



Universitat d'Alacant  
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THREE ESSAYS ON HEALTH ECONOMICS

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Tesis

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# THREE ESSAYS ON HEALTH ECONOMICS

by

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*To my grandparents*



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## Resumen

La economía de la salud es la aplicación de la teoría económica, y de los modelos y técnicas empíricas al análisis de la toma de decisiones de los individuos, los proveedores de la asistencia sanitaria y los gobiernos con respecto a la salud y el cuidado de la salud (Morris et al., 2007). Probablemente, ha sido la sub-disciplina de más rápido crecimiento dentro de economía en los últimos 20 años. Durante este tiempo, se ha dedicado mucha atención a los temas de la Economía de la Salud debido a su importancia directa en los problemas de financiación que han dominado los debates de la política sanitaria en todo el mundo. En esta tesis doctoral se cubren diversos temas de Economía de la Salud Aplicada y en particular se tratan distintas cuestiones relacionadas con la salud mental. Estudiar la Economía de la salud mental es importante, al menos, por tres razones. En primer lugar, los trastornos mentales suelen ser enfermedades crónicas que crean una discapacidad sustancial e impactan a los individuos de forma muy temprana en la vida; son, generalmente, más debilitantes que la mayoría de las enfermedades físicas crónicas. Por ejemplo, el grado de incapacidad impuesta por una depresión es un 50% superior a la impuesta por una angina, o por asma, artritis o diabetes (OMS). En segundo lugar, la enfermedad mental está constantemente asociada con privación, bajos ingresos, desempleo y aumento de comportamientos que suponen un riesgo para la salud. La mayor parte de los gastos derivados de la enfermedad mental son indirectos, principalmente causados por la discapacidad y la pérdida de productividad (bajas por enfermedad, no empleo, mortalidad prematura). También han sido sustancialmente relacionados con el abuso de sustancias, la criminalidad y la violencia. En tercer lugar, la enfermedad mental, a menudo, aumenta la escala de la enfermedad física. Puede empeorar la enfermedad física existente y causar síntomas físicos que no se pueden explicar médicamente: los médicos de cabecera confirman que muchos pacientes enviados para primeras consultas tienen 'síntomas médicamente inexplicados'. Se puede evitar la asistencia médica física adicional causada por la enfermedad mental si se proporcionan terapias psicológicas a aquellas personas que tienen problemas de salud mental, además de síntomas físicos. Todo lo anterior indica que la salud mental tiene un impacto muy significativo en nuestras vidas y en el comportamiento económico. En esta tesis he desarrollado principalmente dos temas relacionados con la interacción entre la economía y la salud mental: el papel de las fluctuaciones económicas en la salud mental y el efecto de la salud mental en la toma de decisiones económicas.

En el primer capítulo investigo si las crisis económicas tienen un coste en términos de las enfermedades mentales de los individuos (ansiedad y depresión) según su situación laboral. El objetivo es evaluar cómo las fluctuaciones económicas, medidas por cambios en la tasa de desempleo regional, afectan a la salud mental de los individuos que son actualmente activos en el mercado de trabajo. En este trabajo utilizo los datos de la Encuesta de la Población Activa de los años 1997 – 2010 para el Reino Unido para analizar si las personas suelen sufrir más problemas mentales cuando la situación económica empeora, y si este efecto es diferente para los empleados y los desempleados.

Los resultados de la serie de artículos de Ruhm (2000, 2003, 2005) sugieren que varios aspectos del estado físico de los individuos mejoran cuando la economía temporalmente se deteriora: una caída en la tasa de desempleo estatal se asocia con una subida de las tasas de mortalidad y con la probabilidad de sufrir una o más morbilidades agudas o tener al

menos un problema de salud. En consecuencia me pregunto qué sucede en términos de los problemas mentales.

Altas tasas de desempleo durante la recesión pueden crear externalidades negativas. Las personas empleadas comienzan a sentirse menos seguras de ser capaces de mantener su trabajo, mientras que los desempleados tienen pocas posibilidades de encontrar uno. Todas estas experiencias pueden tener un impacto negativo sobre la salud mental: cuando las perspectivas del mercado de trabajo empeoran, las personas son más propensas a sufrir problemas mentales tales como ansiedad o depresión. Estos resultados son importantes, ya que la productividad de los trabajadores en las recesiones podría verse afectada por los problemas mentales, ya que los trabajadores sufren de inseguridad en el empleo y otros tipos de estrés inducidos por los recortes en el salario y horas de trabajo. Otra razón para preocuparse por el efecto de la economía de la salud mental es que los costes del cuidado de la salud asociados con las enfermedades mentales han aumentado sustancialmente en las últimas décadas en la mayoría de los países industrializados y en particular en el Reino Unido (McVicar y Anyadike-Danes, 2008), mientras que la dinámica de estos costes puede estar relacionada con las condiciones económicas. Sin embargo, aparte de estos efectos negativos, es posible que haya algunos efectos positivos en los subgrupos de los desempleados: la presión social por no seguir la norma disminuye cuando más gente se desvía de la norma, en este caso estar desempleado. Por lo tanto, algunos desempleados podrían resultar en menor riesgo de caer en problemas de la salud mental.

Una serie de artículos sobre la felicidad han demostrado que menores niveles de bienestar individual se relacionan con mayores niveles de desempleo agregado (Di Tella et al., 2001; Clark y Oswald, 1994). Ruhm (2003) encuentra que aumentos en la tasa de desempleo se asocian positivamente con aumentos en los trastornos mentales no psicóticos. Por lo tanto, parece que la salud mental se deteriora cuando la situación económica empeora. Sin embargo, es importante tener en cuenta la situación laboral del individuo al analizar el efecto de las condiciones económicas sobre los problemas mentales, ya que los trabajadores y los desempleados podrían responder de forma diferente a las recesiones económicas (Clark et al., 2009, 2010). Las personas empleadas, en tiempos de elevado desempleo, experimentan más expectativas pesimistas sobre sus propias oportunidades de empleo, que pueden llevar a la depresión. Además, pueden sufrir cambios involuntarios en el empleo, tales como recortes del salario o las horas de trabajo que pueden tener un impacto negativo sobre su salud mental. Con respecto a la salud mental de los desempleados, el efecto del desempleo es ligeramente diferente. El alto desempleo disminuye sus oportunidades de empleo, sin embargo pueden beneficiarse del "efecto de la norma social" (Clark, 2003): cuando el porcentaje de las personas desempleadas en el entorno cercano aumenta, no cumplir con la norma se hace menos costoso.

Para ver cómo influye la situación de empleo o desempleo, hay que tener en cuenta que el desempleo y la salud mental se relacionan al menos de tres modos diferentes (Warr et al. 1998). En primer lugar, estar desempleado puede afectar la salud mental. Estudios de la Gran Depresión (Eisenberg y Lazarsfeld, 1938) y otros que utilizan datos más actuales (Clark y Oswald, 1994; Björklund, 1985) identifican efectos psicológicos perjudiciales asociados con el propio desempleo. Theodossiou (1998) encontró que el desempleo está asociado con una subida marcada de ansiedad, depresión y pérdida de la confianza en sí mismo, y estas consecuencias psicológicas son significativamente más altas aún cuando se comparan personas desempleadas con personas en empleos con bajos salarios. En

segundo lugar, es probable que la salud mental tenga también un impacto sobre el propio empleo. Podría ser más difícil para una persona deprimida entrar en el mercado laboral, ya que los problemas mentales pueden afectar la intensidad y la calidad de la búsqueda de trabajo, y al rendimiento y capacidad para asistir a las entrevistas (Warr et al., 1998). Además, el empleador podría estar menos dispuesto a contratarla, ya que la depresión puede implicar más bajas por enfermedad, reduciendo la productividad, o tener otros efectos directos sobre el desempeño en el puesto de trabajo (Sociedad Psicológica británica, 2011). En tercer lugar, puede haber otros factores inobservables individuales que afectan a ambos, como una fragilidad general, otros factores genéticos (Schmitz, 2011) o el abuso de sustancias.

Por lo tanto, propongo utilizar el desempleo debido a despidos que no están relacionadas con los problemas de la salud mental para tener en cuenta la posible endogeneidad de la situación de empleo o desempleo de los individuos (Schmitz, 2011; y parcialmente Kuhm, 2009). En general, es difícil obtener datos con información sobre el motivo de los despidos. Sin embargo, los datos que uso, la Encuesta de la Población Activa del Reino Unido, contienen esta información. Mi enfoque difiere de la literatura existente en tres aspectos diferentes. En primer lugar, introduzco la propia situación de empleo o desempleo en el modelo de Ruhm y así intento separar el efecto de las condiciones económicas en los problemas mentales para los empleados y desempleados. En segundo lugar, pretendo tener en cuenta la endogeneidad del propio estado de empleo. Sin esto, el efecto sobre la salud mental de los desempleados estará medido de forma incorrecta, lo que puede afectar a la eficiencia de las políticas diseñadas para mantener la salud mental de los individuos en las recesiones. En tercer lugar, el efecto puede ser diferente según el estado civil, ya que las responsabilidades familiares varían entre los casados y solteros, y por tanto, analizo las personas casadas y solteras por separado.

Como resultado, demuestro que las personas son más propensas a sufrir problemas mentales cuando la situación económica empeora. Además, cuando se tiene en cuenta la endogeneidad del estatus de empleo, el efecto es diferente para los empleados y desempleados. Mis resultados también descubren un patrón interesante en el efecto de las crisis económicas sobre la salud mental de los subgrupos de solteros y casados, hombres y mujeres, que no habían sido discutidos previamente en la literatura. Estas disparidades pueden surgir debido a diferencias en la presión social sobre los hombres y mujeres en las recesiones, que a su vez difieren según el estado civil. Los resultados se confirman mediante varias pruebas de robustez.

En el segundo capítulo evalué el impacto de posibles cambios en las actitudes de riesgo y en la capacidad de razonamiento, debidos a la depresión, sobre las decisiones económicas de los individuos. Utilizando los datos de la Encuesta de la salud, envejecimiento y jubilación en Europa (SHARE), que estudia la población mayor de 50 años, argumento que la depresión puede distorsionar la actitud de los individuos frente al riesgo, y por tanto, tendrá un efecto sobre la manera en que las personas evalúan las oportunidades de inversión. En particular, me pregunto si los hogares cuyos miembros sufren depresión son menos propensos a invertir en activos financieros con riesgo.

Hay varios motivos que me han llevado a interesarme en estudiar la disposición a invertir en los activos financieros con riesgo entre los individual de la tercera edad. Teniendo en cuenta las últimas proyecciones de la población, la toma de decisiones financieras de las personas que se acercan a la edad de jubilación se ha convertido en uno de los temas

más candentes en el análisis de la política hoy en día. Gran parte del ahorro por jubilación se está acumulando en las pensiones estatales y privadas. Sin embargo, las fuentes para la jubilación pueden incluir también activos financieros fuera de las pensiones, como ahorros personales y propiedades inmobiliarias. Las tendencias de crecimiento de diversos instrumentos financieros sugieren que las cohortes que alcanzarán la jubilación en los próximos años tendrán que tomar una decisión mucho más complicada sobre dónde invertir sus activos. Por ejemplo, conforme haya más individuos con pensiones personales de tipo contribución definida y otros tipos de inversiones personales, un mayor número de personas se enfrentarán a la decisión de cómo invertir sus activos una vez que lleguen a edades más avanzadas.

En consecuencia, la demanda de estos productos financieros entre las personas que se acercan a la edad de jubilación, y la gama de características que estas personas requieren de dichos productos, es probable que aumente en el futuro. Conforme más personas requieran comprar estos productos, la regulación de los instrumentos financieros dirigidos a las personas mayores, la información que los proveedores están obligados a dar a los clientes acerca de estos productos y las habilidades cognitivas de los individuos para procesar esta información son probablemente los puntos clave de las políticas públicas del ahorro de jubilación y la provisión de ingresos en la jubilación. Por ejemplo, el número de empleadores del sector privado que estaban ofreciendo el plan de pensiones de prestaciones definidas ha disminuido en las últimas décadas en el Reino Unido y los Estados Unidos. También hay una tendencia a moverse hacia planes de aportaciones definidas para las pensiones de jubilación. Por otra parte, otra estrategia de reforma de pensiones propuesta con el fin de mejorar el sistema público de pensiones es adoptar un plan de aportaciones definidas (AD) junto con (o en vez de) un plan de pensiones de prestaciones definidas (PD). La característica clave del plan AD, es que el riesgo de la inversión y los beneficios de la misma son asumidos por cada empleado, y no por el empleador, por lo tanto se hace extremadamente importante para el legislador saber si los individuos son capaces de invertir sus contribuciones a la pensión óptimamente.

Por otro lado, como la salud tiende a deteriorarse con la edad, los hogares con miembros de edad avanzada están más predispuestos a sufrir tanto shocks de salud física como mental, que podrían llevarlos a revisar sus decisiones de inversión. Este trabajo se centra en el efecto de los shocks de salud mental, en particular sufrir depresión, sobre la decisión de mantener los activos financieros con riesgo. Los resultados indican que la depresión cambia la percepción del individuo de la realidad, y por lo tanto, la capacidad de evaluar las oportunidades de inversión.

Varios estudios han investigado el impacto de la salud física en la elección del portafolio, concluyendo que la mala salud se asocia con una elección de un portafolio con menos riesgo. Rosen y Wu (2004) muestran que los hogares con mal estado de salud suelen tener menos de todo tipo de activos financieros y reducen su participación en los activos con riesgo. Asimismo, Berkowitz y Qiu (2006) encuentran que un shock en la salud física reduce significativamente la riqueza financiera total de los hogares (ya que es más líquida que la riqueza no financiera), que a su vez lleva a la familia a reducir su tenencia de activos financieros con riesgo. Fan y Zhao (2009), y Love y Smith (2010) han criticado los estudios anteriormente mencionados, que dependen de la especificación de efectos aleatorios, y proponen utilizar efectos fijos en su lugar. Sin embargo, los resultados de Fan y Zhao (2009) apoyan la evidencia de Rosen y Wu (2004) sugiriendo que los shocks adversos para

la salud desalientan la posesión de activos con riesgo, Love y Smith (2010) encuentran un efecto negativo de tener mala salud sobre la probabilidad de poseer cualquier acción o fondo para los individuos casados. Por ahora, sólo un artículo, Bogan y Fertig (2012), explícitamente considera el papel de la salud mental en las decisiones de portafolio de la población estadounidense. En términos generales, se encuentra que los hogares afectados por problemas de la salud mental disminuyen las inversiones en instrumentos financieros con riesgo.

Sin embargo, todos los estudios mencionados carecen de un mecanismo para descubrir un canal plausible a través del cual la salud afecte la elección de la cartera. En este capítulo pretendo abordar esta cuestión. Edwards (2010) desarrolla un modelo teórico en el cual los shocks en la salud incitan a los individuos a reducir el porcentaje de acciones en sus carteras de inversión, debido al aumento de su aversión al riesgo. El motivo es que la depresión distorsiona la percepción del individuo. Por ejemplo, un estudio realizado por Smoski et al. (2009) considera que la depresión provoca que los individuos tengan miedo a asumir riesgos, lo que tendría un impacto en su aversión al riesgo. Por otra parte, las personas que sufren depresión pueden enfrentarse a más dificultades al manejar su vida cotidiana y, por lo tanto, son más propensas a evitar decisiones que impliquen un esfuerzo cognitivo alto (adicional), tales como tomar acciones sobre su cartera financiera. El primer canal sugiere que si las personas que sufren depresión comienzan a tener una aversión al riesgo mayor, es más probable que vendan sus activos (cuando tienen algunos) y dejen de comprarlos (cuando no tienen ninguno). Mientras que en el caso de la depresión a través del segundo canal, las personas deprimidas se convierten en más pasivas y menos preocupadas por vender o comprar activos con riesgo. Por lo tanto, en el caso de la compra son menos propensos a comprar activos con riesgo, mientras que en el caso de la venta son menos propensos a venderlos. Mi objetivo es analizar empíricamente cuál de los estos dos canales tiene mayor importancia. Para ello considero submuestras de personas que tienen o no activos con riesgo en algún momento en el tiempo, y observo la probabilidad de mantener dichos activos en el siguiente período. La identificación clave es el signo del efecto de sufrir depresión en la probabilidad de mantener activos con riesgo, condicionada a tener activos con riesgo en el período anterior. Si el signo es negativo, interpreto que las personas que sufren depresión deciden vender sus activos debido al aumento de la aversión al riesgo, mientras que si el signo es no negativo, sostengo que las personas con más síntomas de depresión son pasivas a la hora de tomar decisiones sobre la tenencia de activos con riesgo.

Para resumir, primero compruebo si hay una diferencia en la percepción debido al sufrimiento de una depresión. A continuación, mi objetivo es demostrar si la depresión tiene un impacto sobre la disposición a invertir en activos financieros con riesgo. Los resultados sugieren que la percepción de las personas deprimidas está distorsionada en comparación con aquellos que no están deprimidos. Además, el sufrimiento de los síntomas de la depresión disminuye la probabilidad de adquirir activos financieros con riesgo, como acciones y participaciones en fondos. Estos resultados proporcionan evidencia de que la aversión al riesgo es un mecanismo plausible detrás de esta asociación.

Además, propongo una posible interpretación de la asimetría del impacto de la depresión de los cónyuges en las decisiones del hogar sobre la tenencia de activos con riesgo. En particular, ofrezco evidencia de que el efecto de la depresión en las inversiones en activos con riesgo de los hogares depende también de la combinación de las actitudes frente al

riesgo de los cónyuges y su poder relativo de negociación en el hogar. Como han indicado Rosen y Wu (2004), los maridos y las mujeres puede tener horizontes temporales diferentes, debido a las diferentes expectativas de vida. Además, es un hecho bien establecido que los hombres y las mujeres difieren con respecto a la aversión al riesgo (Barber y Odean, 2001; Lott y Kenny, 1999; Sunden y Surette, 1998). Estas consideraciones sugieren que los hombres y las mujeres favorecen estrategias de cartera diferentes, y que el impacto sobre la cartera familiar puede ser diferente cuando es uno u otro de los cónyuges el que sufre depresión. Por lo tanto, hay razones para esperar que los efectos de la depresión sobre la tenencia de activos con riesgo sean asimétricos para los dos cónyuges. Para tener esto en cuenta, introduzco una medida de la depresión del marido y otra de la de la mujer. En cuanto a la estrategia de identificación, distingo entre dos acciones respecto a los activos con riesgo, compra y venta, y propongo una explicación intuitiva de por qué los efectos de la depresión para los dos cónyuges pueden ser asimétricos entre estas dos decisiones. Mi análisis sugiere que, cuando la mujer, que en promedio tiene una mayor aversión al riesgo, tiene relativamente más poder de negociación, un cambio en sus actitudes de riesgo (que se ven afectados por la depresión) determinaría si el hogar compra los activos de riesgo. Mientras que si el marido tiene relativamente más poder de negociación y el hogar ya posee activos con riesgo, un cambio en sus actitudes de riesgo determinaría si el hogar los vende.

En el tercer capítulo, me centro en la evaluación del efecto de los incentivos financieros sobre las decisiones de jubilación utilizando una versión empírica del modelo del Valor de la Opción. En este trabajo, investigo el papel desempeñado por la enfermedad mental, y su interacción con los incentivos financieros, sobre la probabilidad de jubilarse. Hay una serie de factores que se relacionan con la decisión sobre cuándo es el momento de jubilarse, como por ejemplo la esperanza de vida o la desutilidad del trabajo, y que podrían ser considerados de manera diferente por los individuos cuando sufren una depresión. Por lo tanto, no está claro si propuestas políticas, como el aumento de la edad de jubilación, o el cambio en la tasa de sustitución, funcionarían para aquellas personas cuya percepción está distorsionada.

El envejecimiento de la población es uno de los problemas más importantes de la política en los países desarrollados, que ha planteado dudas sobre la sostenibilidad del régimen de pensiones. Con el aumento en las próximas décadas de la esperanza de vida y el rápido crecimiento del tamaño de la población de pensionistas, está previsto que aumente significativamente el gasto del gobierno en las personas de la tercera edad. Uno de los márgenes claves en los que el comportamiento individual se podría ajustar para reducir este coste sería que los individuos trabajaran más tiempo (Crawford y Tetlow, 2010). Existen numerosos factores que afectan a las actitudes de los individuos frente al trabajo y a sus decisiones sobre trabajar hasta una edad más avanzada. Entre ellos se encuentran las cualificaciones, los recursos financieros, las circunstancias familiares, las expectativas sobre el futuro y, por supuesto, la salud. Esto último puede influir directamente en la capacidad de trabajar a mayor edad y también puede cambiar las expectativas de supervivencia y aumentar la desutilidad del trabajo. Curiosamente, un aspecto importante de la salud que afecta a la decisión de muchos individuos sobre cuándo retirarse es la salud psicológica o mental. Las personas que sufren problemas mentales tienen diferente juicio sobre las circunstancias de la vida y muestran parcialidad en términos de su procesamiento de la información (Smoski et al., 2008). En particular, las personas que están clínicamente

deprimidas, mantienen una visión pesimista de los futuros estados del mundo y unas expectativas poco realistas que probablemente afectan su decisión de cuándo jubilarse. Por lo tanto, las políticas diseñadas para aumentar la participación de las personas mayores en el mercado laboral ofreciendo incentivos financieros, pueden no ser eficaces para aquellos que sufren problemas mentales. En este capítulo se estudia si el efecto de los incentivos financieros en el contexto institucional del Reino Unido difiere entre los individuos que sufren problemas mentales, como la depresión, y quiénes no los sufren, cuándo toman decisiones acerca de la jubilación.

Se ha escrito extensamente sobre la importancia de los incentivos financieros y de la salud en las decisiones relativas a la jubilación (Coile y Gruber, 2007; Lindeboom, 2006; Gruber y Wise, 2004, 1998; Stock y Wise, 1990*a*, 1990*b*; por citar sólo algunos). El trabajo de Gruber y Wise (2004) ofrece un análisis comparativo del efecto de los incentivos financieros a la hora de la jubilación en base a estudios recientes para doce países. Sus resultados indican un fuerte efecto negativo de los incentivos financieros sobre la probabilidad de jubilación. En relación a los problemas de salud, se deduce que también pueden afectar negativamente a la participación laboral de las personas mayores (para una revisión véase Lindeboom, 2006). Usando las expectativas de jubilación, McGarry (2004) ha encontrado un efecto importante y significativo de las malas condiciones de salud en la probabilidad de continuar trabajando. Sin embargo, hay muy poca evidencia sobre cómo los individuos responden a estos incentivos dependiendo de su estado de salud. Sólo algunos artículos (Banks et al., 2007 y Erdogan Ciftci et al., 2011) explícitamente consideran la interacción de los incentivos financieros y el estado de salud física. Sus resultados sugieren un efecto negativo de la acumulación del valor máximo, en inglés “peak value accrual”, en la probabilidad de jubilación sólo para las personas con buena salud. No hay ningún artículo que considere si estos incentivos son diferentes para las personas con problemas de salud mental.

La disponibilidad de los recursos financieros con que los individuos puedan sostenerse durante la jubilación puede suponer una diferencia crucial sobre el momento de la jubilación. Mis datos para este análisis provienen del Estudio Longitudinal de envejecimiento en Inglaterra (ELSA), en el que se encuesta a las personas que nacieron antes del 1 de marzo de 1952 y a sus cónyuges. Aprovechando la ventaja única de la normativa sobre pensiones en el Reino Unido, utilizo datos detallados para determinar el grado de respuesta a los incentivos financieros de los individuos que se están aproximando a la edad de jubilación. También exploto las diferencias entre los incentivos de jubilación implícitos en los distintos regímenes de pensiones individuales (las pensiones del estado y los planes de pensiones privados). El sistema de pensiones del Reino Unido es a dos niveles y se compone de la pensión básica del estado y la segunda pensión estatal. Todos los individuos que ganan por encima de un determinado sueldo están obligados a contribuir a ambas. Sin embargo, pueden cambiar la segunda pensión estatal por uno de los planes de pensiones privados (pensiones ocupacionales y cuentas de jubilación individual). Hay una diferencia importante entre las pensiones estatales y los planes privados que pueden tener un impacto importante en el momento de salida del mercado de trabajo. Por lo general, los individuos no pueden empezar a rescatar la pensión del estado hasta que alcanzan la edad de jubilación estatal, mientras que las pensiones privadas (pensión personal, pensión de accionista o pensiones ocupacionales) son más flexibles, y por lo general ofrecen la posibilidad de una jubilación anticipada. Por lo tanto, los jubilados con un plan de pensiones



privado tienen más libertad para elegir el momento de retirarse del mercado y no tienen que depender de los beneficios de las pensiones del estado inmediatamente después de salir del mercado laboral porque pueden financiar su jubilación con otras fuentes de ingresos, al menos durante algún tiempo. En este trabajo analizo si los incentivos financieros impulsados por los planes de pensiones privados y públicos también varían entre personas con y sin problemas en la salud mental.

La depresión es la enfermedad mental más común en todo el mundo y será uno de los mayores problemas de salud en el año 2020 (Organización Mundial de la Salud). Ninguna otra condición de salud coincide con las enfermedades mentales en el grado combinado de prevalencia, persistencia y amplitud del impacto. Los gastos en los servicios de salud mental representan un 11% del presupuesto sanitario secundario del Servicio de la Salud Nacional (Departamento de Salud, 2011b) y el coste total para el SSN es mucho más elevado que esto. En Inglaterra solamente, el coste de la enfermedad mental es £105 billones al año - 7,7% del PIB, a través de los costes de asistencia médica o atención social, las pérdidas de la productividad y una valoración monetaria de los costes humanos intangibles de la discapacidad, el sufrimiento y la angustia.

En este capítulo recorro a las ideas de Stock y Wise (1990a) para desarrollar las medidas de incentivos financieros con visión de futuro y miro si estos incentivos tienen un efecto diferente sobre la probabilidad de jubilación para los individuos deprimidos y no deprimidos. Esta medida me permite examinar conjuntamente el impacto de las pensiones públicas y las pensiones privadas en la jubilación, así como separar y comparar los efectos de estos incentivos diferentes. Conjeturo que las enfermedades mentales, y en particular la depresión, puede cambiar la forma en que los individuos comprenden y evalúan los incentivos financieros proporcionados por los diferentes planes de pensiones, que, a su vez, puede hacer que los individuos con problemas mentales no respondan a los cambios institucionales que el gobierno considere para aumentar la participación en el mercado laboral de las personas mayores.

Mis conclusiones sugieren, en primer lugar, que la depresión es un factor importante que influye en la jubilación. En particular, las decisiones relativas a la jubilación responden de manera significativa a la opción de un futuro incremento en los beneficios sólo para aquellos empleados que no sufren depresión. Como se esperaba, los individuos con mayores valores en las acumulaciones del valor máximo son menos propensos a retirarse. Notablemente, el efecto negativo de la acumulación de la pensión en la probabilidad de jubilación desaparece para las personas que sufren depresión. En segundo lugar, la diferencia en el efecto total de la acumulación del valor máximo en la probabilidad de jubilación entre deprimidos y no deprimidos es debida exclusivamente a la acumulación de las pensiones privadas. En tercer lugar, aproximadamente la jubilación responde de la misma forma a un cambio comparable en las pensiones públicas y los incentivos privados de las pensiones para personas sin enfermedad mental.

La comprensión de la naturaleza del empleo y la retirada del mercado de trabajo en las edades avanzadas es una cuestión importante. El aumento de la población anciana en la mayoría de los países desarrollados potencialmente podría suponer una mayor presión financiera sobre los recursos públicos y privados para las personas mayores. El aumento del empleo de las personas de tercera edad podría ser una forma importante de aliviar esas presiones.

Para resumir, en mi tesis investigo algunos temas importantes en la Economía de la

Salud. De los tres capítulos que componen esta tesis se desprende mi interés en la aplicación de la Economía de la Salud a otros campos que, indudablemente, están relacionados e interactúan con un tema tan actual como es el estudio de las finanzas de los hogares en múltiples ámbitos y que necesitan de una creciente atención dentro del ámbito de la investigación económica. En particular, estudio el impacto de la crisis económica en la salud mental y la influencia de los problemas de salud mental en las decisiones económicas de los individuos. Teniendo en cuenta que la salud mental es muy importante, y se considera cada vez más como una razón del abandono del mercado del trabajo, la disminución de la productividad y la reducción del bienestar. Es evidente que, desde el punto de vista político estos temas son de elevado interés hoy en día y mi tesis trabaja en la dirección de tratar de divulgar estos temas, proporcionando elementos de juicio influyentes y aumentando la atención sobre estos temas para futuras investigaciones.



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## Summary

Health economics is the application of economic theory, models and empirical techniques to the analysis of decision-making by individuals, health care providers and governments with respect to health and health care (Morris et al., 2007). It has probably been the fastest growing sub-discipline within economics over the past 20 years. During this time, much attention has been dedicated to health economics issues because of its direct policy relevance to the funding concerns that have dominated health policy debates worldwide. In this dissertation I cover a range of topics within applied health economics with the focus on mental health related issues. Studying economics of mental health is important at least for three reasons. First, mental disorders are often chronic conditions that create substantial disability and strike people early in life; it generally more debilitating than most chronic physical conditions. For example, the degree of disability imposed by depression is 50% higher than angina, asthma, arthritis or diabetes (WHO). Second, mental illness is consistently associated with deprivation, low income, unemployment and increased health-risk behavior. The major part of the costs created by mental illness is indirect, mainly caused by disability and lost productivity (sickness absence, nonemployment, premature mortality). It has been also related to substantial abuse, criminal activity and violence. Third, mental illness often increases the scale of physical illness. It can make existing physical illness worse and cause physical symptoms which cannot be medically explained at all: general practitioners in the acute sector confirm that many patients referred for first consultant appointments have "medically unexplained symptoms". We can avoid extra physical healthcare caused by mental illness if provide psychological therapies for those people who have mental health problems on top of their physical symptoms. All of the above indicate that mental health has a very significant impact on our lives and economic behavior. In my dissertation I have mainly developed two topics of the interplay between mental health and economics: the role of economic fluctuations in explaining mental health and the effect of mental health on the economic decision making.

In the first chapter of my dissertation I investigate whether economic crises have a measurable cost in terms of individuals' mental illnesses (anxiety and depression) depending on their employment situation. I seek to assess how economic fluctuations, measured by changes in the regional unemployment rate, affect mental health of individuals who are currently active in the labor market. I use data from the UK's 1997 – 2010 Labour Force Survey to show whether people are more likely to report suffering from mental problems when the economic situation worsens, and whether this effect is different for the employed and unemployed.

The results from the series of papers by Ruhm (2000, 2003, 2005) suggest that several aspects of people's physical health improves when the economy temporarily deteriorates: a fall in the state unemployment rate is associated with a rise in a state's mortality rates and the probability of reporting one or more acute morbidity or having at least one health problem. I consecutively ask what happens in terms of mental problems.

High unemployment rates during recession are likely to create negative externalities. Employed people start to feel less secure about being able to keep their job, while the unemployed have fewer possibilities of finding a new one. All these experiences are likely to have a negative impact on mental health: when labor market prospects worsen, people are more likely to suffer a mental problem such an anxiety or depression. These findings

are important since the productivity of workers might be affected by mental problems in recessions which arise from job insecurity, and other stress induced by cuts in pay or hours. Another reason to care about the effect of economics on mental health is that health care costs associated with mental diseases have substantially risen in the last decades in most industrialized countries and in particular in the UK (McVicar and Anyadike-Danes, 2008), while the dynamics of these costs may be related to economic conditions. However, apart from these negative effects, there may be some positive impact on the subgroups of the unemployed: social pressure for not following the norm decreases when more people deviate from the norm, in this case become unemployed. Thus some unemployed might be at lower risk of mental problems.

A number of papers on happiness have shown that lower individual well-being is related to higher levels of aggregate unemployment (Di Tella et al., 2001; Clark and Oswald, 1994). Ruhm (2003) finds that increases in the unemployment rate are positively associated with the reporting of non-psychotic mental disorders. Hence, I hypothesize that mental health will deteriorate when economic situation worsens. However, it is important to take into account the individual's employment status when analyzing the effect of economic conditions on mental problems, as employed and unemployed might respond differently to economic downturns (Clark et al., 2009, 2010). Employed people in times of high unemployment experience more pessimistic expectations about their own employment opportunities, which may lead to depression. They might likewise experience involuntary changes in the employment, such as pay cuts or reduced hours which are likely to have a negative impact on mental health as well. With regard the mental health of the unemployed, the effect of surrounding unemployment is slightly different. High unemployment lowers their employment opportunities, however they may benefit from a 'social-norm effect' (Clark, 2003): as the percentage of unemployed people in the close environment increases, one's non complying with the norm becomes less suppressing.

When including one's employment status, we should be aware that own unemployment and mental health are related in at least three different ways (Warr et al., 1998). First, being unemployed may affect mental health. Studies of the Great Depression (Eisenberg and Lazarsfeld, 1938) and of more current data (Clark and Oswald, 1994; Björklund, 1985) identified detrimental psychological effects associated with own unemployment. Theodosiou (1998) finds that joblessness is associated with a marked rise in anxiety, depression and loss of self-confidence, and these psychological consequences are significantly higher even when unemployed individuals are compared with individuals in low-wage employment. Second, mental health is also likely to have an impact on own employment. It could be harder for a depressed individual to enter the job market, as mental problems are likely to affect the intensity and quality of her job search, performance and ability to attend the the interviews (Warr et al., 1998). Furthermore, the employer might be less willing to hire her, since being depressed may involve more sick leave thus reducing productivity or have other direct effects on labor market performance (British Psychological Society, 2011). Third, there may be other individual unobservable factors affecting both, such a general frailty, other genetic factors (Schmitz, 2011) or substance abuse.

I therefore propose to use unemployment due to layoffs which are not related to mental health problems in order to account for those channels (following Schmitz, 2011; and partially Kuhm, 2009). In general it is difficult to obtain data with information on the reason for layoffs. However the data I use, the UK's Labour Force Survey, does contain

this information. In combination, my approach differs from the existent literature in three ways. First, I introduce own employment status into Ruhm's model, and thus attempt to separate the effect of the economic conditions on mental problems for the employed and unemployed. Second, I aim to account for the endogeneity of own employment status. Without this, the effect on mental health of the unemployed is probably measured inappropriately which affects the efficiency of policies designed to maintain the mental health of individuals in recessions. Third, the effect might differ by marital status as different family responsibilities are involved and I therefore analyze married and single individuals separately.

As the result, I have demonstrated that people are more likely to report suffering from mental problems when the economic situation worsens, and accounting for the endogeneity between individuals' unemployment and their mental problems, the effect is different for the employed and unemployed. My findings also uncover an interesting pattern in the effect of economic downturns on mental health of the sub-groups of married and single men and women previously not discussed in the literature. There disparities may arise because of differences in social pressure on men and women in recessions, which themselves differ by marital status. The results are confirmed by several robustness checks.

In the second chapter I evaluate the impact of a possible change in individual's risk attitudes and reasoning due to depression on the economic choices. Using data from the Survey of Health, Ageing and Retirement in Europe (SHARE) which studies the elderly population, I argue that depression may distort an individual's attitude towards risk. Hence it will have an effect on how people evaluate investment opportunities. In particular, I ask whether households whose members suffer depression are less likely to invest in risky financial assets.

I study the willingness to invest in risky financial assets among the elderly for several reasons. Taking into account the latest population projections, financial decision making of people approaching retirement became one of the hot topics in the policy analysis nowadays. Much of the retirement saving is being accumulated in state and private pensions. However, the sources for retirement may also include non-pension financial assets, such as personal savings and housing. The growth trends in various financial instruments suggest that the cohorts reaching retirement over the next years will have to make a much more complicated choice over where their assets can be invested. For instance, with more and more individuals having personal pensions of a defined contribution type and other types of personal investments, respectively higher number of people will be faced with decision on how to invest their assets once they reach older ages. Consequently, the demand for such financial products among those approaching retirement and the range of characteristics that these individuals will require from such products is likely to increase in the future. However, with ever more people requiring to buy such products, the regulation of financial instruments aimed at older individuals, the information that providers are required to give customers about these products and the cognitive skills that individuals have to process this information are all likely to become key points of public policy on retirement saving and retirement income provision. For example, the number of private sector employers who were offering defined benefit pension plan has declined over the past decades in the UK and the US. There is also a tendency to move toward defined contribution schemes for occupational pensions. Moreover, another pension reform strategy suggested in order to improve public pension system is to adopt a defined contribution

(DC) scheme along with (or instead of) a defined benefit (DB) pension scheme. The key feature of the DC plan, it is that investment risk and investment rewards are assumed by each employee and not by the employer, hence it becomes extremely important for the policy maker to know whether individuals are able to invest their pension contributions optimally.

On the other hand, as health tends to deteriorate with age, more households with aging become predisposed to both physical and mental health shocks, which might lead them to revise their portfolio decisions. This paper focuses on the effect of shocks to mental health, in particular suffering depression, on the decision to hold risky financial assets. We provide evidence that depression changes an individual's perception of reality, hence the ability to evaluate investment opportunities.

Several studies have investigated the impact of physical health on portfolio choice, and found that poor health is associated with a safer household portfolio allocation. Rosen & Wu (2004) show that households in poor health are less likely to hold all classes of financial assets, and hold smaller shares of their wealth in risky assets. Likewise, Berkowitz & Qiu (2006) find that a physical health shock significantly reduces household total financial wealth (as it is more liquid compared to non-financial wealth) which in turn leads the household to decrease its holding of risky financial assets. Fan & Zhao (2009) and Love & Smith (2010) have criticized the above studies which rely on random effects specification and propose to use fixed effects instead. Nevertheless, Fan & Zhao (2009) support the evidence suggesting that adverse health shocks discourage risky asset holdings, and Love & Smith (2010) find a negative effect of being in poor health on the probability of owning any stocks or mutual funds for married households. Yet, only one paper, by Bogan & Fertig (2012), explicitly considers the role of mental health in household portfolio choice decisions of the US population. Broadly speaking, they find that households affected by mental health issues decrease investments in risky instruments.

However, all the above studies lack a mechanism to uncover a plausible channel through which health affects portfolio choice. In this chapter I aim to address this issue. Edwards (2010) develops a theoretical model in which health shocks prompts individuals to lower their risky portfolio shares as they become more risk averse. I argue that depression distorts individual's perception. For example, a study by Smoski et al. (2009) finds that depression yields individuals to have fear of taking risks, which would have an impact on their risk aversion. On the other hand, people suffering depression may face more difficulties when managing their everyday life, and are hence more likely to avoid choices that involve (an additional) high cognitive effort, such as taking actions about their financial portfolio. The first channel suggests that if people suffering depression become more risk averse they are more likely to sell assets (when they have some) and not to buy them (when they have none). While in the case of depression via the second channel, depressed people become passive and less concerned about either selling or buying assets. Therefore, in the case of buying they are less likely to buy risky assets, whereas in the case of selling they are less likely to sell them. My aim is to disentangle which of the two is of greater importance. For this purpose I consider sub-samples of people who held or did not hold risky assets at some point in time, and look at the probability of holding assets in the next period. The key identification is the sign of the effect of suffering depression on the probability of holding risky assets conditional on having them in the previous period. If the sign is negative, I speculate that individuals who suffer depression decide to sell their

assets due to increase in their risk aversion, while if the sign is nonnegative, I argue that people with more depression symptoms become passive about risky asset holding.

To summarize, I first test whether there is a difference in perception due to suffering depression. Then, I aim to show whether being depressed has an impact on the willingness to invest in risky financial assets. The results suggest that depressed individuals have distorted perception compared to those who are not depressed. Moreover, suffering symptoms of depression lowers the probability of acquiring risky financial assets, such as stocks and shares. I provide evidence that risk aversion is a plausible mechanism behind this association.

Furthermore, I give some intuition about the asymmetry of the impact of the husband's and the wife's suffering depression on household decisions about the holding of risky assets. In particular, I provide evidence that the effect of depression on households' risky asset investments would also depend on the combination of spouses' risk attitudes and their relative bargaining power in the household. As noted by Rosen & Wu (2004), husbands and wives can have different time horizons, due to different life expectancies. Furthermore, it is a well-established fact that men and women differ with respect to risk aversion (Barber & Odean, 2001; Lott & Kenny, 1999; Sunden & Surette, 1998). These considerations suggest that men and women favor different portfolio strategies and that the impact on the family's portfolio might differ when one or the other of the spouses suffers depression. Hence, there is a reason to expect effects of depression on risky asset holding for the two spouses to be asymmetric. To allow for that, I introduce one measure for the husband's depression and another for the wife's. As for the identification strategy I distinguish between two actions with risky assets, buying and selling, and propose an intuitive explanation why the effects of depression for the two spouses might be asymmetric between these two decisions. My findings suggest that, when the wife, who on average is more risk averse, has relatively more bargaining power, a change in her risk attitudes (which are affected by depression) would determine whether the household buys risky assets. While if the husband has relatively more bargaining power and the household already possesses risky assets, a change in his risk attitudes would determine whether the household sells them.

In the third chapter, I focus on the evaluation of the effect of financial incentives on retirement decisions using an empirical version of Option Value model. I investigate the role played by mental illness and its interaction with financial incentives on the probability of retirement. There are a number of factors which are related to the decision when to retire, such as life expectancy or disutility of work, and they might be viewed differently by individuals when they suffer from depression. Hence, it is not obvious whether policy proposals like rising the state retirement age, or the change in the rate of replacement will work for those individuals whose perception is distorted.

Population ageing is one of the most important policy problems in developed countries, which has raised doubts about sustainability of pension arrangements. With life expectancies increasing and the size of the pensioner population projected to grow rapidly over the next few decades, government spending on older people is forecast to rise significantly. One of the key margins on which individual behavior could adjust to reduce this cost would be for individuals to work longer (Crawford and Tetlow, 2010). A variety of factors affect individuals' attitudes to working and whether or not they choose to work at older ages. Among them are qualifications, financial resources, family circumstances, expecta-



tions about the future and, of course, health. The latter may influence directly the ability to work at older ages and also may change survival expectations and enhance disutility of work. Interestingly, an important aspect of health affecting many individuals' decision of when to retire lies in the dimension of psychological or mental health. People, who suffer mental problems, have different judgment about life circumstances and show bias in terms of information processing (Smoski et al., 2008). In particular, people who are clinically depressed, hold a pessimistic view of future states of the world and unrealistic expectations which likely affect their timing of retirement. Hence, policy prescriptions designed to increase workforce participation of the elderly by providing with the financial incentives may be not effective for those who experience mental problems. This chapter studies whether the effect of financial incentives in the institutional context of the United Kingdom differs between individuals who suffer from mental problems, such as depression, and who do not, when make decisions about retirement.

Much has been written about the importance of financial incentives and health on retirement decisions (Coile and Gruber, 2007; Lindeboom, 2006; Gruber and Wise, 2004, 1998; Stock and Wise, 1990*a*, 1990*b*; to cite just a few). A comprehensive work by Gruber and Wise (2004) gives a comparative analysis of the effect of financial incentives on retirement on the base of recent case studies from twelve countries. Their results suggest a strong negative effect of financial incentives on the probability of retirement. Poor health is also found to adversely affect labor force participation of the elderly (for a review see Lindeboom, 2006). Using retirement expectations as an outcome, McGarry (2004) has found a large and significant effect of poor health on the probability of continuing working. However there is very little evidence of how individuals respond to these incentives conditional on their health status. Only few papers (Banks et al., 2007 and Erdogan-Ciftci et al., 2011) explicitly consider the interaction of financial incentives and being in good or bad physical health. Their results suggest a negative effect of peak value accrual on the probability of retirement only for the people in good health. No paper considers whether these incentives differ for individuals with mental problems.

The availability of financial sources with which individuals can sustain themselves during retirement can make a crucial difference for the timing of the retirement. My data for this analysis come from the English Longitudinal Study of Ageing (ELSA), which surveys individuals who were born on or before 29th February 1952 and their spouses. I take the advantage of unique institutional arrangements in the UK and use detailed data to look at the extent to which individuals approaching retirement respond to financial incentives exploiting differences between the retirement incentives implicit in individuals' pension arrangements (state pensions and private pension schemes). The UK pension system is two-tiered and is made up of Basic State Pension (BSP) and Second State Pension (*S2P*). All the individuals who earn above a certain floor are compulsory contributing to both. However, they can change *S2P* to one of the private pension schemes (occupational pensions and individual retirement accounts). There is an important difference between state pensions and private schemes which can have a major impact on the timing of one's exit from the workforce. Usually individuals can not start drawing state pension until they reach the State Pension Age (SPA), while private pensions (personal pension, stakeholder pension or occupational pensions) are more flexible and usually offer early retirement paths. Thus, retirees with a private pension plan have more freedom to choose when to retire and may not need to depend on state pension benefits immediately upon exiting

the workforce because they can fund their retirement from other sources of income, at least for some time. I consecutively look whether financial incentives driven separately by private and public pension plans also differ for people with and without mental problems.

Depression is the most common mental illness worldwide, and will be one of the biggest health problems by the year 2020 (World Health Organization). No other health condition matches mental illness in the combined extent of prevalence, persistence and breadth of impact. Spending on mental health services accounts for 11% of the National Health Service (NHS) secondary health care budget (Department of Health 2011*b*), and the full cost to the NHS goes well beyond this. In England alone, mental illness costs over £105 billion a year - 7.7% of GDP, through the costs of medical or social care, production output losses, and a monetary valuation of the intangible human cost of disability, suffering and distress.

In this chapter I draw on the insights of Stock and Wise (1990*a*) in developing forward looking measures of financial incentives, and look whether these incentives have differential effect on the probability of retirement for depressed and non-depressed individuals. This measure allows me to examine jointly the impact of public and private pensions on retirement, as well as to separate and compare the effects of these different incentives. I conjectured that mental illness, and in particular depression, may change the way individuals understand and evaluate financial incentives provided by different pension arrangements, which in turn can make them non-responsive to institutional changes that government may think about to induce labor force participation of the elderly.

My findings suggest, first, that depression is an important factor which influences retirement. In particular, retirement decisions respond in a significant way to the option of future benefit increment only for those employees who do not suffer depression. As expected, individuals with larger values of peak accruals are less likely to retire. Notably that the negative effect of pension accrual on the probability of retirement is vanished for people who suffer from depression. Second, the difference in the total effect of peak value accrual on the probability of retirement between depressed and non-depressed is driven by private pension accrual solely. Third, retirement is roughly equally responsive to a comparable change in public pension and private pension incentives for people without mental illness.

Understanding the nature of employment and withdrawal from the labor market at older ages is an important issue. The increasingly aged population in most of developed countries will potentially put greater financial pressure on public and private resources to provide for older individuals. Increasing the employment of older people will be one important way of alleviating these pressures.

To summarize, in my dissertation I investigate some of the most important issues in health economics. In particular, I study the impact of the economic crisis on mental health and the influence of mental health problems on the economic decisions of the individuals. Accounting for mental health is very important; it is listed more and more as a reason for withdrawal from the labor force, for the productivity decline and lowering of the well-being. Clearly, from the policy perspective these topics are of the elevated interest nowadays and my dissertation works in the direction of popularization of these topics, providing influential insides and increases the attention to these issues for the future research.

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# Chapter 1

**Mental health and economic conditions: how do economic fluctuations influence mental problems?**



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## 1.1 Introduction

It has been well-established in a series of papers by Ruhm (2000, 2003, 2005) that human mortality and morbidity are procyclical: a fall in the state unemployment rate is associated with a rise in a state's mortality rates and the probability of reporting one or more acute morbidity or having at least one health problem. While this may be surprising at first glance, it has a quite intuitive explanation (Ruhm, 2003): when the economy performs well and people face better labor market opportunities, the opportunity cost of time rises inducing individuals to invest less in health prevention, such as exercise and healthy lifestyles. On the other hand, people are more involved in risky activities, such as smoking, unhealthy eating, drinking and driving, which are linked to health problems and mortality. Hence, the combination of lower investment into health along with detrimental activities results in poorer health in good times.

The results above suggest that several aspects of people's physical health improve when the economy temporarily deteriorates. And what happens in terms of mental problems? One argument is that economic downturns translated into a higher regional unemployment rate might elevate job insecurity, which raises stress and which may transform into mental disorders. Studies using aggregate data (Tefft, 2011*a*; Brenner, 1973) have found a positive relationship: as the unemployment rate goes up, mental problems increase. However, there is a problem in using aggregate time-series data, since it may contain factors that are confounded with economic conditions.<sup>1</sup> These attempts may thus not be appropriate to study the effect of economic conditions on mental health. The question of which impact economic fluctuations have on mental problems of people therefore requires further research using individual data.

The purpose of this study is to analyze the effect of economic conditions on mental health, i.e. whether economic slumps have a measurable cost in terms of an individual's experience of mental problems. A number of papers on happiness have shown that lower individual well-being is related to higher levels of aggregate unemployment (Di Tella et al., 2001; Clark and Oswald, 1994). Ruhm (2003) finds that increases in the unemployment rate are positively associated with the reporting of non-psychotic mental disorders. However, it is important to take into account the individual's employment status when analyzing the effect of economic conditions on mental problems, as employed and unemployed might respond differently to economic downturns. Clark et al. (2009, 2010) suggest that employed people in times of high unemployment experience more pessimistic expectations about their own employment opportunities, which may lead to depression. They might likewise experience involuntary changes in the employment, such as pay cuts or reduced hours which are likely to have a negative impact on mental health as well. With regard the mental health of the unemployed, the effect of surrounding unemployment is slightly different. High unemployment lowers their employment opportunities, however they may benefit from a 'social-norm effect' (Clark, 2003): as the percentage of unemployed people in the close environment increases, one's not complying with the norm becomes less suppressing.

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<sup>1</sup>For instance, when analyzing the effect of economic slumps on mental hospital admissions, Brenner (1973) does not account for changes in hospital capacity (and related factors), admission policy and access to hospital facilities. In Tefft (2011*a*), greater searching for items "depression" and "anxiety" in Google in the recent Great Recession could reflect wider use of the Internet or the popularity of this search engine (in particular for job search).



When including one's employment status, one has to be aware that own unemployment and mental health are related in at least three different ways (Warr et al., 1998). First, being unemployed may affect mental health. Studies of the Great Depression (Eisenberg and Lazarsfeld, 1938) and of more current data (Clark and Oswald, 1994; Björklund, 1985) identified detrimental psychological effects associated with own unemployment. Theodosiou (1998) finds that joblessness is associated with a marked rise in anxiety, depression and loss of self-confidence, and these psychological consequences are significantly higher even when unemployed individuals are compared with individuals in low-wage employment. Second, mental health is also likely to have an impact on own employment. It could be harder for a depressed individual to enter the job market, as mental problems are likely to affect the intensity and quality of her job search, performance and ability to attend the interviews (Warr et al., 1998). Furthermore, the employer might be less willing to hire her, since being depressed may involve more sick leave thus reducing productivity or have other direct effects on labor market performance (British Psychological Society, 2011). Third, there may be other individual unobservable factors affecting both, such a general frailty, other genetic factors (Schmitz, 2011) or substance abuse.

I therefore propose to use unemployment due to layoffs which are not related to mental health problems in order to account for those channels (following Schmitz, 2011; and partially Kuhm, 2009). In general it is difficult to obtain data with information on the reason for layoffs. However the data I use, the UK's Labour Force Survey, does contain this information. In combination, my approach differs from the existent literature in three ways. First, I introduce own employment status into Ruhm's model, and thus attempt to separate the effect of the economic conditions on mental problems for the employed and unemployed. Second, I aim to account for the endogeneity of own employment status. Without this, the effect on mental health of the unemployed is probably measured inappropriately which affects the efficiency of policies designed to maintain the mental health of individuals in recessions. Third, the effect might differ by marital status as different family responsibilities are involved and I therefore analyze married and single individuals separately.

The results suggest all but unemployed men are more likely to suffer from mental problems when the economic situation worsens: the increase in the regional unemployment rate is associated with a rise in the probability of suffering from depression or anxiety. On the contrary, but consistent with previous findings, unemployed men suffer from depression less in bad times. When married and single individuals are analyzed separately, I discover that single unemployed men even benefit from living in high-unemployment regions: when the economy performs poorly, their probability of having a mental problem declines. Unemployed married women have twice as greater probability as employed single women of suffering depression in economic downturns. Employed married men and women show very similar probabilities of experiencing depression or anxiety in an economic downturn. In order to support the robustness of the results, I perform several checks, including checking the correction for endogeneity, checking for possible migration and contemporaneous effects.

The rest of the paper is organized as follows. Section 2 sets out the intuition regarding the model applied in this work. Section 3 describes the dataset. Section 4 provides the results. Section 5 proposes some robustness checks, and Section 6 concludes. Appendix contains all the relevant tables.

## 1.2 Econometric specification

Let  $D_{ijt}^*$  be an unobservable continuous latent variable which measures mental problems. I also define two dummies,  $E_{ijt}$  and  $U_{ijt}$ , one for being employed and another for being unemployed and interact each of them with the gender-specific unemployment rate in a region  $j$  at time  $t$ ,  $UR_{jt}$ . I then consider the following model to evaluate the effect of economic conditions on mental problems:

$$D_{ijt}^* = \alpha_t + Q_t + R_j + \rho E_{ijt} * UR_{jt} + \delta U_{ijt} * UR_{jt} + \gamma U_{ijt} + X_{ijt}'\beta + u_{ijt} \quad (1)$$

where  $\alpha_t$  is a year-specific intercept,  $Q_t$  is a quarter-specific intercept,  $R_j$  is a region fixed-effect. Terms  $E_{ijt} * UR_{jt}$  and  $U_{ijt} * UR_{jt}$  are the interactions of  $E_{ijt}$  and  $U_{ijt}$  with  $UR_{jt}$  and state for the effects of the regional unemployment rate for the employed and unemployed respectively.  $X_{ijt}$  is a vector of personal characteristics of individual  $i$  living in the region  $j$  at time  $t$ ,  $u_{ijt}$  is a disturbance term.

Economic conditions influence employed people's mental problems through  $\rho$ . If a bad economic situation, i.e. a high regional unemployment rate, induces depression,  $\rho$  should be positive,  $\rho > 0$ . Well-being literature (Clark et al. 2009, 2010) emphasizes that employed people in times of high unemployment experience greater job insecurity due to more pessimistic expectations about their own employment opportunities or they may remain in unsatisfactory jobs that they would otherwise have likely left had labor market conditions been better. These circumstances might induce depression and anxiety. For example, Hartley et al. (1991), in their survey on job insecurity, found that depression increases proportionately to the level of job insecurity. Based on the National Alliance on Mental Illness Survey (2009), Roy-Bujnowski (2011) reports that employment in an uncertain economy is not always a protective factor against mental health problems. The employed could experience involuntary changes in the employment, such as pay cuts or reduced hours. As a result, these individuals are likely to suffer depression or some other form of a mental health problem.

The situation is different for the unemployed. On the one hand, they could also be more depressed in bad times, as their chances of finding a job lowers substantially. On the other hand, the social pressure on the unemployed is lower when there is greater unemployment. As Clark (2003) has suggested, unemployment may have less impact on the unemployed the more they see of it around them, as the stigma from their own unemployment is then reduced. One explanation could be that it is easier for the unemployed to establish social connections when others in the local area are also unemployed (Kessler et al. 1988). There could also be greater emotional support for the unemployed, as more people share the same economic situation. As Jackson and Warr (1987) suggest lower levels of psychological distress among unemployed from areas of chronically high unemployment compared to unemployed living in areas of low unemployment perhaps reflect better adaptation through networks, community solidarity and lower costs of living in areas with higher unemployment. Cohn (1978) finds that the individual feel less self-dissatisfied to a smaller extent if she can attribute her change in employment status (becoming unemployed) due to some external cause, and the high level of regional unemployment might be such an external cause. Hence I expect the effect for unemployed ( $\delta$ ), at least for some groups, to be smaller than  $\rho$ , or even negative,  $\delta < 0$ .

Ideally, I would like to know which individuals became unemployed not as a result of

deteriorating mental health, i.e. to distinguish all people who first become unemployed from those who first suffered mental problem, and then became unemployed. Unfortunately, perfect information is not available on the timing of individual's unemployment with respect to the onset of mental problems. Indeed, even if this question is put to the individual, it is not clear if she would be able to tell us for sure what happened first. However I might consider situations where unemployment is not driven by individuals' mental health status. One such example is if a person became unemployed due to redundancy. The main assumption here is that workers who were made redundant lose their job for reasons unrelated to mental health, while other job separation could result from reasons connected to mental health (Browning et al. 2006). I thus identify the effect for those unemployed who lose their jobs regardless of their mental problems.<sup>2</sup> In the UK, redundancy is defined as "dismissal for a reason not related to the individual concerned or for a number of reasons all of which are not so related", i.e. dismissals which are not related to the conduct or capability of the individuals.<sup>3</sup> It may be the case that the jobs of some or all of a firm's employees become redundant. This could be because the business stops trading, relocates or employees carry out work that is no longer necessary - for example, due to the introduction of new technology. There are certain selection criteria which the employer cannot use as grounds for redundancy, i.e. such a dismissal will be recognized by a tribunal as automatically unfair. One such unfair criterion is "taking actions on specified health and safety grounds". Hence mental health problems cannot be grounds for an individual to be made redundant.<sup>4</sup>

I first estimate the model including all unemployed people using probit with robust standard errors.<sup>5</sup> I then attempt to correct the model for endogeneity by redefining  $U_{ijt}$  (and  $E_{ijt}$  respectively) equal to 1 if the individual  $i$  is unemployed due to redundancy and 0 if she is employed (equal to 1 if the individual is employed and 0 if she is unemployed due to redundancy).

### 1.3 Data

The dataset used in this paper comes from the Labour Force Survey (LFS).<sup>6</sup> It is a quarterly sample survey of households living at private addresses in Great Britain. It is conducted by the Office for National Statistics (ONS).<sup>7</sup> LFS is the biggest nationally representative regular survey in the UK which provides a rich and vital information on the labor force. Its sample size is of approximately 500,000 people per year. LFS also contains information on the respondents' economic activity, education, health, family

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<sup>2</sup>This approach is similar to Schmitz (2011). Please refer to Morris & Cook (1991) for an exhaustive review of earlier literature.

<sup>3</sup><http://www.businesslink.gov.uk>. For more information see Department for Work and Pension webpage, <http://www.dwp.gov.uk/>

<sup>4</sup>It is worth noting that redundancy notification should be made within a 30 to 90-day period prior to the first redundancy (depending on the number of redundancies). This ensures that an unemployment notification happens prior to possible depressive reaction.

<sup>5</sup>Following Ruhm (2005) I use heteroskedasticity-robust standard errors, clustered by region, year and quarter. When dealing with non-linear models, one should be careful with computing the marginal effects (Ai and Norton, 2003). I take the advantage of new methodology introduced in STATA 11 to calculate marginal effects which enables me to obtain correct standard errors (Karaca-Mandic et al. 2012).

<sup>6</sup><http://www.esds.ac.uk/government/lfs/>

<sup>7</sup><http://www.statistics.gov.uk/default.asp>

structure, housing information and demographic details. Since the 1997 spring quarter, all individuals have been asked about particular health problems they may have. I use data from the first quarter of 1997 to the fourth quarter of 2010. The analysis refers to individuals aged 25 to 54 of both genders who are active in the labor force (either employed or unemployed).<sup>8</sup> This produces 1, 182, 790 observations in total, from 83, 750 in 1997 to 70, 167 in 2010. 1, 131, 880 individuals are employed, and 50, 910 are unemployed, giving an average unemployment rate over the fourteen years of 4.30%. As the labor market may function differently for male and female, I perform a separate analysis for each gender. Hence I have 550, 661 males, and 632, 129 females.

As a proxy for mental problems I use the question "Do you have depression, bad nerves or anxiety?" with the option of answering "yes" or "no". This question was chosen because anxiety and depression are the most common mental health disorders in the UK (ONS Psychiatric Morbidity report, 2000).<sup>9</sup> The same question is contained in the other nationally representative database, the British Household Panel Survey (BHPS) and has been used to study mental health and state transfers (Whittaker and Sutton, 2010), and the impact of working shifts on mental health (Bara and Arber 2009). Hence, I deem it to be a reliable measure of mental problems.

The main proxy for economic conditions is the seasonally adjusted gender specific regional unemployment rate during the three months ending with the survey month (following Ruhm, 2005).<sup>10</sup> A high unemployment rate is a signal of economic downturns in most people's understanding. If I look at the Great Depression or recent the "Great Recession", both were accompanied by a huge drop in employment. Mental problems, such as depression or anxiety, can be a result of an individual's reflections on the circumstances in which she lives.<sup>11</sup> Hence, if she feels insecure when the unemployment rate rises, it might stimulate depressive thoughts and provoke mental problems. Furthermore, the unemployment rate is widely broadcast in the mass-media and during an economic downturn people are therefore constantly under the pressure of the news about the economic instability which may also have an impact on their mental problems. The quarterly data of the regional unemployment figures are taken from NOMIS,<sup>12</sup> which is a service provided by the ONS, to give free access to the most detailed and up-to-date UK labor market statistics from official sources. Micro and macro data are combined with three months

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<sup>8</sup>Since the particular interest is to investigate how economic fluctuations, which are reflected in changes in the regional unemployment rate, affect people, we focus on currently economically active individuals. Moreover, I focus on individuals aged 25 – 54 in order to avoid confounding with educational and retirement decisions, since, when employment opportunities are low, young people may decide to stay at school longer (or return to education), while people about to retire may opt for early retirement.

<sup>9</sup>Psychiatric morbidity among adults living in private households, 2000 ([www.statistics.gov.uk/products/p8258.asp](http://www.statistics.gov.uk/products/p8258.asp)). Mixed anxiety and depression, according to the ONS 2000 survey, is experienced by 9.2% of adults in UK. This is followed by general anxiety at 4.7% and depression at 2.8%.

<sup>10</sup>Since the probability of becoming unemployed is different depending on the educational level of the individual (Nickell, 1979), regional unemployment rate should also be defined within educational dimension. Unfortunately, the ONS does not provide information about regional unemployment rates by educational attainment.

<sup>11</sup>The National Health Service (<http://www.nhs.uk/>) provides some causes of depression, such as stress due to redundancy, job insecurity etc. British Association for Counselling & Psychotherapy (<http://www.bacp.co.uk/>) reports that "increases in depression over the last few years may be the collateral damage of the financial crisis and the battle against debt".

<sup>12</sup><https://www.nomisweb.co.uk/>

difference as the official unemployment figures are published with a quarterly lag. For example, the individual interviewed in the third quarter observes data from the second quarter.<sup>13</sup> The evolution of the quarterly unemployment rate by region over time is set out in the Appendix.

The LFS also provides detailed information related to the respondent's employment status. The respondent is asked about current economic activity (employed, ILO unemployed or inactive). If she is unemployed, the reason and the duration of unemployment are specified.<sup>14</sup> This paper explores unemployment due to redundancy as an exogenous shock to employment. The idea is that the experience of being made redundant strongly disrupts a worker's employment career, but workers' mental health is unlikely to cause a firm to decide to make an employee redundant. If the respondent became unemployed in the last three months, she is additionally asked whether it happened due to the firm closing down, downsizing the staff or for another reason. While redundancy does not obviously mean that the firm stopped operating, becoming unemployed due to plant closure is a subsample of redundant people. Checking whether the results obtained for all redundant workers hold for this subsample is part of the robustness checks.

I take regions to mean the 11 Government office regions: North West, North East, Yorkshire and The Humber, East Midlands, West Midlands, East, London, South East, South West, Wales and Scotland. I use individual characteristics as controls, such as age in years and its square, six categorical variables for educational levels: "degree", which includes people having at least a Bachelor's degree, "higher", which includes people having completed higher education, "A-level", which includes GCE A-level or equivalent, "O-level", which consists of GCSE grade A-C or equivalent, "Other", people having other qualifications, and the reference group of "no qualification"; two indicators of marital status: "married" which includes married and living as a couple, and "never married" as the reference group;<sup>15</sup> a dummy variable for having children. I also include 14 year dummies with reference 1997, 11 region dummies with reference London, and 4 quarter dummies with the first quarter being the reference. Descriptive statistics are presented in Table 1.

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<sup>13</sup>Another reason is that chronic diseases such as anxiety and depression, in general, have no immediate onset. Hence if they need time to develop this is captured by including the unemployment rate from the previous quarter. The unemployment rates are correlated across periods and today's rate somehow reflects yesterday's rate. Therefore, the results might capture the effect of an economic situation over longer than just a quarter period. For example, correlations between the quarterly unemployment rate and the average during a year concluding with the survey month are 0.965 for men and 0.951 for women. The robustness checks analyze the model with different specification to ensure that the results are robust.

<sup>14</sup>The reasons are "dismissed", "made redundant/took voluntary redundancy", "temporary job finished", "resigned", "gave up work for health reasons", "took early retirement", "retired" (at or after state pension age), "gave up for family or personal reasons", "other reason".

<sup>15</sup>Horwitz et al. (1991, 1996) provided evidences that marriage is a protective factor against depression. The analysis thus focuses on married vs. never married individuals. Widowed, divorced and separated individuals, which account for 13.3% of men and 18.48% of women, are dropped from the sample.

Table 1. Summary statistics

Sample	Male				Female			
	Mean	Std.dev.	Min	Max	Mean	Std.dev.	Min	Max
Depression/Anxiety	1.12	1.05	0	1	1.53	1.22	0	1
Unemployment rate (regional)	6.35	1.94	2.9	12.7	5.08	1.27	2.2	9.5
Unemployment rate (in sample)	4.96	2.17	0	1	3.73	1.89	0	1
Age	39.3	8.43	25	54	39.2	8.29	25	54
Married	64.6	4.78	0	1	70.9	4.54	0	1
Single	35.3	4.78	0	1	29.1	4.54	0	1
Degree	25.7	4.36	0	1	22.6	4.18	0	1
Higher	10.2	3.03	0	1	12.6	3.32	0	1
Alevel	27.9	4.48	0	1	16.7	3.73	0	1
Olevel	17.1	3.76	0	1	27.4	4.46	0	1
Other qualification	11.9	3.24	0	1	11.9	3.23	0	1
No qualification	6.91	2.53	0	1	8.45	2.78	0	1
Having a child	41.4	4.92	0	1	48.8	4.99	0	1
N			550,661				632,129	

The mean probability of depression is greater for women than for men, which is in line with medical evidence. The mean unemployment rate is higher for men than for women, there is a slight difference between unemployment rates in the sample and from NOMIS, since the later are seasonally adjusted, and are calculated for the economically active population aged 16 and over. The mean age is around 39 years; married individuals constitute 64.6% and 71% of men and women sample respectively. There are more men than women with a degree or A-level, while more women have completed higher education, O-level or no qualification. More women than men have at least one child, as very few single men report having children.

## 1.4 Results

The results are summarized in Tables 2.1 and 2.2.<sup>16</sup> The reported coefficients are marginal effects for probit models where the dependent variable is an indicator whether the respondent has depression, anxiety, bad nerves or not. For both "Unemployed due to all reasons" and "Unemployed due to Redundancy" specifications indicator variables for region, year, and quarter are included, and heteroskedasticity-robust standard errors, clustered by region, year and quarter, are reported in parentheses. The main findings suggest that the worsening of economic conditions has a significant detrimental effect on the mental health of the employed: an increase in regional unemployment rate is associated with an increase in the probability to report mental problems. It is consistent with previous findings by Ruhm (2003), Teff (2011a, 2011b). More precisely, when the regional unemployment rate increases by 1 percentage point, the probability of suffering depression increases for the employed men by 0.034 and for the employed women by 0.062 percentage points. This is in line with medical reports which suggest that depression and anxiety are more common in women than men.<sup>17</sup>

<sup>16</sup>The column "Unemployed due to all reasons" refers to the case when all the unemployed are included in the regression, while the column "Unemployed due to Redundancy" presents the results from the regressions with unemployed due to redundancies only. I present here the average marginal effects.

<sup>17</sup>These disparities may be due to women, when asked, being more likely to report symptoms of depression (National Statistics, 2003), while depression in men may have been under diagnosed because they present to their General practitioner with different symptoms. (National Institute For Clinical

One of the main goals was to assess whether economic conditions affect the unemployed differently from the employed. It should first be noted that being unemployed significantly increases the probability of having mental problems. However, one should control for its endogeneity, otherwise the marginal effect of being unemployed is overestimated. For example, it is lower for men and becomes not significant for women when I control for the reason of being unemployed than if all the unemployed are included in the model. These findings are consistent with Khun et. al (2009) who find a significant increase in the prescriptions of antidepressants for male (but not for women) in a year after plant closure. Moreover, job loss results in an increase in hospitalizations for mental health reasons only in the case of men.

The results also show that economic conditions influence the unemployed differently. For unemployed women the rise in the regional unemployment rate of 1 pp increases the probability of depression by 0.35 pp, which is much higher than for the employed women. For unemployed men, the coefficient is negative and not statistically significant, confirming the hypothesis that the unemployed could have less mental problems in bad times: less social pressure for being unemployed in high unemployment times counteracts the adverse effect of a bad economic situation. The results are in line with Clark et al. (2009) findings for German data which report that unemployed men are significantly less negatively affected by regional unemployment than employed men. For women in their study, however, no such offsetting effect appears to exist. Jackson and Warr (1987) for UK also report lower levels of psychological distress among unemployed men from areas of chronically high unemployment than among unemployed men living in areas of low unemployment.

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Excellence, 2003). However it is true that women are twice as likely to experience anxiety as men. (The Office for National Statistics Psychiatric Morbidity report, 2001). The reasons for this are unclear, but are thought to be due to both social and biological factors.

Table 2.1. Results: Marginal Effects. Male

	Unemployed due to all reasons		Unemployed due to Redundancy	
Reg. unemployment rate (Employed)	0,00036** (0,00015)	0,00038*** (0,00015)	0,00031** (0,00015)	0,00034** (0,00015)
Reg. unemployment rate (Unemployed)	-0,00128 (0,00080)	-0,00131 (0,00080)	-0,00084 (0,00096)	-0,00072 (0,00097)
Unemployment dummy	0,04476*** (0,00139)	0,04357*** (0,00142)	0,02211*** (0,00220)	0,02014*** (0,00208)
Age	0,00034*** (0,00002)	0,00034*** (0,00002)	0,00033*** (0,00001)	0,00042*** (0,00002)
Education: Degree	-0,00408*** (0,00050)	-0,00390*** (0,00050)	-0,00388*** (0,00048)	-0,00368*** (0,00048)
Education: Higher	-0,00307*** (0,00052)	-0,00264*** (0,00053)	-0,00290*** (0,00048)	-0,00252*** (0,00049)
Education: Alevel	-0,00403*** (0,00048)	-0,00366*** (0,00049)	-0,00417*** (0,00046)	-0,00382*** (0,00047)
Education: Olevel	-0,00116** (0,00058)	-0,00090 (0,00058)	-0,00144*** (0,00053)	-0,00117** (0,00054)
Education: Other	-0,00139** (0,00061)	-0,00090 (0,00062)	-0,00160*** (0,00056)	-0,00116** (0,00058)
Married		-0,00659*** (0,00039)		-0,00607*** (0,00039)
Children dummy		-0,00188*** (0,00034)		-0,00122*** (0,00031)
N	550,661		531,133	

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. I report average marginal effects.

The regression equations are estimated as probit models with standard errors clustered at region, year and quarter level.



Table 2.2. Results: Marginal Effects. Female

	Unemployed due to all reasons		Unemployed due to Redundancy	
Reg. unemployment rate (Employed)	0,00057* (0,00032)	0,00060* (0,00032)	0,00059* (0,00032)	0,00061* (0,00032)
Reg. unemployment rate (Unemployed)	0,00121 (0,00128)	0,00103 (0,00128)	0,00337* (0,00202)	0,00332* (0,00200)
Unemployment dummy	0,03812*** (0,00131)	0,04007*** (0,00130)	0,01903*** (0,00296)	0,01777*** (0,00288)
Age	0,00029*** (0,00002)	0,00023*** (0,00002)	0,00027*** (0,00002)	0,00034*** (0,00002)
Education: Degree		-0,00763*** (0,00050)	-0,00787*** (0,00050)	-0,00679*** (0,00051)
Education: Higher		-0,00388*** (0,00056)	-0,00344*** (0,00056)	-0,00332*** (0,00054)
Education: Alevel		-0,00325*** (0,00053)	-0,00278*** (0,00053)	-0,00283*** (0,00054)
Education: Olevel		-0,00442*** (0,00053)	-0,00384*** (0,00053)	-0,00417*** (0,00051)
Education: Other		-0,00187*** (0,00060)	-0,00138*** (0,00061)	-0,00161*** (0,00062)
Married			-0,00969*** (0,00053)	-0,00878*** (0,00053)
Children dummy			-0,00258*** (0,00033)	-0,00204*** (0,00032)
N		632,129		612,116

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. I report average marginal effects.

The regression equations are estimated as probit models with standard errors clustered at region, year and quarter level.

Being married is a strong counteractive factor of one’s probability to suffer depression. It is of interest to see whether married and single individual’s mental health respond differently to economic conditions. For instance, married employed men could feel depressed when the economy performs badly, as they are financially responsible for their families compared to single men. On the contrary, married women could feel less anxious about economic downturns compared to single, because they may not be the main breadwinners in the household or have their working preference distorted by the trade-off between time for children or husband and work (Simon 1997).

Table 3. Marginal Effects

	Male		Female	
	Married	Single	Married	Single
Reg. unemployment rate (Employed)	0,00042** (0,00018)	0,00016 (0,00029)	0,00044 (0,00031)	0,00114* (0,00067)
Reg. unemployment rate (Unemployed)	0,00080 (0,00112)	-0,00277* (0,00149)	0,00427* (0,00219)	0,00238 (0,00388)
N	348,859	182,274	438,304	173,812

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . I report average marginal effects. The regression equations are estimated as probit models with standard errors clustered at region, year and quarter level.

Table 3 reports the results by marital status.<sup>18</sup> Mental health of employed women differs depending on whether they are married or not.<sup>19</sup> When economic situation worsen single women are more than twice more likely to suffer depression than married women (0.114 pp vs. 0.044 pp). Married people have more economic resources than unmarried ones (Ross et al., 1990; Zick & Smith, 1991), and the economic benefits of marriage primarily derive from the dual-earning potential for the married and these benefits exists for men as well as women (Ross et al., 1990). Note that the probability of mental problems in married employed men rise by almost the same amount (0.042 pp) as in married employed women (0.044 pp) for the percentage point rise in the regional unemployment rate. Hence, I observe higher probability of depression for single employed women as a downturn of the labor market raises their job insecurity to a greater extent since in the case of unemployment they will face more financial strain than married women. Unemployed married women have the highest probability of suffering depression in response to a rise in the regional unemployment rate. It should be first noted that women have generally been shown to respond to stressful life events (such as unemployment) with higher levels of depression and anxiety (Eliason & Storrie, 2009) compared to men. Furthermore, Cochrane (1981) finds that whether or not a married woman is employed is a major predictor of depression symptoms. Hence, unemployed married women are affected more by economic downturns than employed, married or single women. Compared to unemployed married men, they also have a higher probability of anxiety and depression in bad times. Rosenfield (1989)

<sup>18</sup>I report the effects of the main variables of interest. Table A.2.1 with the full set of explanatory variables is included in the Appendix.

<sup>19</sup>I shall acknowledge that our analysis cannot reveal the mechanism behind the effect of marriage among women and men, as I do not use the information about spouse’s employment status. This is clearly a fruitful avenue for further research.

uses power explanation for this difference that predicts that employment for women is associated with greater power in the family, thus married women might have higher rates of anxious and depression symptoms than married men when they become unemployed, since unemployment would reduce this power and the bad economic situation would lower her chances to find employment. An alternative explanation would involve the fact that unemployed married women worry more about the economic situation compared to the employed. If a woman is unemployed, her spouse, if employed, is the sole family wage earner. During an economic downturn, not only do her chances to be reemployed decrease, but also her spouse's probability to lose a job rises (or should he already be unemployed, his chances of finding a job). Thus, she might feel more depressed than if she is employed.

Compared to single men, a more pronounced effect of macroeconomic conditions on the mental health of married men may then be explained by being married entails additional stress due to greater financial responsibilities and the role as the primary provider for the family. I do not observe much difference between the probability of depression as a response to changes in the unemployment rate for employed and unemployed married men, except that it is not significant for the unemployed. The effect of regional unemployment is opposite for unemployed single men: they benefit from living in high unemployment regions in bad times. This finding is consistent with a 'social norm' effect of unemployment in mental well-being literature (Jackson and Warr, 1987; Clark, 2003; Shields and Wheatley Price, 2005). Similar results have been found for Germany (Clark et al. 2009), Australia (Shields et al., 2009), and Switzerland (Stutzer and Lalive, 2004). Kessler et al. (1988) highlight the importance of psychological and social support from others to attenuate the negative impact of own unemployment on mental health. It might be easier for unemployed men to find such support when the others in the local area are also unemployed, which helps them to resist depression and anxiety. Jackson and Warr (1987) note that the long-term high local unemployment may give rise to stronger social support networks, greater material help, and institutional changes, which protect jobless people to some extent. However, it seems that it is not the case for the unemployed married men, perhaps due to the overlap with family responsibilities.

## 1.5 Robustness checks

### 1.5.1 Unemployment due to redundancy

I perform a series of check in order to check whether the results are robust. The first one concerns whether I have corrected well for endogeneity of own employment status. The LFS survey is quarterly and the individuals are asked in every quarter when they became unemployed. If they became unemployed due to redundancy in the last three months, they are additionally asked whether or not it was due to plant closure. Note that plant closure is a particular case of redundancy, widely used in the literature (Sullivan and von Wachter, 2009; Eliason and Storrie, 2009; Salm, 2009; Browning, et al. 2006). Mass layoffs are frequently used in the literature since they are considered as not related to individual's health outcomes as reasons of unemployment (Schmitz, 2011; Khun et al., 2009). Hence it is of interest to see whether the results obtained for all redundant workers (in this case those being made redundant in the last three months, since I have information only about plant closure redundancies in the last three months) are in line with the results for the plant closure subsample. Specification (1) includes all the unemployed individuals

who became unemployed in the last three months, specification (2) includes those who became unemployed due to redundancy in the last three months, and specification (3) those who lost their job as a result of firm or plant closure in the last three months. Table 4 summarizes the results:

Table 4. Robustness checks: Firm closure

	Male			Female		
	(1)	(2)	(3)	(1)	(2)	(3)
Reg. unemployment rate (Employed)	0,00031** (0,00016)	0,00034** (0,00016)	0,00033** (0,00015)	0,00054* (0,00031)	0,00056* (0,00031)	0,00056* (0,00031)
Reg. unemployment rate (Unemployed)	-0,00208** (0,00096)	-0,00047 (0,00098)	-0,00062 (0,00268)	-0,00095 (0,00213)	0,00280 (0,00293)	0,00743 (0,00563)
N	528,433	525,264	523,769	612,270	609,469	608,777

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . I report average marginal effects.

(1)Unemployed due all reasons, (2)Unemployed due redundancy, (3)Unemployed due firm closure.

It is worth noting that the results for the employed do not vary greatly in all specifications and are similar to those from Tables 2.1 and 2.2. Hence, I confirm that economic downturns are associated with a higher probability of mental problems for the employed. For the unemployed men, the direction of the results is also similar to those in Table 2.1. The magnitudes in specifications (2) and (3) are similar and the effect of the increase in the regional unemployment rate is negative, suggesting that unemployed men are at lower risk of depression compared to employed men. The coefficient of being unemployed is much smaller and not significant compared to specification (1) which provides few important conclusions. First, without controlling for endogeneity, the result seems to go from mental health to unemployment: depressed people are more likely to become unemployed. This finding is in line with Hamilton et al. (1997) that documents the beneficial effects of mental health on employability. Second, the effect is smaller compared to results from Table 2.1, the only difference was in the duration of unemployment. I thus confirm that short unemployment does not lead to mental problems, compared to longer unemployment spells, which is in line with Bjorklund and Eriksson (1998) for mental health, and Classen and Dunn (2012) who found that unemployment duration is the dominant force in the relationship between job loss and suicide. For unemployed women, while the coefficients are not significant and different in magnitudes, I confirm that they are at higher risk of depression when the economic situation worsens, however signs of unemployment dummies are negative.

### 1.5.2 Mobility

One important issue that I have not discussed so far is the possibility of migration from high-unemployment regions to low unemployment regions. People without mental problems could be more flexible about moving to another region with better employment conditions<sup>20</sup> More people with mental problems may be observed in regions with high

<sup>20</sup>In Ruhm (2000, 2005), he notes that migrants tend to be young and healthy and usually relocate into areas with robust economies, which in the case of mortality rates may induce a spurious negative correlation between economic conditions and mortality rates, and in the case of healthy lifestyles militate against the finding that lifestyles become healthier when economic conditions deteriorate.

unemployment just because they are more likely to stay in these regions, while people without such problems could move more easily to regions with lower unemployment. One possibility is to exclude individuals who have recently arrived to the region.<sup>21</sup> According to the ONS (and United Nations definition for population estimates), the usually resident population of an area includes people who have resided in this area for a period of at least 12 months. Thus, I restrict the sample to those who live at the same address for at least 12 months.<sup>22</sup> Specification "All" includes all individuals and specification "More than 1 yr" only those who have lived in a region for at least 12 months. The idea is to ensure that the results will not change greatly if I exclude those who have recently moved, the probability of suffering mental problems if the individual lives in the high unemployment region would be smaller than if I analyzed the whole sample, since by deleting migrants I increase the proportion of mentally ill people in the regions with low unemployment rate. The results are presented in Table 5.

Table 5. Robustness checks: Length of residence

	Male		Female	
	All	More than 1 yr	All	More than 1 yr
Reg. unemployment rate (Employed)	0,00034** (0,00015)	0,00039** (0,00016)	0,00062* (0,00032)	0,00068** (0,00034)
Reg. unemployment rate (Unemployed)	-0,00066 (0,00096)	-0,00080 (0,00100)	0,00351* (0,00199)	0,00339 (0,00218)
N	531,133	471,342	612,116	558,999

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . I report average marginal effects.

The regression equations are estimated as probit models with standard errors clustered at region, year and quarter level.

The results for those living in the region longer than a year are not smaller than those for the sample including individuals who have recently moved; in fact they are slightly bigger. Thus migration of people without mental problems to regions with low unemployment does not seem to be a problem of the study.

### 1.5.3 Lags

Following Ruhm (2000, 2003, 2005), I wanted to check whether economic conditions have the non-contemporaneous effect on mental problems. As he noted, it may seem surprising that using unemployment rates during only a three-month period I am able to find effects for depression and anxiety which probably respond slowly to changes in macroeconomic conditions. But since unemployment rates correlate over time, the results reflect the effects of economic conditions over a longer than just a quarter period. In particular, I tried to look at what would happen if I moved the unemployment window: I estimate the

<sup>21</sup>Another possibility is to assess the information on the region of birth, and analyze the sample of those working and living in their region of birth. However, LFS does not provide such information.

<sup>22</sup>In principle LFS can discriminate whether an individual resides at the same address for less than 12 months, between 12 months and 2 years, between 2 and 3 years, between 3 and 5 years, between 5 and 10 years, and over 10 years. However, this information relates to address rather than place. It may be possible that an individual is living at a different address from 12 months ago but is living in the same town and county. Hence, I do not have precise information regarding for how long an individual has resided in the region.

model taking the unemployment rate from a quarter before (3-m un.rate) the survey date, and the 12-months average (12-m un.rate) before the survey date. Table 6 summarizes the results for these specifications.

Table 6. Lags

	Male		Female	
	3-m un.rate	12-m un.rate	3-m un.rate	12-m un.rate
Reg. unemployment rate (Employed)	0,00033** (0,00015)	0,00048*** (0,00015)	0,00062* (0,00032)	0,00058* (0,00035)
Reg. unemployment rate (Unemployed)	-0,00066 (0,00096)	0,00021 (0,00098)	0,00352* (0,00198)	0,00452** (0,00215)
N	531,133	531,133	612,116	612,116

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . I report average marginal effects.

The regression equations are estimated as probit models with standard errors clustered at region, year and quarter level.

The findings suggest that the macroeconomic effects accumulate over time for employed men and unemployed women: higher unemployment during previous year predicts a statistically significant rise in mental problems. For the employed women, the effect for one quarter unemployment rate is very similar to a 1-year average, while is slightly smaller. Unemployed men are at lower risk of depression compared to employed men in both specifications, while if I consider a 1-year average, the sign is not negative. Together these findings show that mental health problems associated with economic downturns occur with a delay for some subgroups, which should be carefully considered when suggesting health policies promoting mental health.

## 1.6 Conclusion

The deterioration of labor market conditions during the 2007 recession has led many to refer to the downturn as the Great Recession (Elsby, 2010). High unemployment rates are likely to create negative externalities. Employed people start to feel less secure about being able to keep their job, while the unemployed have fewer possibilities of finding a new one. All these experiences are likely to have a negative impact on mental health: when labor market prospects worsen, people are more likely to suffer a mental problem such as anxiety or depression. These findings are important since the productivity of workers might be affected by mental problems in recessions which arise from job insecurity, and other stress induced by cuts in pay or hours. Another reason to care about the effect of economics on mental health is that health care costs associated with mental diseases have substantially risen in the last decades in most industrialized countries and in particular in the UK (McVicar and Anyadike-Danes, 2008), while the dynamics of these costs may be related to economic conditions. However, apart from these negative effects, there may be some positive impact on the subgroups of the unemployed: social pressure for not following the norm decreases when more people deviate from the norm, in this case become unemployed. Thus some unemployed might be at lower risk of mental problems.

This study sought to assess how economic fluctuations, through changes in the regional unemployment rate, affect the mental health of individuals who are active on the labor market. I use the UK's Labour Force Survey from 1997 to 2010 in order to clarify

whether increases in the regional unemployment rate affect mental problems. Since the unemployment rate influences people differently depending on their employment status I control for it. I show that it is important to correct for endogeneity of the former, otherwise the results are biased.

The obtained results suggest that, when the economy deteriorates, married employed men, married employed and unemployed women are more likely to suffer depression or anxiety. Employed married men may have depressive thought about their working prospects in the light of higher unemployment and worry that they will be unable to provide sufficient financial support for their families. Moreover, jobs are related to social status and self-assertion, and they therefore could be depressed due to fear of losing these social identifications. In the case of women, the results are more complex. Employed married women are as likely to suffer depression in recession as employed married men, while employed single women are at higher risk. This difference could be attributed to greater economic resources associated with marriage. However, the unemployed married women are even at higher risk of mental problems in recessions than single ones, which might be related to power in the family related to employment, that married women lose once they became unemployed. The interesting part is that single unemployed men are at lower risk of mental problems compared to all above groups. Several factors could be responsible for this. The first is that social pressure on the unemployed in bad times is much lower, than when there are just a few unemployed people. Society seems to be more tolerant and compassionate with respect to unemployed single men when unemployment is widespread. And second, other unemployed people could provide emotional support, which in the case of mental problems such as anxiety is of great importance. Several robustness checks confirm my findings.

Some limitations of the research regarding data unavailability exist. First, the probability of becoming unemployed is different depending on the educational level of the individual (Nickell, 1979) and I would thus rather define the regional gender-specific unemployment rate at educational level as well. Unfortunately, the ONS does not provide information about regional unemployment rates by educational attainment. Second, information is needed about the spouse's employment status to reveal the mechanism behind the differential effect of economic conditions on mental problems among men and women. Since LFS is not a household survey, it does not provide information about spouses.

The results are in line with previous research (in particular Ruhm, 2003; Clark, 2003, 2009, 2010; Tefft, 2011*a*, 2011*b*), while I provide wider evidence related to subgroups. This is important to bear in mind when designing labor and health policies, as they could be more efficient if target groups are correctly specified.

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# Appendix

## A.1 Figures: regional unemployment rate

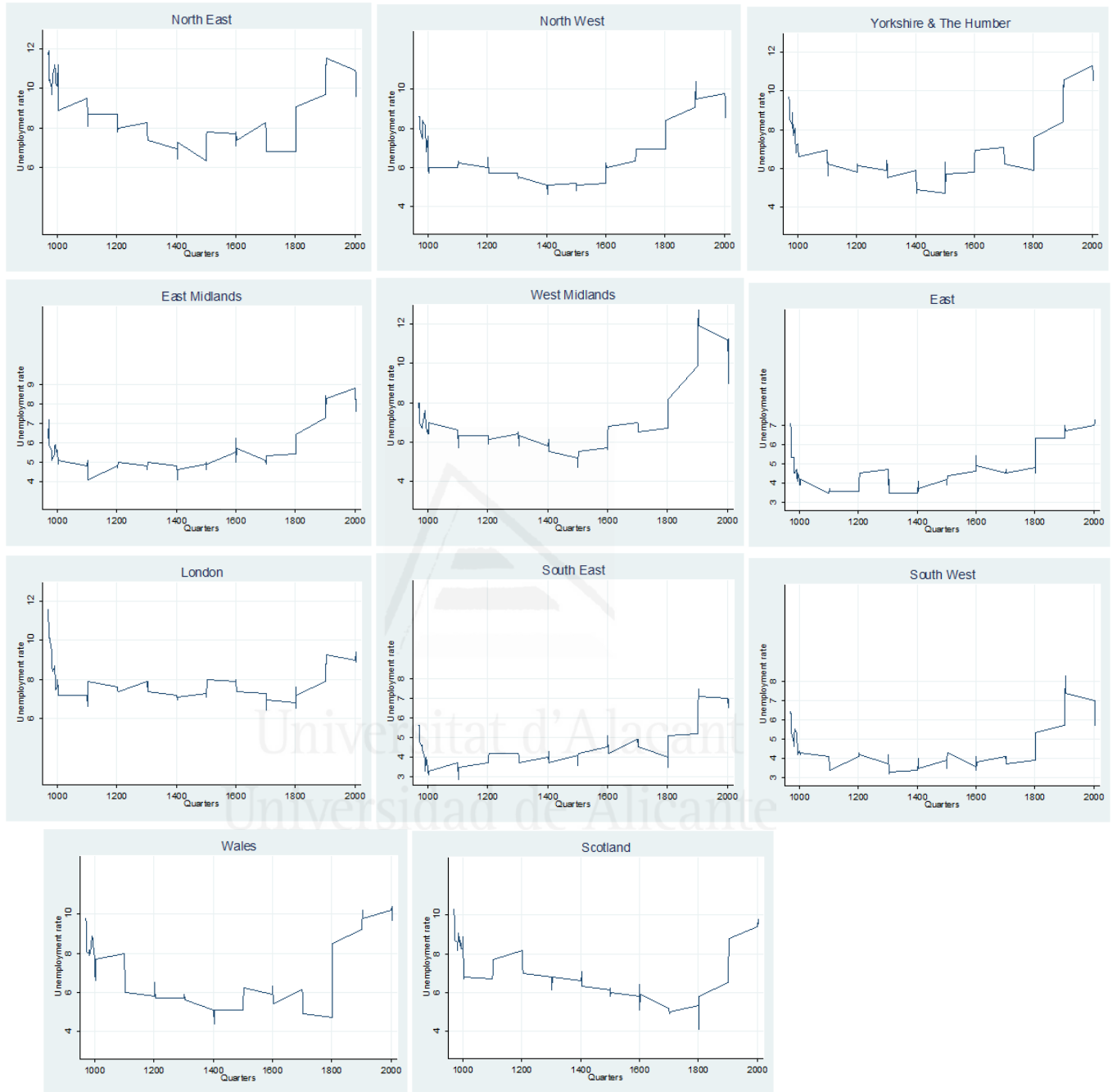


Table A.1 Unemployment rate correlations

	Male				Female			
	t	t+1	t+2	t+3	t	t+1	t+2	t+3
t+1	0.9610				0.9273			
t+2	0.9282	0.9622			0.8839	0.9266		
t+3	0.8845	0.9299	0.9635		0.8487	0.8852	0.9276	
Year avrg	0.9652	0.9861	0.9869	0.9681	0.9515	0.9719	0.9717	0.9518
N	550,661				632,719			

Note: t refers to a quarter ending with a survey month, t+1 refers to a quarter ending three months before the survey month, t+2 refers to a quarter ending six months before the survey month, t+3 refers to a quarter ending nine months before the survey date. Year avrg refers to the t, t+1, t+2, and t+3 average.

## A.2 Results

Table A.2.1 Marginal Effects

	Male		Female	
	Married	Single	Married	Single
Reg. unemployment rate (Employed)	0,00042** (0,00018)	0,00016 (0,00029)	0,00044 (0,00031)	0,00114* (0,00067)
Reg. unemployment rate (Unemployed)	0,00080 (0,00112)	-0,00277* (0,00149)	0,00427* (0,00219)	0,00238 (0,00388)
Unemployment dummy	0,01256*** (0,00237)	0,02407*** (0,00300)	0,00878*** (0,00305)	0,02478*** (0,00511)
Age	0,00037*** (0,00003)	0,00062*** (0,00003)	0,00021*** (0,00003)	0,00076*** (0,00004)
Education: Degree	-0,00339*** (0,00051)	-0,00420*** (0,00094)	-0,00608*** (0,00056)	-0,01114*** (0,00113)
Education: Higher	-0,00246*** (0,00057)	-0,00249** (0,00103)	-0,00181*** (0,00061)	-0,00700*** (0,00116)
Education: Alevel	-0,00368*** (0,00050)	-0,00392*** (0,00087)	-0,00166** (0,00065)	-0,00554*** (0,00112)
Education: Olevel	-0,00107* (0,00055)	-0,00121 (0,00096)	-0,00283*** (0,00060)	-0,00687*** (0,00117)
Education: Other	-0,00079 (0,00056)	-0,00195 (0,00120)	0,00022 (0,00076)	-0,00612*** (0,00132)
Children dummy	-0,00021 (0,00033)	-0,00415*** (0,00065)	-0,00143*** (0,00037)	-0,00402*** (0,00071)
N	348,859	182,274	438,304	173,812

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. I report average marginal effects.

The regression equations are estimated as probit models with standard errors clustered at region, year and quarter level.

Table A.2.2 Robustness checks: Firm closure

	Male			Female		
	(1)	(2)	(3)	(1)	(2)	(3)
Reg. unemployment rate (Employed)	0,00031** (0,00016)	0,00034** (0,00016)	0,00033** (0,00015)	0,00054* (0,00031)	0,00056* (0,00031)	0,00056* (0,00031)
Reg. unemployment rate (Unemployed)	-0,00208** (0,00096)	-0,00047 (0,00098)	-0,00062 (0,00268)	-0,00095 (0,00213)	0,00280 (0,00293)	0,00743 (0,00563)
Unemployment dummy	0,00941*** (0,00183)	0,00308 (0,00261)	0,00216 (0,00498)	0,01296*** (0,00263)	0,00098 (0,00343)	-0,00161 (0,00612)
Age	0,00042*** (0,00002)	0,00042*** (0,00002)	0,00042*** (0,00002)	0,00034*** (0,00002)	0,00034*** (0,00002)	0,00034*** (0,00002)
Education: Degree	-0,00358*** (0,00048)	-0,00356*** (0,00048)	-0,00351*** (0,00047)	-0,00701*** (0,00051)	-0,00699*** (0,00051)	-0,00697*** (0,00051)
Education: Higher	-0,00248*** (0,00049)	-0,00246*** (0,00049)	-0,00241*** (0,00049)	-0,00299*** (0,00055)	-0,00296*** (0,00055)	-0,00294*** (0,00055)
Education: Alevel	-0,00367*** (0,00048)	-0,00366*** (0,00048)	-0,00359*** (0,00048)	-0,00247*** (0,00053)	-0,00246*** (0,00053)	-0,00243*** (0,00054)
Education: Olevel	-0,00120** (0,00053)	-0,00120** (0,00053)	-0,00113** (0,00053)	-0,00372*** (0,00052)	-0,00371*** (0,00052)	-0,00368*** (0,00052)
Education: Other	-0,00111* (0,00057)	-0,00112* (0,00057)	-0,00109* (0,00057)	-0,00106* (0,00063)	-0,00110* (0,00063)	-0,00110* (0,00063)
Married	-0,00591*** (0,00038)	-0,00593*** (0,00038)	-0,00590*** (0,00037)	-0,00869*** (0,00053)	-0,00864*** (0,00053)	-0,00864*** (0,00053)
Children dummy	-0,00129*** (0,00031)	-0,00126*** (0,00031)	-0,00127*** (0,00031)	-0,00209*** (0,00032)	-0,00206*** (0,00032)	-0,00207*** (0,00032)
N	528,433	525,264	523,769	612,270	609,469	608,777

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. I report average marginal effects

(1) Unemployed due all reasons, (2) Unemployed due to redundancy, (3) Unemployed due firm closure.

The regression equations are estimated as probit models with standard errors clustered at region, year and quarter level.

Table A.2.3 Robustness checks: Length of residence

	Male		Female	
	All	More than 1 yr	All	More than 1 yr
Reg. unemployment rate (Employed)	0,00034** (0,00015)	0,00039** (0,00016)	0,00062* (0,00032)	0,00068** (0,00034)
Reg. unemployment rate (Unemployed)	-0,00066 (0,00096)	-0,00080 (0,00100)	0,00351* (0,00199)	0,00339 (0,00218)
Unemployment dummy	0,01753*** (0,00192)	0,01770*** (0,00206)	0,01512*** (0,00265)	0,01634*** (0,00296)
Age	0,00042*** (0,00002)	0,00040*** (0,00002)	0,00034*** (0,00002)	0,00031*** (0,00002)
Education: Degree	-0,00368*** (0,00048)	-0,00355*** (0,00051)	-0,00708*** (0,00050)	-0,00702*** (0,00052)
Education: Higher	-0,00252*** (0,00049)	-0,00259*** (0,00053)	-0,00302*** (0,00054)	-0,00320*** (0,00055)
Education: Alevel	-0,00382*** (0,00047)	-0,00391*** (0,00052)	-0,00250*** (0,00054)	-0,00251*** (0,00055)
Education: Olevel	-0,00117** (0,00054)	-0,00101* (0,00057)	-0,00375*** (0,00051)	-0,00377*** (0,00054)
Education: Other	-0,00116** (0,00058)	-0,00088 (0,00063)	-0,00125** (0,00063)	-0,00108 (0,00066)
Married	-0,00607*** (0,00039)	-0,00596*** (0,00043)	-0,00878*** (0,00053)	-0,00926*** (0,00057)
Children dummy	-0,00122*** (0,00031)	-0,00148*** (0,00032)	-0,00204*** (0,00032)	-0,00224*** (0,00036)
N	531,133	471,342	612,116	558,999

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . I report average marginal effects.

The regression equations are estimated as probit models with standard errors clustered at region, year and quarter level.

Table A.2.4 Lags

	Male		Female	
	3-m un.rate	12-m un.rate	3-m un.rate	12-m un.rate
Reg. unemployment rate (Employed)	0,00034** (0,00015)	0,00050*** (0,00016)	0,00062* (0,00032)	0,00450** (0,00216)
Reg. unemployment rate (Unemployed)	-0,00066 (0,00096)	0,00021 (0,00098)	0,00351* (0,00199)	0,00058* (0,00035)
Unemployment dummy	0,01753*** (0,00192)	0,01718*** (0,00185)	0,01512*** (0,00265)	0,01481*** (0,00258)
Age	0,00042*** (0,00002)	0,00042*** (0,00002)	0,00034*** (0,00002)	0,00034*** (0,00002)
Education: Degree	-0,00368*** (0,00048)	-0,00368*** (0,00048)	-0,00708*** (0,00050)	-0,00708*** (0,00050)
Education: Higher	-0,00252*** (0,00049)	-0,00253*** (0,00049)	-0,00302*** (0,00054)	-0,00302*** (0,00054)
Education: Alevel	-0,00382*** (0,00047)	-0,00382*** (0,00047)	-0,00250*** (0,00054)	-0,00250*** (0,00054)
Education: Olevel	-0,00117** (0,00054)	-0,00117** (0,00054)	-0,00375*** (0,00051)	-0,00375*** (0,00051)
Education: Other	-0,00116** (0,00058)	-0,00117** (0,00058)	-0,00125** (0,00063)	-0,00125** (0,00063)
Married	-0,00607*** (0,00039)	-0,00607*** (0,00039)	-0,00878*** (0,00053)	-0,00878*** (0,00053)
Children dummy	-0,00122*** (0,00031)	-0,00122*** (0,00031)	-0,00204*** (0,00032)	-0,00204*** (0,00032)
N	531,133	531,133	612,116	612,116

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . I report average marginal effects.

The regression equations are estimated as probit models with standard errors clustered at region, year and quarter level.





## Chapter 2

**Depression and willingness to invest in risky financial assets**



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## 2.1 Introduction

With the ageing of baby boomers, the economists are dedicating increasing attention to the household financial decision making of people approaching retirement. As reported by the United Nations in 2011, 22% of population is already aged 60 years or over in the most developed regions and that proportion is projected to reach 32% in 2050.<sup>23</sup> A key underlying factor of the ageing population has been the rapid increase in life expectancy over the last fifty years. Individuals reaching age 65 should now expect to live substantially longer in retirement than in the past. It has raised policy makers' doubts about the sustainability of pension arrangements around the world and some countries have already introduced an increase in the normal retirement age (OECD, 2009).

Much of the retirement saving is being accumulated in state and private pensions. However, the sources for retirement may also include non-pension financial assets, such as personal savings and housing. The growth trends in various financial instruments suggest that the cohorts reaching retirement over the next years will have to make a much more complicated choice over where their assets can be invested. For instance, with more and more individuals having personal pensions of a defined contribution type and other types of personal investments, respectively higher number of people will be faced with decision on how to invest their assets once they reach older ages. Consequently, the demand for such financial products among those approaching retirement and the range of characteristics that these individuals will require from such products is likely to increase in the future. However, with ever more people requiring to buy such products, the regulation of financial instruments aimed at older individuals, the information that providers are required to give customers about these products and the cognitive skills that individuals have to process this information are all likely to become key points of public policy on retirement saving and retirement income provision. For example, the number of private sector employers who were offering defined benefit pension plan has declined over the past decades in the UK and the US. There is also a tendency to move toward defined contribution schemes for occupational pensions. Moreover, another pension reform strategy suggested in order to improve public pension system is to adopt a defined contribution (DC) scheme along with (or instead of) a defined benefit (DB) pension scheme.<sup>24</sup> The key feature of the DC plan, it is that investment risk and investment rewards are assumed by each employee and not by the employer, hence it becomes extremely important for the policy maker to know whether individuals are able to invest their pension contributions optimally.

On the other hand, as health tends to deteriorate with age, more households with aging become predisposed to both physical and mental health shocks, which might lead

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<sup>23</sup>By 2050, the share of the European population aged 60 years and over would rise from 22% in 2011 to 34% in 2050, and Northern America's population from 19% to 27% over the same period (United Nations Population Division, 2011).

<sup>24</sup>The defined contribution (DC) pension scheme is a retirement plan in which the amount of the employer's annual contribution is specified. These contributions are then invested, for example in the stock market, and the returns on the investment (which may be positive or negative) are credited to the individual's account. Only employer contributions to the account are guaranteed, not the future benefits, which fluctuates on the basis of investment earnings. The defined benefit (DB) pension scheme is a retirement plan where employee benefits are sorted out based on a formula using factors such as salary history and duration of employment. Unlike the DC plan, investment risk and portfolio management of the DB plan are entirely under the control of the employer.

them to revise their portfolio decisions.<sup>25</sup> This paper focuses on the effect of shocks to mental health, in particular suffering depression, on the decision to hold risky financial assets. I provide evidence that depression changes individual's perception of reality, hence the ability to evaluate investment opportunities.

Several studies have investigated the impact of physical health on portfolio choice, and found that poor health is associated with a safer household portfolio allocation. Rosen & Wu (2004) show that households in poor health are less likely to hold all classes of financial assets, and hold smaller shares of their wealth in risky assets. Likewise, Berkowitz & Qiu (2006) find that a physical health shock significantly reduces household total financial wealth (as it is more liquid compared to non-financial wealth) which in turn leads the household to decrease its holding of risky financial assets. Fan & Zhao (2009) and Love & Smith (2010) have criticized the above studies which rely on random effects specification and propose to use fixed effects instead. Nevertheless, Fan & Zhao (2009) support the evidence suggesting that adverse health shocks discourage risky asset holdings, and Love & Smith (2010) find a negative effect of being in poor health on the probability of owning any stocks or mutual funds for married households. Yet, only one paper, by Bogan and Fertig (2012), explicitly considers the role of mental health in household portfolio choice decisions of the US population. Broadly speaking, they find that households affected by mental health issues decrease investments in risky instruments.

However, all the above studies lack a mechanism to uncover a plausible channel through which health affects portfolio choice. This paper aims to address this issue. Edwards (2010) develops a theoretical model in which health shocks prompts individuals to lower their risky portfolio shares as they become more risk averse. I argue that depression distorts individual's perception. For example, a study by Smoski et al. (2009) finds that depression yields individuals to fear taking risks, which would have an impact on their risk aversion. On the other hand, people suffering depression may face more difficulties when managing their everyday life, and are hence more likely to avoid choices that involve (an additional) high cognitive effort, such as taking actions about their financial portfolio. The first channel suggests that if people suffering depression become more risk averse they are more likely to sell assets (when they have some) and not to buy them (when they have none).<sup>26</sup> While in the case of depression via the second channel, depressed people become passive and less concerned about either selling or buying assets. Therefore, in the case of buying they are less likely to buy risky assets, whereas in the case of selling they are less likely to sell them.<sup>27</sup> The aim is to disentangle which of the two is of greater importance.

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<sup>25</sup>Awareness of future shocks to physical health, which lead to higher medical expenditures, rises background risk and this shifts investments toward safer portfolios. The other effects of physical health shocks acknowledged in the literature are the effect on marginal utility of consumption (which might be negative if health and consumption are complements and positive if health shocks increase the marginal value of labor-saving consumption, such as taxi rides or cleaning services) and the effect on life span or planning horizon.

<sup>26</sup>Another concern is that individuals who suffer depression might evaluate investment opportunities differently. Several researches (Fehr-Duda et al., 2011; Alloy et al. 1987) have shown that individuals with worse than normal mood weigh gain and loss probabilities more pessimistically compared to people without such problems. As behavioral response due to either increase in risk aversion or more pessimistic evaluation of probabilities of gains and loses are similar, to simplify the exposition, henceforth we would refer to "more risk averse" for both.

<sup>27</sup>It is noted in Love & Smith (2010), that a life-cycle model also suggests that health shocks affect portfolio choice by altering life expectancy. One of the symptoms of depression is suicidality, and we

For this purpose I consider sub-samples of people who held or did not hold risky assets at some point in time, and look at the probability of holding assets in the next period. The key identification is the sign of the effect of suffering depression on the probability of holding risky assets conditional on having them in the previous period. If the sign is negative, I speculate that individuals who suffer depression decide to sell their assets due to increase in their risk aversion, while if the sign is nonnegative, I argue that people with more depression symptoms become passive about risky asset holding.

I consider risky asset holding at the household level. This is not problematic as elderly couples pool their financial assets to a significant degree.<sup>28</sup> As noted by Rosen & Wu (2004), husbands and wives can have different time horizons, due to different life expectancies. Furthermore, it is a well-established fact that men and women differ with respect to risk aversion (Barber & Odean, 2001; Lott & Kenny, 1999; Sunden & Surette, 1998). These considerations suggest that men and women favor different portfolio strategies and that the impact on the family's portfolio might differ when one or the other of the spouses suffers depression. Hence, there is a reason to expect effects of depression on risky asset holding for the two spouses to be asymmetric. To allow for that, I introduce one measure for the husband's depression and another for the wife's. As for the identification strategy I distinguish between two actions with risky assets, buying and selling, and I propose an intuitive explanation why the effects of depression for the two spouses might be asymmetric between these two decisions.

To summarize, I first test whether there is a difference in perception due to suffering depression. Second, I aim to show whether being depressed has an impact on the willingness to invest in risky financial assets. Third, I provide some intuition about the asymmetry of the husband's and the wife's suffering depression on household decisions about the holding of risky assets. For this purpose I use The Survey of Health, Ageing and Retirement in Europe (SHARE). The results suggest that depressed individuals have distorted perception compared to those who are not depressed. Moreover, suffering symptoms of depression lowers the probability of acquiring risky financial assets, such as stocks and shares. I provide evidence that risk aversion is a plausible mechanism behind this association. I also find that the wife's depression level is a significant determinant of the probability to buy assets, while the husband's depression level is important for the probability to sell assets.

The rest of the paper is organized as follows. Section 2 describes the dataset. Section 3 provides some insights about the relation between depression and perception. Section 4 sets out the intuition regarding the model applied in this work. Section 5 provides the results and the robustness check, and Section 6 concludes.

## 2.2 Data

Vast datasets were designed and financed to study the determinants of the economic choices in elderly population (English Longitudinal Survey of Ageing (ELSA), US Health Retirement Survey (HRS), The Survey of Health, Ageing and Retirement in Europe

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argue that changes in a horizon length due to depression would correspond to a "passivity" response rather than to a "risk aversion" response.

<sup>28</sup>Most data for the elderly are designed as household surveys, and financial questions are asked at the household level.

(SHARE)).<sup>29</sup> The source of data are the first two waves SHARE data<sup>30</sup> that took place in 2004–05 (wave 1) and 2006–07 (wave 2) in 11 countries (Austria, Belgium, Denmark, France, Germany, Greece, Italy, The Netherlands, Spain, Switzerland, Sweden).<sup>31</sup> Based on probability samples, SHARE represents the non-institutionalized population aged 50 and older (including spouses, irrespective of age), and contains information on demographics, physical and mental health, housing, employment, income, assets and cognition (Börsh-Supan et al, 2005).<sup>32</sup> I would refer to wave 1 as  $t - 1$  and to wave 2 as  $t$ .

In order to analyze whether suffering depression has an impact on individual’s perception I use vignettes’ sub-sample of SHARE. Vignettes are short descriptions of characteristics of hypothetical persons (e.g. suffering depression), which respondents are asked to evaluate on the same scale on which they assess their own suffering depression. Only a sub-sample of the main SHARE sample (4,544 participants) was asked to answer the vignettes questionnaire (which I describe in details in Section 3). I use data from the first wave, since it has three vignettes per item. One of two versions of the vignettes module (different gender of hypothetical person and vignettes’ ordering) was randomly assigned to respondents.<sup>33</sup>

The key variable for the analysis is a measure of household risky asset holdings. I use the information about risky assets of couples only, which are defined as being married and living together with a spouse or having a registered partnership and living with a partner. As a proxy of risky asset holding I use total household stockownership, and define it as stocks held directly plus stocks held through mutual funds and investment accounts (likewise in Christelis et al., 2010, Love and Smith, 2010). For this purpose I combine two questions: "Do you [or your partner] currently have any money in stocks or shares (listed or unlisted on the stock market)?" and "Do you [or your partner] currently have any money in mutual funds or managed investment accounts?"<sup>34</sup> with the option of answering "yes" or "no". I construct a binary variable  $A_{i,t}$ , which equals 1 if the household financial respondent answers "yes" in either question in period  $t$  and zero otherwise. I create a risky asset transition by conditioning on households’ possessing of risky assets in  $t - 1$ , where  $A_{i0,t} = \{0, 1\}$  states for holding assets in  $t$  conditional on  $A_{i,t-1} = 0$ , while  $A_{i1,t} = \{0, 1\}$  states for holding assets in  $t$  conditional on  $A_{i,t-1} = 1$ .

I use the EURO-D depression scale according to Prince et al. (1999a, 199b) to mea-

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<sup>29</sup>SHARE is modeled closely to the Health and Retirement Study (HRS) conducted in the United States and the English Longitudinal Survey of Ageing (ELSA) in the United Kingdom. There are other studies that follow SHARE model: China Health and Retirement Longitudinal Study (CHARLS), Indonesia Family Life Survey (IFLS), Japanese Study on Aging and Retirement (JSTAR), Korean Longitudinal Study of Aging (KLoSA), Longitudinal Aging Study in India (LASI), Mexican Health and Aging Study (MHAS), Study on Global Ageing and Adult Health (SAGE), The Irish Longitudinal Study on Ageing (TILDA). For more information see <https://mmicdata.rand.org/meta/?section=studies>

<sup>30</sup>For more information about SHARE see <http://www.share-project.org/>

<sup>31</sup>Additional data came from Israel in 2006, however this country was not surveyed in the wave 2, hence we exclude it from the analysis. The second wave took place also in Czech Republic, Poland, and Ireland, but given we need to work with variables available also in the wave 1, I do not use the information from these countries.

<sup>32</sup>The questionnaire has been translated according to a protocol ensuring functional equivalence.

<sup>33</sup>One can find more detailed information about the vignettes on [www.compare-project.org](http://www.compare-project.org)

<sup>34</sup>Mutual funds in SHARE are defined as "pool of money belonging to many investors who trust a manager to invest in stocks and/or bonds". One can sort on the weight of stocks in mutual funds, using information about whether mutual funds are mostly stocks or mostly bonds, however as we are interested in holding stocks per se, I assume that whoever hold mutual funds has some stock in them.

sure depression. This scale is a recognized measurement of mental health (Castro-Costa et al. 2008). It was introduced by the 'EURODEP Concerted Action Programme', a collaboration of 14 research groups and was originally developed to harmonize data on late-life depression throughout Europe. The EURO-D is a 12-item scale that indicates the presence of depression, pessimism, suicidality, guilt, sleeping problems, loss of interest, irritability, loss of appetite, fatigue, concentration difficulties, enjoyment, and tearfulness.<sup>35</sup> The individuals' answers for each item are coded as 1 when the symptom is 'present' and 0 if it is 'not present', and then are summed up. The total score ranges from 0 (not depressed) to 12 (very depressed). Prince et al. (1999a, 1999b) show in a validation study that the EURO-D scale is internally consistent and provides a good assessment of developing clinical depression or anxiety disorders. Since several optimal cut-off points are suggested in the literature, thus I use this measure as a score. The index is constructed using EURO-D information from the first wave,  $D_{i,t-1}$ .

As suggested by Berkowitz and Qiu (2006) health shocks have an impact on household total financial wealth, leading them to restructure the composition of their financial assets. Therefore, household wealth is an important determinant of risky asset holding, which might likewise be related to suffering depression. I define total net household wealth, as the sum of real assets (value of primary residence net the mortgage on it, the value of other real estate, the owned share of own business and the owned cars) and net financial assets (gross financial assets net financial liabilities).<sup>36</sup> I control for net household initial wealth in  $t - 1$ , as richer households had more resources to deal with the consequences of depression compared to households with less wealth. On the other hand, household with greater wealth are also more likely to acquire risky assets in  $t$  (or less likely to sell them) compared to households that had less wealth.

Finally, I include controls for both spouses, such as age in years and its square, five categorical variables for education attainment (according to the international standard classification of education ISCED-97).<sup>37</sup> "tertiary" for ISCED 5 – 6, "upper secondary" for ISCED 3 – 4, "lower secondary" for ISCED 2, "primary" for ISCED 1, and "no education" as the reference; household controls, such as number of children, and eleven countries' dummies (for reside in Austria, France, Belgium, The Netherlands, Switzerland, Greece, Italy, Spain, Denmark or Sweden) with Germany as the reference. While many studies (for more details see Bago d'Uva et al. 2011a) suggest that education is a better indicator of long-term socioeconomic status than income for older populations, I include household income as well, since it is a strong determinant of the financial market participation. People who have more disposable income could be more willing to invest in the risky assets.<sup>38</sup> Following Christelis et al. (2010), I also include a measure of cognitive

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<sup>35</sup>A detailed description can be found in the Appendix.

<sup>36</sup>Gross financial assets are the sum of the seven categories of financial assets: bank and other transaction accounts, government and corporate bonds, stocks, mutual funds, individual retirement accounts, contractual savings for housing and life insurance policies owned by the household. Financial liabilities are the sum of all household debts.

<sup>37</sup>United Nations Educational, Scientific and Cultural Organization, 1997.

<sup>38</sup>It is worth noting that all financial variables are adjusted for the purchasing power parity (PPP), using Germany as the basis. The reasons for using PPP adjustments are explained in Christelis et al. (2005), who also outlines how the PPP adjustments should be performed. All amounts are in Euro, for countries that use a different currencies (Denmark, Switzerland, Sweden) we divide the amounts by the exchange rate. Any missing income and wealth information due to item-nonresponse has been imputed according to Christelis et al. (2011)



ability (numeracy) of each spouse. This indicator measures the ability to perform basic numerical operations, which, in turn, affects how people make investment and saving decisions. SHARE respondents are asked to perform the following calculations: *i*) find 10 percent of a number; *ii*) find one half of a number; *iii*) find two thirds of a number; *iv*) calculate a simple interest rate. Each of the questions is asked in a specific economic or financial context. On the basis of these four questions, following Dewey & Prince (2005), I construct a numeracy indicator, which ranges from 1 to 5.<sup>39</sup>

Descriptive statistics are presented in Table 1.

Table 1. Summary statistics

Variable	No assets in t-1				Assets in t-1				Mean Diff	p-value
	Mean	Std.dev.	Min	Max	Mean	Std.dev.	Min	Max		
Assets in t%	12.82	0.33	0	1	71.41	0.45	0	1	-58.6	0.000
Husband's Depr in t-1	1.68	1.88	0	11	1.42	1.55	0	9	0.26	0.000
Wife's Depr in t-1	2.49	2.27	0	11	2.11	1.91	0	12	0.38	0.000
Ln(Income) in t	10.15	1.12	2.95	13.55	11.28	1.16	5.40	14.86	-1.13	0.000
Ln(Net Worth) in t-1	11.74	1.98	0	17.25	13.34	1.28	7.62	18.14	-1.60	0.000
Husband's Cogn Abil in t	3.49	1.11	1	5	3.99	0.99	1	5	-0.50	0.000
Wife's Cogn Abil in t	3.21	1.11	1	5	3.65	1.03	1	5	-0.45	0.000
Retirement %										
Husband Retired	66.75	0.47	0	1	61.29	0.49	0	1	5.46	0.000
Wife Retired	37.73	0.48	0	1	43.05	0.50	0	1	-5.32	0.001
Husband's Age	66.37	9.08	41	98	65.23	8.63	45	95	1.14	0.000
Wife's Age	62.86	9.34	33	91	62.42	8.55	37	89	0.44	0.132
Children	2.33	1.32	0	12	2.24	1.16	0	9	0.09	0.020
Education %										
Husband's No Education	5.05	0.22	0	1	0.80	0.09	0	1	4.25	0.000
Husband's Primary	29.82	0.46	0	1	16.14	0.37	0	1	13.68	0.000
Husband's Lower second	16.52	0.37	0	1	14.25	0.35	0	1	2.27	0.056
Husband's Upper second	32.19	0.47	0	1	33.14	0.47	0	1	-0.95	0.532
Husband's Tertiary	16.42	0.37	0	1	35.67	0.48	0	1	-19.25	0.000
Wife's No Education	6.40	0.24	0	1	1.88	0.14	0	1	4.52	0.000
Wife's Primary	32.39	0.47	0	1	15.56	0.36	0	1	16.83	0.000
Wife's Lower secondary	20.98	0.41	0	1	20.33	0.40	0	1	0.65	0.625
Wife's Upper secondary	28.17	0.45	0	1	33.80	0.47	0	1	-5.63	0.000
Wife's Tertiary	12.07	0.33	0	1	28.43	0.45	0	1	-16.36	0.000
N			3032				1382			

The mean probability of holding assets in  $t$  is higher for those holding assets in  $t - 1$ . The means of depression symptoms of both spouses in  $t - 1$  are higher for those not owning assets in  $t - 1$ . The second subgroup (those who possessed assets in  $t - 1$ ) is slightly younger, wealthier than the first subgroup (those who did not possess assets in  $t - 1$ ), the larger proportion of its husbands and wives have upper secondary and tertiary education. Cognitive abilities of both spouses are also higher for the second subgroup. I also calculate the transition matrix for risky asset possessing between  $t - 1$  and  $t$  to ensure that I have sufficient transitions from holding to not holding assets and vice versa (see Table A1 in the Appendix).

<sup>39</sup>If a person answers (*i*) correctly she is then asked (*iii*) and if she answers correctly again she is asked (*iv*). Answering (*i*) correctly results in a score of 3, answering (*iii*) correctly but not (*iv*) results in a score of 4 while answering (*iv*) correctly results in a score of 5. On the other hand if she answers (*i*) incorrectly she is directed to (*ii*). If she answers (*ii*) correctly she gets a score of 2 while if she answers (*ii*) incorrectly she gets a score of 1.

## 2.3 Depression and perception

### 2.3.1 Motivation

Economic consequences of heterogeneous perception of the reality involve differences in risk-attitudes, beliefs and expectations about the future. The way people form perceptions is extremely important to understand the individuals' decision making. Perception is a cognitive process that organizes the interpretation of the reality. People's behavior is based on their perception of what reality is, not on reality itself. Our personality, past experiences, background and attitudes influence how I understand ourselves and those around us. Differences in perception explain why two people can see the same thing but interpret it differently. Stock traders disagree about expected profits of different financial assets, investors about the rates of return, real estate brokers about the value of houses in the future. When a person considers an event as being very likely, another may perceive the same event as being unlikely.

Heterogeneity of perception might be state dependent. There may be a structural bias in the perception through one's own circumstances, which could involve mental health status. Some descriptive evidences (Smoski et al., 2008) highlighted that people who experience depression show bias in terms of information processing, and evaluate the potential outcomes in a more pessimistic way compared to the non-depressed. Kirk et al. (2000) also noted that people who had previously experienced depression avoid taking risks in professional life or personal relationships for fear of being unable to meet those demands.<sup>40</sup> According to Beck's (1967) cognitive theory of depression, it consists of a cognitive triad: negative view of self, of the world, and of the future. Hence it might be the case that depressed individuals perceive reality as more pessimistic which could have an impact on their economic behavior.

Let us consider a situation when a person is asked: "Overall in the last 30 days, how much of a problem did you have with feeling sad, low, or depressed?" with response categories "none", "mild", "moderate", "severe", and "extreme". She is then provided with some examples of persons who suffer serious and less serious depression problems, and asked to evaluate the health of these persons, assuming that they have the same age and background as she has.

The hypothetical situations are:

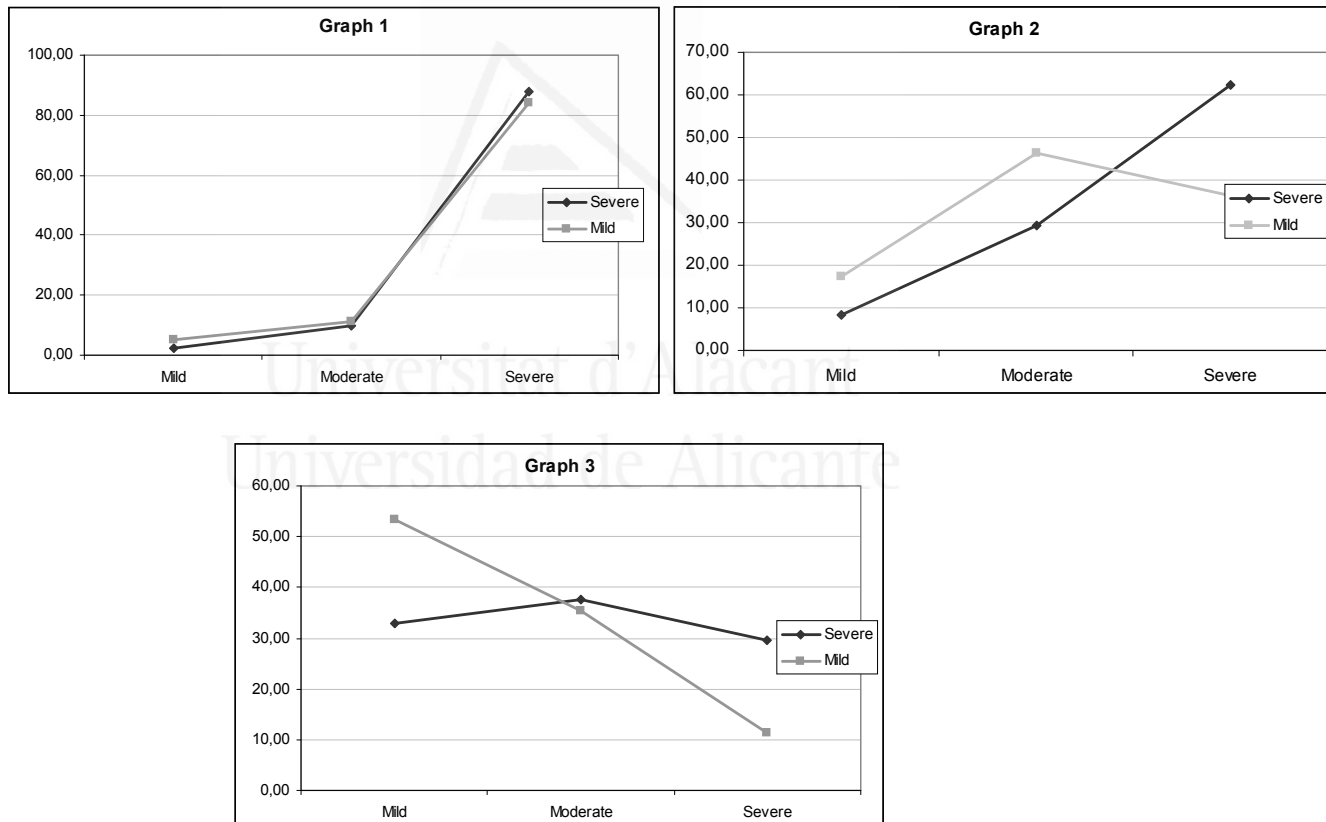
1. An individual A feels depressed most of the time. She weeps frequently and feels hopeless about the future. She feels that she has become a burden on others and that she would be better dead. Overall in the last 30 days, how much of a problem did an individual A have with feeling sad, low, or depressed?
2. An individual B feels nervous and anxious. She worries and thinks negatively about the future, but feels better in the company of people or when doing something that really interests her. When she is alone she tends to feel useless and empty. Overall in the last 30 days, how much of a problem did an individual B have with feeling sad, low, or depressed?

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<sup>40</sup>The other experiences of depression involve feeling more loss of energy, being a burden on others, need to hide depression symptoms, strength drawn from depression, need to maintain a balance in life, fear of relationships, fear of taking risks, fear of recurrence of depression, and sense of stigma (Coyne et al. 1998).

3. An individual C enjoys her work and social activities and is generally satisfied with her life. She gets depressed every 3 weeks for a day or two and loses interest in what she usually enjoys but is able to carry on with her day-today activities. Overall in the last 30 days, how much of a problem did an individual C have with feeling sad, low, or depressed?

Would her answers about feeling depressed of these hypothetical individuals depend on her own suffering depression? I arrange responders into three groups according to their self-reports: people with mild (answer "none" or "mild" in self-reported depression question), moderate (answer "moderate") and severe (answer "severe" or "extreme") self-reported depression. Similarly I organize their responses about hypothetical individuals' depression. Graphs 1, 2, and 3 present the answers to corresponding questions that are grouped by individuals' self-reported suffering depression. These graphs report the percentage of people who placed the hypothetical individual into one of three categories ("mild", "moderate", and "severe"). The grey curve corresponds to people who in their self-reports say that suffer "mild" problems, while black curve represents the "severe" self-reported group.



I observe that there are differences in evaluation of the others' depression based on own suffering depression, in particular people who report suffering severe or extreme depression evaluate others' depression problems as more severe compared to people who report suffering mild or no depression. E.g. in the graph 3, people from the 'severe' self-reported group report that the described depression problem is severe about 3 times more frequently than people from the 'mild' self-reported group, i.e. they are likely to report a problem where it should not be any. The evidences I have considered so

far are descriptive, and can be attributed either to differences in perception (depressed individuals perceive described problems in a more pessimistic way) or merely to differences in reporting behavior. These issues shall be addressed below.

### 2.3.2 Empirical specification

In order to analyze whether individuals perceive things differently when they are depressed, I use an approach based on vignettes (Bago d’Uva et al., 2011b). Since the health states described in vignettes are the same for all individuals, the systematic association between being depressed and vignette ratings can be attributed to differential perception of a given state of health.

Let us consider a particular vignette which represents a latent health level  $H_i^*$ . I allow the perceived health,  $H_i$  (measured on 5-level ordinal scale, with higher values for worse state) to depend on suffering symptoms of depression ( $D_i$ ) and other personal characteristics ( $X_i$ ).  $D_i$  is measured by EURO-D depression scale as described in Section 2.

$$H_i = \alpha_0 + \alpha_1 D_i + \alpha_2 X_i' + \epsilon_i \quad (2)$$

If individuals’ perception of described health does not depend on suffering depression,  $\alpha_1$  should be zero. While  $\alpha_1$  different from zero left the model unidentified, as it might be the case, that the response scale of depressed individuals is different from that of not depressed. That is, depressed and non-depressed individuals may perceive  $H_i^*$  in the same way, however the first group call it ‘severe’, while the other group call it ‘mild’. Hence with only one vignette question I can not identify whether observed difference in the rating is due to differences in perception or to differences in the reporting thresholds.

However, when at least two vignettes describing different states within the depression domain are available, I can identify the effect of suffering depression on  $H_i^*$ . Thus, I estimate

$$H_{i1}^* = \alpha_0^1 + \alpha_1^1 D_i + \alpha_2^1 X_i' + \nu_i^1 \quad (3)$$

and

$$H_{i2}^* = \alpha_0^2 + \alpha_1^2 D_i + \alpha_2^2 X_i' + \nu_i^2 \quad (4)$$

A necessary condition of no difference in perception of health between depressed and non-depressed is  $\alpha_1^1 = \alpha_1^2$ , while  $\alpha_1^1 = \alpha_1^2 \neq 0$  indicates that there is a difference in reporting behavior, but not in perception of the health status, and  $\alpha_1^1 \neq \alpha_1^2$  indicates that there is a difference in perception of health status described by a vignette.<sup>41</sup> In particular

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<sup>41</sup>This is equivalent to say that I test the ‘vignettes’ equivalence’ assumption (the perceived difference between the levels of health represented by vignettes does not vary systematically across individuals (Bago d’Uva et al., 2011b; King et al., 2004). The alternative is that the cut-points are also affected by depression, i.e. ‘severe’ or ‘mild’ does not mean the same for people who suffers depression and who does not. This is the standard approach for which scholars use vignettes’ method. However if the vignettes’ equivalence assumption fails I can not test it explicitly. Indeed, rejecting vignettes’ equivalence assumption is sufficient to conclude that individuals who suffer depression perceive described health differently.

if  $\alpha_1^1 \neq \alpha_1^2$ ,  $\alpha_1^j > 0$  indicates that depressed people perceive one's problems as more severe compared to non-depressed people.

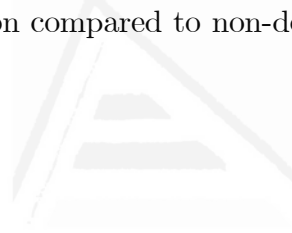
The dataset I use in this paper has three vignettes describing different states within the depression domain. I use dummies for each vignette  $V_i^1$ ,  $V_i^2$ , and  $V_i^3$  and consider the model:

$$H_{ji}^* = \alpha_0^1 V_i^1 + \alpha_0^2 V_i^2 + \alpha_0^3 V_i^3 + \alpha_1^1 V_i^1 D_i + \alpha_1^2 V_i^2 D_i + \alpha_1^3 V_i^3 D_i + \alpha_2 X_i' + \nu_i^j \quad (5)$$

Where  $H_{ji}^*$  with  $j = 1, 2, 3$  are perceived depression of each of the three vignettes,  $V_i^j D_i$  are the interactions of the vignettes' dummies and suffering depression. Since vignettes' answers are on an ordinal scale, I estimate an ordinal probit model, and omit  $\alpha_0^1 V_i^1$ . I test  $\alpha_1^1 = \alpha_1^2 = \alpha_1^3$ . If I reject this hypothesis, I conclude that there is a difference in perception due to suffering depression. While if I can not reject it, but I reject  $\alpha_1^1 = \alpha_1^2 = \alpha_1^3 = 0$ , then depressed people have just different reporting behavior.

### 2.3.3 Results

If depressed individuals perceive described health state differently compared to non-depressed, and this difference varies across the three vignettes, I conclude that depressed people have a distorted perception compared to non-depressed. I estimated (5) and presented the results in Table 2.



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Table 2. Perception of depression

Variable	Coeff
Vignette 2	-1,28008*** (0,03255)
Vignette 3	-2,10210*** (0,04610)
Vignette 1 * Depression ( $\alpha_1^1$ )	0,00417 (0,01017)
Vignette 2 * Depression ( $\alpha_1^2$ )	0,03443*** (0,00781)
Vignette 3 * Depression ( $\alpha_1^3$ )	0,03887*** (0,00855)
Log(Income)	-0,03609** (0,01812)
Log(Net wealth)	0,01514* (0,00896)
Cognitive ability	0,04907*** (0,01503)
Age	-0,02066 (0,01765)
Age2	0,00011 (0,00014)
Male	0,02672 (0,02519)
Married	0,02699 (0,04971)
Children	0,00695 (0,01278)
Primary	-0,03042 (0,06767)
Lower secondary	-0,01721 (0,07098)
Upper secondary	-0,00694 (0,07039)
Tertiary	0,05902 (0,07438)
Cut1	-3,92750*** (0,60492)
Cut2	-2,71309*** (0,60224)
Cut3	-1,60290*** (0,60100)
Cut4	-0,38251 (0,59908)
N	10,983

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The equation includes countries' dummies

The main variables of interest are the coefficients of the interactions of the level of depression with vignettes dummies ( $\alpha_1^1$ ,  $\alpha_1^2$ ,  $\alpha_1^3$ ). They are not the same, suggesting that people suffering depression differ in their interpretation of health status described by vignettes. I reject  $\alpha_1^1 = \alpha_1^2 = \alpha_1^3$  (p-value is almost 0). The positive signs of  $\alpha_1^i$  suggest that people who themselves suffer depression perceive other people as having more severe problems compared to people who themselves do not suffer depression. As more symptoms of depression an individual has, more severe the vignettes' problems seem to

her. If I consider the described health problems as some objective reality, then individuals perceive this reality in a more pessimistic way when they are depressed. Which impact could it have on the economic behavior? I shall consider situations where individuals' attitudes toward reality matter for economic choices, e.g. the decision to participate in the financial market. As I explained in Section 1, depressed people might have more pessimistic expectations regarding future rewards or become more risk averse, which are likely connected to the decision of investing in the risky assets and could translate into less willingness to acquire stocks or shares.<sup>42</sup> Another consideration is that suffering depression may likewise lead them to become passive on the financial market. To disentangle which of two channels is more important I consider sub-samples of people who do and do not hold risky assets at some point in time, and look at the probability of holding assets in the future.

## 2.4 Depression and holding of risky assets

As suffering depression affects individual's perception of reality, which might be associated with some determinants of financial asset holding, depression may also affect the decision to acquire risky financial assets. Suppose there is an unobservable and continuous latent variable,  $A_{i,t}^*$ , that reflects the willingness to hold risky financial assets, such as stocks or shares.<sup>43</sup> Suppose also there is an unobservable index of couple's depression,  $D_{i,t}^*$ . To minimize the possibility of reverse causality, as negative experience of asset holding might also affect depression, I use this index lagged one period.<sup>44</sup>

$$A_{i,t}^* = \beta_0 + \beta_1 D_{i,t-1}^* + \beta_2 X'_{i,t} + \varepsilon_{i,t} \quad (6)$$

Where  $X'_{i,t}$  are some household control variables. I am interested in the sign of  $\beta_1$ . One may expect  $\beta_1 < 0$ , which means that the household has lower willingness to hold stocks or shares if its members suffer depression. However with this specification I am not able to identify via which channel suffering depression could influence asset holding. Observing a negative sign for  $\beta_1$  might indicate that households whose members suffer depression are more risk averse, but it might also indicate that they are not concerned about their financial portfolio. In both cases depressed households will be less willing to buy risky assets and therefore, no matter whether they became more risk averse or just passive, their willingness to hold assets will be smaller. In order to disentangle which of the two channels, risk aversion or passivity, is more influential I am going to consider the decision of buying and selling assets separately. In the case of buying both channels suggest a negative sign: if being depressed increases one's risk aversion, people are less likely to buy assets, likewise if they become passive due to depression. But, signs would be different in the case of selling: people would be more likely to sell assets when risk aversion increases (a negative sign), while if they become passive they are not concern

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<sup>42</sup>When people are clinically depressed, they hold a pessimistic view of the future and unrealistic expectations. Depression is associated with behavioral avoidance of potentially rewarding environmental contexts (Smoski et al. 2009). Depressed individuals' predictions of the likelihood of future outcomes are more pessimistic than those of non-depressed individuals given identical information and identical conditions for forecasting (Alloy et al. 1987).

<sup>43</sup>Henceforth under the name of financial assets we mean stock and shares.

<sup>44</sup>However if depression was affected by some factors prior to  $t - 1$ , which could influence holding of risky assets throughout the entire period, this would not be captured in the model.

about any actions with their assets compared to non depressed people who may or may not sell them, hence the sign should be non negative. It is important to distinguish between these two channels, as they are fundamentally different, and have different consequences for the financial markets.

I consider two sub-samples. The first is comprised of households who did not hold assets at time  $t - 1$ , and the second of those who held assets at  $t - 1$ . The problem might arise when the unobservables (to the econometrician) of the initial condition of asset holding in  $t - 1$  are correlated with the unobservables of asset holding in  $t$ , causing current asset holding to be endogenous with respect to holding assets in  $t - 1$ . In the literature this problem could be solved by allowing errors between the conditional and conditioning risky asset holding to be correlated (Lokshin and Glinskaya, 2009; Aakvik et al., 2004; Cappellari, 2002; Carrasco, 2001). I implement this strategy utilizing a bivariate probit model with endogenous switching.<sup>45</sup>

Consider the following model, which describes willingness to possess risky financial assets in  $t$  under two regimes: having or not them in  $t - 1$ . Consider also a latent variable  $A_{i,t-1}^*$  that determines whether a household hold risky assets in  $t - 1$ :

$$\text{No assets in } t - 1 : A_{i0,t}^* = \beta_0^0 + \beta_1^0 D_{i,t-1}^* + \beta_2^0 X'_{i,t} + \varepsilon_{i0,t} \quad (7)$$

$$\text{Some assets in } t - 1 : A_{i1,t}^* = \beta_0^1 + \beta_1^1 D_{i,t-1}^* + \beta_2^1 X'_{i,t} + \varepsilon_{i1,t} \quad (8)$$

$$A_{i,t-1}^* = \gamma Z'_{i,t-1} + u_{i,t-1} \quad (9)$$

Here,  $A_{i0,t}^*$  and  $A_{i1,t}^*$  are the continuous latent variables,  $D_{i,t-1}$  is the depression index,  $X'_{i,t}$  is a vector of household characteristics that is thought to influence holding assets in  $t$ , and  $\beta_k^j$  and  $\gamma$  are vectors of parameters.  $Z'_i$  is a vector of characteristics that influences the decision regarding holding assets in  $t - 1$ .

The observed dichotomous realization  $A_{ij,t}$  of a latent variable  $A_{ij,t}^*$  of whether the household  $i$  possesses risky assets in  $t$  has the following form:

$$A_{ij,t} = I [A_{ij,t}^* \geq 0] = I [\beta_0^j + \beta_1^j D_{i,t-1}^* + \beta_2^j X'_{i,t} + \varepsilon_{ij,t} \geq 0], \quad j = 0, 1 \quad (10)$$

The observed dichotomous realization  $A_{i,t-1}$  of a latent variable  $A_{i,t-1}^*$  of whether the household  $i$  had risky assets in  $t - 1$  has the following form:

$$A_{i,t-1} = I [A_{i,t-1}^* \geq 0] = I [\gamma Z'_{i,t-1} + u_{i,t-1} \geq 0] \quad (11)$$

Where  $I[\cdot]$  is the indicator function. Error terms  $u_i$ ,  $\varepsilon_{i0}$  and  $\varepsilon_{i1}$  are assumed to be jointly normally distributed, with zero-mean vector and correlation matrix:

$$\Omega = \begin{bmatrix} 1 & \rho_{u0} & \rho_{u1} \\ & 1 & \rho_{01} \\ & & 1 \end{bmatrix}$$

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<sup>45</sup>Endogenous switching equations models for continuous variables are set out in Lee (1978). See Maddala (1983) for a comprehensive survey of this model.



where  $\rho_{u0}$  and  $\rho_{u1}$  are the correlations between  $u_i$  and  $\varepsilon_{i0}$ , and  $u_i$  and  $\varepsilon_{i1}$  respectively. The correlation between  $\varepsilon_{i0}$  and  $\varepsilon_{i1}$  is  $\rho_{01}$ . Since  $A_{i0}$  and  $A_{i1}$  are never observed simultaneously, the joint distribution of  $(\varepsilon_{i0}, \varepsilon_{i1})$  is not identified, and consequently  $\rho_{01}$  cannot be estimated. The model is identified through the functional form by nonlinearities even if the variables in  $X'_i$  and  $Z'_i$  overlap completely. To make estimates more robust to alternative functional assumptions, stronger identification restriction is imposed on the model. As an exclusion restriction, I include variables that are believed to influence holding of risky assets in  $t - 1$ , but which do not directly affect holding assets in  $t$ , such as income in  $t - 1$ , which will not affect asset holding in  $t$  once income in  $t$  and net wealth in  $t - 1$  are taken into account. Given the assumption with respect to the distribution of the disturbance terms, the logarithmic likelihood function for the system of (4 – 5) is:

$$\begin{aligned} \ln L = & \sum_{A_i=1, I_i=1} \ln \{ \Phi(\beta_0^1 + \beta_1^1 D_{i,t-1}^* + \beta_2^1 X'_{i,t}, \gamma Z'_{i,t-1}, \rho_{u1}) \} \\ & + \sum_{A_i=0, I_i=1} \ln \{ \Phi(-\beta_0^1 - \beta_1^1 D_{i,t-1}^* - \beta_2^1 X'_{i,t}, \gamma Z'_{i,t-1}, -\rho_{u1}) \} \\ & + \sum_{A_i=1, I_i=0} \ln \{ \Phi(\beta_0^0 + \beta_1^0 D_{i,t-1}^* + \beta_2^0 X'_{i,t}, -\gamma Z'_{i,t-1}, -\rho_{u1}) \} \\ & + \sum_{A_i=0, I_i=0} \ln \{ \Phi(-\beta_0^0 - \beta_1^0 D_{i,t-1}^* - \beta_2^0 X'_{i,t}, -\gamma Z'_{i,t-1}, \rho_{u0}) \} \end{aligned}$$

Where  $\Phi$  is the cumulative function of a bivariate normal distribution. I test whether correlation coefficients  $\rho_{u0}$  and  $\rho_{u1}$  are significant.

I am interested in the parameter  $\beta_1^j$ . For the sub-group of those who did not hold risky assets in  $t - 1$ , the sign of  $\beta_1^0$  is not informative, as for this group both channels predict a negative effect of depression on the probability of holding assets in  $t$ : if depression involves either passivity (Kahneman et al. 1999) or rises risk aversion (Smoski et al. 2009), people are less likely to buy assets. However I am able to identify the underlying relationship between depression and risky asset holdings using the sub-group of those who had assets in  $t - 1$ ,  $\beta_1^1$ . For this group, if the first channel dominates, one expects  $\beta_1^1$  to be non negative in  $t$ : depressed individuals will stand aside and do nothing about their assets compared to non-depressed who may or may not sell their assets. While if the second channel dominates, individuals suffering depression becomes more risk averse therefore more willing to sell their assets, thus one expects  $\beta_1^1 < 0$ . Therefore, I conjecture that if  $\beta_1^1 < 0$  for the sub-group of people having assets in  $t - 1$ , risk aversion is a channel through which depression affects risky asset holdings in  $t$ , while if  $\beta_1^1 \geq 0$ , then depression leads to passivity about risky asset holdings.<sup>46</sup>

## 2.5 Results

One of the main goals is to show whether suffering depression has an impact on the willingness to participate in risky financial assets. As it is difficult to say how spouses'

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<sup>46</sup>The other concern is that in the case of couples, I should consider estimated coefficients of both spouses simultaneously, since a bargaining process underlying purchase or selling of risky assets usually takes place. I would address this issue further in Section 2.5.

depression levels are combined into one household depression index, I proxy  $D_{i,t-1}^*$  with a linear combination of the husband's and wife's depression indexes,  $HD_{i,t-1}$  and  $WD_{i,t-1}$  respectively. With this approach I allow for the different effects of each spouse's depression on the probability of household buying and selling of risky assets.<sup>47</sup> Thus, I estimate:

$$A_{ij,t} = \beta_0^j + \beta_{1H}^j HD_{i,t-1} + \beta_{1W}^j WD_{i,t-1} + \beta_2^j X'_{i,t} + \varepsilon_{ij,t}, \quad j = 0, 1 \quad (12)$$

and

$$A_{i,t-1} = \gamma Z'_{i,t-1} + u_{i,t-1} \quad (13)$$

The results are summarized in Table 3.

The first three columns correspond to the probability of owning assets in  $t$  conditional on not having them in  $t$ . The next three columns correspond to the probability of owning assets in  $t$  conditional on having them in  $t - 1$ . As it has been discussed in Section 4, unobservables of the initial asset holdings in  $t - 1$  might be correlated with unobservables of asset holdings in  $t$ , causing current asset holdings to be endogenous with respect to holding assets in  $t - 1$ . In order to ensure that estimating of asset holdings in  $t$  conditional on having them or not in  $t - 1$  did not affect the results, I allow the error terms between the conditional and conditioning risky asset holding to be correlated, and estimate the model using the Endogenous Switching probit model ((1) and (4)). I compare its estimated coefficients with those from the standard probit model in (2) and (5), and conclude that both results are very similar. Furthermore, the correlation coefficients  $\rho_{u0}$  and  $\rho_{u1}$  are not significant, suggesting that unobservables of asset holdings in  $t - 1$  are not correlated with unobservables of asset holdings in  $t$ , hence I may rely on the convenient probit model, and its marginal effects in (3) and (6).

When the household wife experienced one more depression symptom in  $t - 1$ , the probability of household's holding assets in  $t$  conditional on not having them in  $t - 1$  decreases by 0.54 pp. The coefficient of the husband is positive however is not significant and much smaller in magnitude than that of his spouse. Hence I conclude that the wife's depression is a significant determinant of household probability of buying assets when they did not have any. When I turn to the probability of household holding assets in  $t$  conditional on having them in  $t - 1$ , it looks that the husband's depression determine whether the household maintain risky assets. More precisely, when the husband reports one more depression symptom in  $t - 1$ , the probability of selling the asset in  $t$  increases by 1.7 pp. The sign of the effect of the husband's depression is negative which according to the identification means that risk aversion could be the explanation for the lower probability of risky asset holding.

The results above suggest that households whose members suffer depression in general are less likely to hold the risky financial assets. In particular, when the household wife reports one more depression symptom it decreases the probability to acquire risky assets when the household had none. While, when the husband reports one more depression symptom, it decreases the probability of maintaining risky assets. A plausible explanation

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<sup>47</sup>I do not run separate regressions for two partners, because I am interested in the simultaneous effects of each spouse's depression on the risky asset holding decision.

Table 3. Holding of risky assets

	No assets in t-1			Assets in t-1		
	(1) Switching Probit Coefficients	(2) Probit Coefficients	(3) Probit Marginal Effects	(4) Switching Probit Coefficients	(5) Probit Coefficients	(6) Probit Marginal Effects
Husband's Depression in t-1	0,01106 (0,01892)	0,01081 (0,01898)	0,00157 (0,00276)	-0,05075** (0,02448)	-0,05335** (0,02533)	-0,01720** (0,00816)
Wife's Depression in t-1	-0,03684** (0,01622)	-0,03684** (0,01623)	-0,00536** (0,00240)	0,01839 (0,02004)	0,01995 (0,02091)	0,00643 (0,00674)
Ln(Income) in t	0,07476* (0,04057)	0,07160* (0,03994)	0,01042* (0,00582)	0,20644*** (0,07199)	0,17584** (0,07260)	0,05670** (0,02346)
Ln(Net Worth) in t-1	0,18394*** (0,02609)	0,18286** (0,02608)	0,02662*** (0,00356)	0,15725*** (0,03783)	0,15645*** (0,03899)	0,05045*** (0,01252)
Husband's Cognitive Ability in t	0,05696* (0,03320)	0,05485* (0,03323)	0,00799* (0,00483)	0,03311 (0,04112)	0,02420 (0,04279)	0,00780 (0,01381)
Wife's Cognitive Ability in t	-0,04974 (0,03303)	-0,05262 (0,03314)	-0,00766 (0,00482)	-0,02080 (0,03927)	-0,03172 (0,03992)	-0,01023 (0,01287)
Husband's Age	0,10625 (0,06478)	0,10419 (0,06472)	0,01517 (0,00944)	0,02729 (0,07796)	0,01300 (0,07906)	0,00419 (0,02549)
Wife's Age	-0,08184 (0,05027)	-0,08409* (0,04990)	-0,01224* (0,00735)	0,12132* (0,07134)	0,11782 (0,07262)	0,03799 (0,02343)
Children	-0,00812 (0,02451)	-0,00529 (0,02409)	-0,00077 (0,00351)	0,00593 (0,03439)	0,02065 (0,03470)	0,00666 (0,01119)
Husband's Primary	0,22459 (0,26294)	0,21345 (0,26374)	0,03306 (0,04316)	0,09748 (0,39022)	0,01875 (0,40482)	0,00602 (0,12945)
Husband's Lower secondary	0,31677 (0,27216)	0,29956 (0,27312)	0,05018 (0,05170)	0,32959 (0,39830)	0,22531 (0,41203)	0,06864 (0,11791)
Husband's Upper secondary	0,54389** (0,26485)	0,52496** (0,26539)	0,08765* (0,04976)	0,30124 (0,39411)	0,18831 (0,40557)	0,05940 (0,12496)
Husband's Tertiary	0,68069** (0,27695)	0,64372** (0,27538)	0,12537* (0,06714)	0,43521 (0,40863)	0,24526 (0,41046)	0,07714 (0,12564)
Wife's Primary	0,26340 (0,21116)	0,26138 (0,21102)	0,04069 (0,03477)	0,21103 (0,26524)	0,21286 (0,27543)	0,06520 (0,07976)
Wife's Lower secondary	0,26180 (0,21986)	0,25280 (0,21895)	0,04083 (0,03868)	0,28773 (0,26662)	0,25680 (0,27569)	0,07846 (0,07938)
Wife's Upper secondary	0,30135 (0,22032)	0,28766 (0,21826)	0,04583 (0,03757)	0,32168 (0,26523)	0,26674 (0,27315)	0,08341 (0,08260)
Wife's Tertiary	0,32469 (0,23689)	0,30387 (0,23254)	0,05190 (0,04552)	0,30130 (0,27471)	0,22505 (0,28062)	0,07015 (0,08432)
$\rho$	0,02129 (0,10724)			0,29537 (0,15621)		
N	3032	3032	3032	1382	1382	1382

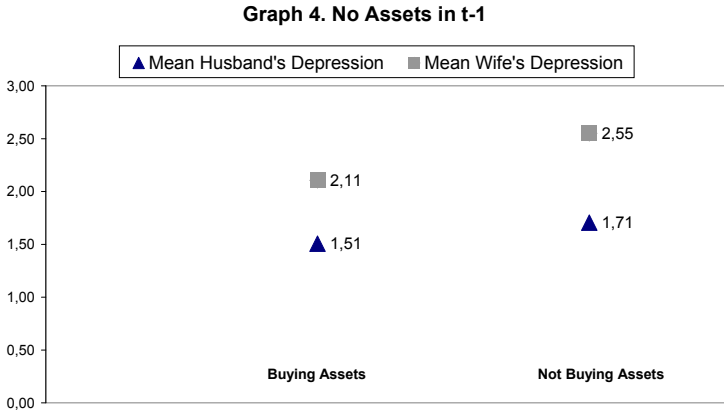
Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. All regression equations are estimated with robust standard errors and include countries' dummies.

for this asymmetry could involve differences in men’s and women’s risk aversion, a stylized fact acknowledged in the literature (Neelakantan, 2010; Barber & Odean, 2001; Lott & Kenny, 1999; Sunden & Surette, 1998; Jianakopulos & Bernasek, 1998; Barsky, Juster, Kimball, and Shapiro, 1997).

Since couples pool their assets to a significant degree, they should coordinate the investment decision as well. On the other hand, if depression influences this decision via the risk aversion channel, then a difference between spouses’ risk aversion should be considered. On average, women exhibit relatively more risk aversion in financial decision making than men. In particular, women are less likely to invest in risky assets and hold smaller portfolio shares in the risky assets (Bajtelsmit & Bernasek, 1996; Sunden & Surette, 1998). Keeping other factors constant, I consider that the husband’s and wife’s risk aversion (define respectively  $\gamma^h$  and  $\gamma^w$ , with  $\gamma^h < \gamma^w$ ) would determine their willingness to hold assets. I also define a threshold value  $\bar{\gamma}$ , below which individuals want to possess risky assets. Suppose that, in order to make a decision, a couple should reach an agreement. If a couple does not have any risky assets, they should agree to buy it, otherwise they continue not to have it. While when they have an asset, they should agree to sell it, otherwise they continue having it. Suppose also that in order to buy or to sell, risk aversion of both should be either below or above  $\bar{\gamma}$ .

First, I consider the situation when two household members decide whether to buy or not a risky financial asset. The baseline is not having any risky asset. In order to buy it, household risk aversion should decrease. Consider there is a positive shock that affects risk aversion of either spouse in such a way that risk aversion decreases. Because the wife’s background risk aversion is higher than the husband’s, on average she would be less willing to buy the asset (on average  $\gamma^w$  would be above  $\bar{\gamma}$ , while  $\gamma^h$  might be below  $\bar{\gamma}$ ). If the shock affects  $\gamma^w$ , such that it approaches  $\bar{\gamma}$ , the household decides to buy the risky asset, while if the shock affects  $\gamma^h$ , as  $\gamma^h < \gamma^w$ , it will not affect the buying decision. Therefore, changes in risk aversion of a wife (which to some extent are driven by depression) would determine whether the household buys the risky asset or not.

In order to provide descriptive evidences for this explanation, I plot on Graph 4 the unconditional means of depression of the husband and wife when they buy and do not buy risky assets in  $t$ , conditional they did not have them in  $t - 1$ :

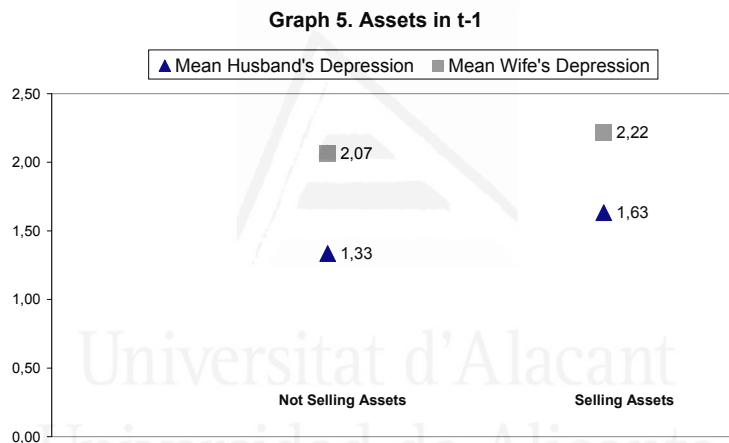


On Graph 4, the means of depression for the households who decide to buy assets in  $t$  are smaller in magnitudes compared to the means of those who decide not to buy assets,

suggesting that these households' risk aversion has decreased. The difference in means of wives is twice that of their husbands (0.45 vs. 0.20), suggesting that risk aversion of wives decreased in order to buy assets.

I next I consider the situation, when the household has a risky asset in  $t - 1$ , and decides whether to sell it or not. The baseline state is not selling the asset. In order to sell the asset, household risk aversion should increase. Consider there is a negative shock such that it increases risk aversion. Because the husband's background risk aversion is lower than the wife's, on average he would be less willing to sell the asset (on average  $\gamma^h$  would be below  $\bar{\gamma}$ , while  $\gamma^w$  could be above  $\bar{\gamma}$ ). If the shock affects  $\gamma^h$ , such that it crosses  $\bar{\gamma}$ , the household decides to sell risky assets, while if the shock affects  $\gamma^w$ , as  $\gamma^h < \gamma^w$ , it will not affect selling decision, as  $\gamma^w$  is already above  $\bar{\gamma}$ . Therefore, now changes in risk aversion of the husband (which to some extent are driven by depression) would determine whether the household sells the risky asset or not.

In order to provide descriptive evidences for this explanation, I plot on Graph 5 the unconditional means of the husband's and wife's depression when they sell and do not sell risky assets in  $t$ , conditional they had it  $t - 1$ :



On Graph 5, the means of depression for the households who decide to sell assets in  $t$  are larger in magnitudes compared to the means of those who decide not to sell assets, suggesting that these households' risk aversion has increased. The difference in means of husbands is twice that of their wives (0.30 vs. 0.15), suggesting that risk aversion of husbands increases in order to sell assets.

To summarize, I consider the following household decision rule:

$$\begin{cases} (A_{i,t} = 1 \mid A_{i,t-1} = 0) & \text{if } \max(\gamma^h, \gamma^w) \leq \bar{\gamma} \\ (A_{i,t} = 0 \mid A_{i,t-1} = 1) & \text{if } \min(\gamma^h, \gamma^w) > \bar{\gamma} \end{cases}$$

Where  $(A_{i,t} = 1 \mid A_{i,t-1} = 0)$  is decision of buying,  $(A_{i,t} = 0 \mid A_{i,t-1} = 1)$  is decision to sell. This rule ensures that both spouses agree on the decision: in the case of buying the degrees of risk aversion of both are on or below the threshold, in the case of selling both are above the threshold. In the first situation, the change in risk aversion of the wife will determine whether the household buys the asset, while in the second situation, in order to sell the assets, a change in the husband's risk aversion makes a difference. For example, consider a situation when a couple decides whether or not to buy a heavy yellow

vehicle.<sup>48</sup> The wife, who is on average more risk averse, will be last to say, since she might lack confidence on the road, have doubts about affordability and garaging, or excess road pollution. So in the order for the household to buy this car, her risk preferences have to adjust. However, in the situation when they already own this vehicle, the husband most probably takes care of the car, does all technical examinations and repairs it. Hence, changes in his preferences determine whether the household sells this vehicle or not.

### 2.5.1 Differences in bargaining power

Another dimension that can help us to explain the asymmetry of results for buying and selling decisions between the wife's and husband's changes in depression is bargaining power. Scholars analyzing bargaining power in the household consumption-saving framework (Browning, 2000; Lundberg et al., 2003) suggest that when the husband loses his bargaining power, the household decisions might shift toward the wife's preferences. The problem arises because wives, who are on average younger and have longer life expectancy, prefer to save more than their husbands. Lundberg et al. (2003) found that household consumption falls after the husband retires, which one may interpret as the husband's bargaining power decreasing after his retirement. As wives are more risk averse, they might prefer to save in non risky assets. Hence I would observe that households are less willing to acquire risky assets when the wife's depression increases and the husband is retired (i.e. when the wife's risk aversion increases and she has more bargaining power). While the husband's depression would be a significant determinant of household willingness to sell assets only if he is not retired (i.e. when the husband's risk aversion increases and he has more bargaining power). To do so I include the dummies for the husband's and wife's retirement status,  $HRet_i$  and  $WRet_{i,t}$  respectively, equal 1 if s/he is retired and 0 otherwise, and interact them with each spouse's depression,  $HD_{i,t-1} * HRet_{i,t}$  and  $WD_{i,t-1} * WRet_{i,t}$ . Furthermore, I allow the impact of each spouse's depression to depend not only on whether s/he is retired, but also on whether her/his partner is retired as well. Thus, I include the interactions of each spouse's depression and her/his partner retirement status:  $HD_{i,t-1} * WRet_{i,t}$  and  $WD_{i,t-1} * HRet_{i,t}$ :

$$\begin{aligned}
A_{i0,t}^* &= \beta_0^0 + \beta_1^0 HD_{i,t-1} + \beta_2^0 WD_{i,t-1} + \beta_3^0 HRet_{i,t} + \beta_4^0 WRet_{i,t} \\
&+ \beta_5^0 [HD_{i,t-1} * HRet_{i,t}] + \beta_6^0 [WD_{i,t-1} * WRet_{i,t}] \\
&+ \beta_7^0 [HD_{i,t-1} * WRet_{i,t}] + \beta_8^0 [WD_{i,t-1} * HRet_{i,t}] + \beta_9^0 X'_{i,t} + \varepsilon_{i0} \quad (14)
\end{aligned}$$

$$\begin{aligned}
A_{i1,t}^* &= \beta_0^1 + \beta_1^1 HD_{i,t-1} + \beta_2^1 WD_{i,t-1} + \beta_3^1 HRet_{i,t} + \beta_4^1 WRet_{i,t} \\
&+ \beta_5^1 [HD_{i,t-1} * HRet_{i,t}] + \beta_6^1 [WD_{i,t-1} * WRet_{i,t}] \\
&+ \beta_7^1 [HD_{i,t-1} * WRet_{i,t}] + \beta_8^1 [WD_{i,t-1} * HRet_{i,t}] + \beta_9^1 X'_{i,t} + \varepsilon_{i1} \quad (15)
\end{aligned}$$

The results are summarized in Table 4:<sup>49</sup>

<sup>48</sup>Insurance companies rate yellow cars as having significantly higher car accident risks. From the other side, big vehicles, as vans, are safer than small cars.

<sup>49</sup>I present here only the coefficients of interest. Table A.2.2 in the Appendix contains the whole set of estimated coefficients.

Table 4. Differences in the impact of spouse's depression due to retirement

		No assets in t-1	Assets in t-1
Husband's Depression			
Husband NotRetired, Wife NotRetired	$(\beta_1^c)$	0,03949	-0,07730*
Husband NotRetired, Wife Retired	$(\beta_1^c + \beta_7^c)$	0,03609	-0,11649*
Husband Retired, Wife NotRetired	$(\beta_1^c + \beta_5^c)$	-0,00620	-0,01561
Husband Retired, Wife Retired	$(\beta_1^c + \beta_5^c + \beta_7^c)$	-0,00960	-0,05480
Wife's depression			
Husband NotRetired, Wife NotRetired	$(\beta_2^c)$	-0,01335	0,01841
Husband NotRetired, Wife Retired	$(\beta_2^c + \beta_6^c)$	0,01479	0,01021
Husband Retired, Wife NotRetired	$(\beta_2^c + \beta_8^c)$	-0,06950**	0,03002
Husband Retired, Wife Retired	$(\beta_2^c + \beta_6^c + \beta_8^c)$	-0,04136	0,02182

As before, the wife's depression is a significant determinant of whether the household buys the assets, however it is significant only when the husband is retired and she is not (hence she has more bargaining power). While the husband's depression is a significant determinant of whether the household sells the assets, when he is not retired (with larger effect when his wife is retired).

### 2.5.2 Robustness check

One concern is whether there is a selection into who is the household financial respondent. At the beginning of the interview the couple is asked the following: "Which of you would be the most able one to answer questions about your finances?" It might be the case that the spouse who suffers depression problems is less likely to be the financial respondent, in particular because s/he has lost interest in household financial activities (passivity). Likewise, s/he could be not able to participate in financial decisions anymore or take responsibility for financial operations due to mental problems and has thus been removed from financial planning (voluntary or forcibly). Briefly speaking, it might be more costly for the household (in terms of time, effort, and likelihood of wrong financial choice) that the depressed person is in charge for household finance. Therefore, if a spouse with less depression problems is more likely to be selected, his/her preferences would be acknowledged in the household decision about risky asset holding which makes the intuitive explanation about asymmetry not correct.

I analyze the possibility of this kind of selection by regressing the dummy of financial respondent (husband or wife) on the household characteristics and indexes of the husband's and wife's depression. The marginal effects are summarized in Table 5:

Table 5. Selection to be a financial respondent

	No assets in t-1	Assets in t-1
Husband's Depression in t-1	-0,00794 (0,00521)	0,00791 (0,00909)
Wife's Depression in t-1	0,00320 (0,00438)	0,00440 (0,00738)
N	3032	1382

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Regressions are probit with robust standard errors

The results suggest that neither spouse is more or less likely to be selected to answer financial questions if s/he suffers more depression symptoms. The marginal effects of depression index either of the husband or wife are not significantly different from zero. To

summarize, the selection issue does not seem to affect the findings, and I conclude that the results are robust.

## 2.6 Conclusion

This paper evaluates the impact of a possible change in individual's risk attitudes due to depression on the economic choices (e.g. willingness to invest in risky financial assets) nearing retirement. In particular, I sought to answer three questions: whether depressed people might have distorted perception, whether suffering depression has an impact on willingness to hold risky financial assets, and how spouses' depression levels are combined for the household decision to possess risky assets. For this purpose I use The Survey of Health, Ageing and Retirement in Europe (SHARE). In overall, the empirical results support the conjectured hypothesis: depressed people have differences in perception and are less likely to hold risky assets. I also conclude that risk aversion is the plausible channel for the association between depression and household risky asset holding. These findings are very important from a policy perspective. Given that many countries are considering a change of a pension system, it is of interest to know that suffering depression may affect economic decisions. As individuals who suffer depression have different perceptions about the states of the world, they may favor different investment scenario compared to those who do not suffer depression. Hence, creating effective economic incentives for this group of people could be challenging.

Concerning couples' decisions about risky asset holding, the effect of depression would depend on the combination of spouses' risk attitudes and their relative bargaining power in the household. The wife, who is on average more risk averse, would incline the household towards not buying risky assets, when she suffers greater depression symptoms and has relatively more bargaining power (the husband is retired, and she is not). While, if the household already has risky assets, the husband is more likely to be responsible for decisions about its maintenance. Hence changes in his risk attitude (which might be affected by depression) would determine whether the household sell or not the assets, when he has relatively more bargaining power (he is not retired).

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## Appendix

### A.1 EURO-D: list of symptoms

1. Depression.

Q In the last month, have you been sad or depressed?

A Yes/ No

2. Pessimism.

Q What are your hopes for the future?

A Any hopes mentioned/ No hopes mentioned

3. Suicidality

Q In the last month, have you felt that you would rather be dead?

A Any mention of suicidal feelings or wishing to be dead/ No such feelings

4. Guilty

Q Do you tend to blame yourself or feel guilty about anything?

A Obvious excessive guilt or self-blame/ No such feelings

5. Sleep

Q Have you had trouble sleeping recently?

A Trouble with sleep or recent change in pattern/ No trouble sleeping

6. Interest

Q In the last month, what is your interest in things?

A Less interest than usual mentioned/ No mention of loss of interest

7. Irritability

Q Have you been irritable recently?

A Yes/ No

8. Appetite

Q What has your appetite been like?

A Diminution in desire for food/ No diminution in desire for food

9. Fatigue

Q In the last month, have you had too little energy to do the things you wanted to do?

A Yes/ No

10. Concentration

Q How is your concentration? For example, can you concentrate on a television programme, film or radio programme?

A Difficulty in concentrating on entertainment/ No such difficulty mentioned

11. Enjoyment

Q What have you enjoyed doing recently?

A Fails to mention any enjoyable activity/ Mentions ANY enjoyment from activity

12. Tearfulness

Q In the last month, have you cried at all?

A Yes/ No

## A.2 Results

Table A.2.1 Transition Matrix

	No assets in t	Assets in t	N
No Assets in t-1	2643	389	3032
Assets in t-1	395	987	1382
N	3038	1376	4414

Table A.2.2 Holding of risky assets and retirement. Coefficients.

	No assets in t-1	Assets in t-1
Husband's Depression in t-1	0,03949 (0,03063)	-0,07730* (0,04234)
Wife's Depression in t-1	-0,01335 (0,02720)	0,01841 (0,03373)
Husband Retired	0,36872*** (0,12840)	0,21180 (0,16289)
Hus.Dep * Hus.Ret.	-0,04569 (0,04126)	0,06169 (0,05718)
Hus.Dep * Wife Ret.	-0,00339 (0,04131)	-0,03919 (0,05753)
Wife Retired	0,00436 (0,11446)	0,10897 (0,15511)
Wife Dep. * Wife Ret.	0,02814 (0,03656)	-0,00820 (0,04642)
Wife Dep. * Hus.Ret.	-0,05616 (0,03723)	0,01161 (0,04619)
Ln(Income) in t	0,06991* (0,04032)	0,17011** (0,07208)
Ln(Net Worth) in t-1	0,18620*** (0,02654)	0,15849*** (0,03908)
Husband's Cognitive Ability in t	0,05467* (0,03319)	0,02463 (0,04296)
Wife's Cognitive Ability in t	-0,05378 (0,03334)	-0,03012 (0,04051)
Husband's Age	0,06452 (0,06672)	-0,06127 (0,08449)
Husband's Age2	-0,00059 (0,00050)	0,00036 (0,00061)
Wife's Age	-0,09777** (0,04980)	0,09459 (0,07362)
Wife's Age2	0,00073* (0,00039)	-0,00077 (0,00057)
Children	-0,00089 (0,02427)	0,02815 (0,03473)
Husband's Primary	0,20431 (0,26638)	0,00467 (0,40566)
Husband's Lower secondary	0,27977 (0,27578)	0,22677 (0,41273)
Husband's Upper secondary	0,51709* (0,26728)	0,18803 (0,40587)
Husband's Tertiary	0,63297** (0,27743)	0,24361 (0,41060)
Wife's Primary	0,23619 (0,21306)	0,18026 (0,27961)
Wife's Lower secondary	0,23042 (0,22003)	0,24522 (0,27942)
Wife's Upper secondary	0,26608 (0,21916)	0,25890 (0,27652)
Wife's Tertiary	0,28436 (0,23260)	0,22662 (0,28377)
Const	-3,30584 (2,12209)	-4,75978* (2,75122)
N	3032	1382

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Countries' dummies are included. Regressions are probit with robust standard errors.

Table A.2.3 Selection to be a financial respondent

	No assets in t-1	Assets in t-1
Husband's Depression in t-1	-0,00794 (0,00521)	0,00791 (0,00909)
Wife's Depression in t-1	0,00320 (0,00438)	0,00440 (0,00738)
Ln(Income) in t	0,00509 (0,01046)	0,03108 (0,02536)
Ln(Net Worth) in t-1	0,00112 (0,00482)	0,00479 (0,01338)
Husband's Cognitive Ability in t	0,05828*** (0,00975)	0,08324*** (0,01479)
Wife's Cognitive Ability in t	-0,04873*** (0,00991)	-0,07018*** (0,01429)
Husband's Age	0,07670*** (0,01722)	0,03098 (0,02846)
Husband's Age2	-0,00054*** (0,00013)	-0,00022 (0,00021)
Wife's Age	-0,07230*** (0,01481)	-0,05643** (0,02627)
Wife's Age2	0,00055*** (0,00012)	0,00041** (0,00020)
Children	0,00684 (0,00710)	-0,00243 (0,01203)
Husband's Primary	-0,03981 (0,04918)	-0,15472 (0,16112)
Husband's Lower secondary	0,01555 (0,05368)	-0,13880 (0,16360)
Husband's Upper secondary	0,02307 (0,05245)	-0,11108 (0,15736)
Husband's Tertiary	0,08264 (0,05488)	0,02727 (0,15477)
Wife's Primary	-0,01161 (0,04460)	-0,01263 (0,10664)
Wife's Lower secondary	-0,03981 (0,04985)	-0,08014 (0,10985)
Wife's Upper secondary	-0,04193 (0,04942)	-0,13323 (0,10720)
Wife's Tertiary	-0,06874 (0,05694)	-0,18325* (0,11034)
N	3032	1382

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Countries' dummies are included.

Regressions are probit with robust standard errors

## **Chapter 3**

**The effect of mental health on the responsiveness of retirement decisions to financial incentives**



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### 3.1 Introduction

Population ageing is one of the most important policy problems in developed countries, which has raised doubts about sustainability of pension arrangements. With life expectancies increasing and the size of the pensioner population projected to grow rapidly over the next few decades, government spending on older people is forecast to rise significantly. One of the key margins on which individual behavior could adjust to reduce this cost would be for individuals to work longer (Crawford and Tetlow, 2010). A variety of factors affect individuals' attitudes to working and whether or not they choose to work at older ages. Among them are qualifications, financial resources, family circumstances, expectations about the future and, of course, health. The latter may influence directly the ability to work at older ages and also may change survival expectations and enhance disutility of work. Interestingly, an important aspect of health affecting many individuals' decision of when to retire lies in the dimension of psychological or mental health. People, who suffer mental problems, have different judgment about life circumstances and show bias in terms of information processing (Smoski et al., 2008). In particular, people who are clinically depressed, hold a pessimistic view of future states of the world and unrealistic expectations which likely affect their timing of retirement. Hence, policy prescriptions designed to increase workforce participation of the elderly by providing with the financial incentives may be not effective for those who experience mental problems. This paper studies whether the effect of financial incentives in the institutional context of the United Kingdom differs between individuals who suffer from mental problems, such as depression, and who do not, when make decisions about retirement.

Much has been written about the importance of financial incentives and health on retirement decisions (Coile and Gruber 2007; Lindeboom, 2006; Gruber and Wise, 2004, 1998; Stock and Wise 1990*a*, 1990*b*; to cite just a few). A comprehensive work by Gruber and Wise (2004) gives a comparative analysis of the effect of financial incentives on retirement on the base of recent case studies from twelve countries. Their results suggest a strong negative effect of financial incentives on the probability of retirement. Poor health is also found to adversely affect labor force participation of the elderly (for a review see Lindeboom, 2006). Using retirement expectations as an outcome, McGarry (2004) has found a large and significant effect of poor health on the probability of continuing working. However there is very little evidence of how individuals respond to these incentives conditional on their health status. Only few papers (Banks et al. 2007 and Erdogan-Ciftci et al. 2011) explicitly consider the interaction of financial incentives and being in good or bad physical health. Their results suggest a negative effect of the peak value accrual on the probability of retirement only for the people in good health. No paper considers whether these incentives differ for individuals with mental problems.

The availability of financial sources with which individuals can sustain themselves during retirement can make a crucial difference for the timing of the retirement. The data for this analysis come from the English Longitudinal Study of Ageing (ELSA), which surveys individuals who were born on or before 29<sup>th</sup> February 1952 and their spouses. I take the advantage of unique institutional arrangements in the UK and use detailed data to look at the extent to which individuals approaching retirement respond to financial incentives exploiting differences between the retirement incentives implicit in individuals' pension arrangements (state pensions and private pension schemes). The UK pension system is two-tiered and is made up of Basic State Pension (BSP) and Second State Pension (S2P).

All the individuals who earn above a certain floor are compulsory contributing to both. However, they can change S2P to one of the private pension schemes (occupational pensions and individual retirement accounts). There is an important difference between state pensions and private schemes which can have a major impact on the timing of one's exit from the workforce. Usually individuals can not start drawing state pension until they reach the State Pension Age (SPA), while private pensions (personal pension, stakeholder pension or occupational pensions) are more flexible and usually offer early retirement paths. Thus, retirees with a private pension plan have more freedom to choose when to retire and may not need to depend on state pension benefits immediately upon exiting the workforce because they can fund their retirement from other sources of income, at least for some time. I consecutively look whether financial incentives driven separately by private and public pension plans also differ for people with and without mental problems.

Depression is the most common mental illness worldwide, and will be one of the biggest health problems by the year 2020 (World Health Organization). While everyone experiences strong feelings of tension, fear, or sadness at times, a mental illness is present when these feelings become so disturbing and overwhelming that people have great difficulty coping with day-to-day activities, such as work, enjoying leisure time, and maintaining relationships. According to the National Health Service (NHS) in the UK, 17.6% of adults are mentally ill (2007 figures),<sup>50</sup> which compares with over a third of adults suffering from long-term physical conditions such as cardiovascular disease, respiratory disease, musculoskeletal problems or diabetes (Naylor et al., 2012). This makes mental problems the largest single source of disability in the United Kingdom, accounting for 23% of the total 'burden of disease' (a composite measure of premature mortality and reduced quality of life) (Department of Health 2011b). No other health condition matches mental illness in the combined extent of prevalence, persistence and breadth of impact. Spending on mental health services accounts for 11% of the NHS secondary health care budget (Department of Health 2011b), and the full cost to the NHS goes well beyond this.<sup>51</sup> Mental illness is consistently associated with deprivation, low income, unemployment and increased health-risk behavior. The major part of the costs created by mental illness is indirect, mainly caused by disability and lost productivity (sickness absence, nonemployment, premature mortality). In England alone, mental illness costs over £105 billion a year - 7.7% of GDP, through the costs of medical or social care, production output losses, and a monetary valuation of the intangible human cost of disability, suffering and distress.<sup>52</sup>

To summarize, in this paper I draw on the insights of Stock and Wise (1990a) in developing forward looking measures of financial incentives, and look whether these incentives have differential effect on the probability of retirement for depressed and non-depressed individuals. This measure allows me to examine jointly the impact of public and private pensions on retirement, as well as to separate and compare the effects of these different incentives. I have three major findings. First, retirement decisions respond in a significant

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<sup>50</sup>[http://www.nhsconfed.org/Publications/Documents/Key\\_facts\\_mental\\_health\\_080911.pdf](http://www.nhsconfed.org/Publications/Documents/Key_facts_mental_health_080911.pdf)

<sup>51</sup>One should include costs to primary care or increased costs elsewhere caused by poor mental health exacerbating other health problems and hindering their treatment. Also, one needs to take account of the wider economic impact of mental health problems through their effect on employment and workplace productivity (Centre for Mental Health 2010), or the substantial costs of informal care borne by family members and others (McCrone et al. 2008).

<sup>52</sup><http://www.mentalhealth.org.uk/content/assets/PDF/campaigns/MHF-Business-case-for-MH-research-Nov2010.pdf>

way to the option of future benefit increment only for those employees who do not suffer depression. In particular, as expected, individuals with larger values of peak accruals are less likely to retire. Second, the difference in the total effect of the peak value accrual on the probability of retirement between depressed and non-depressed is driven by private pension accrual solely. Third, retirement is roughly equally responsive to a comparable change in public pension and private pension incentives for people without mental illness.

The paper proceeds as follows. Section 2 describes the retirement modeling methodology I follow and provides some insights about the relation between financial incentives and retirement behavior. Section 3 describes the dataset used in the analysis. Section 4 sets out the intuition regarding the empirical specification applied in this work. Section 5 provides the results and the robustness check, and Section 6 concludes.

## 3.2 Methodology and institutional background

### 3.2.1 The Option Value Model

A significant economic determinant of the probability of retirement is the accrual of retirement wealth due to continued work, not the level of retirement wealth at a point in time. The decision when to retire can be modeled using Stock and Wise (1990) approach of 'option value' which incorporates the entire future path of retirement incentives. The idea is that when an individual decides about the timing of retirement, he compares the utility of retirement at the current date and at the date that maximizes her/his utility. This implies that the option of future benefit increments affects retirement decision today in this framework.

The model is based on the individual's utility function over work and leisure. An individual while working receives wage income  $Y_s$  in year  $s$ . If he is retired in year  $s$ , he will receive real retirement benefits  $B_s$ . Let  $R$  denote the first full year of individual's retirement and  $T$  denotes the time of death. Suppose that the individual derives indirect utility  $U_w(Y_s)$  from the real income if he works in year  $s$  and utility  $U_r(B_s(R))$  from the pension income if he is retired. Suppose that in deciding whether to retire the individual weights future income by the discount factor  $\beta$ , and the probability  $p_{s|t}$  of being alive at year  $s$  conditional on being alive today. The present discounted value of retiring at  $R$  is:

$$V_t(R) = \sum_{s=t}^{R-1} p_{s|t} \beta^{s-t} E_t U_w(Y_s) + \sum_{s=R}^T p_{s|t} \beta^{s-t} E_t U_r(B_s(R)) \quad (16)$$

The utility function indirectly derived from income is assumed to exhibit constant relative risk aversion (*CRRA*) with parameter  $\gamma < 1$ . Working also yields disutility while retirement provides larger amounts of leisure time; hence the utility from one unit of retirement income is higher than the utility from a unit of earned income. A parameter  $k > 1$  accounts for this:

$$\begin{aligned} U_w(Y_s) &= Y_s^\gamma \\ U_r(B_s(R)) &= [k B_s(R)]^\gamma \end{aligned} \quad (17)$$

The individual chooses either to work during year  $t$ , so that  $R > t$ , or to retire, so that  $R = t$ . He makes the decision by comparing the value he would receive if retires now,

$R = t$ , with the greatest of the values from possible retirement dates  $R > t$  in the future. Let  $R^* > t$  be the future retirement year yielding the highest expected value, i.e.

$$R^* \text{ solves } \max_{R \in \{t+1, t+2, \dots, T\}} V_t(R) \quad (18)$$

The option value ( $OV$ ) at time  $t$ ,  $OV_t$ , is the difference between the indirect utility from retirement at the optimal date,  $R^*$ , and the indirect utility from retiring today:

$$OV_t = V_t(R^*) - V_t(t) \quad (19)$$

The individual retires if there is no gain from continued work, that is  $OV_t \leq 0$ . Otherwise he postpones retirement. The option value prescription is that the person will continue to work if this option value is positive, and the probability of keep working increases with  $OV_t$ .

### 3.2.2 Institutional arrangements in the UK

The UK pension system is two-tiered. The first tier, provided by the state, consists of the Basic State Pension (BSP) and of means-tested benefits.<sup>53</sup> The second tier, compulsory for all employees with earnings above a certain threshold (Lower Earnings Limit), is made up of the State Second Pension (S2P)<sup>54</sup> and a variety of private pension provision. Any additional private retirement saving is voluntary.

#### The Basic State Pension

The Basic State Pension is a flat rate, pay-as-you-go financed, payable to people aged over the state pension age (65 for men and 60 for women<sup>55</sup>) who have made sufficient contributions throughout their working lives. Individuals are entitled to some part of the BSP if they have made National Insurance Contributions (NICs) for at least 25% of their working lives (i.e. from 16 to the State Pension Age). To qualify for the full BSP, individuals need to have made or be credited with NICs for 90% of their working lives, i.e. 44 years for men and 39 for women.<sup>56</sup> Credits are available for periods of illness, disability, or unemployment. Additionally, all individuals are credited with accrual when they were aged 16, 17 or 18. To calculate a fraction of the BSP to which an individual is entitled, one would divide the number of years in employment (plus additional years credited for when they were aged between 16 and 18) by 49 (or 44 for women).

#### The Second tier Pension

The baseline second tier pension is the State Second Pension (S2P). However, any individual can choose to 'contract out' of S2P, into either employer-provided plan (an

<sup>53</sup>In April 1999 the Government has introduced Minimum Income Guarantee with an aim to support lower-income pensioners and reduce relative income poverty. It has two main schemes: Pension Credit Guarantee and the Pension Credit Savings Credit.

<sup>54</sup>This replaced the State Earnings-Related Pension Scheme (SERPS) from April 2002 and is relatively more generous to lower earners.

<sup>55</sup>According to Pensions Act 1995 (began to be phased in 2010), the age at which a woman can start drawing her state pension is increasing from 60 (for women born before 6 April 1950) to 65 (for those born after 5 April 1955).

<sup>56</sup>This numerator increases gradually as the SPA for women increases and eventually equalizes with the SPA for men.

occupational pension, which can be defined benefit or defined contribution in nature) or individually arranged defined contribution pension (individual retirement account). In the case of joining employer-provided defined benefit plan, both employees and their employer pay reduced NICs. While those with defined contribution occupational pensions or personal pensions receive a National Insurance rebate paid directly into their fund each year as compensation for S2P that they would have otherwise accrued.

Occupational pensions currently cover around 45% of employees, down from a peak of over 50% in the early 1980s. They are typically defined benefit (DB) schemes, although since 1988, employees have also been allowed to opt out into defined contribution (DC) occupational schemes, and there has been a gradual shift from DB to DC schemes since then (see Disney & Stears, 1996). The decline in coverage of occupational pension schemes is due to a number of factors. It reflects changing employment patterns and a shift to smaller employers. Also, it reflects increasing pension choice among individuals working for employers offering occupational pensions who, since 1988, can no longer be compelled to join the scheme. Since 1988, individuals have been able to contract out of S2P (and leave their occupational scheme) and take out a personal pension. To kick start these schemes when they were introduced, a bonus NICs of 2% was paid by the government, in addition to the contracted-out rebate. By the mid-1990s, around 6 million people (more than one-quarter of all employees) had taken out a personal pension. Take up was higher among younger workers, as would be expected. However, there is a serious issue over the number of older workers who were “missold” personal pensions by financial advisers who wrongly advised them that they would be better off leaving their occupational pension scheme.

### 3.2.3 Incentive variable calculation

In order to address the question empirically I need a measure that incorporates the insights of the option value measure which focuses on the variation in retirement income. A simplified version of the option value measure at age  $t$  can be described by:<sup>57</sup>

$$\begin{aligned}
 OV_t &= \sum_{s=1}^{R^*-1} p_{s|t} \beta^{s-t} U_w(Y_s) + \left[ \sum_{s=R^*}^S p_{s|t} \beta^{s-t} E_t(B_s(R^*)) - \sum_{s=t}^S p_{s|t} \beta^{s-t} E_t(B_s(t)) \right] \quad (20) \\
 &= \sum_{s=1}^{R^*-1} p_{s|t} \beta^{s-t} U_w(Y_s) + PV_t(R^*)
 \end{aligned}$$

where  $PV_t$  states for the ‘peak value accrual’:

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<sup>57</sup>The issue of identification arises in considering the option value as compared with the peak value incentive measures. If individual heterogeneity were not a concern, the option value measure would be the most parsimonious incentive measure to use, as it captures the full financial incentive on retirement of both future wage earnings and retirement benefits combined. However, individual wage differences may also proxy for differences in the preference for work versus retirement. Thus, to the extent that wages proxy for the taste for work, the option value variation across individuals may reflect in part this wage proxy for heterogeneity, rather than the financial retirement incentive. The peak value measure recognizes this possibility by measuring the retirement incentive by the future stream of retirement benefits only, without including the future stream of wage earnings. But to the extent that future wage earnings have an important incentive influence on retirement, the peak value approach understates the full effect of financial incentives on retirement. For the detailed overview see Gruber and Wise, 2004.

$$PV_t(R^*) = \sum_{s=R^*}^S p_{s|t} \beta^{s-t} E_t(B_s(R^*)) - \sum_{s=t}^S p_{s|t} \beta^{s-t} E_t(B_s(t)) \quad (21)$$

Following Coile & Gruber (2007) I use a 'peak value model' which calculates the difference between expected present value of pension wealth at its maximum value and expected present value of pension wealth at today's value. In this way, the peak value appropriately considers the trade-off between retiring today and working to a period with much higher pension wealth, thereby capturing the option value of continued work.<sup>58</sup> One straightforward result of this model is that the probability of continuing work increases with  $PV_t$ . Another advantage of using the peak value approach is that its linear structure allows for decomposition into state pension and private pension incentive effects in order to assess whether individuals respond similarly to financial incentive from different retirement income sources.

In this paper I use pension entitlements calculated for ELSA data in Banks, Emmerson and Tetlow (2005) which I describe in details in the next section. Because of the institutional setup in the UK, the date when the individual maximizes his pension wealth is when he reaches the State Pension Age (SPA). Hence the peak value accrual is calculated as a difference between the level of pension wealth that could be attained if the individual stays in paid work till he reaches SPA and the level of pension wealth already accrued. The details on how current pension wealth and future accrual of pension wealth were estimated can be found in the Appendix.

### 3.3 Data

The data for this analysis come from the first two waves (2002 – 03 and 2004 – 05) of the English Longitudinal Study of Ageing (ELSA). This is a representative sample of the household population aged 50 and over in England. ELSA provides a rich source of information on various aspects of individuals' circumstances that could impact on their labor force participation decision. It began in 2002 and was drawn from the sample of the households that had previously participated in the Health Survey of England (HSE) cross-sections in 1998, 1999, and 2001. As I am interested in retirement decisions I make use only of data on those aged between 50 and the State Pension Age in 2002 – 03. That is men aged 50 to 64 and women aged 50 and 59. There is a total of 3,108 observations (1,680 males and 1,428 females) in wave 1.<sup>59</sup>

The analysis examines how financial incentives from state and private pensions affect retirement decisions. Following the previous literature (Banks, Emmerson and Tetlow, 2007, Blundell, Meghir and Smith, 2002) I restricted attention to those in paid work in wave 1 and model the probability of retirement between two waves of the panel. I define individuals as working if they reported, when interviewed, having been engaged in any

<sup>58</sup>According to Coile & Gruber (2007) the decision to continue to work is a function of the increase in retirement consumption resulting from an additional year of work, relative to the value of an additional year of leisure

<sup>59</sup>Initially the sample consisted of 3,834 respondents (out of which 3,156 were working) for whom I know all necessary information to address the research question. Approximately 20% of this sample is lost through attrition at wave 2 and the final estimation sample consist of 3,108 individuals in wave 1.

paid employment or self-employment in the last month.<sup>60</sup> I define individuals as retired if they reported that they have not engaged in any form of employment or self-employment in the month prior to the interview (i.e. fully or partially retired, unemployed, permanently sick or disabled, cared for someone or looking after the home or family). Thus I model the transition from work to inactivity. This broad definition of retirement is preferred since I am interested in the extent to which financial incentives influence the decision to stop working and, in middle-age, unemployment, disability or housework may be used as routes into retirement (O'Donnell et al. 2008). There are 2,584 who were working in the first wave (1,417 males and 1,167 females). The crude probability of retirement between two waves is around 15%, the mean found in other studies using the ELSA data. Table 1 reports the summary statistics of the variables used in the analysis.

Table 1. Summary statistics

Variable	Mean	Std.dev.	Min	Max
Probability of retirement %	14.82	0.355	0	1
Depressed %	15.90	0.366	0	1
Peak value accrual (£000s)	1.591	49.77	-585.1	452.8
Public peak value accrual (£000s)	12.93	8.951	-0.575	42.31
Private peak value accrual (£000s)	-11.34	48.29	-610.4	413.0
Ln (Non-pension) Wealth	11.85	1.350	1.792	16.16
Ln (Earnings)	5.996	1.075	-3.951	9.493
Self-employed %	16.87	0.375	0	1
Reach state pension age %	12.15	0.327	0	1
Age	55.10	3.462	50	64
Male %	54.82	0.498	0	1
Single %	16.75	0.373	0	1
Number of Children	2.241	1.352	0	11
University degree %	35.28	0.478	0	1
Household size	2.457	0.977	1	6
Cardiovascular diseases	34.04	0.474	0	1
Other severe health problems	36.48	0.481	0	1
N		2,584		

The key explanatory variable for the analysis is the peak value accrual. It is calculated as a difference between the present discounted value of total pension wealth that could be attained if the individual retires at SPA and the present discounted value of total pension wealth already accrued in 2002.<sup>61</sup> The total pension wealth is the sum of individual state pension wealth and individual private pension wealth. I use the data on pension wealth which is reported in the ELSA, where the methodology of pension entitlement calculations

<sup>60</sup>I have also included self-employed, however, the incentives for them might be slightly different. I present the results excluding self-employed in the robustness checks.

<sup>61</sup>Following Coile and Gruber (2007), I assume that workers claim state pension when they become eligible for it or at retirement (if these two events coincide). In fact, this is not necessarily true; retirement and claiming are two distinct events, and for certain values of mortality prospects and discount rates it is optimal to delay claiming until some time after retirement due to actuarial adjustment of benefits. Given this, the incentive measures will therefore slightly overstate any subsidies to continued work, since part of this subsidy will come from delayed claiming that could be obtained without delaying retirement.



is based on Banks, Emmerson and Tetlow (2005).<sup>62</sup> In the data the mean value of the accrual is £1591.<sup>63</sup>

For measuring mental health, I use CES-D indicator of depression (Radloff, 1977) from the Psychosocial Module of the ELSA data.<sup>64</sup> This indicator of depression is the one also used in the US Health and Retirement Study (HRS) and similar to EURO-D scale (Prince et al. 1999) in the Survey of Health, Ageing and Retirement in Europe (SHARE) data. It is a well-validated instrument for identifying populations at risk of developing clinical depression or anxiety disorders and has been used in numerous studies to assess depression risks in several populations (Turvey, Wallace, and Herzog 1999; Han 2002; Emptage, Sturm, and Robinson 2005). It consists of eight items, six of which are negatively phrased statements that reflect the presence of depressive symptoms (depression, that everything was an effort, restless sleep, felt lonely, felt sad and inability to get going). Two positively phrased statements reflect the absence of depressive symptoms (happiness and enjoying life). To create the variable used in the analyses, I reverse the coding of the positively phrased items and sum up the binary (yes/no) responses to achieve a count variable from 0 to 8 where higher values suggest worsening depressive symptoms. Further, I use a cut-off of 3 points or more (Doshi et al., 2008) to create a dummy variable that indicates whether respondents are considered to be depressed. This cutoff value has been used in previous studies and has been found to consistent with probable clinical depression. On average, 15% of the sample is classified as depressed, which is close enough to the average number of people over 65 with mental illness in the UK population.<sup>65</sup>

As I noted in Section 1, depression is likely to change individual expectations about the future state of the world. ELSA also contains data on retirement expectations and subjective survival probabilities of the survey respondents. This enables us to take a closer look at whether people who suffer depression have different expectations of their future circumstances than non-depressed. Banks and Casanova (2003) suggested that answers to ELSA questions on individuals expectations contain useful information and can be an accurate predictor of future behavior. There is evidence from the HRS (Chan & Stevens, 2001; Hurd and McGarry, 1999) that answers to questions about expected retirement age are quite consistent with aggregate observed retirement probabilities and that they vary with the factors that determine actual retirement in predictable ways. McGarry (2004) explored the variation in retirement expectations among workers to re-examine the role of health and changes in health status. She suggested that it might be a good approximation of timing of retirement, especially when using health as an explanatory variable, as it eliminates the concern about justification bias (McGarry, 2004). With regard to subjective survival probabilities, it has been found that the sample averages of the survival probabilities are close to survival probabilities calculated from life tables, and they have been found to covary with known mortality risk factors.

The ELSA question on retirement expectations reads as follows: "*What are the chances that you will be working after you reach age  $T$* ". Permitted answers are in the 0 – 100 range, but I rescale to 0 – 1. The target age ( $T$ ) is chosen in relation to the respondent's

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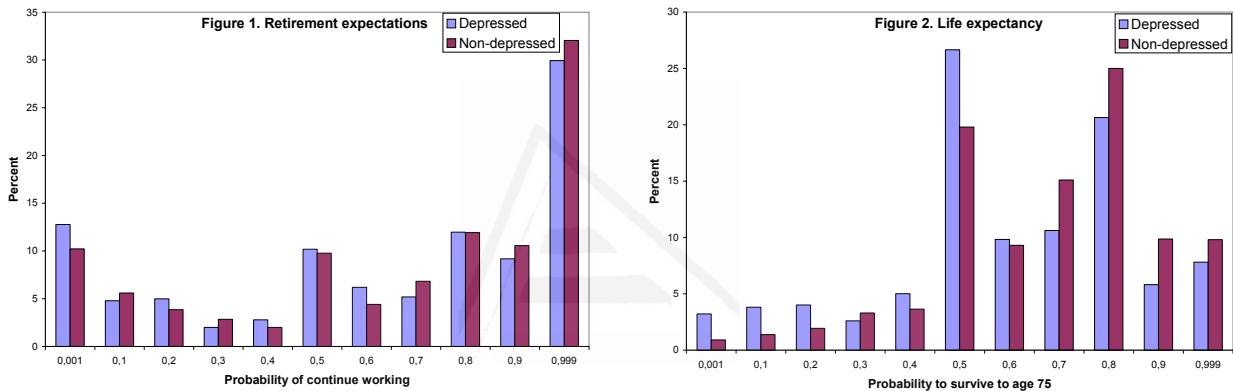
<sup>62</sup>For the basic assumptions of the pension entitlement calculations see the Appendix.

<sup>63</sup>I excluded one observation with the value of accrual of  $-\pounds 1,221,237$ , as it is a clear outlier. The results did not change if we keep this observation.

<sup>64</sup>See the Appendix.

<sup>65</sup>Between 10 – 16% of people over 65 have depression. Mental Health Foundation. <http://www.mentalhealth.org.uk/help-information/mental-health-a-z/O/older-people/>

gender and current age. It is 60 for male respondents under 60, and 55 for female respondents under 55.<sup>66</sup> The question on subjective survival probability reads as follows: "What are the chances that you will live to be  $T$  or more?" The range is as for the question about retirement expectations and the  $T$  is chosen in relation to respondent's current age, which is 75 for those under 65, which essentially is the upper age limit of the sample for this analysis. I plot the answers to these questions on the Figures 1 and 2 for depressed and non-depressed.<sup>67</sup> The patterns on both graphs suggest that depressed individuals more frequently report lower probabilities of continue working and lower survival chances relative to non-depressed. While non-depressed seem slightly more optimistic about their chances of surviving to 75 and continue working. Similar to previous studies (Hurd et al., 1998) I observe the tendency of respondents to provide focal-point answers (0, 0.5, or 1). Taking this into account, non-depressed individuals appear more certain about their chances to survive to or to work about the target age.



I also control for other background characteristics, such as family total net non-pension wealth (the sum of total net financial wealth, total net physical wealth (non-housing wealth) and total net housing wealth), earnings (wage and salary income), whether the respondent is self-employed, whether respondents reach SPA between the two waves (a categorical variable = 1 if the respondent reaches SPA (65 for male and 60 for female) in wave 2), age of the respondent minus 50, and its square, gender, marital status (a categorical variable = 1 if the respondent is neither married or cohabiting and = 0 if the respondent is married or cohabiting), number of children, qualifications (a categorical variable = 1 if the respondent has a university degree, higher education or equivalent), household size and pre-existing severe health conditions, such as cardiovascular diseases

<sup>66</sup>Men aged 60 and over were asked what are their chances they will be working after they reach 65, and women aged 55 and over were asked what are the chances they will be working after they reach 60. As 65 and 60 are the SRA for male and female respectively, individuals who decide to work after they reach normal retirement age are likely to have special tastes or preferences for work which are beyond the scope of this study. Hence, I do not include men aged over 60 and women aged over 55 for the retirement expectation regressions.

<sup>67</sup>I have also performed simple OLS regressions to show that the effect of depression on life expectancy and retirement expectations controlling for all background characteristics is significant. The results are reported in the Appendix. The sample size for retirement expectations is much smaller than that for the main sample of the analysis, as I do not consider the retirement expectations of the individuals who might choose to work after they reach the SRA (as explained in the previous footnote).

(CVD), which include minor and major CVD,<sup>68</sup> and other severe diseases.<sup>69</sup> An interesting pattern is that 12% of the sample reached pension age and around 15% retired between two waves. One third of the people in the sample has at least one severe illness, slightly half of the sample are men, 17% are single, the average number of children and the average household size are 2.24 and 2.45 respectively. One third of the respondents have a university degree, equivalent or higher education.

### 3.4 Empirical strategy

In this section I present the empirical specification for the peak value retirement model outlined in Section 2.2. Let  $R_i^*$  be the willingness of individual  $i$  to move out of paid work over the next two years. Let  $A_i$  be a measure of financial incentives which is the peak value accrual calculated as a difference between the present discounted value of total pension wealth if the individual retires immediately and its value if he continue working till State Pension Age. Let  $D_i$  measure mental illness in wave 1 which is a binary variable of whether the individual suffer depression in wave 1.  $X_i$  is a vector of explanatory variables including socio-demographic and socio-economic characteristics, such as non-pension wealth, earnings, household and individual characteristics (age, gender, marital status, number of children, household size, education attainment). There may be of course a substantial overlap between mental and physical illness,<sup>70</sup> and thus I shall also account for the presence of pre-existing severe (mostly) physical health problems,  $H_i$ . Thus, by conditioning on individuals in employment in wave 1 and modeling the willingness to enter inactivity (retirement) the next wave as a function of financial incentives, depression and other covariates in wave 1 I avoid bias from reverse causality - the possibility that retirement itself causes a change in mental health. Another possible source of endogeneity bias is the correlation between individual unobserved characteristics and depression. Disney et al. (2005) suggested that "identifying health shocks offers a convenient way to eliminate a potential source of endogeneity bias caused by the correlation between individual-specific unobserved characteristics and health", thus in robustness checks I include the measures of the new (physical and mental health conditions which has been discovered between two waves (health shocks)).<sup>71</sup> The multivariate model that I would like to estimate is:<sup>72</sup>

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<sup>68</sup>Minor CVD are high blood pressure, angina, a heart murmur, an abnormal heath rhythm, diabetes or high blood sugar. Major CVD are a heart attack (including myocardial infarction or coronary thrombosis), congestive heart failure, and a stroke (cerebral vascular disease).

<sup>69</sup>Other severe diseases include chronic lung disease (such as chronic bronchitis or emphysema), asthma, arthritis (including osteoarthritis , or rheumatism), osteoporosis (sometimes called thin or brittle bones), cancer or a malignant tumor (excluding minor skin cancers), Parkinson's disease, any emotional, nervous or psychiatric problems, Alzheimer's disease, dementia, organic brain syndrome, senility or any other serious memory impairment.

<sup>70</sup>Research evidence consistently demonstrates that people with long-term conditions are two to three times more likely to experience mental health problems than the general population (Naylor et al. 2012).

<sup>71</sup>One might expect that exits from work would be more strongly correlated with the onset of a health problem rather than a pre-existing condition. I have not included onset of health problems as an explanatory variable in the main regressions for two reasons. First, it is difficult to identify which happened first, the change in health or the exit from work. Second, as I observe only a two year period, the number of people experiencing the onset of a new health condition is small (Banks, Emmerson and Tetlow, 2007).

<sup>72</sup>Following the previous literature (Coile and Gruber, 2007), I ignore in this analysis joint retirement issues, as handling such issues properly is beyond the scope of this study; for more evidence on the

$$R_i^* = \alpha_0 + \alpha_1 A_i + \alpha_2 D_i + \alpha_3 X_i + \alpha_4 H_i + \varepsilon_i \quad (22)$$

The main goal in this study is to analyze whether financial incentives have differential effects on the retirement decisions depending on whether the individual suffers depression or not. Therefore, I introduce the interaction term of the peak value accrual and being depressed,  $A_i \times D_i$ , into the model:

$$R_i^* = \alpha_0 + \alpha_1 A_i + \alpha_2 D_i + \alpha_3 (A_i \times D_i) + \alpha_4 X_i + \alpha_5 H_i + \varepsilon_i \quad (23)$$

Based on psychological literature, depression is likely to distort individual's perception of future states of world (Smoski et al. 2008). Hence, depressed individuals are likely to respond differently to financial incentives provided by the peak value accrual. The possible channels could work through life expectancy (as I have already seen in the previous session, depressed people are more pessimistic about their survival probabilities) but also via a cognitive decline. There is a discussion in the literature about the relationship between cognitive abilities and retirement. Cognitive decline is very important for job productivity and job satisfaction, especially now, when most of jobs require intellectual capacity and cerebral strength. On the other hand, persistent depression symptoms (in particular measured by CES-D scale) predict cognitive decline in elderly people.<sup>73</sup> Therefore I expect that depressed people will be less sensitive to financial incentives.

The latent willingness to retire is not observed - instead, I only observe whether or not an individual moves out of paid work:

$$R_i = I[R_i^* > 0] = I[\alpha_0 + \alpha_1 A_i + \alpha_2 D_i + \alpha_3 (A_i \times D_i) + \alpha_4 X_i + \alpha_5 H_i + \varepsilon_i > 0] \quad (24)$$

where  $I[\cdot]$  is the indicator function. I estimate this model using probit model specification.<sup>74</sup> I take the advantage of new methodology introduced in STATA 11 to calculate marginal effects which enables me to obtain correct standard errors (Karaca-Mandic et al. 2012).

## 3.5 Results

### 3.5.1 The probability of retiring

Table 2 presents the full results from the analysis of whether or not individuals remain in paid work.<sup>75</sup> I operate the simple probit models with robust standard errors adjusted for clustering at the level of the household and report the average marginal effects.<sup>76</sup>

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spillover effects of incentives on spouses' retirement decisions, see Coile (2004).

<sup>73</sup>In the study by Paterniti et al. (2002) depressive symptoms preceded cognitive decline, in the absence of previous loss of cognitive performance; it is therefore unlikely that depression is only a psychological reaction to perceived cognitive loss.

<sup>74</sup>For comparison I have also estimated linear probability model separately for non-depressed and depressed. The results can be found in Table A.4.2 in the Appendix.

<sup>75</sup>In the Appendix I provide the regression results of the probability of attrition as a function of depression and other covariates. I define a binary variable "Attrition" equals 1 if an individual is working in wave 1 and s/he is not observed in wave 2, and equals 0 if s/he is working in wave 1, and is also observed in wave 2. The results indicate that depression is not a statistically significant determinant of attrition.

<sup>76</sup>The coefficients are reported in Table A.4.3 in the Appendix.

Table 2. Results of the probability of retiring: Marginal effects

Depressed ( $D_i$ )	0,04460** (0,01935)
Peak value accrual if $D_i = 0$	-0,00060*** (0,00015)
Peak value accrual if $D_i = 1$	0,00006 (0,00051)
Ln (Non-pension) Wealth	0,01180** (0,00546)
Ln (Earnings)	-0,01586** (0,00626)
Self-employed	-0,04840*** (0,01629)
Reach state pension age	0,09252*** (0,02979)
Age-50	0,01616*** (0,00262)
Male	-0,02321 (0,01578)
Single	-0,00679 (0,02003)
Number of children	0,00424 (0,00516)
Degree	-0,03850*** (0,01454)
Household size	-0,00706 (0,00947)
Severe cardiovascular disease	0,04193*** (0,01448)
Other severe health problems	0,02614* (0,01399)
N	2,584

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Robust standard errors corrected for clustering on household in parentheses.

The results show that, as expected, depressed workers are more likely to retire: suffering depression in wave 1 has a strong and significant positive effect on the probability of retiring in wave 2. Financial incentives are also strongly associated with retirement. Those individuals with higher peak value accrual in 2002 are less likely to retire. Higher family non-pension wealth, lower earnings, being self-employed and having at least some higher education are all associated with a higher probability of retirement and all of the coefficients are statistically different from zero. Men and single seem less likely to retire compared to women and married, however these effects are not significantly different from zero. Larger household size, although not statistically different from zero, is also associated with a lower probability of retirement. Being older or reaching SPA between two waves increase the probability of retirement. After controlling for pre-existing severe physical problems, the effect of depression does not disappear. Even considering the co-

morbidity of physical and mental illness, the marginal effect of depression is as large as of all cardiovascular diseases, and twice as large as of other severe physical diseases.

I now focus on the differential effects of financial incentives on the probability of retiring. In particular, I examine whether the effects of pension accrual differ between workers in good mental health (i.e. who are not depressed) and those in poor mental health (who are depressed). Starting with the results in Table 2, I find that, the significant negative effect of the peak value on the odds of retirement ( $-0.0006$ ) vanishes for workers who have experienced depression ( $0.00006$ ). To look closely at how changes in the financial incentives are associated with retirement, Figures 3 and 4 show how predicted retirement probabilities change with increasing peak value accrual for non-depressed and depressed individuals respectively.<sup>77</sup>

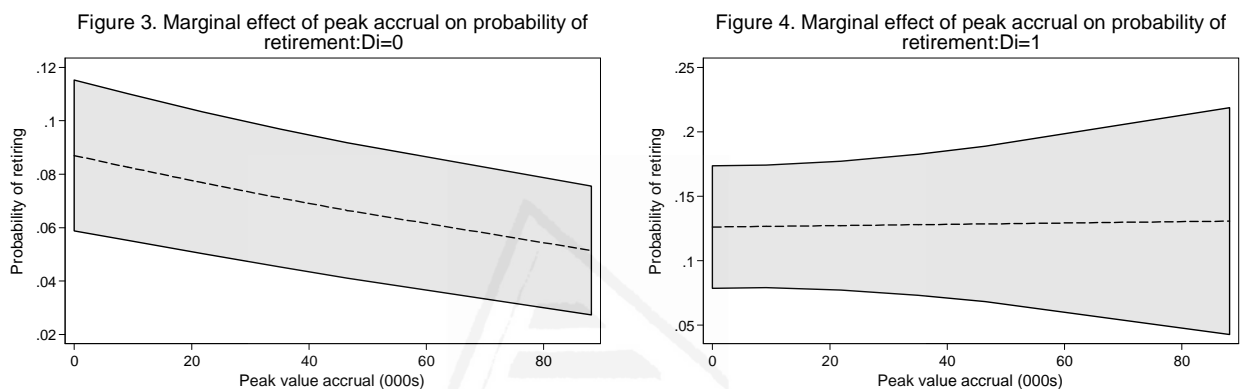


Figure 3 shows that individuals who are not depressed respond strongly to increases in their peak value accrual. While Figure 4 confirms what I observed in Table 3, that retirement probabilities among individuals who suffer depression are not associated with future accrual of pension wealth unlike retirement probabilities of non-depressed. Figure 3 shows that, for an individual with this specific set of characteristics, an increase in peak accrual from £0 to £20,000 is associated with a decrease in the retirement probability of about 1.14 percentage points, compared to almost zero change for depressed individuals.

### 3.5.2 State pension accrual versus private pension accrual incentives

As highlighted earlier, I would like to decompose the effect of pension accrual into public and private components in order to test whether financial incentives arising from state and from private pensions have similar effects on retirement decisions of depressed and non-depressed individuals. Table 3 presents the average marginal effects of the main variables of interest. Specification 1 refers to the marginal effects without interaction terms, while in specification 2 I differentiate the effects of private and public pension accrual among depressed and non-depressed.

<sup>77</sup>Those graphs are drawn for a representative individual - aged 55, male, in a couple, with 2 children, with no health problems, not self-employed, does not hit the SPA, no degree, median earnings and median non-pension wealth. I plotted the marginal effects for the top 90% of the individuals: the value of PVA which corresponds to the 25% is 0, to the 50% is 9.112, to the 75% is 21.887, to the 90% is 35.075, to the 95% is 46.538, to the 99% is 88.150. The 10% of individuals with the lowest PVA are not shown on the graph.

Table 3. Private and Public peak value accruals: Marginal effects

	1		2
Depressed	0,04839** (0,01933)		0,04545** (0,01933)
Private peak value accrual	-0,00046*** (0,00014) [-0,02209]	$D_i = 0$	-0,00052*** (0,00014)
		$D_i = 1$	0,00042 (0,00063)
Public peak value accrual	-0,00341*** (0,00114) [-0,03056]	$D_i = 0$	-0,00311*** (0,00118)
		$D_i = 1$	-0,00517** (0,00231)
N	2,584		2,584

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Robust standard errors corrected for clustering on household in parentheses.

Marginal effects of one-standard-deviation change are in brackets.

Likewise in the study by Coile and Gruber (2007), where the authors have also examined the effects of public and private pension incentives separately on the probability of retiring, I find that there are highly significant marginal effects of peak value for both public and private pensions, and the marginal effect of peak value of public pensions is six times as large as that for private pensions. This finding is also in line with the study by Diamond and Hausman (1984) which suggested that retirement was actually more responsive to state pensions than to private pensions. This is a somewhat surprising result, as one may consider that the accrual patterns in private pensions are generally sharper than in state pensions. Moreover, it might seem that workers are better informed about the details of their private retirement plans than about publicly provided pensions. On the other hand, however, the uniformity of the social security system across everyone, not just co-workers, may actually make information more readily accessible. At the same time, it is also true that there is much more variation in the private pension peak value accrual than in public pension peak value (see summary statistics in Table 1). Thus, when I evaluate the impact of a one standard deviation change in incentives in square brackets, the implied effects are very similar for publicly provided pensions and for private pensions: in the case of private pension, a one-standard-deviation increase in peak value leads to a reduction in retirement probabilities of about 2.2 percentage points (or 15% of baseline retirement probability), while a similar change in public peak pension accrual reduces the probability of retiring by almost 3 percentage points (or 20% of baseline retirement probability). Thus, it appears that individuals are roughly equally responsive to comparable changes in public and pension incentives, while slightly more responsive to public pension incentives.

Let us take a closer look at differential impact of private and public pension accrual incentives on the probability of retirement of individuals who do and do not suffer depression. I assess this issue by plotting the predicted probabilities against private and public peak accruals for depressed and non-depressed separately (Figures 5 – 8).<sup>78</sup>

<sup>78</sup>The value of public PVA which corresponds to the 25% is 6.567, to the 50% is 11.828, to the 75% is 18.244, to the 90% is 26.051, to the 95% is 29.686, to the 99% is 36.461. The value of private PVA which

Figure 5. Marginal effect of private peak accrual on probability of retirement:  $Di=0$

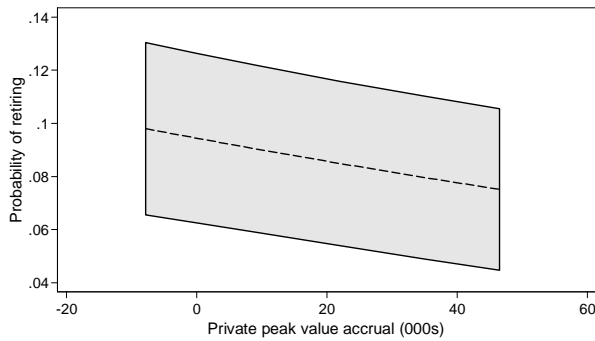


Figure 6. Marginal effect of private peak accrual on probability of retirement:  $Di=1$

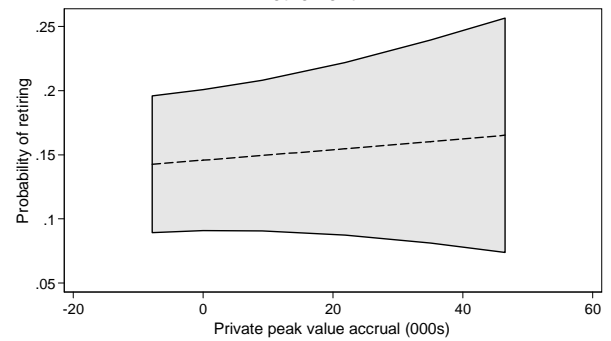


Figure 7. Marginal effect of public peak accrual on probability of retirement:  $Di=0$

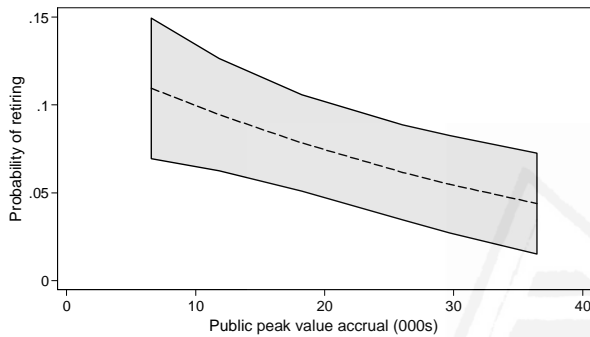
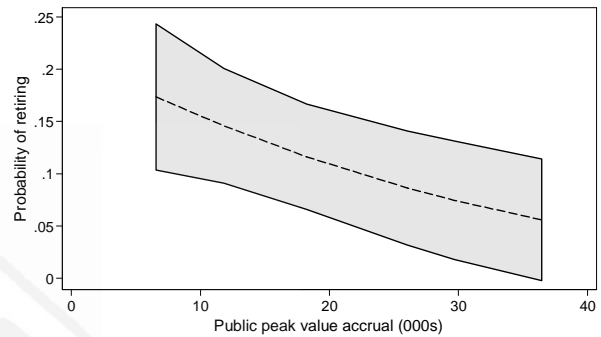


Figure 8. Marginal effect of public peak accrual on probability of retirement:  $Di=1$



Figures 5 – 6 show how retirement probabilities are related to the private peak value accrual and figures 7–8 are related to the public peak value accrual. One can note that the incentive effect from private pension accrual vanishes for workers who suffer depression. On the other hand, I do not observe differences in responses to financial incentives which operate through public pension accrual between depressed and non-depressed workers. It worth noting, that an individual can not start drawing her state pension before she turn SRA (even if s/he retires before SRA), while s/he can start drawing her private pension at the moment she stop working. Therefore the above finding makes sense as people who are budgetary constrained can not just stop working (and earning wages) because of depression or switch to some welfare program (e.g. disability scheme). Hence, the difference in the total effect of financial incentives on the probability of retirement between depressed and non-depressed seems to be driven by the private peak value accrual solely.

### 3.6 Robustness checks

#### 3.6.1 Self-employed

As I have noted in Section 2, self-employed individuals might be more flexible in adjusting their retirement patterns. Also financial incentives, especially publicly provided, might

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corresponds to the 25% is  $-7.845$ , to the 50% is  $0$ , to the 75% is  $3.054$ , to the 90% is  $14.012$ , to the 95% is  $25.434$ , to the 99% is  $66.303$ . The 10% of individuals with the lowest PVA are not shown on the graph.



work slightly different for them. To test whether the results are sensitive to excluding self-employed from the analysis, I estimate again model (24) but now without self-employed individuals and present results in Table 5.

Table 4. Probability of retiring: excluding self-employed. Marginal effects

Depressed	0,03418*
	(0,02093)
Peak value accrual if $D_i = 0$	-0,00054***
	(0,00017)
Peak value accrual if $D_i = 1$	0,00064
	(0,00061)
Ln (Non-pension) Wealth	0,01210**
	(0,00610)
Ln (Earnings)	-0,01500**
	(0,00708)
Reach state pension age	0,11004***
	(0,03407)
Age-50	0,01793***
	(0,00292)
Male	-0,01075
	(0,01725)
Single	-0,00313
	(0,02221)
Number of children	0,00549
	(0,00584)
Degree	-0,04136**
	(0,01645)
Household size	-0,00964
	(0,01050)
Severe cardiovascular disease	0,04093***
	(0,01579)
Other severe health problems	0,03018*
	(0,01575)
N	2,151

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Robust standard errors corrected for clustering on household in parentheses.

The results in Table 4 are very similar to those I obtain in Table 2. The effect of depression on the probability of retiring is a little bit smaller, however not much more different. The effects of peak value accruals have the same impact on the timing of retirement as I observed for the whole sample.

### 3.6.2 New health conditions

To check whether the results are sensitive to inclusion of health shocks, I run regressions for the model (24) and include categorical variables = 1 if the respondent has experienced an onset of a new cardiovascular disease (CVD) or other severe disease between two waves.

I also included one regression where I add an onset of depression in wave 2. The results are reported in Table 5.<sup>79</sup>

Table 5. Results. Marginal Effects: new health conditions

Depressed	0,04285** (0,01924)	0,04557** (0,01959)
Peak value accrual if $D_i = 0$	-0,00060*** (0,00014)	-0,00057*** (0,00014)
Peak value accrual if $D_i = 1$	0,00004 (0,00053)	0,00000 (0,00052)
Ln (Non-pension) Wealth	0,01266** (0,00558)	0,01389** (0,00545)
Ln (Earnings)	-0,01636*** (0,00633)	-0,01665*** (0,00627)
Self-employed	-0,04868*** (0,01626)	-0,04502*** (0,01648)
Reach state pension age	0,09276*** (0,02980)	0,09001*** (0,02969)
Age-50	0,01564*** (0,00262)	0,01622*** (0,00263)
Male	-0,02142 (0,01586)	-0,02712* (0,01600)
Single	-0,00582 (0,02014)	-0,00509 (0,02003)
Number of children	0,00494 (0,00511)	0,00518 (0,00513)
Degree	-0,03648** (0,01458)	-0,03673** (0,01450)
Household size	-0,00727 (0,00949)	-0,00841 (0,00898)
Severe cardiovascular disease	0,03547** (0,01474)	0,03733** (0,01466)
Other severe health problems	0,02207 (0,01377)	0,01948 (0,01367)
New cardiovascular disease	0,01717 (0,01513)	0,01966 (0,01516)
New severe disease	0,07170*** (0,02286)	0,06471*** (0,02226)
New depression		0,01292 (0,02317)
N	2,577	2.559

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Robust standard errors corrected for clustering on household in parentheses.

<sup>79</sup>7 observations were excluded because of non-codable responses in CVD, and 18 due to missing information about depression in wave 2.

The main effects do not change after including the onset of new diseases and depression. To summarize, the issues of whether include or not individuals who are self-employed in the analysis, and whether to control for health shocks do not seem to affect the findings, and I conclude that the results are robust.

### 3.7 Conclusion

Understanding the nature of employment and withdrawal from the labor market at older ages is an important issue. The increasingly aged population in most of developed countries will potentially put greater financial pressure on public and private resources to provide for older individuals. Increasing the employment of older people will be one important way of alleviating these pressures. Furthermore, the increasingly aged workforce means that a greater proportion of potential employees will be older in coming years than has previously been the case; this perhaps makes issues around the barriers to working posed by health-induced disability even more salient (Crawford and Tetlow, 2010).

In this work I analyze the effect of financial incentives on retirement decisions of older workers using an empirical version of the Option Value model. I investigate the role played by mental illness and its interaction with financial incentives on the probability of retirement. I conjectured that mental illness, and in particular depression, may change the way individuals understand and evaluate financial incentives provided by different pension arrangements, which in turn can make them non-responsive to institutional changes that government may think about to induce labor force participation of the elderly. The findings show, first, that depression is an important factor which influences retirement, and second, that the negative effect of pension accrual on the probability of retirement is vanished for people who suffer from depression.

The results have some implications for the recent reforms of public pensions in the UK (Pensions Act 2007) and most European countries (France, Germany, Netherlands, Spain just to name a few).<sup>80</sup> One of the key messages of these reforms is an increase of SPA (or statutory age of retirement) in order to sustain population ageing. Moreover, in the UK, the Pensions Act 2007 (and following Pensions Act 2008) provided more incentives for the personal savings for retirement, some increase in generosity of state pensions and made it easier for some groups to qualify for a full pension. On the other hand, financial advisors and governmental portals highlight the advantages of deferring retirement, such as extra State pension: for every 5 weeks of delay pension claiming a 1% increase in the

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<sup>80</sup>According to Pensions Act 1995 (began to be phased in 2010), the age at which a woman can start drawing her state pension is increasing from 60 (for women born before 6 April 1950) to 65 (for those born after 5 April 1955). The extent to which this increase is reflected in retirement behavior will depend not just on how individuals' labor force participation decisions depend on the financial constraints imposed by not receiving the state pension income as soon, but also crucially on whether all individuals will react to the changes to their State Pension Age (SPA) in the same way. Further changes to the SPA were legislated in Pensions Act 2007. This legislated for an increase in the SPA for both men and women from 65 to (ultimately) 68, which was to be phased in between 2024 and 2046, however members of our sample are very unlikely to be affected by these reforms (they are above the target age). Though some the coalition government (which came to power in May 2010) is now reviewing the possibility of bringing forward these further increases in SPA for men and women, with a review due to report in autumn 2010. Depending on the conclusions of the review, some ELSA sample members may be affected by the reforms. Thus I hope to extend knowledge about the differential effect of responsiveness of retirement behavior to financial incentives among ELSA respondents who might be affected by these further reforms in future.

State pension (or equivalently 10.4% per year of deferring pension), and disadvantages of early retirement, such as fewer years to receive (private) pension and smaller amount of this pension.<sup>81</sup> Individuals are also encouraged to wait for "better annuity rates" and "stock market recovery". However, as the results of this study show, many people are not sensitive to these advises, in particular because of problems with mental health, hence are the least likely continue working. It is of interest to calculate exactly how much compensation people who suffer depression require in order to change their behavior in response to financial incentives. This is clearly a fruitful avenue for the further research.

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<sup>81</sup>For more information, please visit <http://www.nidirect.gov.uk/early-retirement-effect-on-your-pension> and <https://www.gov.uk/deferring-state-pension/>

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## Appendix

### A.1 Psychosocial Module

1. (Much of the time during the past week), you felt depressed?  
Q Would you say yes or no?  
A Yes/ No
2. (Much of the time during the past week), you felt that everything you did was an effort?  
Q Would you say yes or no?  
A Yes/ No
3. (Much of the time during the past week), your sleep was restless?  
Q Would you say yes or no?  
A Yes/ No
4. (Much of the time during the past week), you were happy?  
Q Would you say yes or no?  
A Yes/ No
5. (Much of the time during the past week), you felt lonely?  
Q Would you say yes or no?  
A Yes/ No
6. (Much of the time during the past week), you enjoyed life?  
Q Would you say yes or no?  
A Yes/ No
7. (Much of the time during the past week), you felt sad?  
Q Would you say yes or no?  
A Yes/ No

8. (Much of the time during the past week), you could not get going?

Q Would you say yes or no?

A Yes/ No

## A.2 Pension entitlement calculations

### Basic State Pension (BSP) entitlement

Here I provide the assumptions under which the first tier Basic State Pension is calculated. For the details of the calculation of Second tier State Pension entitlements please see Banks J., Emmerson C. and Tetlow G. (2005).

#### *Retirement in 2002*

When calculating the BSP wealth of an individual who retires in 2002, it is assumed that he stops working in 2002 (i.e. accrues no more years of entitlement) and starts drawing his BSP at the SPA. To calculate the net present value (in 2002) of the flow of BSP income between the state pension age and death, nominal BSP income in all future years is discounted back to 2002 (using a 5% nominal annual discount rate). Throughout all the calculations of pension wealth, it is assumed that everyone dies at his life expectancy. The life expectancies used are gender and age-specific on a cohort basis.

#### *Future retirements*

In order to calculate the BSP to which an individual is entitled if he retires in some future year, it is assumed he works in all years between 2002 and the year of retirement. (i.e. accrues more years of entitlement), then retires and then starts drawing his BSP at the SPA. To calculate the BSP wealth of an individual retiring at some future date I simply take the flow of all remaining BSP income as of a particular year and discount it back (again using a 5% discount rate) to the year of interest. This then gives the nominal value of wealth from the stream of BSP income in each year going forwards. This figure is then discounted back to 2002 using a 5% nominal discount rate to get the net present value of BSP income if an individual continues to work until that year.

### Private pension wealth

#### *Retirement in 2002*

For all defined contribution schemes, ELSA respondents are asked to give the current value of their fund. This measure includes wealth from personal pensions, stakeholder pensions, S226 plans and additional voluntary contributions and freestanding additional voluntary contributions to (DB) schemes for the two most important current pensions. If the individual does not know any element of his fund he is asked to give a range in which it lies from various upper and lower bound options. If the individual does not know the fund value precisely, a value (conditional on the quartile of current earnings multiplied by pension tenure) was hotdecked from within the range the individual indicated. A variable is included in the data to indicate whether any element of the fund value was found using a hotdeck.



The fund value in 2002 assumes that the individual stops contributing to all his DC schemes in 2002. For anyone in 2002 aged between 50 and 74, it is assumed they retire in 2002 and annuitize their fund immediately. The annuity rate they receive was the second best age and gender specific single life annuity rate quoted by the Financial Services Authority (FSA) in January 2005 assuming a £100,000 fund. Different rates were used for smokers and non-smokers. These individuals then receive this annual income between 2002 and their life expectancy. Partners of ELSA sample members are also given a full interview, even if they are aged below 50. These younger partners cannot immediately annuitize their fund. Therefore, they are assumed to retire and cease contributions to the fund in 2002 but leave it accruing interest (at 5% a year) until they reach 50. When they reach 50 they annuitize their fund and receive income from the annuity between age 50 and death.

#### *Future retirements*

In order to calculate the DC pension wealth if the individual continues working into the future, one needs to know not only at what rate the current fund will appreciate but also how much the individual will contribute to the fund in future years if he continues working. From ELSA I know the value of contributions in 2002. In future years, I assume that individuals contribute the same fraction of their salary as they did in 2002.

However, some individuals did not know what their contributions were to either their first or second DC pension. For those who did not know some or all elements of their contributions to their first pension scheme that was DC (23.4% of those aged 50 to the SPA with a first current scheme that is DC), a contribution level is hotdecked (as a percentage of current salary) conditional on gender and education level.

The same hotdeck procedure was carried out for those with a second current scheme that was DC who did not know their contribution level (8.9% of those aged 50 to the SPA with a second current scheme that is DC). However, in some cases the number of people who knew their contribution rate and had characteristics matching those of the people who did not was very small. If the matching group had less than 10 people in it (which was the case for 61.5% of those people whose second scheme contributions were tried to impute), one of two different methods was used.

Firstly, if the individual who did not know their second contribution level also had a first current scheme that was DC (60.6% of those have not yet been imputed a contribution level for), it was assumed that their contribution level to their second scheme is 35% of their contribution level to their first scheme. If the individual's first current pension scheme is not DC (the remaining 39.4% of those who had not yet been imputed a second contribution level for), instead were hotdecked a contribution level conditional on education level only.

Two indicator variables are included in the data: one shows if any element of personal contributions was unknown, the other shows if any element of employer contributions was unknown.

It is assumed that a nominal annual return on the fund is of 5%. Combining these two elements one can calculate the value of the fund in all future years, assuming the individual continues working and contributing until that year. For anyone in a future year aged between 50 and 74, they are (as before) assumed to annuitize immediately. The annuity rates used are the same as were used for 2002. In other words, it is assumed

that annuity rates remain constant over time. This is in line with the assumption that life expectancies do not increase over time either. In reality, longevity is increasing so younger individuals will have a longer life expectancy when they reach, for example, the SPA than individuals currently at the SPA do. Therefore, in the future, one would expect annuity rates to fall since the income will be received over a longer period. However, since I assume constant life expectancies, it is reasonable to also assume constant annuity rates.

The stream of annuity income they receive until death is then discounted back to 2002 using a 5% discount rate to find DC pension wealth in 2002 terms if the individual retires in some future year.

### A.3 Probability of continue working. Life expectancy

Table A.3. Probability of continue working. Life expectancy

	Prob of working	Life expectancy
Depressed	-0,05818*** (0,01982)	-0,06857*** (0,01273)
Ln (Non-pension) Wealth	-0,02075*** (0,00593)	0,00524 (0,00383)
Ln (Earnings)	0,00282 (0,00895)	0,00895* (0,00476)
Self-employed	0,07924*** (0,01826)	-0,00032 (0,01196)
Reach state pension age		0,00351 (0,01689)
Age-50	0,01905*** (0,00360)	0,00181 (0,00170)
Male	-0,22563*** (0,01551)	-0,06018*** (0,00983)
Single	0,03609 (0,02272)	-0,00404 (0,01403)
Number of children	0,00778 (0,00577)	0,00113 (0,00345)
Degree	-0,00377 (0,01584)	0,02351** (0,00926)
Household size	0,00909 (0,00828)	-0,00001 (0,00507)
Severe cardiovascular disease	-0,00148 (0,01495)	-0,04396*** (0,00923)
Other severe health problems	-0,00797 (0,01490)	-0,02723*** (0,00945)
N	1,778	2,570

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Robust standard errors corrected for clustering on household in parentheses.

## A.4 Results

Table A.4.1 Attrition

Depressed	-0,00433 (0,01873)
Peak value accrual if $D_i = 0$	0,00030 (0,00019)
Peak value accrual if $D_i = 1$	0,00012 (0,00045)
Ln (Non-pension) Wealth	-0,01097* (0,00584)
Ln (Earnings)	-0,00581 (0,00741)
Self-employed	0,00684 (0,01928)
Age-50	0,00581** (0,00236)
Male	0,00036 (0,01238)
Single	-0,03923* (0,02134)
Number of children	-0,01431** (0,00631)
Degree	-0,04587*** (0,01529)
Household size	0,00650 (0,00929)
Severe cardiovascular disease	0,00367 (0,01439)
Other severe health problems	-0,02447* (0,01412)
N	3,156

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Robust standard errors corrected for clustering on household in parentheses.

Table A.4.2 Results. Linear Probability Model

	Non-depressed	Depressed
Peak value accrual	-0,00060*** (0,00016)	0,00013 (0,00042)
Ln (Non-pension) Wealth	0,01047* (0,00582)	0,01545 (0,01244)
Ln (Earnings)	-0,01501* (0,00830)	-0,03826* (0,02263)
Self-employed	-0,05494*** (0,01769)	-0,03493 (0,05568)
Reach state pension age	0,16749*** (0,03663)	0,03209 (0,10068)
Age-50	-0,00717 (0,00705)	0,03142** (0,01598)
Age-50 <sup>2</sup>	0,00179*** (0,00065)	-0,00010 (0,00155)
Male	-0,01689 (0,01394)	0,01119 (0,04065)
Single	-0,00721 (0,02341)	-0,03251 (0,05387)
Number of children	0,00124 (0,00576)	0,01941 (0,01501)
Degree	-0,03617** (0,01509)	-0,03227 (0,04367)
Household size	-0,00506 (0,00832)	-0,02336 (0,02579)
Severe cardiovascular disease	0,04341*** (0,01603)	0,04656 (0,04048)
Other severe health problems	0,01116 (0,01543)	0,09883*** (0,03757)
HSE year dummy	Yes	Yes
N	2,584	2,584

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Robust standard errors corrected for clustering on household in parentheses.

Table A.4.3 Results for the probability of retiring: Coefficients

Depressed	0,24516*** (0,08329)	0,25405*** (0,08343)	0,22156*** (0,08375)		0,21483** (0,08395)
Peak value accrual	-0,00275*** (0,00070)	-0,00268*** (0,00068)	-0,00274*** (0,00069)	$D_i = 0$	-0,00308*** (0,00075)
				$D_i = 1$	0,00025 (0,00210)
Ln (Non-pension) Wealth		0,05246** (0,02666)	0,05825** (0,02700)		0,05839** (0,02698)
Ln (Earnings)		-0,08063*** (0,03093)	-0,07838** (0,03106)		-0,07847** (0,03118)
Self-employed	-0,21525** (0,09422)	-0,26460*** (0,09559)	-0,26042*** (0,09598)		-0,26070*** (0,09611)
Reach state pension age	0,39763*** (0,11062)	0,39696*** (0,11117)	0,39244*** (0,11110)		0,39296*** (0,11099)
Age-50	0,05074 (0,03167)	0,04701 (0,03177)	0,04048 (0,03194)		0,04137 (0,03203)
Age-50 <sup>2</sup>	0,00283 (0,00240)	0,00277 (0,00241)	0,00310 (0,00242)		0,00305 (0,00243)
Male	-0,14106* (0,07705)	-0,11252 (0,07685)	-0,11217 (0,07762)		-0,11451 (0,07751)
Single	-0,02346 (0,09811)	-0,04625 (0,10092)	-0,03518 (0,10124)		-0,03396 (0,10121)
Number of children	0,01849 (0,02587)	0,02146 (0,02557)	0,02108 (0,02551)		0,02097 (0,02552)
Degree	-0,19262*** (0,07388)	-0,19276** (0,07587)	-0,19723*** (0,07649)		-0,19611** (0,07655)
Household size	-0,04145 (0,04632)	-0,03881 (0,04654)	-0,03465 (0,04704)		-0,03492 (0,04694)
Severe cardiovascular disease			0,19922*** (0,06753)		0,20119*** (0,06759)
Other severe health problems			0,12883* (0,06714)		0,12729* (0,06721)
HSE year dummy	Yes	Yes	Yes		Yes
Constant	-1,390819242 0,180345154	-1,528137967 0,373802696	-1,715252983 0,378576722		-1,71703858 0,378026391
N	2,584	2,584	2,584		2,584

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Robust standard errors corrected for clustering on household in parentheses.

Table A.4.4 Private and Public peak value accruals: Marginal effects

	1		2
Depressed	0,04839** (0,01933)		0,04545** (0,01933)
Private peak value accrual	-0,00046*** (0,00014) [-0,02209]	$D_i = 0$ $D_i = 1$	-0,00052*** (0,00014) 0,00042 (0,00063)
Public peak value accrual	-0,00341*** (0,00114) [-0,03056]	$D_i = 0$ $D_i = 1$	-0,00311*** (0,00118) -0,00517** (0,00231)
Ln (Non-pension) Wealth	0,01180** (0,00545)		0,01173** (0,00544)
Ln (Earnings)	-0,01529** (0,00618)		-0,01545** (0,00619)
Self-employed	-0,05920*** (0,01632)		-0,05907*** (0,01630)
Reach state pension age	0,08596*** (0,02944)		0,08586*** (0,02935)
Age-50	0,01185*** (0,00290)		0,01174*** (0,00291)
Male	0,00132 (0,01790)		0,00187 (0,01790)
Single	-0,00646 (0,02008)		-0,00510 (0,02007)
Number of children	0,00383 (0,00513)		0,00377 (0,00512)
Degree	-0,03815*** (0,01454)		-0,03819*** (0,01451)
Household size	-0,00609 (0,00952)		-0,00578 (0,00947)
Severe cardiovascular disease	0,04241*** (0,01447)		0,04290*** (0,01447)
Other severe health problems	0,02714* (0,01404)		0,02720* (0,01400)
N	2,584		2,584

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Robust standard errors corrected for clustering on household in parentheses.  
Marginal effects of one-standard-deviation change are in brackets.