure 1: Graphical Representation of Socio-Economics Variables by the Number of Transitions.

Table 4. Variable Definitions & Summary Statistics for Sub-sample whose Initial GHQ Condition was Good Mental Health

		N	Mean	Std. Dev.	Min	Max
GHQ	Self-assessed psychological health (higher score = poorer health)	20799	8.020	3.312	0	36
GENDER	1 if male, 0 otherwise	20799	0.496	0.500	0	1
AGE	Age in years at 1st January of current wave	20799	42.165	18.223	17	92
AGESQ	Age Squared	20799	2109.980	1703.088	289	8464
AGECUB	Age Cubed	20799	119436.400	135551.400	4913	778688
LNEQINC	Natural log of equivalised annual real household income in Irish pounds	20799	9.909	0.675	3.760	12.691
NOCH	Number of Children in Household	20799	0.918	1.229	0	7
IRISH	**1 if Irish citizen, 0 otherwise**	**20799**	**0.980**	**0.138**	**0**	**1**
NONIRISH	1 if non-Irish citizenship, 0 otherwise	20799	0.020	0.138	0	1
NOQUAL	**1 if no qualifications, 0 otherwise**	**20799**	**0.250**	**0.433**	**0**	**1**
JUNIOR	1 if highest academic qualification is Junior Cert or equivalent, 0 otherwise	20799	0.250	0.433	0	1
SENIOR	1 if highest academic qualification is Leaving Cert or equivalent, 0 otherwise	20799	0.292	0.455	0	1
DIPDEGHDEG	1 if highest academic qualification is PLC Course, Diploma, degree or higher degree, 0 otherwis	20799	0.208	0.406	0	1
EMPLOYED	**1 if employed, 0 otherwise**	**20799**	**0.558**	**0.497**	**0**	**1**
UNEMPLOYED	1 if unemployed, 0 otherwise	20799	0.040	0.195	0	1
RETIRED	1 if retired, 0 otherwise	20799	0.092	0.289	0	1
HOMECARE	1 if family care, 0 otherwise	20799	0.217	0.412	0	1
FTEDUC	1 if in full time education, 0 otherwise	20799	0.085	0.280	0	1
LFSOTHER	1 if Labour Force Status is other (e.g., illness, etc.), 0 otherwise	20799	0.008	0.089	0	1
MARRIED	**1 if married or living as a couple, 0 otherwise**	**20799**	**0.591**	**0.492**	**0**	**1**
WIDOWED	1 if widowed, 0 otherwise	20799	0.044	0.205	0	1
DIVSEP	1 if divorced or separated, 0 otherwise	20799	0.012	0.110	0	1
NVRMAR	1 if never married, 0 otherwise	20799	0.352	0.478	0	1
SAHDUM	1 if reported that general health is Bad or Very Bad, 0 otherwise	20799	0.009	0.093	0	1
INCAPACITY	1 if hampered by a chronic, physical or mental health problem, illness or disability, 0 otherwise	20799	0.085	0.278	0	1
MEDCARD	1 if holder of medical card, 0 otherwise	20799	0.243	0.429	0	1
INSURANCE	**1 if holder of medical insurance policy, 0 otherwise**	**20799**	**0.473**	**0.499**	**0**	**1**
NOCOVER	1 if has no medical cover (no medical card or insurance), 0 otherwise	20799	0.301	0.459	0	1
BOTH	1 if holder of medical card and insurance policy, 0 otherwise	20799	0.017	0.130	0	1
INC_NOQUAL	**Interaction dummy of income and No Qualifications**	**20799**	**2.375**	**4.128**	**0**	**11.848**
INC_JUNIOR	Interaction dummy of income and Junior Certificate	20799	2.471	4.292	0	12.311
INC_SENIOR	Interaction dummy of income and Leaving Certificate	20799	2.931	4.576	0	12.691
INC_DIPDEGHDEG	Interaction dummy of income and degree holder	20799	2.132	4.167	0	12.630
INC_EMPLOYED	**Interaction dummy of income and employed**	**20799**	**5.635**	**5.033**	**0**	**12.691**
INC_UNEMPLOYED	Interaction dummy of income and unemployed	20799	0.383	1.888	0	11.647
INC_RETIRED	Interaction dummy of income and retired	20799	0.860	2.711	0	11.351
INC_HOMECARE	Interaction dummy of income and homecare	20799	2.098	4.001	0	12.691
INC_FTEDUC	Interaction dummy of income and further education	20799	0.857	2.809	0	12.311
INC_LFSOTHER	Interaction dummy of income and if Labour Force status is other (e.g., illness etc.)	20799	0.076	0.851	0	11.095

NOTE: **Variables in bold refer to the excluded categories.**

Table 5: Summary Statistics of Size of Jump by Transition						
	N	**Number of Clusters**	**Variance**	**Mean**	**Goodness of fit chi-2**	**Prob>chi2**
First Transition	11696	2245	12.656	5.372	22891.870	(11664) 0.000
Second Transition	7853	1195	10.296	5.032	13547.240	(7821) 0.000
Third Transition	3754	519	10.465	4.910	6731.224	(3722) 0.000
Fourth Transition	1849	246	8.527	4.660	2806.480	(1817) 0.000

Table 6: Probit followed by Negative Binomial (Part 1)

	First Transition- Healthy to Unhealthy				Second Transition - Unhealthy to Healthy			
	Probit (MFX)		Negative Binomial		Probit (MFX)		Negative Binomial	
	dF/dx	Std. Err.	%	Std. Err.	dF/dx	Std. Err.	%	Std. Err.
Male	-0.018 **	0.008	-4.400 *	0.036	0.001	0.012	-13.800 ***	0.044
Age	0.028 ***	0.004	-1.600	0.019	0.021 ***	0.007	-4.200 **	0.024
Age Squared	-0.001 ***	0.000	0.000	0.000	0.000 ***	0.000	0.100 **	0.000
Age Cubed	0.000 ***	0.000	0.000	0.000	0.000 ***	0.000	0.000 **	0.000
Log of Equiv Income	0.016 *	0.012	4.400	0.046	0.018	0.017	-3.100	0.053
Number of Children	-0.001	0.003	0.200	0.013	-0.011 ***	0.005	-0.700	0.015
Non-Irish	-0.005	0.025	15.200	0.142	0.015	0.039	10.800	0.132
Junior Cert	0.324 **	0.163	21.200	0.478	0.139	0.208	-57.800 *	0.587
Leaving Cert	0.036	0.140	-17.200	0.528	-0.045	0.191	-44.200	0.611
3rd Level	0.164	0.185	51.800	0.583	0.077	0.251	-56.800	0.716
Retired	0.627 ***	0.164	-40.900	0.715	0.583 **	0.220	-27.600	0.747
Unemployed	0.315	0.295	-11.800	0.791	0.183	0.395	445.900 **	0.827
Home maker	0.056	0.135	27.400	0.451	0.235 *	0.199	59.600	0.567
Further Education	-0.173	0.093	335.200 **	0.724	0.151	0.424	286.200 *	0.958
LFS Other	-0.177	0.095	-20.000	1.567	-0.011	0.587	25.600	1.211
Divorced/Separated	-0.008	0.030	15.900 *	0.123	0.017	0.045	-11.800	0.147
Widowed	-0.011	0.016	8.800	0.071	-0.025	0.025	11.200 *	0.087
Never Married	-0.003	0.011	0.300	0.045	0.022 *	0.016	-1.400	0.053
Bad / V.Bad SAH	0.047 *	0.034	29.300 ***	0.074	-0.053 *	0.040	23.300 **	0.093
Physical Disability	0.039 ***	0.012	8.800 ***	0.034	-0.022 *	0.016	13.800 ***	0.042
Medical Card Holder	0.026 ***	0.011	10.000 ***	0.041	0.003	0.016	6.200	0.050
Med Card + Insurance	0.031 *	0.024	-2.400	0.083	0.023	0.034	-17.000 **	0.091
No Medical Cover	0.007	0.008	6.200 **	0.033	-0.008	0.013	2.500	0.042
Income*Junior Cert	-0.027 **	0.013	-1.800	0.049	-0.010	0.020	8.900 *	0.060
Income*Leaving Cert	-0.004	0.014	2.000	0.054	0.007	0.020	5.800	0.062
Income*3rd Level	-0.013	0.015	-4.700	0.058	-0.003	0.023	7.600	0.072
Income*Retired	-0.054 ***	0.017	6.400	0.075	-0.059 **	0.028	4.100	0.079
Income*Unemployed	-0.020	0.022	2.200	0.082	-0.012	0.035	-15.500 **	0.085
Income*Home maker	-0.004	0.013	-2.800	0.045	-0.021	0.018	-4.900	0.058
Income*Further Ed	0.022	0.021	-14.100 **	0.071	-0.020	0.036	-12.700 *	0.095
Income*LFS Other	0.034	0.043	2.100	0.159	0.003	0.062	-1.300	0.128
N	20799		11696		11696		7853	
Observed P	0.206				0.276			
Predicted P (at x-bar)	0.202				0.275			
lnalpha			-1.721	0.074			-1.910	0.100
alpha			0.179	0.013			0.148	0.015

***Significant at the 1% Level, **Significant at the 5% Level, *Significant at the 10% Level

Table 6: Probit followed by Negative Binomial (Part 2)

	Third Transition - Healthy to Unhealthy				Fourth Transition - Unhealthy to Healthy			
	Probit (MFX)		Negative Binomial		Probit (MFX)		Negative Binomial	
	dF/dx	Std. Err.	%	Std. Err.	dF/dx	Std. Err.	%	Std. Err.
Male	0.001	0.020	-13.300 **	0.071	0.048 *	0.033	-4.000	0.097
Age	0.010	0.011	-0.700	0.043	0.017	0.018	17.200 ***	0.057
Age Squared	0.000	0.000	0.000	0.001	0.000	0.000	-0.300 ***	0.001
Age Cubed	0.000	0.000	0.000	0.000	0.000	0.000	0.000 ***	0.000
Log of Equiv Income	0.054 **	0.024	-5.600	0.079	-0.038	0.041	4.800	0.125
Number of Children	-0.003	0.007	-2.500	0.023	-0.005	0.012	-2.000	0.041
Non-Irish	0.061	0.060	8.300	0.127	0.037	0.081	-7.000	0.198
Junior Cert	0.547 **	0.275	43.000	0.848	-0.427 *	0.205	167.400	1.172
Leaving Cert	-0.214	0.202	-82.100 **	0.928	-0.346	0.256	98.300	1.434
3rd Level	0.617 *	0.332	27.800	1.143	-0.421 *	0.160	71.300	1.473
Retired	0.520	0.401	-76.300 *	1.156	0.487	0.564	-77.200	1.335
Unemployed	0.261	0.563	198.100	1.182	-0.208	0.332	-38.600	1.358
Home maker	0.024	0.264	-21.600	0.889	-0.648 ***	0.156	165.600	1.191
Further Education	0.746	0.244	-9.400	1.716	0.555	0.636	10.300	2.162
LFS Other	0.750	0.148	-12.300	2.219	0.757 **	0.022	-73.300	4.882
Divorced/Separated	0.046	0.058	16.300	0.205	0.012	0.096	5.800	0.160
Widowed	-0.023	0.035	2.900	0.141	-0.085 *	0.062	-26.500 *	0.228
Never Married	0.014	0.024	5.500	0.080	-0.050 *	0.039	32.700 ***	0.106
Bad / V.Bad SAH	0.186 ***	0.077	-5.900	0.132	0.057	0.089	10.500	0.207
Physical Disability	-0.002	0.021	14.900 ***	0.056	-0.037	0.032	4.900	0.084
Medical Card Holder	0.061 ***	0.024	-3.700	0.073	-0.015	0.038	-5.800	0.097
Med Card + Insurance	-0.013	0.043	-3.300	0.130	0.064	0.077	-17.200	0.161
No Medical Cover	0.025 *	0.019	-8.300 *	0.064	0.006	0.030	-6.200	0.081
Income*Junior Cert	-0.050 **	0.027	-3.700	0.088	0.062 *	0.048	-9.800	0.124
Income*Leaving Cert	0.021	0.030	18.800 **	0.095	0.049	0.057	-6.000	0.149
Income*3rd Level	-0.054 *	0.034	-2.500	0.114	0.078 *	0.054	-5.600	0.151
Income*Retired	-0.045	0.039	16.600 *	0.121	-0.051	0.060	16.800	0.138
Income*Unemployed	-0.016	0.045	-9.900	0.123	0.040	0.073	8.500	0.138
Income*Home maker	-0.001	0.026	3.100	0.091	0.107 ***	0.045	-9.100	0.120
Income*Further Ed	-0.085 *	0.068	2.200	0.170	-0.045	0.081	-0.600	0.213
Income*LFS Other	-0.089	0.079	-2.100	0.232	-0.272 **	0.147	6.800	0.519
N	7853		3754		3754		1849	
Observed P	0.240				0.283			
Predicted P (at x-bar)	0.235				0.276			
lnalpha			-1.802	0.144			-2.137	0.252
alpha			0.165	0.024			0.118	0.030

***Significant at the 1% Level, **Significant at the 5% Level, *Significant at the 10% Level