Tesis doctoral

Factores explicativos de la evasión fiscal

Doctorando: Antonio Llácer Echave
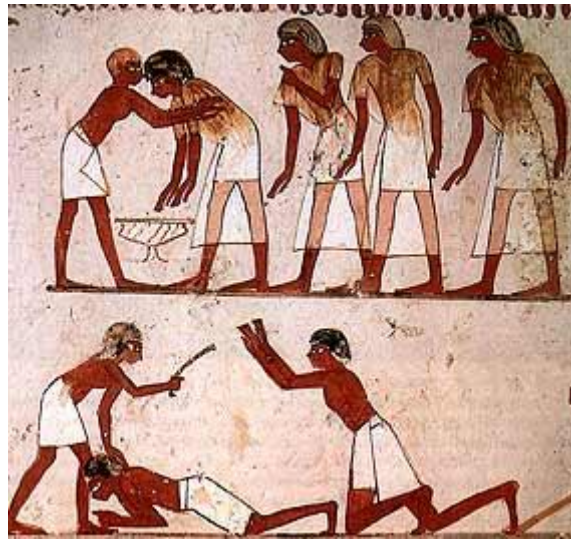
Director: José Antonio Noguera Ferrer

~

Doctorat en Sociologia

Departament de Sociologia – Facultat de Ciències Polítiques i Sociologia

Universitat Autònoma de Barcelona

2014

Recaudación de impuestos y castigo de un evasor.
Detalle de la tumba de Menna (ca. 1400–1352 a.C.).

Índice

I.   Introducción

La presente tesis doctoral, «Factores explicativos de la evasión fiscal», adopta la forma de un compendio de publicaciones. En particular, se compone de tres artículos:

(1) el primero de ellos se titula «Resentimiento fiscal: una propuesta de mecanismo explicativo de la relación entre la edad y la moral fiscal» y ha sido publicado en la *Revista Internacional de Sociología* (vol. 72, enero-abril, nº 1, pp. 35-56, 2014).   Este trabajo, que ha sido elaborado de forma individual a partir de datos de encuesta, presenta una explicación del nivel de tolerancia ante el fraude de los contribuyentes que reciben un salario.

Los dos artículos restantes se ocupan del *SIMULFIS*, un modelo multi-agente que simula el comportamiento fiscal y que ha sido desarrollado junto a J. A. Noguera, E. Tapia y F.J. Miguel. Concretamente, se trata de:

(2) «An Agent-Based Model of Tax Compliance: An Application to the Spanish Case», artículo publicado en *Advances in Complex Systems* (vol. 16, nº 4-5, 2013), y que corresponde a una primera versión del modelo;

(3) y «Tax Compliance, Rational Choice, and Social Influence: An Agent-Based Model», que incorpora algunas modificaciones del modelo original, entre ellas una calibración de los parámetros más ajustada para el caso español. Este artículo ha sido aceptado para su publicación en un número especial de la *Revue Française de Sociologie* que llevará por título «Agent-based modelling in sociology».[1]

a. Justificación de la unidad de la tesis

El problema de la evasión fiscal

Los trabajos que componen la tesis se proponen, desde dos aproximaciones diferentes, ofrecer una mejor comprensión de algunos de los mecanismos que determinan la evasión fiscal. Tal como se expone en la Ley de 2006 de lucha contra el fraude fiscal (España, 2006), este último

> es un fenómeno del que se derivan graves consecuencias para la sociedad en su conjunto. Supone una merma para los ingresos públicos, lo que afecta a la presión fiscal que soportan los

---

[1] En adelante nos referiremos a estos artículos de forma abreviada: el primero de ellos será RF (por *Resentimiento Fiscal*) y los dos restantes S1 y S2 (por *SIMULFIS 1* y *SIMULFIS 2*).

contribuyentes cumplidores; condiciona el nivel de calidad de los servicios públicos y las prestaciones sociales; distorsiona la actividad de los distintos agentes económicos, de tal modo que las empresas fiscalmente cumplidoras deben enfrentarse a la competencia desleal de las incumplidoras; en definitiva, el fraude fiscal constituye el principal elemento de inequidad de todo sistema tributario.

El problema de la evasión de impuestos adquiere una dimensión singularmente preocupante para el caso de España. Según diversas estimaciones, la economía sumergida española ha aumentado considerablemente en las últimas décadas (Alañón y Gómez-Antonio, 2005; Arrazola *et al*. 2011; Gestha, 2014) y, en cualquier caso, se sitúa varios puntos por encima de la media de países similares de la OCDE (Schneider, 2012).[2] Específicamente, y de acuerdo con las estimaciones del sindicato de inspectores de Hacienda, en 2009 la evasión fiscal alcanzó los 59.515 millones de euros (Gestha, 2011), una cifra que representa el 22% del PIB español. Para hacernos una idea de las consecuencias del fraude tributario en el presupuesto estatal, resultará útil el siguiente dato: si pudieran recaudarse los impuestos evadidos, la totalidad de la deuda pública española quedaría saldada en un periodo inferior a nueve años (Murphy, 2012). Por otro lado, la dimensión del problema no escapa a los ojos de la ciudadanía, tal y como señalan las encuestas más recientes en materia de política fiscal. Así, según el IEF (2013), un 59% de los españoles cree que la evasión tributaria está "muy generalizada" y un 86% que ha aumentado "bastante" o "algo" en la última década. La última encuesta del CIS (2013) va aún más lejos y nos muestra que un 94,8% de la población considera que existe "bastante" o "mucho" fraude.

Vemos, pues, que la evasión fiscal es un problema de enorme importancia. Así, parece apropiado emprender investigaciones que traten de comprender el fenómeno del fraude y, en consecuencia, puedan ayudar a diseñar actuaciones que palíen sus consecuencias negativas. La pertinencia de esta tarea se acentúa en el caso de España, país en el que, habida cuenta de sus niveles de fraude, cabría esperar un corpus más abundante de trabajos académicos especializados. El artículo RF se suma, así, a la media docena de trabajos que se han dedicado a analizar la *moral fiscal* de los españoles. [3] Cabe señalar que este tipo de análisis es oportuno en la medida en que existe evidencia de asociación entre

---

[2] Ver Schneider (2005) para una descripción de la relación entre economía sumergida y evasión fiscal.

[3] Prieto, Sanzo y Suárez (2006), Alm y Gómez (2008), Alarcón, De Pablos y Garre (2009), Torgler y Martínez Vázquez (2009), María-Dolores, Alarcón y Garre (2010), Alarcón, Beyaert y De Pablos (2012) y Giachi (2014).

la moral fiscal y la conducta evasora, tanto a nivel individual (Dulleck *et al.* 2012) como agregado (Halla, 2012). Por otro lado, los artículos S1 y S2 suponen los primeros intentos realizados en territorio español de explicar la evasión fiscal a través de un modelo basado en agentes. Se ha pretendido, además, que el modelo SIMULFIS esté calibrado en lo posible para el caso de España, tanto a la hora de determinar sus parámetros como a la de validar sus resultados.

La perspectiva analítica

> «Pensar es deambular de calle en calleja, de calleja en callejón, hasta dar con un callejón sin salida.» Antonio Machado, *Juan de Mairena*.

Además de ocuparse de los factores que están detrás de la evasión fiscal (tanto a nivel actitudinal –RF– como conductual –S1 y S2–), los trabajos tienen en común la voluntad de obtener un 'grano más fino' en la explicación del fenómeno a estudiar. Este rasgo es propio del posicionamiento teórico de la sociología analítica contemporánea, una corriente que en los últimos años ha ido haciendo acto de presencia en las ciencias sociales de forma creciente (Noguera y De Francisco, 2011; Aguiar *et al.*, 2009).

Según la perspectiva analítica, todo fenómeno debe explicarse en referencia a los procesos causales típicos -*mecanismos*- que lo producen (Hedström y Ylikoski, 2010; Elster, 2007; Hedström 2005; Hedström y Swedberg, 1998). En este sentido, la empresa de explicar fenómenos sociales debe pasar por hallar sus microfundamentos a nivel individual. Se trata, en concreto, de encontrar mecanismos referidos a *estados intencionales*, es decir, a entidades mentales como "creencias" y "deseos" que, de acuerdo con la psicología folk, constituyen propiamente las razones o causas por las cuales las personas se comportan de determinada manera.[4] Por ello, desde la óptica analítica, el objetivo último de una investigación científica debe ser el de "proporcionar una cadena continua y contigua de vínculos causales o intencionales entre el *explanans* y el *explanandum*" (Elster, 1989). Cabe señalar que, si bien es cierto que la tarea explicativa podría descender a un terreno aún más micro (neurológico, bioquímico...), el nivel intencional "captura regularidades (*de facto* y *de iure*) que se pierden en el micronivel de la descripción del funcionamiento causal de la maquinaria interna" (Ezquerro, 1991: 103). Este hecho debería resultar suficiente para justificar la utilización, en ciencias sociales, de mecanismos explicativos de naturaleza psicológica como los que aquí se manejarán. Al fin

---

[4] En Malle (2002) se encuentra un excelente resumen de las características de la 'psicología del sentido común' o *folk psychology*. La argumentación filosófica más elaborada de esta idea es el "monismo anómalo" de Davidson (1980). Por su parte, Hedström (2005) y su *DBO theory* son los encargados de trasladarla al campo de la sociología, entre otros.

y al cabo, no existen explicaciones que sean propiamente 'completas': determinar el grado de completitud de una explicación depende del tipo de público al que se dirige la investigación y es, por tanto, una cuestión meramente pragmática (Freese, 2009: 96).

Las consideraciones precedentes deben permitir comprender en qué sentido los trabajos que componen esta tesis doctoral tienen en común la pretensión de ofrecer mecanismos explicativos que resulten tan 'atómicos' como sea posible. De entrada, el propósito explícito de RF es el de "ir más allá de las relaciones estadísticas para explorar el mecanismo responsable de ellas" (Boudon, 1976). Su aportación fundamental es la de ofrecer un mecanismo psicológico –el del *resentimiento fiscal*– que desgrana una correlación estadística ampliamente reconocida en la literatura, a saber, que la moral fiscal aumenta con la edad. Aunque este tipo de asociaciones entre variables suele presentarse como una herramienta que 'abre la caja negra' de la moral fiscal (Torgler, 2004; Torgler y Murphy, 2004), a ojos de la sociología analítica no son más que nuevas cajas negras que es preciso abrir -y ésa es precisamente la operación llevada a cabo en RF. Por su parte, S1 y S2, al emplear un modelo basado en agentes, constituyen dos ejemplos que ilustran cómo desmenuzar la explicación de un objeto de estudio de alcance social. Precisamente uno de los motivos por los cuales la simulación social multi-agente se ha convertido en un método privilegiado dentro de la sociología analítica (Noguera y De Francisco, 2011) es que, en su proceso de programación informática a través de algoritmos simples, obliga a explicitar mecanismos de acción individual y de agregación que, puestos en funcionamiento en una sociedad virtual, dan lugar a fenómenos en el nivel macro. Cabe añadir que, tanto en RF como en S1 y S2, se ha intentado que los mecanismos empleados gocen del máximo grado de realismo en términos motivacionales y cognitivos, otro requisito fundamental de la epistemología analítica.

La manera quizá más clara de ilustrar la cuestión de los mecanismos es a través del "barco de Coleman", un diagrama que representa las relaciones macro→micro→macro (figura 1). Según este planteamiento, la relación entre dos macrofenómenos (flecha 1) no resulta propiamente 'explicativa' y constituye, en cambio, una 'caja negra'; éste sería, por ejemplo, el caso de la asociación existente entre el nivel de autoempleo y el volumen de economía sumergida de un país (Schneider y Buehn, 2012). Por el contrario, según Coleman, la explicación integral de un fenómeno social debe recorrer el camino marcado por las flechas 2, 3 y 4.

Figura 1: El "barco de Coleman"
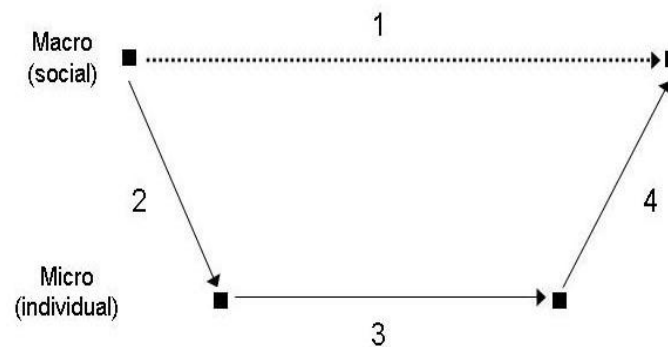
Elaboración propia a partir de Coleman (1990:646)

- En primer lugar, debemos ocuparnos de la transición macro→micro (flecha 2), esto es, de cómo las situaciones sociales específicas en las que se encuentran inmersas las personas afectan a sus deseos, creencias y posibilidades de acción (*mecanismos situacionales*, en la terminología de Coleman). Es en este sentido que, por ejemplo, los tres artículos de la tesis contemplan el hecho de que la condición de asalariado o autónomo determina las oportunidades de defraudar del contribuyente (algo que, además, está detrás de su valoración moral del fraude, tal y como se expone en RF). En el caso del SIMULFIS, este rasgo se manifiesta además en la medida en que parámetros como la renta de los agentes o las condiciones punitivas (inspecciones y sanciones) restringen las posibilidades individuales de evasión .

- El siguiente paso (flecha 3, micro→micro) consiste en dar cuenta del modo en que lo que un individuo cree, desea y puede hacer desemboca en una determinada acción (*mecanismos de formación de acciones*). Esta transición queda especialmente plasmada en el modelo SIMULFIS, donde la conducta efectiva de evasión de impuestos de cada contribuyente es el resultado de la aplicación de una secuencia de filtros individuales de decisión.

- Por último, nos encontramos con la transición micro→macro (la netamente 'sociológica', según Coleman), que recoge la manera en que las diferentes acciones individuales se agregan de forma compleja para dar lugar a un fenómeno social (*mecanismos transformacionales*). En este sentido, el SIMULFIS, a partir de las decisiones individuales de los agentes y de determinados patrones de interacción entre ellos, es capaz de producir resultados agregados de evasión que pueden cotejarse con los datos existentes (véase, por ejemplo, la figura 5 de S2),

ofreciendo así una microfundamentación de las estimaciones globales de fraude que elaboran los economistas. En concreto, la interacción social queda recogida de tres maneras, pues los agentes tienen en cuenta a sus vecinos: (i) al compararse con ellos para determinar si se encuentran en una situación de privación relativa en lo que respecta a su balanza fiscal; (ii) a la hora de estimar la probabilidad de ser inspeccionados, para lo cual tienen en cuenta tanto su propia experiencia como la de su vecindario; y, por último, (iii) en tanto que la renta que finalmente deciden ocultar converge a la media ocultada por el grupo de referencia.

En definitiva, puede afirmarse que los artículos que aquí se presentan forman un conjunto coherente de investigaciones, tanto porque (1) contribuyen, desde dos abordajes metodológicos diferentes, a una mejor comprensión de la evasión fiscal, un problema muy extendido en España pero insuficientemente estudiado; bien porque (2) lo hacen desde una perspectiva teórica, la de la sociología analítica, que enfatiza la necesidad de ofrecer mecanismos explicativos que sean capaces de abrir ciertas 'cajas negras' presentes en la literatura precedente.

b. Resumen y discusión de los resultados

El mecanismo del resentimiento fiscal

Resumen

El principal resultado que puede extraerse del artículo RF es, como se ha señalado, un mecanismo que desentraña la asociación positiva entre edad y moral fiscal (entendida como intolerancia ante el fraude). Los datos provienen de la encuesta "Valores y actitudes sobre justicia distributiva: prestaciones sociales y fiscalidad" (Centro de Estudios de Opinión de la Generalitat de Catalunya, 2010), en cuya elaboración y análisis tuve ocasión de participar como miembro del GSADI. En esta encuesta puede observarse, en efecto, que los más jóvenes presentan una menor moral fiscal que el resto de la población. En concreto, si calculamos un índice de la moral fiscal media (0= "Siempre está justificado evadir" y 1= "Nunca está justificado evadir") de diferentes grupos de edad, comprobamos que éste aumenta hasta los 65 años, para disminuir sensiblemente a partir de entonces (figura 2).

Figura 2: Moral fiscal media de cuatro grupos de edad[5]
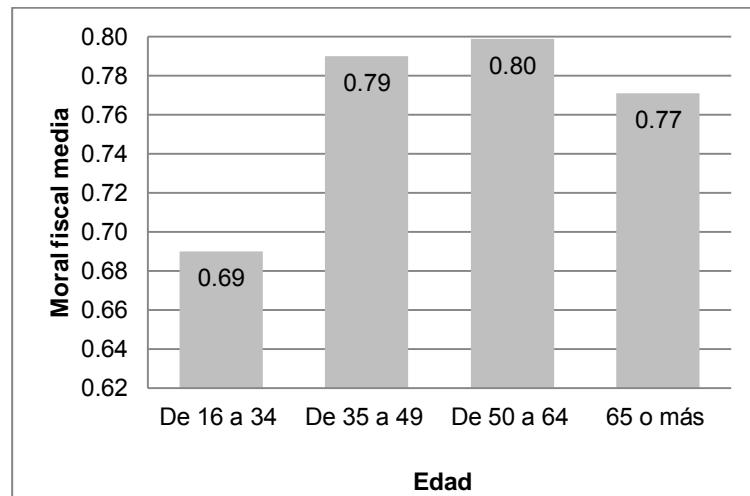
Para analizar esta tendencia, a continuación se dividió la muestra entre asalariados y autónomos, pues se manejó la hipótesis de que la moral fiscal está influida por las diferentes oportunidades de fraude de que gozan sendos colectivos ocupacionales. Tras varios procedimientos, se realizó una serie de regresiones logísticas (Tabla 1). El primer modelo constata que, aunque con diferentes intensidades, tanto en los asalariados como en los autónomos los grupos de mayor edad presentan una mayor moral fiscal que los más jóvenes. En cambio, al introducir nuevas variables en el segundo modelo, la única variable que resulta significativa en el caso de los asalariados pasa a ser los ingresos (cuanto mayores son, mayor es el rechazo ante la evasión fiscal), mientras que en los autónomos ninguna de las variables de control resulta relevante.

---

[5] Media y desviación típica (entre paréntesis), toda la muestra, N=1855, CEO 2010.

Tabla 1: Modelos de regresión logística para asalariados y autónomos[6]

		Asalariados				Autónomos			
		Modelo 1		Modelo 2		Modelo 1		Modelo 2	
Variables predictivas		β	Exp(β)	B	Exp(β)	β	Exp(β)	B	Exp(β)
Edad	25 - 34	,038	1,039	-,122	,885	,851	2,343	,944	2,571
	35 - 44	,429	1,535	,191	1,210	**1,765****	**5,844****	**1,650***	**5,206***
	45 - 54	**,694***	**2,002***	,401	1,493	**1,508***	**4,518***	1,365	3,916
	55 - 64	**,695***	**2,003***	,443	1,557	**1,666***	5,288	1,464	4,324
Ingresos	501-1.000			.362	1.436			-,100	,905
	1.001-3.000			**,720***	**2,054***			,564	1,758
	> 3.001			**1,729****	**5,636****			,221	1,247
Género	Mujer			-.290	.748			-,311	,733
Estado civil	Soltero/a			,013	1,013			-,238	,788
	Divorciado/a			-,317	,728			1,254	3,504
	Viudo/a			,598	1,819			20,979	1290842478,2
Prestaciones	Sí			-,220	,803			-,384	,681
Idioma	Castellano			-,224	,799			-,839	,432
	Indiferente			,274	1,315			-,238	,789

La categoría de referencia de la variable dependiente es 'no justificar la evasion fiscal' y en las variables predictivas, por orden: 'tener entre 16 y 24 años', 'tener ingresos hasta 500 euros', 'ser hombre, 'estar casado', 'no recibir prestaciones' y 'preferir contestar el cuestionario en catalán'.
*p<0,05, **p<0,01

Así, centrándonos ya exclusivamente en los trabajadores por cuenta ajena, se trata ahora de averiguar por qué existe una relación positiva entre su moral fiscal y sus ingresos (y no su edad por sí misma). En busca de datos más fiables sobre el salario de los diferentes grupos de edad, se consultó la Encuesta Anual de Estructura Salarial (INE, 2009) y, a continuación, se determinó el tipo efectivo correspondiente a cada salario a partir de la Memoria de la Administración Tributaria (MEH, 2008). Los resultados pueden verse en la Figura 3: como es de esperar en un sistema fiscal progresivo, el tipo impositivo aumenta con el nivel de renta.

---

[6] Trabajadores por cuenta ajena y propia menores de 65 años, N=731 y N=186, CEO 2010.

Figura 3: Salario anual medio en Cataluña y tipo impositivo efectivo para cinco grupos de edad[7]
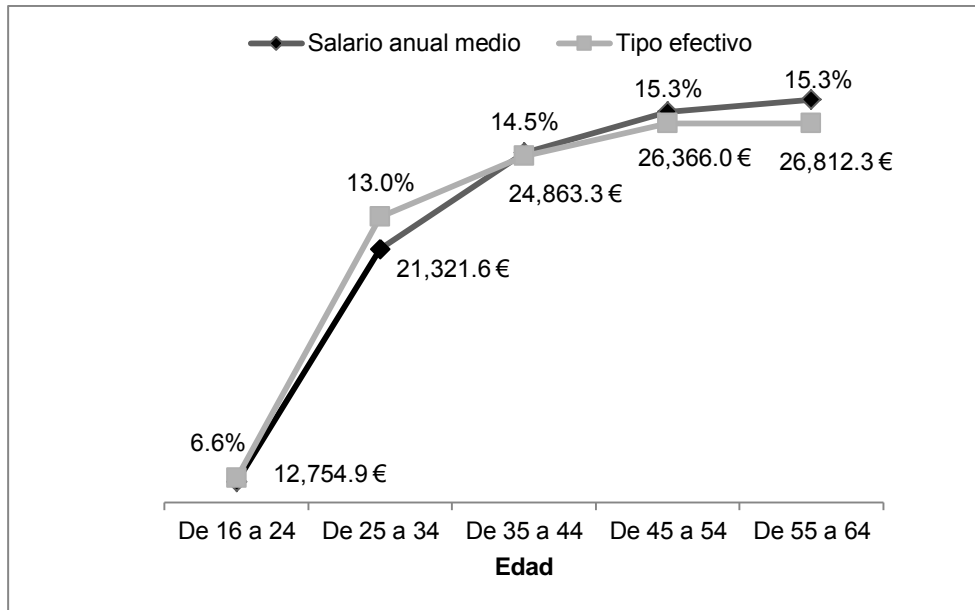
Para completar el análisis y extenderlo a las personas mayores de 65 años, incorporamos la pensión media de jubilación a partir del documento "Evolución mensual de las pensiones del Sistema de la Seguridad Social" (MTIN, 2010). Por último, para cada grupo de edad, cruzamos el tipo efectivo correspondiente a su renta con su moral fiscal media. El gráfico resultante (Figura 4) nos muestra que, efectivamente, ambas magnitudes siguen una evolución análoga: hasta la edad de jubilación, la moral fiscal y el tipo impositivo aumentan , y descienden a partir de los 65 años.

Así, y teniendo en cuenta que los asalariados y pensionistas apenas tienen oportunidades para evadir (pues están sujetos a una retención en origen por parte del empleador o del Estado), la pregunta de investigación se convierte finalmente en la siguiente: ¿por qué el hecho de (no tener más remedio que) pagar impuestos provoca un creciente rechazo de la evasión fiscal -y al revés?

---

[7] Euros y porcentajes, INE 2009 y MEH 2008.

Figura 4: Moral fiscal media y tipo efectivo de asalariados y pensionistas para seis grupos de edad[8]
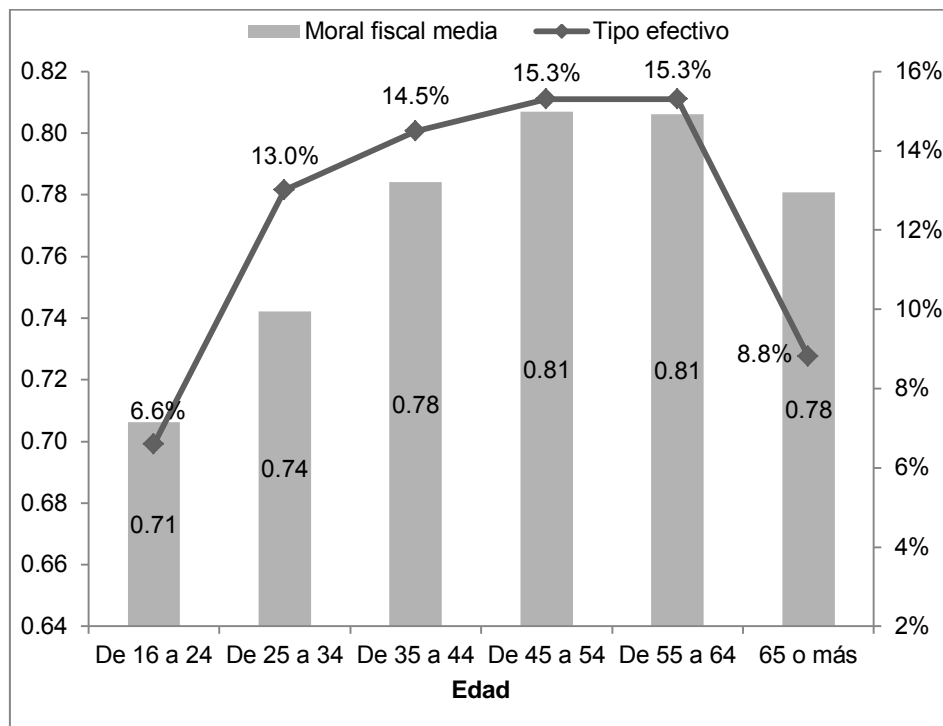
[Coeficiente de correlación de Spearman =0,896 (p-valor =,016)]

Para contestar a semejante pregunta, se propone un mecanismo psicológico de racionalización llamado *resentimiento fiscal* (Figura 5): el asalariado medio transforma el malestar que le produce el querer evadir impuestos y no tener oportunidad de hacerlo (en un contexto en el que percibe que otras persones sí pueden defraudar: autónomos, rentas más altas…) en una actitud de intolerancia hacia la evasión. En esencia, este mecanismo consiste en "hacer de la imposibilidad virtud" y constituye, por consiguiente, un caso de moral adaptativa: la propia conducta (no poder eludir las obligaciones fiscales) se justifica *post-hoc*, de modo que se produce un alivio de los costes psíquicos que tal conducta provoca.

Figura 5: Diagrama-resumen del mecanismo de resentimiento fiscal

---
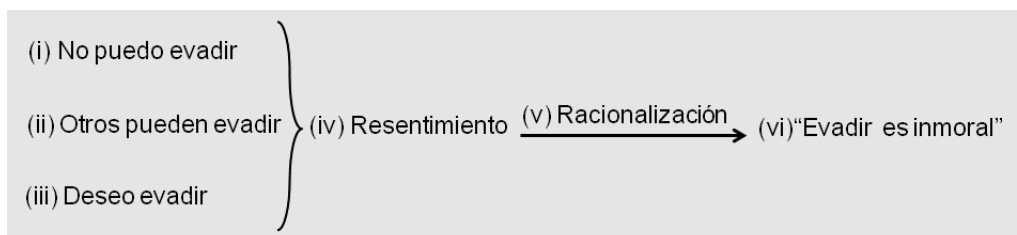
[8] Trabajadores por cuenta ajena de 65 años y pensionistas por jubilación mayores de 65 años, N=999, CEO 2010, MEH 2008 y MTIN 2009.

Discusión

El artículo presenta, en definitiva, la microfundamentación de una relación estadística cuyos mecanismos explicativos se suelen mantener ocultos en los trabajos sobre moral fiscal. Además, se suma al reducido grupo de trabajos que contemplan la existencia de fenómenos psicológicos de naturaleza adaptativa en el campo de la evasión fiscal. En particular, en la línea de Falkinger (1988) y Wenzel (2005), RF contempla la posibilidad de que los juicios morales sean el resultado de una racionalización del autointerés; por otro lado, en concordancia con el trabajo de Blanthorne y Kaplan (2008), considera que el hecho de tener menores oportunidades para evadir está detrás de una mayor condena de la evasión. En cualquier caso, cabe tener en cuenta que RF es el primer estudio de este tipo en el ámbito de la moral fiscal.

Los resultados obtenidos presentan, sin embargo, ciertas limitaciones. La hipótesis explicativa propuesta se desarrolla mediante el empleo de diversas técnicas estadísticas y gráficas; como hemos visto, su principal argumento descansa en la correspondencia existente entre la evolución de la moral fiscal media y el tipo impositivo medio para cada grupo de edad. No obstante, para poner de manifiesto tal correspondencia se utilizan datos procedentes de varias fuentes. Con tal de evitar este problema, cabría emplear un procedimiento a través del cual poder imputar un tipo efectivo a cada encuestado; de este modo, se evitaría trabajar únicamente con los valores medios y se podría encontrar evidencia estadística más sólida acerca de la existencia de la relación planteada. Por otro lado, la plausibilidad del mecanismo del resentimiento fiscal quedaría sin duda reforzada si se empleasen datos que provengan de otras encuestas de moral fiscal, españolas (e.g: CIS, IEF) o internacionales (WVS, EVS…); adicionalmente, cabría diseñar un experimento conductual capaz de testar su validez.

El modelo SIMULFIS

Resumen

A continuación se resumirán los resultados de los experimentos realizados en S1 y S2. Aunque recogen versiones diferentes del modelo SIMULFIS, ambos artículos arrojan unas conclusiones muy similares y pueden, por tanto, ser comentados de forma conjunta.[9] Cabe señalar que, para comprender adecuadamente los resultados que se van a resumir a continuación, y puesto que el SIMULFIS posee una complejidad considerable, se

---

[9] Los gráficos que se presentarán corresponden a los resultados de las simulaciones de la segunda versión del modelo, que supone un perfeccionamiento de la primera.

recomienda consultar cualquiera de los dos artículos para hacerse una idea del funcionamiento del modelo.

Un primer resultado obtenido, previsible desde un punto de vista teórico, es que un aumento de los instrumentos disuasorios produce una mejora del cumplimiento fiscal. En la figura 6 se muestra cómo el FOUR –o *Fraud Opportunity Use Rate,* esto es, el grado en que los contribuyentes aprovechan sus oportunidades de defraudar- desciende en los cuatro escenarios posibles conforme aumentan las inspecciones (de izquierda a derecha) y las multas (de arriba abajo). No obstante, tal y como se observa en los gráficos (y como confirman los análisis de regresión realizados con posterioridad), a la hora de mejorar el cumplimiento fiscal resulta proporcionalmente más efectivo incrementar las inspecciones antes que las sanciones.

Figura 6: *FOUR medio por condiciones disuasorias y escenarios conductuales*
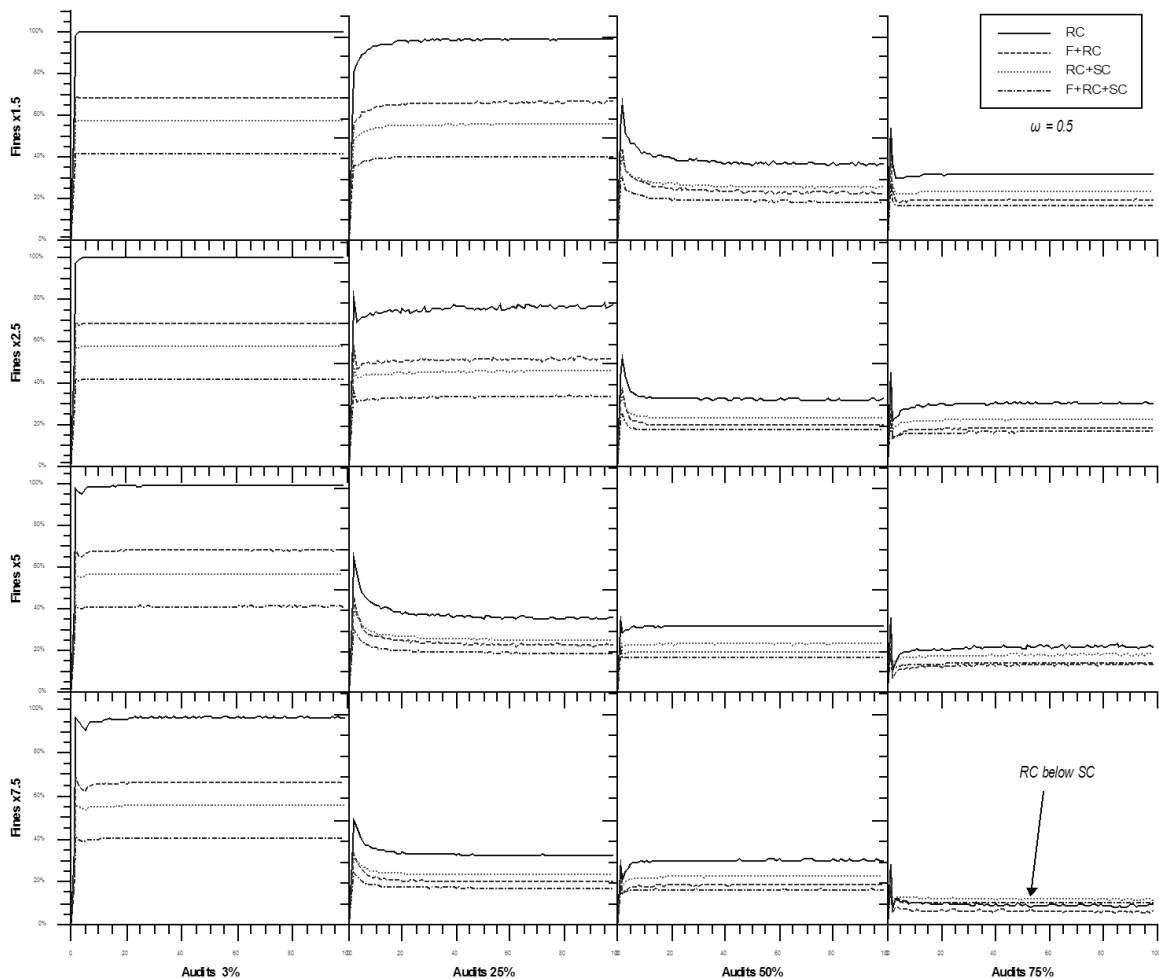
RC=filtro de elección racional activado (*Rational Choice*). F+RC =filtros de justicia y elección racional activados (*Fairness* y *Rational Choice*). RC+SC=filtros de elección racional y contagio social activados (*Rational Choice* y *Social Contagion*). F+RC+SC= filtros de justicia, elección racional y contagio social activados (*Fairness, Rational Choice* y *Social Contagion*). Las inspecciones (*audits*) se expresan en porcentajes y las multas (*fines*) como multiplicadores de los impuestos evadidos. El eje de ordenadas representa el FOUR y el de abcisas el tiempo.

En segundo lugar, nos encontramos con el resultado quizá más interesante: el efecto del contagio social sobre el cumplimiento es ambivalente y depende de la intensidad de los instrumentos disuasorios. Cuando los niveles de inspección y punición son bajos, la introducción del mecanismo de contagio social produce un descenso substancial del FOUR; sin embargo, este efecto pierde intensidad a medida que aumentan las inspecciones y las multas (de izquierda a derecha y de arriba a abajo en la Figura 6). Siguiendo esta tendencia, llega un punto en que los escenarios con influencia social (*RC+SC* y *F+RC+SC*), frente a los que están desprovistos de tal influencia (*RC* y *F+RC*), obtienen un mayor aprovechamiento de las oportunidades de evadir (tal y como se aprecia en el gráfico del extremo inferior derecho de la Fig. 6). Tal resultado queda específicamente ilustrado en la figura 7, donde vemos que el contagio social tiene un efecto positivo sobre el FOUR conforme se endurecen los instrumentos disuasorios; en particular, tal efecto es marginalmente decreciente, hasta el punto que el escenario con contagio social acaba por ser subóptimo respecto a los escenarios en que los agentes deciden sin tener en cuenta las decisiones de sus vecinos.[10]

Figura 7
Diferencias medias de FOUR entre los escenarios con y sin contagio social según la condición disuasoria (referencia: escenarios con contagio social)
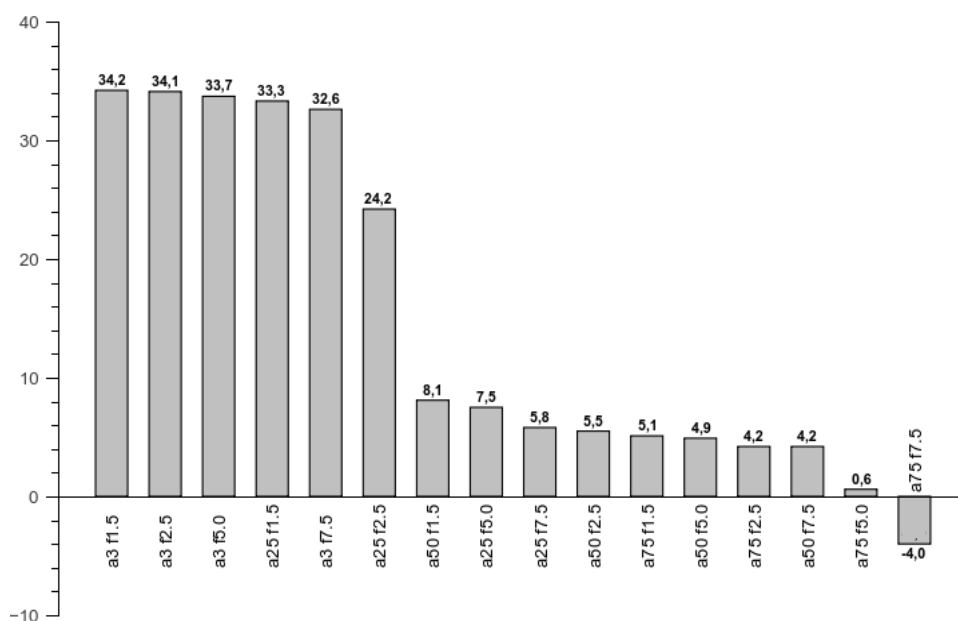
La etiqueta vertical de cada barra indica el porcentaje de inspecciones (*audits*, 'a') y el multiplicador de las sanciones (*fines*, 'f'); el número en horizontal es la diferencia porcentual de FOUR respecto a los escenarios de referencia.

---

[10] Las razones de este hecho tienen que ver con la dinámica que se establece en las primeras rondas de las simulaciones y están debidamente expuestas en el artículo S2.

En tercer lugar, observamos que el escenario en que los agentes actúan exclusivamente conforme a los supuestos de la teoría de la elección racional sobreestima los niveles de fraude. Concretamente, en las condiciones más realistas de disuasión (inspecciones del 3% y multas de 1,5 - 2 veces el monto evadido; ver los dos gráficos superiores de la primera columna en la Figura 6), los contribuyentes aprovechan en su totalidad las oportunidades de defraudar que se les presentan, algo que se antoja poco plausible. Gracias a que el SIMULFIS, además de resultados 'conductuales' (relativos al *FOUR*), permite obtener resultados 'económicos' (en unidades monetarias), en nuestro modelo podemos calcular, por ejemplo, la proporción de renta ocultada respecto a la renta total (Figura 8) y compararla con datos externos. Así, si tenemos en cuenta las estimaciones disponibles sobre el fraude fiscal en España (un 22% del PIB: Gestha, 2011), vemos que sólo los escenarios con influencia social (*RC +SC* y *F+RC+SC*) arrojan cifras similares.

Figura 8

Proporción de renta ocultada respecto a la renta total por escenario conductual
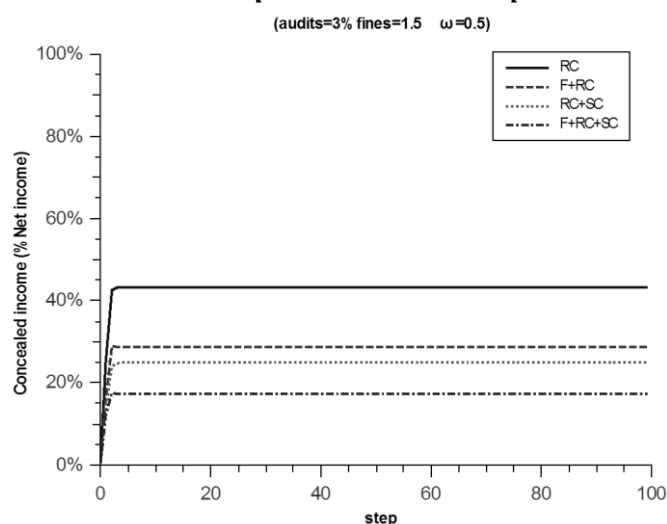
RC=filtro de elección racional activado (*Rational Choice*). F+RC =filtros de justicia y elección racional activados (*Fairness y Rational Choice*). RC+SC=filtros de elección racional y contagio social activados (*Rational Choice y Social Contagion*). F+RC+SC= filtros de justicia, elección racional y contagio social activados (*Fairness, Rational Choice y Social Contagion*). Las inspecciones (*audits*) se expresan en porcentajes y las multas (*fines*) como multiplicadores de los impuestos evadidos. El eje de ordenadas representa el FOUR y el de abcisas el tiempo.

Discusión

Los resultados de los experimentos realizados demuestran que el modelo es robusto internamente y funciona conforme a los supuestos teóricos con los que fue diseñado. Adicionalmente, los resultados permiten establecer un diálogo provechoso con la literatura precedente. Así, la evidencia obtenida en referencia a la diferente efectividad de los instrumentos disuasorios concuerda con los hallazgos producidos en el laboratorio

(Alm y Jacobson, 2007). Por su parte, la constatación del efecto ambivalente de la influencia social sobre la evasión fiscal resulta novedosa en relación a otros modelos (e.g. Korobow *et al.*, 2007), en los que su efecto es unívoco e independiente de la intensidad de inspecciones y multas. En este sentido, puede afirmarse que el SIMULFIS adopta una perspectiva más netamente –y analíticamente- sociológica, ya que aporta un 'grano más fino' en el estudio del papel de la influencia social en el comportamiento fiscal[11]. Por último, el hecho de que los escenarios en que los contribuyentes son meros agentes maximizadores arrojen unos niveles de fraude sobredimensionados, proporciona un argumento a favor de una crítica fundamental en la literatura reciente (Feld y Frey, 2002), a saber: que la teoría de la elección racional es por sí sola insuficiente a la hora de explicar el fenómeno de la evasión y, por tanto, necesita ser enriquecida con factores no estrictamente económicos.

Cabe señalar, además, que los resultados permiten extraer recomendaciones institucionales en vistas a luchar contra el fraude fiscal. En primer lugar, y en referencia a los instrumentos disuasorios, la evidencia obtenida aconseja que se dediquen mayores esfuerzos a mejorar la presencia y alcance de las inspecciones antes que al endurecimiento de las sanciones. En segundo lugar, y en la medida en que la inclusión del mecanismo de influencia social puede resultar más eficaz que un aumento de multas e inspecciones, se sugiere que la estrategia de generar una determinada percepción de cumplimiento puede tener una efectividad igual o mayor a la de intensificar la persecución de la evasión por parte de las autoridades.

Por lo que respecta a la validación externa de los resultados del modelo, hay que reconocer que se trata de una tarea delicada. No debe perderse de vista la escasez de datos fiables acerca de los niveles reales de evasión. Sin embargo, la información disponible nos permite ser optimistas. Así, por ejemplo, se estima que los trabajadores autónomos españoles ocultan un 25% más de renta que los asalariados (Martínez, 2012), mientras que las últimas simulaciones llevadas a cabo con el SIMULFIS arrojan un porcentaje del 26,9%. En cualquier caso, la calibración empírica de los resultados es sin duda una de las tareas más importantes de cara a futuros desarrollos del modelo. Semejante tarea podría consistir en adoptar una perspectiva dinámica -introduciendo datos históricos para el caso español-, o dotarlo de una dimensión internacional -implementando el modelo con datos de otros países-. La flexibilidad es, precisamente, una de las principales virtudes de los

---

[11] Este rasgo resulta especialmente patente en el caso de S2, donde se ofrece una revisión de la literatura y una taxonomía integral de mecanismos de influencia social.

modelos de simulación basados en agentes en relación a otras herramientas metodológicas.

Referencias

AGUIAR, F.; DE FRANCISCO, A. y NOGUERA, J.A. (2009), "Por un giro analítico en sociología", *Revista Internacional de Sociología*, 67 (2): 437-456

ALAÑON, A. y GOMEZ-ANTONIO, M (2005), "Estimating the size of the shadow economy in Spain: a structural model with latent variables", *Applied Economics*, 37 (9): 1011-1025.

ALARCÓN G., BEYAERT, A. y DE PABLOS, L (2012), "Fiscal Awareness: a study of the female attitude towards fraud in Spain", en M. Pickhardt y A. Prinz (eds.), *Tax Evasion and the Shadow Economy*. Chentelham: Edward Elgar.

ALARCÓN, L., DE PABLOS, L. y GARRE, E. (2009), "Análisis del comportamiento de los individuos ante el fraude fiscal. Resultados obtenidos a partir de la Encuesta del Observatorio Fiscal de la Universidad de Murcia", *Principios*, 13: 55-84.

ALM, J. y GOMEZ, J.L. (2008), "Social Capital and Tax Morale in Spain", *Economic Analysis & Policy*„ 38 (1): 73-87.

ALM, J. y JACOBSON, S. (2007), "Using Laboratory Experiments in Public Economics", *National Tax Journal*, 60(1): 129-152.

ARRAZOLA, M., DE HEVIA, J., MAULEÓN, I. Y SÁNCHEZ, R. (2011), "Estimación del volumen de economía sumergida en España" en *Cuadernos de Información Económica*, 220.

BLANTHORNE, C. y KAPLAN, S. (2008), "An egocentric model of the relations among the opportunity to underreport, social norms, ethical beliefs, and underreporting behaviour", *Accounting, Organizations and Society*, 33 (7-8): 684-703.

BOUDON, R. (1976), "Comment on Hauser's Review of Education, Opportunity, and Social Inequality", *American Journal of Sociology*, 81 (5): 1175-1187.

C.I.S. (Centro de Investigaciones Sociológicas) (2013), *Opinión pública y política fiscal*. Centro de Investigaciones Sociológicas, Estudio nº 2.994.

COLEMAN, J. S. (1990), *Foundations of Social Theory*. Cambridge: The Belknap Press.

DAVIDSON, D. (1980), *Ensayos sobre sucesos y acciones*. Barcelona: Crítica, 1995.

DULLECK, U., FOOKEN, J., NEWTON, C., RISTL, A., SCHAFFNER, M. y TORGLER, B. (2012), "Tax Compliance and Psychic Costs: Behavioral Experimental Evidence Using a Physiological Marker", QuBE Working Papers 001, QUT Business School.

ELSTER, J. (2007), *Explaining Social Behavior. More nuts and bolts for the social sciences*. Cambridge: Cambridge University Press. [Traducción española en ELSTER, J. (2010), *La explicación del comportamiento social*. Barcelona: Gedisa].

ESPAÑA (2006), "Ley 36/2006, de 29 de noviembre, de medidas para la prevención del fraude fiscal", *Boletín Oficial del Estado, 30 de noviembre del 2006, num. 286:* 42087-42118.

EZQUERRO, J. (1991), "Davidson, Fodor, Dennett y conexionismo/s: razones y causas en los marcos actuales de explicación causal de la acción racional", *Δαίμων (Daimon)*, 3: 81-111.

FALKINGER, J. (1988), "Tax evasion and equity: a theoretical analysis", *Public Finance, 3*, 388–395.

FELD, L.P. y FREY, B.S. (2002), "Trust breeds trust: How taxpayers are treated," *Economics of Governance*, 3(2): 87-99.

FREESE, J. (2009), "Preferences", en P. Hedström y P. Bearman (eds.), *The Oxford Handbook of Analytical Sociology.* Oxford: Oxford University Press.

GESTHA (2011), *El fraude en grandes empresas triplica al de pymes y autónomos*. Nota de prensa, 9 de setiembre del 2011. Disponible en internet:

<http://www.ioncomunicacion.es/noticia.php?id=10723>

GESTHA (2014), *La economía sumergida pasa factura. El avance del fraude en España durante la crisis.* Disponible en internet:

<http://cd00.epimg.net/descargables/2014/01/29/323fc63650907548f7491c007d99
9b03.pdf>

GIACHI, S. (2014), "Dimensiones sociales del fraude fi scal: confianza y moral fiscal en la España contemporánea", *Revista Española de Investigaciones Sociológicas*, 145: 73-98.

HALLA, M. (2012), "Tax Morale and Compliance Behavior: First Evidence on a Causal Link", *The B.E. Journal of Economic Analysis & Policy*, 12 (1): 1935-1682.

HEDSTRÖM, P. (2005), *Dissecting the Social. On the Principles of Analytical Sociology*. New York: Cambridge University Press.

HEDSTRÖM, P. y YLIKOSKI, P. (2010), «Causal Mechanisms in the Social Sciences», *Annual Review of Sociology*, 36: 49-67.

HEDSTRÖM, P. y SWEDBERG, R. (eds.) (1998), *Social Mechanisms. An Analytical Approach to Social Theory*. Cambridge: Cambridge University Press.

I.E.F. (Instituto de Estudios Fiscales) (2013), "Opiniones y actitudes fiscales de los españoles en 2011", Doc. nº 21/2013

KOROBOW, A., JOHNSON, C. y AXTELL, R. (2007), "An Agent-Based Model of Tax Compliance with Social Networks", *National Tax Journal*, LX (3): 589-610.

MALLE, B.F. (2002), "From Attributions to Folk Explanations: An Argument in 10 (or so)", Institute of Cognitive and Decision Sciences, University of Oregon Series, ICDS Technical Reports.

MARÍA-DOLORES, R., ALARCÓN, G. y GARRE, E. (2010), "Tax Morale in Spain: A Study into Some of Its Principal Determinants", *Economic Analysis & Policy*, 38 (1): 855-876.

MARTÍNEZ, DAVID (2012). "The underreporting of income by self-employed workers in Spain", *Journal of the Spanish Economic Association*: 1-19.

MURPHY, R. (2012), "Closing the European Tax Gap: A report for Group of the Progressive Alliance of Socialists & Democrats in the European Parliament", *Tax Research LLP*. Disponible en internet: <http://www.socialistsanddemocrats.eu/gpes/media3/documents/3842_EN_richard_murphy_eu_tax_gap_en_120229.pdf>

NOGUERA, J. A. y DE FRANCISCO, A. (2011). "La sociología analítica", en Salvador Giner (ed.): Teoría Sociológica Moderna (2ª edición revisada y ampliada). Barcelona: Ariel.

PRIETO, J., SANZO, M.J. y SUÁREZ, J. (2006), "Análisis económico de la actitud hacia el fraude fiscal en España", *Hacienda Pública Española/ Revista de Economía Pública*, 177: 107-128.

SCHNEIDER, F. (2005), "Shadow Economies Around the World: What Do We Really Know?", *European Journal of Political Economy*, 21(3): 598-642.

SCHNEIDER, F. (2012), "Shadow Economies in Highly Developed OECD Countries: What are the Driving Forces?", IZA Discussion Paper No. 6891.

SCHNEIDER, F. y BUEHN, A. (2012), "The Shadow Economy and Work in the Shadow: What Do We (Not) Know?", IZA Discussion Paper No. 6423.

TORGLER, B. y MARTINEZ-VÁZQUEZ, J. (2009), "The Evolution of Tax Morale in Modern Spain", *Journal of Economic Issues*, 43 (1): 1 - 28.

WENZEL, M. (2005): "Motivation or rationalisation? Causal relations between ethics, norms and tax compliance", *Journal of Economic Psychology*, 26 (4): 491-508.

II. Artículos publicados

Se incluyen a continuación los tres artículos publicados. Por orden, se trata de:

- Llacer, T. (2014), «Resentimiento fiscal: una propuesta de mecanismo explicativo de la relación entre la edad y la moral fiscal», *Revista Internacional de Sociología*, 72 (1): 35-56.
- Llacer, T., Miguel, F. J., Noguera, J. A. y Tapia, E. (2013), «An Agent-Based Model of Tax Compliance: An Application to the Spanish Case», *Advances in Complex Systems*, 16 (4-5).
- Noguera, J. A., Miguel, F. J., Tapia, E. y Llacer, T. (De próxima aparición), «Tax Compliance, Rational Choice, and Social Influence: An Agent-Based Model», *Revue Française de Sociologie*, 55 (4).

RESENTIMIENTO FISCAL
Una propuesta de mecanismo explicativo de la relación entre la edad y la moral fiscal

TAX RESENTMENT
A proposed mechanism to explain the relationship between age and tax morale

TONI LLACER   toni.llacer@uab.cat
Universidad Autónoma de Barcelona. España

RESUMEN
El presente artículo trata de micro-fundamentar una de las evidencias más sólidas de la literatura sobre moral fiscal, a saber, que los jóvenes tienden a manifestar una mayor tolerancia ante el fraude tributario que las personas de los demás grupos de edad. Basándose en varias fuentes de datos, el estudio muestra que la evolución de la moral fiscal de los asalariados catalanes sigue un patrón análogo al tipo impositivo que soportan a lo largo de los años. Para explicar este hecho se propone un mecanismo de racionalización llamado "resentimiento fiscal". Tal mecanismo resulta novedoso en la medida en que tiene en consideración las diferentes oportunidades de evasión de los contribuyentes, así como aspectos emocionales y de naturaleza adaptativa, presentando de este modo un "grano más fino" en la explicación de la moral fiscal que las habituales investigaciones en la materia.

PALABRAS CLAVE
Cumplimiento fiscal; Evasión fiscal; Moral Fiscal; Sociología analítica.

ABSTRACT
The aim of this paper is to find the micro-foundations of one of the strongest statistical evidence in tax morale literature, namely, that young people tend to show greater tolerance to tax evasion than people of other age groups. Based on various data sources, the study shows that the evolution of tax morale in Catalan wage-earners follows a similar pattern to the tax rate they support over the years. A rationalization mechanism called "tax resentment" is proposed. Such mechanism is innovative, as it takes into account the different opportunities for evasion of taxpayers, as well as a range of emotional and adaptive aspects, thus presenting a "finer grain" in the explanation of tax morale than most of the previous research done in this field so far.

KEYWORDS
Analytical Sociology; Tax Compliance; Tax Evasion; Tax Morale.

Introducción[*]

La evasión fiscal —es decir, la reducción voluntaria de la carga impositiva por medios ilegales (Elffers *et al.* 1987)— es un problema de gran relevancia social. Esto es así ya que, en primer lugar, reduce los recursos de los que dispone el sector público, hecho que resulta especialmente sangrante para el caso de España, cuya economía sumergida representa en torno al 20% de su PIB[1]. En segundo lugar, el fraude tributario, en la medida en que no se extiende de igual modo entre los contribuyentes, provoca que el sistema fiscal viole de facto los principios de justicia, igualdad y progresividad[2].

Las investigaciones académicas que tratan de explicar el fenómeno de la evasión fiscal han ido reconociendo de forma creciente la necesidad de incorporar aspectos psicológicos y culturales en sus explicaciones, tradicionalmente basadas en los supuestos restringidos del *homo oeconomicus*. Entre tales trabajos destacan los estudios que tienen como objeto de estudio la "moral fiscal" del contribuyente, a saber, su tolerancia ante el fraude tributario. Recientemente se ha demostrado la existencia, a nivel agregado, de un vínculo causal entre la moral fiscal y el volumen de economía sumergida de un país (Halla 2012); a nivel individual, se han hallado pruebas de su relación con la evasión autodeclarada (Cummings *et al.* 2009) y con la conducta evasora observada en el laboratorio (Kirchler y Wahl 2010).

En definitiva, tratar de comprender las causas de la formación de una determinada moral fiscal se presenta como una tarea pertinente en tanto que debe contribuir al diseño de estrategias institucionales que, en última instancia, permitan combatir la evasión fiscal y, por tanto, contribuyan a mejorar la justicia efectiva del sistema fiscal y a aumentar los ingresos públicos sin necesidad de aumentar los tipos impositivos. Este hecho resulta de especial interés si se tienen en cuenta las dificultades que en los últimos tiempos atraviesan los gobiernos a la hora de mantener las políticas propias del Estado del bienestar.

[1] En Arrazola *et al.* (2011) se calcula que la economía sumergida española representa aproximadamente el 17% de su PIB. El Sindicato de Técnicos del Ministerio de Hacienda (GESTHA), por su parte, eleva la cifra hasta un 23,3%. (http://www.gestha.es/?seccion=actualidad&num=104).

[2] Para consultar una exposición de los principios rectores de los sistemas impositivos y de su relación con la ética, véase el documento del Instituto de Estudios Fiscales (2004).

Antecedentes

El disparo de salida en la investigación de la evasión tributaria lo dio el modelo desarrollado por Allingham y Sandmo (1972) —y, de forma paralela, por Srinivasan (1973)—, basado en la teoría económica de corte neoclásico. Este modelo es una adaptación de la "economía del crimen" de G. Becker (1968), es decir, un intento de explicar la conducta desviada en términos de elección racional: el individuo decide qué cantidad de su renta le conviene declarar en función de los beneficios de ocultarla (dado el tipo impositivo) y los costes de ser descubierto (dada la probabilidad de inspección y la cuantía de la multa). La principal crítica lanzada contra este enfoque ha sido la de que predice un nivel de evasión muy superior al observado: dadas las escasas probabilidades de inspección y el nivel de sanciones existentes en el mundo real, la conducta mayoritaria debería ser la de evadir, cosa que de hecho no sucede (Alm *et al.* 1992). Así, las investigaciones de las últimas dos décadas pueden verse como los intentos sucesivos de ampliar el modelo neoclásico tradicional con el objeto de dar cuenta de un acto, el cumplimiento fiscal, que aparece como "cuasi-voluntario" (Levi 1988).

No resulta sorprendente, pues, que en tal empresa ocupen un lugar destacado aquellos estudios que, a través de encuestas de opinión, intentan medir y explicar la moral fiscal (*tax morale*) de la ciudadanía, entendida como "motivación intrínseca" (Feld y Frey 2002) o "voluntad interiorizada" de pagar impuestos (Braithwaite y Ahmed 2005). Tales investigaciones han proliferado recientemente y tienen como figura principal a Benno Torgler, autor de varias decenas de estas publicaciones en la última década. Los trabajos de este tipo tratan de explicar la moral fiscal tomando como *proxy* la tolerancia declarada ante la evasión fiscal —a menudo a partir de una sola pregunta— e incluyéndola como variable dependiente en diversos modelos de regresión. Así, aunque con resultados en su mayoría poco concluyentes, estas investigaciones nos permiten obtener información acerca de las correlaciones de la moral fiscal tanto con variables socio-demográficas (edad, sexo, estado civil, nivel educativo o de ingresos…) como ideológicas (religiosidad, patriotismo, confianza en las instituciones, etc.)[3].

En España se han realizado algunos trabajos académicos de este tipo como los de Prieto, Sanzo y Suárez (2006), Alm y Gómez (2008), Alarcón, De Pablos y Garre (2009), Torgler y Martínez Vázquez (2009) y María-Dolores, Alarcón y Garre (2010). No obstante, tratándose de un país en el que el fraude fiscal alcanza dimensiones preocupantes y en el que, además, existe un fuerte debate sobre la financiación del sistema autonómico, sería sin duda deseable que se hicieran más investigaciones de este tipo[4].

---

[3] Véase un resumen en Torgler (2007).

[4] Hay que tener en cuenta, además, que en España existen desde hace años encuestas periódicas de carácter específico sobre fiscalidad: véanse la de *Opinión pública y política fiscal* del Centro de Investigaciones

Objeto de la investigación

El objeto de estudio consiste en una de las evidencias más sólidas de la literatura sobre moral fiscal, a saber: que la intolerancia ante el fraude crece con la edad (Torgler 2007; McGee y Tyler 2007). Semejante hallazgo, sin embargo, no representa propiamente un avance en términos explicativos si adoptamos la perspectiva de los mecanismos (Hedström 2005; Elster 2007) propia de la sociología analítica contemporánea (Noguera y De Francisco 2011). A pesar de que este tipo de trabajos se presentan explícitamente como capaces de "abrir la caja negra" de la moral fiscal (Torgler 2004; Torgler y Murphy 2004), constatar la mera correlación entre dos variables supone de hecho una nueva caja negra: ¿por qué —en virtud de qué diferencias en sus estados intencionales— los más jóvenes presentan una mayor tolerancia ante el fraude que los demás grupos de edad? En la literatura especializada a lo sumo de pueden encontrar sugerencias de mecanismos explicativos; así, se ha apuntado al hecho de que la gente mayor siente más respeto por la autoridad y el gobierno (Alm y Torgler 2005), recibe más beneficios del Estado de bienestar (Prieto *et al.* 2006), siente un mayor apego a la comunidad (Torgler 2007) y, dada su mayor posición social, asigna unos costes potenciales superiores a la detección (Torgler 2003b; Orviska y Hudson 2003)[5]. Una excepción a esta manera de proceder es el trabajo de Braithwaite *et al.* (2010), dedicado en exclusiva a explicar el menor cumplimiento fiscal de los menores de treinta años. Su resultado más interesante es quizá el que indica que el mayor compromiso moral que presentan los adultos frente al pago de impuestos se explica, parcialmente, gracias a un mejor conocimiento de sus obligaciones como contribuyentes. La otra excepción corresponde al reciente trabajo de Nordblom y Žamac (2012), que trata de explicar la evolución de la moral fiscal a lo largo del ciclo vital como el producto de la doble influencia del propio comportamiento pasado (disonancia cognitiva) y de la actitud de los demás (conformidad a la norma) a través de un modelo de simulación social basado en agentes.

En definitiva, y salvo las excepciones señaladas, los estudios sobre moral fiscal que utilizan datos de encuestas se conforman con admitir de forma tácita que "es difícil encontrar intuiciones sociológicas o psicológicas que justifiquen tales diferencias [en la moral fiscal] según el género y la edad" (Molero y Pujol 2012). El presente trabajo, en cambio, aborda tal dificultad en tanto que se propone hallar un mecanismo explicativo de la relación entre moral fiscal y edad, entendiendo que un "mecanismo" "proporciona una cadena continua y contigua de vínculos causales o intencionales entre el *explanans* y el *explanandum*" (Elster 1989).

Sociológicas (CIS) y *Opiniones y actitudes fiscales de los españoles* del Instituto de Estudios Fiscales (IEF).

[5] Esto último, en todo caso, constituiría una hipótesis que explicaría el mayor cumplimiento fiscal de las personas de mayor edad, pero no necesariamente su mayor moral fiscal.

ANÁLISIS EMPÍRICO

Los datos provienen de la encuesta *Valores y actitudes sobre justicia distributiva: prestaciones sociales y fiscalidad*, diseñada por el Grupo de Sociología Analítica y Diseño Institucional (GSADI) de la Universidad Autónoma de Barcelona y financiada por el Centro de Estudios de Opinión (CEO) de la Generalidad de Cataluña. Se trata de una encuesta telefónica a 1.900 personas, representativa de la población catalana mayor de 16 años y realizada durante el mes de marzo del 2010. En ella se incluye un bloque específico sobre fiscalidad consistente en veinte preguntas que recogen las opiniones acerca de diferentes aspectos del sistema impositivo. En un trabajo anterior llevado a cabo por miembros del GSADI, se clasificó a los encuestados en dos *clusters* genéricos ("anti-impuestos" y "pro-impuestos") en base a sus respuestas a las preguntas de este bloque de fiscalidad; posteriormente se llevaron a cabo una serie de regresiones logísticas que trataban de explicar la pertenencia o no a tales *clusters* a través de determinadas variables estructurales y actitudinales. Todos los detalles de la encuesta, así como los resultados de estos procedimientos estadísticos, pueden consultarse en la monografía de Noguera *et al.* (2011), disponible en internet[6].

En la presente investigación, sin embargo, el interés se centra en una única pregunta del cuestionario, la referente al grado de justificación de la evasión: "¿Cree usted que está justificado no pagar los impuestos que la ley estipula?". Se ha elegido esta pregunta ya que es idéntica a la incluida en encuestas como la World Values Survey (WVS) y la European Values Survey (EVS) y es la que suele emplearse como *proxy* de la moral fiscal en buena parte de los trabajos especializados —como los de Torgler— con los que se desea dialogar. En nuestro caso, la respuesta se divide en tres posibles categorías: "no", "sí, en determinadas circunstancias" y "sí, siempre", recogiendo de este modo las tres posturas básicas que pueden adoptarse frente a los impuestos (McGee 2006). Cabe señalar que esta pregunta, a diferencia de otras del bloque de fiscalidad que exigían un conocimiento más específico del sistema fiscal, presenta una proporción especialmente baja de valores perdidos (2,4%).

En primer lugar, veamos los porcentajes totales de justificación del fraude. Tal y como se aprecia en la figura 1, el 59% de la muestra se muestra intolerante ante el fraude, un 34,6% lo tolera de algún modo y un 6,4% lo encuentra totalmente justificado. A continuación dividiremos a los encuestados en cuatro grupos de edad, según la clasificación habitual en estudios similares (Torgler 2007): menores de 30 años, de 30 a 49 años, de 50 a 64 años y 65 o más años[7]. En la figura 2 se observa que el rechazo a la evasión (% "no") es la opción mayoritaria en todos los grupos excepto en los más jóvenes. Esta actitud crece hasta los 65 años, edad a partir de la cual experimenta un descenso. De forma inversa, el

---

[6] http://ceo.gencat.cat/ceop/AppJava/export/sites/CEOPortal/estudis/monografies/contingut/justiciadistributiva01.pdf

[7] En adelante, a falta de datos longitudinales, los grupos de edad se van a interpretar como un "ciclo vital". Así, se asumirá que sus diferencias se deben al envejecimiento y no a divergencias generacionales.

porcentaje de personas que consideran que el fraude es parcialmente aceptable (% "sí, en determinadas circunstancias") disminuye hasta la edad de jubilación y a partir de ella se incrementa. Este comportamiento también se aprecia en la justificación incondicional de la evasión (% "sí, siempre"), aunque su punto de inflexión se sitúa en torno a los 50 años y se trata, para todos los grupos, de una postura claramente minoritaria.

Figura 1.
Justificación de la evasión fiscal

¿Está justificado evadir impuestos?
■ No ■ Sí, depende ■ Sí, siempre

6,4%

34,6%

59%
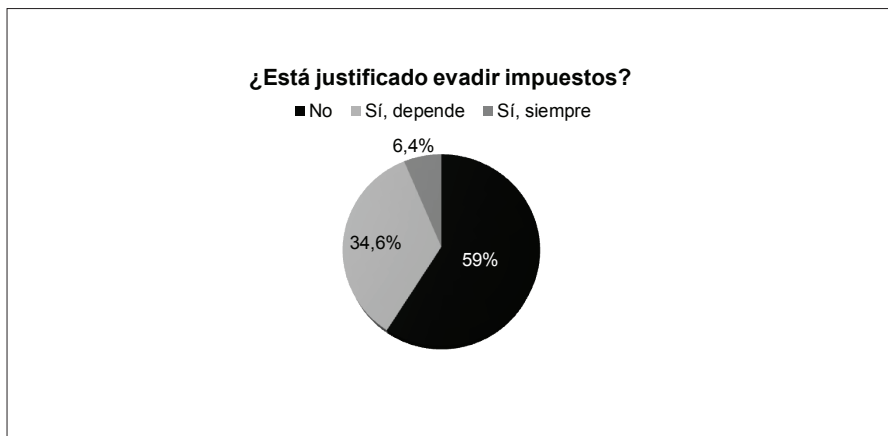
Fuente: Porcentajes, toda la muestra, N=1855, Centre d'Estudis d'Opinió, 2010.

Figura 2.
Justificación de la evasión fiscal para cuatro grupos de edad

¿Está justificado evadir impuestos?
■ No ■ Sí, depende ■ Sí, siempre

	De 16 a 34	De 35 a 49	De 50 a 64	65 o más
Sí, siempre	6,8%	5,0%	6,7%	8,1%
Sí, depende	48,1%	32,8%	26,8%	29,7%
No	45,1%	62,2%	66,5%	62,2%
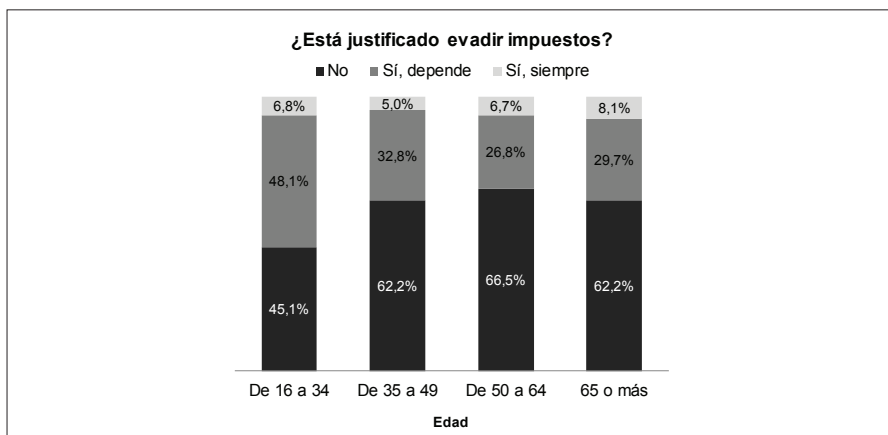
Edad

Fuente: Porcentajes, toda la muestra, N=1855, Centre d'estudis d'Opinió, 2010.

La evolución de la justificación de la evasión a través de los distintas edades también puede analizarse si se construye un índice de moral fiscal. Una forma intuitiva y razonable de transformar la tolerancia ante el fraude en una variable cuantitativa es otorgando unos valores de 0 y 1 para las dos opciones extremas ("sí, siempre" y "no", respectivamente) y 0,5 para la categoría intermedia ("sí, en determinadas circunstancias"). La figura 3 nos muestra cómo la moral fiscal media también aumenta desde los 16 hasta los 65 años, edad a partir del cual disminuye ligeramente. Al realizar la prueba no paramétrica de Kruskal-Wallis (Gibbons y Chakraborti 2010), encontramos que existen diferencias significativas (intervalo de confianza = 99%) entre las medias de los diferentes grupos de edad (ver tabla 1). En particular, al realizar las comparaciones por parejas, comprobamos que los menores de 30 años se diferencian significativamente del resto de grupos de edad.

Así, tanto si comparamos los porcentajes de rechazo como la moral fiscal media, este análisis inicial nos permite afirmar que, en línea con la literatura existente, los más jóvenes presentan una moral fiscal más baja que el resto de grupos poblacionales. Sin embargo, no podemos afirmar sin más que la moral fiscal crece con la edad, pues nuestros datos muestran un ligero aumento de la tolerancia ante el fraude a partir de la edad de jubilación. Este aumento también puede hallarse en la última encuesta sobre *Opiniones y actitudes fiscales de los españoles* (Instituto de Estudios Fiscales 2012:40). Además, si lo comparamos con los estudios que toman la edad como variable categórica, el resultado señalado concuerda también con el de Torgler (2003), basado en la WVS de 1990 para Canadá. Por otro lado, conviene señalar que los

Figura 3.
Moral fiscal media de cuatro grupos de edad.
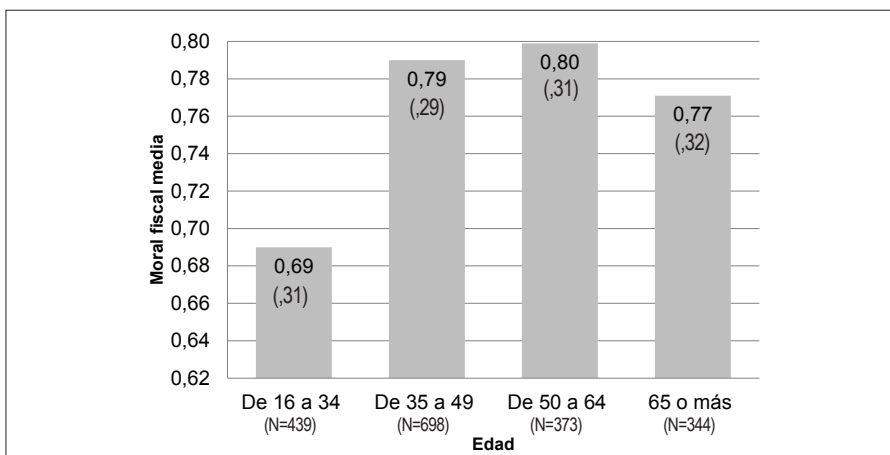
Fuente: Media y desviación típica (entre paréntesis), toda la muestra: N=1855, Centre d'estudis d'Opinió, 2010.

Tabla 1.

Prueba de Kruskal-Wallis y comparaciones por parejas de la media de moral fiscal para cuatro grupos de edad.

Resumen de prueba de hipótesis:

Hipótesis nula	Test	Sig.	Decisión
La distribución de la Moral fiscal es la misma entre las categorías de la variable Edad	Prueba Kruskal-Wallis de muestras independientes	,000	Rechazar la hipótesis nula

Comparaciones por parejas:

Muestra 1 – Muestra 2	Prueba estadística	Error típico	Desv prueba estadística	Sig.	Sig. ady.
De 16 a 29 – 65 o más	-143,525	33,445	-4,291	,000	,000
De 16 a 29 – de 30 a 49	-155,126	28,293	-5,483	,000	,000
De 16 a 29 – de 50 a 64	-186,124	32,708	-5,690	,000	,000
65 o más – de 30 a 49	11,601	30,598	,379	705	1,000
65 o más – de 50 a 64	42,600	34,721	1,227	,220	1,000
De 30 a 49 – de 50 a 64	-30,999	29,791	-1,041	,298	1,000

Fuente: Toda la muestra: N=1855, Centre d'Estudis d'Opinió, 2010.

trabajos que utilizan la edad como variable numérica suelen conformarse con detectar una relación creciente entre la edad y la moral fiscal, siendo escasos los artículos que tratan de capturar una posible asociación no lineal entre ambas variables, en concreto mediante la inclusión en la regresión de la edad elevada al cuadrado. Dentro de este tipo de investigaciones, Orviska y Hudson (2003) y Barone y Mocetti (2011) detectan, de forma estadísticamente significativa, que, a medida que la edad aumenta, la moral fiscal presenta cierta forma de U invertida para el caso del Reino Unido en 1996 e Italia en 2004, respectivamente[8].

---

[8] Otras excepciones de este tipo son Prieto *et al.* (2006) y Alm y Gomez (2008), aunque en ambos casos la variable de la edad al cuadrado no resultó significativa.

En cualquier caso, la evidencia encontrada nos obligaría a desestimar la hipótesis de Prieto *et al.* (2006) según la cual la intolerancia ante el fraude crece con la edad debido a que el intercambio con el Estado se vuelve más favorable conforme las personas envejecen (pues pasan a recibir pensiones de jubilación, a beneficiarse en mayor grado de la sanidad pública, etc.). Si bien los datos del CEO nos permiten afirmar que, como era previsible, la edad está relacionada con el hecho de percibir prestaciones públicas (V de Cramer=0,4, p-valor=0,00), este último no ha demostrado tener ningún efecto significativo sobre la moral fiscal, así como tampoco sobre la percepción de equilibrio en el intercambio con el Estado[9]. Este resultado, que concuerda con otros trabajos (véase, por ejemplo, Liebig y Mau 2006), parece contradecir la importancia otorgada en los últimos tiempos a las percepciones de justicia distributiva en el campo de la evasión fiscal (Wenzel 2003).

Con objeto de explicar las causas del patrón observado —a saber, que la moral fiscal crece hasta la edad de jubilación—, el siguiente paso en nuestro análisis consiste en dividir la muestra en los dos grandes colectivos de trabajadores, a saber, asalariados y trabajadores por cuenta propia. Estos dos grupos presentan notables diferencias en cuanto a sus oportunidades de evasión: mientras los primeros están mayoritariamente sujetos a retenciones en origen y tienen por tanto una capacidad muy limitada de evadir impuestos sin ser descubiertos, los segundos disponen de mayores opciones de engañar al fisco de forma exitosa (ocultando rentas, haciendo pasar sus gastos personales como gastos de empresa, etc.). Tradicionalmente se ha constatado que los autónomos evaden más que los asalariados (*e.g.*, Pissarides y Weber 1989) y, por lo general, presentan una menor conciencia fiscal (*e.g.*, Schmölders 1965). Sin embargo, así como la relación entre las oportunidades de evasión y la evasión efectiva es fácilmente explicable desde un modelo elemental de elección racional, el vínculo entre la oportunidad de evadir y la tolerancia ante el fraude sugiere, en cambio, la existencia de mecanismos explicativos más complejos (en particular, de moral adaptativa) que no han sido convenientemente estudiados hasta la fecha. Teniendo en cuenta lo anterior, se procedió a analizar la moral fiscal diferenciando entre asalariados y autónomos y a examinar su evolución a través de los diferentes grupos de edad, ahora en tramos más reducidos de diez años[10].

Si nos centramos ahora en aquellos que no justifican de ninguna manera la evasion —los "kantianos fiscales"— en relación a los que sí la toleran de algún modo y, por tanto, tratamos la variable de forma dicotómica (valores "no" y "sí" = "sí, en determinadas cir-

---

[9] Ni el hecho de percibir prestaciones públicas, ni el número total de prestaciones recibidas por el encuestado ni por el conjunto de su hogar han presentado una asociación con la moral fiscal (prueba del Chicuadrado).

[10] En los siguientes análisis se han excluido, por su baja frecuencia, las personas trabajadoras mayores de 65 años (siete autónomos y un asalariado), así como aquellas que, por incoherentes, declararon trabajar por cuenta propia o ajena pero al mismo tiempo manifestaron no obtener ningún ingreso (tres y cuatro casos, respectivamente). Por otro lado, los parados han sido excluidos de los análisis ya que solo una parte de ellos está obligada a pagar impuestos directos (por ejemplo, por tener dos o más pagadores), y la encuesta no permite discriminarla.

cunstancias" + "sí, siempre"), podemos observar que, para el caso de los asalariados, el porcentaje de rechazo, aunque con diferentes intensidades, aumenta sucesivamente desde el grupo más joven hasta el de mayor edad (figura 4). En cambio, la intolerancia ante el fraude de los autónomos presenta una asociación con la edad más irregular: crece hasta los 35-44 años, donde alcanza su máximo, para caer a los 45-54 y volver a aumentar en los diez años previos a la jubilación.

Figura 4.
Justificación de la evasión fiscal de los asalariados y autónomos para cinco grupos de edad
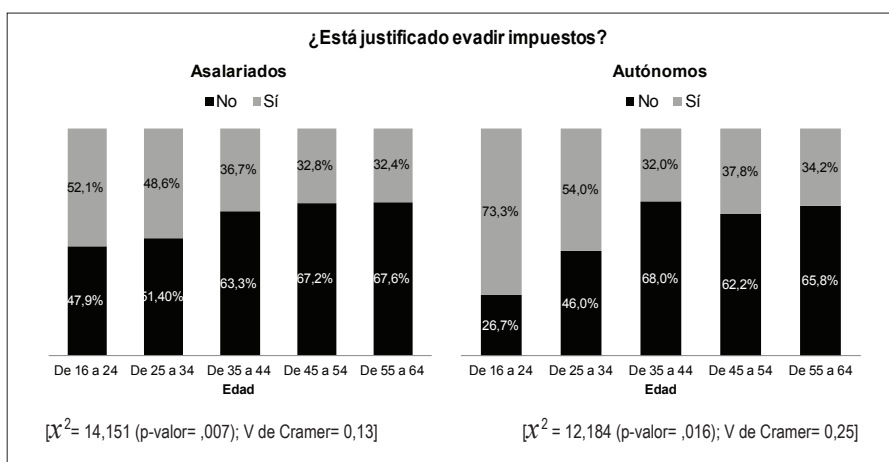
Fuente: Porcentajes, trabajadores por cuenta ajena y propia menores de 65 años, N=783 y N=190, Centre d'Estudis d'Opinió, 2010.

Fijémonos ahora en la evolución de los ingresos mensuales netos de los encuestados entre los distintos grupos de edad[11]. En los asalariados (ver figura 5), hasta la edad de 45-54 años se produce un descenso del porcentaje de personas que ganan menos de mil euros, así como un aumento del porcentaje de quienes ganan de 1.000 a 3.001 euros; a partir de ese umbral, si bien es cierto que aumenta el porcentaje de personas pertenecientes a los dos intervalos de ingresos más bajos, también lo hace el de individuos con mayores ingresos, proporción que de hecho aumenta consecutivamente entre los cinco grupos de edad. En definitiva, y a grandes rasgos, entre los asalariados puede apreciarse una tendencia creciente de los ingresos conforme avanza la edad, al

---

[11] La variable original referente a los ingresos mensuales netos de la persona encuestada constaba de siete intervalos, los cuales han sido recodificados en cuatro.

Figura 5.
Porcentaje de intervalos mensuales de ingresos netos de los asalariados y autónomos para cinco grupos de edad

$[x^2 = 130,71$ (p-valor= ,00); V de Cramer= 0,24] $[x^2 = 22,522$ (p-valor=, 03); V de Cramer= 0,2]
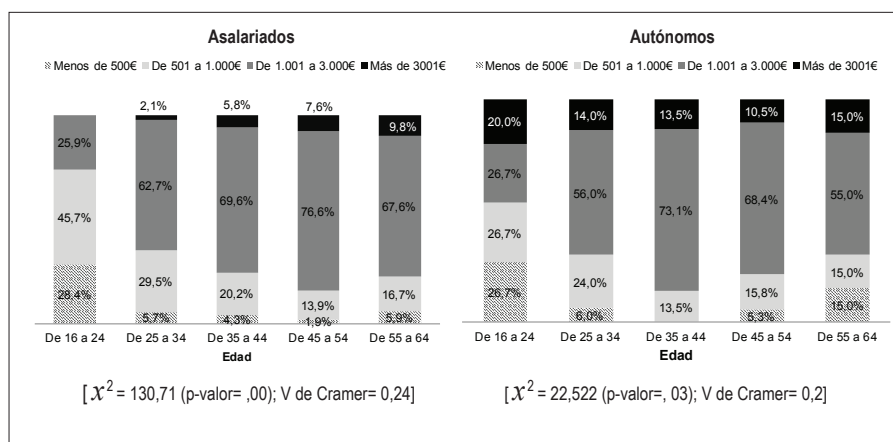
Fuente: Trabajadores por cuenta ajena y propia menores de 65 años, N=791 y N=195, Centre d'Estudis d'Opinió, 2010.

menos de forma clara hasta el grupo de 44-54 años. Esta tendencia, en cambio, no se observa entre los autónomos.

Para analizar de forma más adecuada las interrelaciones entre moral fiscal, edad e ingresos en ambos colectivos, el siguiente paso consistió en llevar a cabo una serie de regresiones logísticas. Los modelos tienen como variable dependiente la moral fiscal (en versión dicotómica); en un primer paso se incluye únicamente la edad como variable explicativa y, en un segundo paso, se añaden cinco variables. Así, además de los ingresos, se incluyen variables sociodemográficas de control que suelen ser relevantes para la moral fiscal, esto es, el género y el estado civil[12] (las mujeres y las personas casadas acostumbran a ser más intolerantes al fraude) y, adicionalmente, se han incluido dos nuevas variables. La primera de ellas se refiere a la percepción de justicia en el intercambio con el Estado (a través de la pregunta "¿Cree usted que paga demasiados impuestos en relación a lo que recibe de la Admnistración?"). Previsiblemente esta percepción afecta a la moral fiscal, y un análisis comparativo entre asalariados y autónomos puede resultar de interés si se tiene en cuenta que estos últimos se consideran un colectivo tradicionalmente agraviado por el sistema fiscal y de la Seguridad Social.

---

[12] Las seis categorías originales de la variable original de estado civil se han recodificado en cuatro: casado/a, soltero/a o en pareja estable, divorciado/a o separado/a y viudo/a.

Por último, se incorpora una variable que da cuenta del idioma (catalán, castellano, o indiferente) en el que se prefirió contestar el cuestionario. Esta es la única variable que puede utilizarse como *proxy* para capturar de algún modo el sentimiento identitario de la persona encuestada, algo que se antoja relevante en una encuesta realizada en Cataluña y habida cuenta de la difícil relación fiscal que esta comunidad atraviesa en los últimos tiempos con el Estado español. Como es sabido, el patriotismo afecta positivamente a la moral fiscal (*e.g.* Torgler 2003a), aunque en el caso español este factor debe analizarse a un doble nivel, tal y como demuestra el hecho de que los votantes de los partidos nacionalistas catalanes y vascos manifiesten una mayor permisividad hacia el fraude fiscal (Prieto *et al.* 2007).

Los resultados de las regresiones se muestran en la tabla 2. El coeficiente *β* indica la aportación explicativa de cada categoría; sin embargo, su interpretación es menos inteligible que en el caso de la regresión lineal clásica y por ello se incluyen, además, los valores de la *odds ratio* o *exp(β)*, que miden, *céteris páribus*, la probabilidad que representa el hecho de poseer el factor correspondiente (en nuestro caso, ser intolerante ante el fraude fiscal) respecto a no poseerlo (ser tolerante al fraude) para la categoría en cuestión. Como medida de la potencia predictiva del modelo utilizaremos el porcentaje de clasificación correcta, que indica la probabilidad de que una persona cualquiera sea clasificada, según el modelo, en la clase a la que realmente pertenece. Así pues, observamos que, en los asalariados, los dos últimos grupos de edad (de 45 a 54 y de 55 a 64 años) presentan aproximadamente el doble de probabilidades de rechazar el fraude que los más jóvenes; en el caso de los autónomos, la significatividad se extiende a los tres últimos grupos (de 35 a 44, de 45 a 54 y 55 a 64), que son mucho más intolerantes que sus homólogos más jóvenes, aunque con una intensidad no lineal (5,8, 4,5 y 5,2 veces más intolerantes, respectivamente). Sin embargo, el aspecto más destacado es que, para el caso de los asalariados, las nuevas variables introducidas en la regresión (ingresos, género, estado civil, idioma y justicia en el intercambio con el Estado) no resultan significativas a excepción del nivel de ingresos. En concreto, el poder explicativo atribuido inicialmente a la edad se traslada a los dos tramos de mayores ingresos: quienes ganan de 1.001 a 3.000 euros son prácticamente el doble de aversos a la evasión que las personas con menores ingresos, mientras que los que ganan más de 3.001 euros lo son 5,6 veces más. En los autónomos, por su parte, en el segundo modelo también se diluye la significatividad de los dos grupos de personas más mayores, pero en cambio ninguna de las categorías de las nuevas variables introducidas resulta relevante a la hora de explicar la moral fiscal.

En resumen, podemos afirmar que la moral fiscal de los autónomos aumenta hasta la edad de jubilación, aunque de forma no lineal y por causa de algún factor que, en cualquier caso, es distinto al nivel de ingresos. Por otro lado, aunque los asalariados entre 45 y 64 años manifiestan un rechazo mayor al fraude tributario que sus homólogos más jóvenes, el efecto de la edad se diluye cuando tenemos en cuenta otras variables, en particular los ingresos. Lo anterior nos obliga a reformular la pregunta inicial de la investigación (¿por qué la moral fiscal crece con la edad?) del siguiente modo: ¿por

Tabla 2.
Modelos de regresión logística para asalariados y autónomos

		Asalariados				Autónomos			
		Modelo 1		Modelo 2		Modelo 1		Modelo 2	
Variables predictivas		β	Exp(β)	B	Exp(β)	β	Exp(β)	β	Exp(β)
Edad	25 - 34	,038	1,039	-,122	,885	,851	2,343	,944	2,571
	35 - 44	,429	1,535	,191	1,210	1,765**	5,844**	1,650*	5,206*
	45 - 54	,694*	2,002*	,401	1,493	1,508*	4,518*	1,365	3,916
	55 - 64	,695*	2,003*	,443	1,557	1,666*	5,288	1,464	4,324
Ingresos	501-1.000			,362	1,436			-,100	,905
	1.001- 3.000			,720*	2,054*			,564	1,758
	> 3.001			1,729**	5,636**			,221	1,247
Genero	Mujer			-,290	,748			-,311	,733
Estado civil	Soltero/a			,013	1,013			-,238	,788
	Divorciado/a			-,317	,728			1,254	3,504
	Viudo/a			,598	1,819			20,979	1290842478,2
Prestaciones	Sí			-,220	,803			-,384	,681
Idioma	Castellano			-,224	,799			-,839	,432
	Indiferente			,274	1,315			-,238	,789
% clasif. correcta	Sí	0		24,0		46,9		44,9	
	No	100		85,1		75,2		82,4	
	Total	60,9		61		63,2		66,7	

La categoría de referencia de la variable dependiente es 'no justificar la evasión fiscal' y en las variables predictivas, por orden: 'tener entre 16 y 24 años', 'tener ingresos hasta 500 euros', 'ser hombre, 'estar casado', 'no recibir prestaciones' y 'preferir contestar el cuestionario en catalán'.
*p<0,05, **p<0,01

Fuente: Trabajadores por cuenta ajena y propia menores de 65 años, N=731 y N=186, Centre d'Estudis d'Opinió, 2010.

qué el hecho de recibir un salario superior —y no el hecho de envejecer *per se*— provoca una mayor moral fiscal? Cabe señalar que esta reformulación supone un distanciamiento respecto de las investigaciones al uso, que analizan el efecto de los ingresos sobre la moral fiscal sin contemplar si los ingresos provienen del trabajo asalariado o no —aspecto que explicaría, en parte, la ambigüedad de los resultados de tales análisis (ver un repaso en Torgler 2007)—. Así, teniendo en cuenta que, por un lado, las rentas salariales son difícilmente ocultables al estar sujetas a una retención en origen y, por el otro, que en un sistema fiscal progresivo el tipo impositivo crece con la renta, la pregunta inicial queda concretada del siguiente modo: ¿por qué el hecho de (no tener más opción que) soportar una carga impositiva superior provoca una mayor moral fiscal?.

Existiendo suficientes razones para dudar de la fiabilidad de los ingresos autodeclarados en encuestas de opinión como la que nos ocupa, se consultó el salario medio de Cataluña para cada intervalo de edad según la "Encuesta Anual de Estructura Salarial del Instituto Nacional de Estadística" (INE 2009); posteriormente se determinó el tipo efectivo correspondiente a cada salario gracias a los datos de la Memoria de la Administración Tributaria de 2008 del Ministerio de Economía y Hacienda. La figura 6 recoge los resultados[13]. Observamos, de entrada, que existe una fuerte correspondencia —como era de esperar— entre el salario medio y el tipo efectivo. En concreto, ambas magnitudes aumentan con la edad, y lo hacen de forma marginalmente decreciente: el aumento es muy pronunciado en el paso del primer grupo de edad al siguiente, y a partir de ahí la intensidad del aumento disminuye (el tipo efectivo llega a estabilizarse en los dos últimos grupos de edad, pues el aumento del salario medio es muy reducido). A continuación, se muestra la evolución del tipo impositivo efectivo correspondiente al salario medio de cada grupo de edad con su moral fiscal media según los datos del CEO (figura 7). Tal comparación nos permite comprobar que, efectivamente, existe una fuerte correspondencia entre la evolución de ambas magnitudes desde los 16 hasta los 64 años.

Por último, con el objeto de comprobar la validez de esta relación en la tercera edad, añadiremos al análisis la moral fiscal media de las personas con una edad superior a 65 años que cobran pensiones de jubilación —también sujetas a retención en origen—, así como el tipo efectivo medio que les corresponde[14]. Para ello, se calculó el importe de la pensión media en el Régimen General de la Seguridad Social para Cataluña a partir de los datos incluidos en el documento "Evolución mensual de las pensiones del Sistema de la Seguridad Social. Enero 2010" del Ministerio de Empleo y Seguridad Social[15]. La figura

---

[13] El salario medio del último grupo de edad corresponde, de hecho, a mayores de 55 años y no a los que tienen una edad entre 55 y 64 años. No obstante, cabe tener en cuenta que los asalariados de 65 o más años representan únicamente el 0,8% de los afiliados a la Seguridad Social (datos del INE, enero del 2011).

[14] No se ha podido discriminar entre quienes cobran una pensión de jubilación en el Régimen General o en el Régimen de Trabajadores Autónomos, pues la encuesta del CEO no permitía obtener tal información.

[15] La pensión media anual en el Régimen General para Cataluña no aparecía en el documento del Ministerio, así que se procedió a su cálculo aproximado del siguiente modo:

Pensión mensual media de jubilación en España, todos los regímenes: 874,97 euros (=1)

Figura 6.

Salario anual medio en Cataluña y tipo impositivo efectivo para cinco grupos de edad
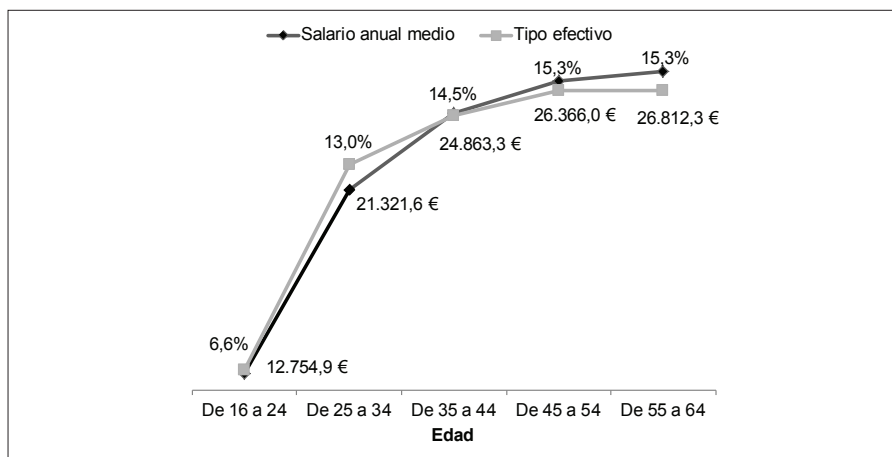
Fuente: Euros y porcentajes, Instituto Nacional de Estadística 2009 y Ministerio de empleo y Seguridad Social 2008.

Figura 7.

Moral fiscal media y tipo efectivo para seis grupos de edad.
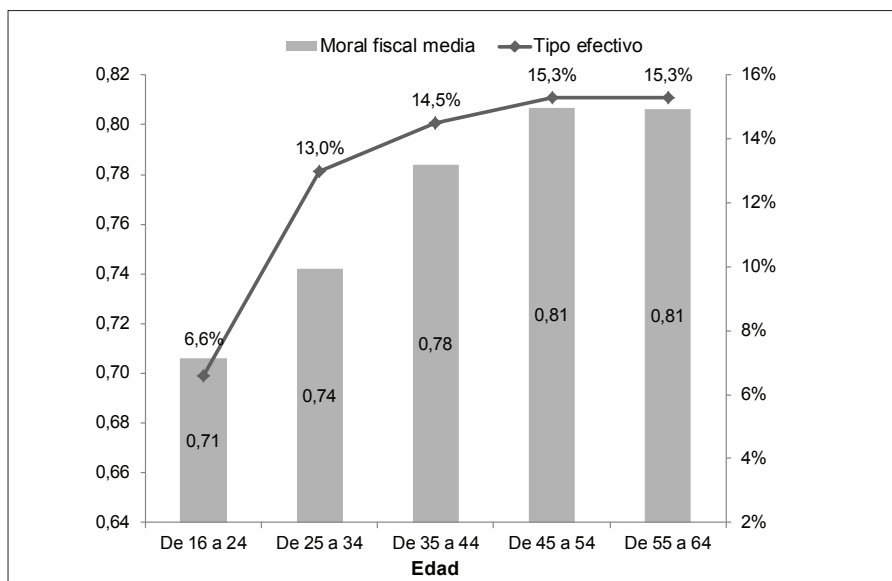
[Coeficiente de Pearson =,925 (p-valor=,024)]
Fuente: Trabajadores asalariados menores de 65 años, N=783, Centre d'Estudis d'Opinió, 2010 y Ministerio de empleo y Seguridad Social 2008.

Figura 8.
Moral fiscal media y tipo efectivo de asalariados y pensionistas para seis grupos de edad*
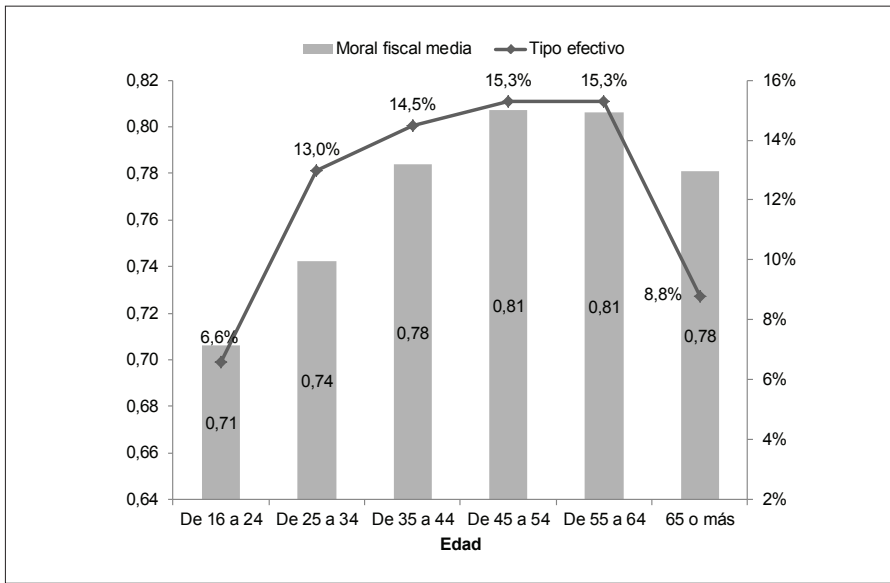
[Coeficiente de correlación de Spearman =0,896 (p-valor =,016)].
* Trabajadores por cuenta ajena de 65 años y pensionistas por jubilación mayores de 65 años, N=999, Centre d'Estudis d'Opinió, 2010, Ministerio de Hacienda y Aministraciones Públicas, 2008 y Ministerio de Empleo y Seguridad Social, 2009.

8 nos permite comprobar que, a partir de la edad de jubilación, tanto el tipo impositivo como la moral fiscal caen, si bien la segunda lo hace en menor medida que la primera.

En conclusión, todos los análisis anteriores nos conducen a establecer el verdadero objeto de nuestra investigación, que puede formularse a través de una doble pregunta:

1. ¿por qué, hasta la edad de jubilación, el hecho de estar sujeto a una retención en origen cada vez mayor provoca un aumento de la moral fiscal? y
2. ¿por qué, a partir de la edad de jubilación, el hecho de estar sujeto a una menor retención en origen provoca un descenso de la moral fiscal?

Pensión mensual media de jubilación en Cataluña, todos los regímenes: 887,64 euros (=1,014)
Pensión mensual media de jubilación en España, R. General: 1089,88 euros
Pensión mensual media de jubilación en Cataluña, R.General (aprox.): 1089,88 euros * 1,014= 1105, 14 euros.
Pensión anual media de jubilación en Cataluña, R.General (aprox.): 1105,662 euros * 14 pagas= 15.471,96 euros.

Hipótesis explicativa

Para contestar las preguntas anteriores proponemos un mecanismo explicativo que puede desgranarse del siguiente modo (véase la figura 9):

1. Dada la retención en origen de las rentas salariales, el asalariado medio no tiene oportunidad de evadir impuestos;
2. sin embargo, percibe que otras personas defraudan (autónomos, rentas más altas...)
3. y es consciente de que él mismo estaría mejor si también lo hiciera.
4. La suma de lo anterior genera en él un malestar psíquico —una mezcla de indignación e impotencia a la que llamaremos "resentimiento"—
5. que, merced a un proceso de racionalización,
6. da lugar a una condena moral de la evasión fiscal.

Figura 9.
Diagrama-resumen del mecanismo de resentimiento fiscal.
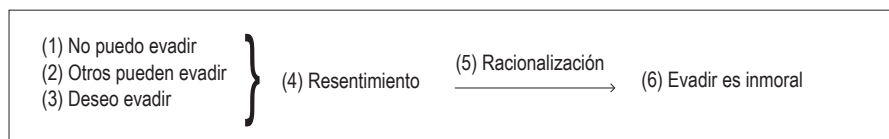
Nótese que el mecanismo propuesto se asemeja al de privación relativa, que precisamente hace referencia al malestar que genera el hecho de no estar en condiciones de obtener algo que se desea y que otras personas sí pueden obtener (Runciman 1966). Sin embargo, nuestro interés no se centra tanto en el nivel de frustración que una situación de privación relativa ocasiona, como en el hecho de que tal nivel de frustración es la causa del diferente grado de apoyo a un juicio moral[16]. Se trata, en concreto, de un fenómeno de moral adaptativa: la interacción de determinadas creencias fácticas ("estoy obligado a pagar todos mis impuestos" + "los demás no están obligados a pagar todos sus impuestos" + "deseo evadir impuestos") desemboca en una creencia normativa ("pagar impuestos es moral / evadir es inmoral") que supone una justificación *post-hoc* de la propia conducta en relación a la de los demás. Este proceso, si bien mistifica el

---

[16] Por otro lado, puede discutirse acerca de qué emoción o conjunto de emociones intervienen en el proceso propuesto; en este punto, las consideraciones de Elster (2007) pueden resultar un punto de partida muy útil (en especial, las referentes a la "indignación cartesiana" y la "indignación aristotélica").

verdadero orden de los eventos mentales, permite al sujeto paliar el malestar psíquico provocado por sus creencias iniciales[17]. En definitiva, el mecanismo del resentimiento fiscal consiste, parafraseando el dicho popular, en "hacer de la imposibilidad virtud"[18].

La principal ventaja del mecanismo que acabamos de exponer es que nos permite dar cuenta de la evolución de la tolerancia ante el fraude de los asalariados (y pensionistas) a lo largo del ciclo vital. Una mayor edad comporta un mayor salario y, dado un sistema progresivo, una carga impositiva superior, hecho que supone un mayor incentivo para la evasión (ya que aumenta el coste de oportunidad del cumplimiento). En una situación de privación relativa, el asalariado padecerá un aumento de los costes psíquicos del cumplimiento que, racionalizado, dará lugar a un aumento de la intolerancia ante el fraude[19]. A partir de la edad de jubilación, en cambio, los ingresos experimentan un descenso, provocando que el proceso anterior se revierta y dé como resultado un descenso de la moral fiscal.

Es preciso señalar, no obstante, que la intensidad del efecto del mecanismo propuesto no se mantiene constante con el paso de los años. Según los datos (ver tabla 3), observamos que la elasticidad de la moral fiscal —es decir, cuánto varía en relación a la variación del tipo impositivo— aumenta hasta la edad de jubilación. Dicho de otro modo: de los 16 a los 64 años, cuanto mayor es la edad, mayor es la influencia relativa de los impuestos pagados sobre la intolerancia ante el fraude; a partir los 65 años, la influencia relativa desciende. Esto sugiere la existencia de un "efecto anclaje" (Tversky y Kahneman 1974) que en nuestro caso parece tomar como referencia los valores mínimos y máximos. Durante los primeros años de vida laboral, la moral fiscal aumenta a un ritmo menor que el tipo efectivo, pues la estimación de los impuestos que se pagan permanece 'anclada' en los valores iniciales, que son los más bajos. Este efecto pierde fuerza conforme los asalariados se alejan de la juventud, pero vuelve a resultar importante a la edad de jubilación: a partir de los 65 años, la moral fiscal desciende a un ritmo menor que el tipo efectivo, ya que la estimación de los impuestos pagados toma como referencia los valores de los años inmediatamente anteriores a la jubilación, que son los más altos.

---

[17] A diferencia de lo aquí expuesto, en la literatura sobre evasión fiscal se asume que las creencias normativas se producen de forma "sincera' y que poseen un papel "causal" sobre la conducta o sobre otras creencias del sujeto. Las únicas excepciones son las de Falkinger (1988) y Wenzel (2005), quienes contemplan la posibilidad de que los juicios normativos sean en realidad una forma de enmascarar comportamientos auto-interesados.

[18] Se ha optado por el término de "resentimiento" en la medida en que, referido al *resentment* nietzscheano, permite dar cuenta de cómo "los débiles y oprimidos de todo tipo" son víctimas de un "autoengaño consistente en interpretar la debilidad misma como libertad, su ser lo que son como mérito" (Nietzsche [1887] 2009:611).

[19] Deberá estudiarse en qué medida el comportamiento observado interactúa con la evidencia de que los contribuyentes de ingresos mas elevados practican en mayor medida la elusión fiscal (*tax avoidance*), es decir, una reducción de su carga fiscal a través de asesores fiscales, etc.

Tabla 3.

Elasticidad de la moral fiscal media respecto al tipo efectivo de los asalariados y pensionistas para cinco grupos de edad.

Edad	Moral fiscal	Tasa de variación*	Tipo efectivo	Tasa de variación*	Elasticidad**
De 16 a 24	0,70	–	6,6%		
De 25 a 34	0,74	5,7%	13,0%	97,0%	0,1
De 35 a 44	0,78	5,4%	14,5%	11,5%	0,5
De 45 a 64***	0,81	3,8%	15,3%	5,5%	0,7
65 o más	0,78	-3,7%	8,8%	-40,0%	0,1

* Las tasas de variación porcentual se calculan respecto al grupo de edad anterior.
** La elasticidad es el cociente entre la tasa de variación de la moral fiscal y la tasa de variación del tipo efectivo (es decir, qué porcentaje de variación experimenta la moral fiscal cuando el tipo efectivo aumenta en un 1%).
*** Se han unido los grupos de 45-54 y 55-64, pues presentaban una moral fiscal media idéntica.
Fuente: Trabajadores por cuenta ajena menores de 65 años y pensionistas por jubilación mayores de 65 años, N=999, Centre d'Estudis d'Opinió, 2010, Ministerio de Hacienda y Aministraciones Públicas, 2008 y Ministerio de Empleo y Seguridad Social, 2009.

Conclusiones

Con el propósito de "ir más allá de las relaciones estadísticas para explorar el mecanismo responsable de ellas" (Boudon 1976), el presente estudio ha tratado de ofrecer un mecanismo, el del "resentimiento fiscal", que clarifica la relación existente entre la edad, los ingresos y la tolerancia ante el fraude, aportando un "grano más fino" que las explicaciones habituales en los estudios sobre moral fiscal. Sus resultados muestran la necesidad de emprender investigaciones que tengan en cuenta aspectos que no han sido convenientemente considerados por la literatura precedente sobre evasion fiscal, a saber:
•	las diferentes oportunidades de evadir que presentan los contribuyentes;
•	el papel de las emociones en la formación de creencias y acciones; y
•	la existencia de fenómenos psicológicos de naturaleza adaptativa.

Cabe señalar, por último, que sería deseable comprobar la validez del mecanismo propuesto con datos provenientes de otras encuestas de opinión, así como tratando de aislar su efecto en el contexto de un laboratorio.

REFERENCIAS BIBLIOGRÁFICAS

Alarcón, L., De Pablos y E. Garre. 2009. "Análisis del comportamiento de los individuos ante el fraude fiscal. Resultados obtenidos a partir de la Encuesta del Observatorio Fiscal de la Universidad de Murcia". *Principios* 13:55-84.

Allingham, M. G. y A. Sandmo. 1972. "Income tax evasion: a theoretical analysis". *Journal of Public Economics* 1:323-338.

Alm, J. y J. L. Gomez. 2008. "Social Capital and Tax Morale in Spain". *Economic Analysis & Policy* 38:73-87.

Alm, J., G. H. McClelland y W. D. Schulze. 1992. "Why do people pay taxes?". *Journal of Public Economics* 48:21-38.

Alm, J. y B. Torgler. 2005. "Estimating the Determinants of Tax Morale". *National Tax Association Papers and Proceedings* (Minneapolis 2004): 269-274.

Arrazola, M., J. de Hevia, I. Mauleón y R. Sánchez. 2011. "Estimación del volumen de economía sumergida en España". *Cuadernos de Información Económica* 220.

Barone, G. y S. Mocetti. 2011. "Tax Morale and Public Spending Inefficiency". *International Tax and Public Finance* 18:1-26.

Becker, G. 1968. "Crime and Punishment-An Economic Approach". *Journal of Political Economy* 76:169-217.

Boudon, R. 1976. "Comment on Hauser's Review of Education, Opportunity, and Social Inequality". *American Journal of Sociology* 81:1175-1187.

Braithwaite, V. y E. Ahmed. 2005. "A threat to tax morale: the case of Australian higher education policy". *Journal of Economic Psychology* 26:523-540.

Braithwaite, V., M. Reinhart y M. Smart. 2010. "Tax non-compliance among the under-30s: Among the Under-30s: Knowledge, Obligation or Skepticism?". Pp. 217-237 en *Developing Alternative Frameworks for Explaining Tax Compliance,* Avoidance and Evasion, editado por B. Torgler, J. Alm and J. Martinez. London: Routledge.

Cummings, R. G., J. Martínez Vázquez, M. Mckee y B. Torgler. 2009. "Tax morale affects tax compliance: Evidence from surveys and an artefactual field experiment". *Journal of Economic Behavior & Organization* 70:447-457.

Elffers, H., R. H. Weigel y D. J. Hessing. 1987. "The consequences of different strategies for measuring tax evasion behavior." *Journal of Economic Psychology* 8:311-337.

Elster, J. 1989. *Nuts and bolts for the social sciences.* Cambridge: Cambridge University Press.

Elster, J. 2007. *Explaining Social Behavior. More nuts and bolts for the social sciences*. Cambridge: Cambridge University Press.

Falkinger, J. 1988. "Tax evasion and equity: a theoretical analysis". *Public Finance* 3:388-395.

Feld, L. P. y B. S. Frey. 2007. "Compliance as the Result of a Psychological Tax Contract: The Role of Incentives and Responsive Regulation". *Law* & *Policy* 29:102-120.

Gibbons, J. D. y S. *Chakraborti. 2010. Nonparametric statistical inference.* Boca Raton: Taylor & Francis.

Halla, M. 2010. "Tax Morale and Compliance Behavior: First Evidence on a Causal Link". *The B. E. Journal of Economic Analysis & Policy* 12:1935-1682.

Hedström, P. 2005. *Dissecting the Social. On the Principles of Analytical Sociology.* New York: Cambridge University Press.

Instituto de Estudios Fiscales, 2004. "Ética fiscal". Documento de trabajo / Working paper. 10/04.

Instituto de Estudios Fiscales, 2012. "Opiniones y actitudes fiscales de los españoles en 2011". Doc. 19/2012.

Kirchler, E. e I. Wahl. 2010. "Tax Compliance Inventory: TAX-I Voluntary tax compliance, enforced tax compliance, tax avoidance, and tax evasion". *Journal of Economic Psychology* 31:331-346.

Levi, M. 1988. *Of Rule and Revenue*. University of California Press: Berkeley.

Liebig, S. y S. Mau. 2006. "What people think is fair: evaluating one's own tax burden". *Public Policy Research* 12:93-101.

María-Dolores, R., G. Alarcón y E. Garre. 2010. "Tax Morale in Spain: A Study into Some of Its Principal Determinants". *Economic Analysis & Policy* 381:855-876.

Mcgee, R. W. 2006. "Three Views on the Ethics of Tax Evasion". *Journal of Business Ethics* 67:15-35.

Mcgee, R. W. y M. Tyler. "Tax Evasion and Ethics: A Demographic Study of 33 Countries". *Proceedings of the International Academy of Business and Public Administration Disciplines* 4:709-729.

Molero, J. C. y F. Pujol. 2012. "Walking Inside the Potential Tax Evader's Mind: Tax Morale Does Matter". *Journal of Business Ethics* 1052:151-162.

Nietszche, F. [1887] 2009. *La genealogía de la moral. Obras Nietzsche II.* Madrid: Gredos.

Noguera, J. A. y A. de Francisco. 2011. "La sociología analítica". Pp. 309-344 en *Teoría Sociológica Moderna*, 2.ª edición revisada y ampliada, editado por Salvador Giner. Barcelona: Ariel.

Noguera, J. A, X. Guijarro, F. J. León, T. Llacer, F. J. Miguel, E. Tapia, J. Tena y M. Vinagre. 2011. *Valors i actituds sobre justícia distributiva: prestacions socials i fiscalitat.* Barcelona: Centre d'Estudis d'Opinió (CEO) - Generalitat de Catalunya.

Nordblom, K. y J. Žamac. 2012. "Endogenous Norm Formation Over the Life Cycle - The Case of Tax Morale". *Economic Analysis & Policy* 42:153-170.

Orviska, M. y J. Hudson. 2003. "Tax evasion, civic duty and the law abiding citizen". *European Journal of Political Economy* 19:83-102.

Pissarides, C. A. y G. Weber. 1989. "An expenditure-based estimate of Britain's black economy". *Journal of Public Economics* 39:17-32.

Prieto, J., M. J. Sanzo y J. Suárez. 2006. "Análisis económico de la actitud hacia el fraude fiscal en España". *Hacienda Pública Española/Revista de Economía Pública* 177:107-128.

Runciman, W. G. 1966. *Relative deprivation and Social Justice.* Berkeley: University of California Press.

Schmölders, G. 1965. *Problemas de psicología financiera.* Madrid: Editorial de Derecho Financiero.

Srinivasan, T. N. 1973. "Tax evasion: A model". *Journal of Public Economics* 2:339-46.

Torgler, B. 2003a. "To evade taxes or not to evade: that is the question". *Journal of Socio-Economics* 32:283-302.

Torgler, B. 2003b. "Tax Morale, Rule-Governed Behaviour and Trust". *Constitutional Political Economy* 14:119-140.

Torgler, B. 2004. "Tax morale in Asian Countries". *Journal of Asian Economics* 15:237-266.

Torgler, B. y Murphy, K. 2004. "Tax morale in Australia: what shapes it and has it changed over time?, *Journal of Australian taxation* 7:298-335.

Torgler, B. 2007. *Tax Compliance And Tax Morale: A Theoretical and Empirical Analysis*. Chentelham: Edward Elgar.

Torgler, B. y J. Martínez-Vázquez. 2009. "The Evolution of Tax Morale in Modern Spain". *Journal of Economic Issues* 43:1-28.

Tversky, A. y D. Kahneman. 1974. "Judgment under uncertainty: Heuristics and biases". *Science* 185:1124-1131.

Wenzel, M. 2003. "Tax compliance and the psychology of justice: Mapping the field". Pp.41-70 en *Taxing Democracy: Understanding Tax Avoidance and Evasion*, editado por V. Braithwaite. Aldershot: Ashgate.

Wenzel, M. 2005. "Motivation or rationalisation? Causal relations between ethics, norms and tax compliance". *Journal of Economic Psychology* 26:491-508.

Toni Llacer es licenciado en Economía por la Universitat Pompeu Fabra y en Filosofía por la Universitat de Barcelona (Premio Extraordinario de Licenciatura), y cursó el Máster en Investigación Sociológica Aplicada de la Universitat Autònoma de Barcelona. En la actualidad recibe una beca de la Generalitat de Catalunya para realizar su tesis doctoral sobre los factores explicativos de la evasión fiscal y es miembro del Grupo de Sociología Analítica y Diseño Institucional (GSADI).

World Scientific
www.worldscientific.com

AN AGENT-BASED MODEL OF TAX COMPLIANCE: AN APPLICATION TO THE SPANISH CASE

TONI LLACER

*Analytical Sociology and Institutional Design Group (GSADI),
Department of Sociology, Universitat Autònoma de Barcelona (UAB),
Cerdanyola del Vallès, Barcelona 08193, Spain
toni.llacer@uab.cat*

FRANCISCO J. MIGUEL

*Laboratory for Socio-Historical Dynamics Simulation (LSDS),
Analytical Sociology and Institutional Design Group (GSADI),
Department of Sociology, Universitat Autònoma de Barcelona (UAB),
Cerdanyola del Vallès, Barcelona 08193, Spain
miguel.quesada@uab.cat*

JOSÉ A. NOGUERA* and EDUARDO TAPIA[†]

*Analytical Sociology and Institutional Design Group (GSADI),
Department of Sociology, Universitat Autònoma de Barcelona (UAB),
Cerdanyola del Vallès, Barcelona 08193, Spain
*jose.noguera@uab.cat
†eduardo.tapia@e-campus.uab.cat*

In this paper, we present a new agent-based model for the simulation of tax compliance and tax evasion behavior (SIMULFIS). The main novelties of the model are the introduction of a "behavioral filter approach" to model tax decisions, the combination of a set of different mechanisms to produce tax compliance (namely rational choice, normative commitments and social influence), and the use of the concept of "fraud opportunity use rate" (FOUR) as the main behavioral outcome. After describing the model in detail, we display the main behavioral and economic results of 1,920 simulations calibrated for the Spanish case and designed to test for the internal validity of SIMULFIS. The behavioral outcomes show that scenarios with strict rational agents strongly overestimate tax evasion, while the introduction of social influence and normative commitments allows to generate more plausible compliance levels under certain deterrence conditions. Interestingly, the relative effect of social influence is shown to be ambivalent: it optimizes

*Corresponding author.

compliance under low and middle deterrence conditions, but not when deterrence is made harder. Finally, SIMULFIS economic outcomes are broadly in line with theoretical expectations, thus supporting the reliability of the model.

Keywords: Rational choice; social influence; tax behavior; tax evasion; tax morale.

1. Presentation and Purpose of SIMULFIS

Tax evasion, usually defined as the voluntary reduction of the tax burden by illegal means [29], is a problem of huge social relevance at present times.[a] This is so, first, because tax evasion reduces the volume of resources available for the public sector. This reduction is specially damaging in the Spanish case, where different authors estimate that the shadow economy represents around 20% of the Spanish GNP.[b] Second, since tax evasion behavior is not equally distributed among taxpayers, it violates the principles of fairness, equality and progressivity that the tax system ought to satisfy.[c]

Academic researchers who aim to explain tax evasion and tax compliance are increasingly acknowledging the need to include psychological, social and cultural factors in their explanatory models; traditional explanations were too often linked to the strict assumptions of rational choice (RC) theory and the *homo oeconomicus* model [2]. Instead, new studies focus, for example, on taxpayers' *tax morale* (their tolerance toward tax fraud [61]). Recently, it has been shown that there is a causal link between aggregated tax morale and the volume of the shadow economy at the national level [36]; at the individual level, some contributions have proved the relationship between individual tax morale and self-declared levels of tax evasion [19, 24, 62], as well as tax noncompliance behavior in the laboratory [43]. Besides tax morale, factors such as social norms, social influence (SI), fairness concerns and perceptions of the distributive outcomes of the tax system are increasingly taken as likely determinants of tax compliance [5, 20, 39, 41, 42, 50].

There is little doubt that the understanding of the causes and determinant factors of the variations of tax evasion levels across time and space is a pressing need in the present context of economic crisis and scarcity of public resources. Such an understanding would help to design robust institutional strategies and policies in order to tackle tax evasion and, therefore, improve the efficacy and fairness of the tax system. Besides, reducing tax evasion allows increasing public resources without the need to raise tax rates. This is especially interesting when one looks at the difficulties that governments face today in order to achieve public budget equilibrium and fund welfare programs.

---

[a]We will take the expressions "tax evasion" and "tax fraud" as equivalent for our purposes, though they might have slightly different meanings in part of the literature on tax compliance.
[b]Arrazola [12] estimates that Spanish shadow economy represents approximately 17% of GNP; GESTHA [32] estimates a higher 23,3% (http://www.gestha.es/?seccion=actualidad&num=104).
[c]A useful presentation of the normative principles that guide tax systems and of their relationship with ethical theory may be found in [7].

The SIMULFIS project is conceived as the first stone of a research strategy to fill three gaps in contemporary research on tax evasion:

(i) Theoretically, most of the studies on tax compliance deal separately with different factors which hypothetically affect tax behavior. On the contrary, SIMULFIS seeks to integrate different mechanisms which have been tested in isolation by previous research, in order to make them interact in a complex computational setting. Thus, SIMULFIS aims to test the consistency and acceptability of different theoretical hypothesis proposed in the literature on tax compliance. Specifically, the model includes the possibility of interactions between the three main types of mechanisms which have been considered by the literature as likely determinants of tax evasion decisions: RC (or utility maximization), fairness concerns and SI. To study this interaction through a virtual agent-based model is the main theoretical motivation of the paper.

(ii) Methodologically, the use of agent-based models allow to overcome one of the most important shortcomings of standard economic models of tax evasion: the huge difficulty to simulate complex social dynamics in a realistic way while keeping at the same time mathematical tractability. Agent-based methodology allows to build more realistic models where, for example, each agent may have specific individual properties, and social interaction may be properly modeled.

(iii) Politically, once the model is properly calibrated and validated, it is likely to become a useful tool (though complementary of others) in order to assess existing tax policies as well as their possible reforms, by providing virtual outcomes on their direct and indirect behavioral and economic effects. As an example, in this paper we present the first results of an empirical calibration of the model for the Spanish case.

2. Previous Research on Tax Evasion Modeling

The first economic models of tax evasion were presented four decades ago by Allingham and Sandmo [2] and Srinivasan [57]. Those neoclassical economic models adapted Gary Becker's "crime economics" to the study of tax behavior. The aim was to explain deviant behavior (in this case, tax evasion) as RC: each taxpayer decides how much of her income she declares as a function of the benefits of concealing it (given a tax rate) and the costs of being caught (given a probability of being audited and the amount of the fine). Research on tax evasion in the last two decades can be depicted as a series of consecutive attempts to broaden the traditional neoclassical economic model in order to explain an action (tax compliance) which appears to be "almost-voluntary" [45].

It is not surprising, then, that among these attempts a remarkable role is played by survey studies which try to measure and explain citizens' tax morale, understood as an "intrinsic motivation" or "interiorized will" to pay taxes [18, 61]. Such studies seek to explain tax morale by taking declared tolerance toward tax evasion as a

proxy, and including it as dependent variable in regression models. Even though the results are often inconclusive, they give interesting information about the statistical correlations between tax morale and different socio-demographical variables (age, gender, marital status, educational level or income level), as well as ideological or attitudinal variables (such as religious beliefs, patriotism or trust in institutions; see a useful overview in Torgler [61]).[d]

All these contributions suggest that the standard economic approach alone is not able to account for a complex social phenomenon such as tax evasion. However, survey data analysis is insufficient to test properly the causal mechanisms involved in such phenomenon, since the description of statistical correlations does not open the "black box" of the generative causal processes that bring about the aggregated outcomes [37]. That is why a remarkable number of studies have recently tried to explain tax evasion by adopting one of the two following methodological strategies: on the one side, experimental designs along the lines of behavioral economics and psychology [4, 5, 41, 56]; on the other, agent-based computational methods.

Although the number of works using agent-based models to explain tax fraud is still small, most of them seek to formalize and test different types of social interaction effects. A brief chronological overview of these studies could be summarized as follows:

- The first attempts to apply agent-based methodology to the study of tax compliance are due to Mittone and Patelli [51], Davis *et al.* [25] and Bloomquist [15] who is the first in using the software *NetLogo* (also used in SIMULFIS). This model presents interesting features: agents are programmed with a higher number of properties, the audit probability and its effects are determined in a more complex way, and the results are tested against real data.[e]
- Subsequently we find the model series *EC** by Antunes, Balsa *et al.* [8–11, 13].[f] The *EC** models are made increasingly complex by introducing agents with memory, adaptive capacities and social imitation. The most remarkable novelties in these models are the inclusion of tax inspectors able to decide autonomously and, above all, the explanation of noncompliance with indirect taxes through collusion between sellers and buyers.
- The *NACSM* model by Korobow *et al.* [44] analyzes the relationship between tax compliance and social networks, using a Moore neighborhood structure in which each agent has eight adjacent neighbors in a two-dimensional grid.
- More recently, the proposal by Zaklan *et al.* [66–68] adapts Ising physical model to the tax field: instead of elementary particles interacting in different ways as a function of temperature, we have individuals behaving in different ways as a function of their level of dependence on their neighbors' behavior.

---

[d]In Spain, some works following this approach are available [53, 6, 3, 1, 48].
[e]Bloomquist [16] summarize and compare the three models mentioned in this paragraph.
[f]An overview is available in Antunes *et al.* [9].

- The *TAXSIM* model by Szabó *et al.* [58–60] presents a particularly complex design, since it includes four types of agents (employers, employees, the government and the tax agency). It also takes into account factors such as agents' satisfaction with public services, which depends on their previous experience and on that of their neighbors.
- Hedström and Ibarra [38] have proposed a social contagion model inspired by the principles of analytical sociology in order to show how tax evasion may spread as a consequence of tax avoidance's social contagiousness.
- Finally, Bloomquist [17] deals with tax compliance in small business by modeling it as an evolutionary coordination game. His model is calibrated with data from behavioral experiments.

In short, social simulation using agent-based models is a promising research option in a field in which, despite the abundant literature, significant and uncontroversial results have been rare and hardly coordinated. More specifically, there are some key questions which are not still solved by the literature on the matter:

- To what extent is RC theory enough to explain estimated levels of tax compliance?
- What is the effect of normative commitments on tax compliance?
- What is the effect of SI on tax compliance?
- Which social scenario optimizes tax compliance?
- Which combination of tax policies is able to reduce tax evasion?
- How to calibrate empirically an agent-based model for the study of tax compliance?

SIMULFIS aims to provide a computational tool capable of shedding some light on these questions and other similar ones, by going beyond traditional economic approaches and integrating a diversity of factors and mechanisms which may cause different levels of tax evasion.

3. Description of the Model

3.1. *Main features of SIMULFIS*

SIMULFIS offers some highlights that distinguish it from other similar models; the design of SIMULFIS makes it capable of more realistic simulations and more detailed empirical calibration than previous models. The most important aspects of this novel design are:

(i) A "filter" approach to tax decisions: agents decide how much income they evade after going through four successive filters that affect their decision: opportunity, normative commitments, RC and SI. This approach aims to capture recent developments in behavioral social science and cognitive decision theory

which disfavor the usual option of balancing all determinants of decision in a single individual utility function [14, 30, 33]. Therefore, tax compliance is produced by a combination of mechanisms, most of which may be activated or de-activated in order to run controlled experiments.

(ii) Since our main focus is behavioral, SIMULFIS outcomes go beyond traditional indicators for compliance (such as the amount of their personal income agents evade) toward determining how much relative advantage agents take of their opportunities to evade: thus we define agent's "fraud opportunity use rate" (FOUR) as the main dependent variable of the behavioral experiments that SIMULFIS is able to execute.

(iii) Different degrees of opportunity to evade may be assigned to different categories of agents.

(iv) Agents' normative commitments and fairness concerns toward taxation are modeled in a complex way, taking into account factual as well as normative beliefs, and relative deprivation feelings [46, 47].

(v) Agents' decision algorithm goes beyond binary or ternary choice which is typical in previous models ("evade/do not evade", "evade more/evade less/do not evade"). In SIMULFIS, agents maximize a utility function to decide what percentage of their income they will conceal.

(vi) Finally, SIMULFIS makes it possible to assign different weights to SI in agents' decision algorithm.

3.2. *Model parameters*

3.2.1. *Agents' random properties*

A first group of two parameters change their values randomly for each agent in each simulation's starting point, which is to say in each "world" when it is generated:

(i) **Income level.** Agents are assigned an amount of annual income following an exponential distribution. In the results showed in Sec. 4, SIMULFIS is calibrated empirically for Spanish income distribution (see Table 1). The top of the distribution has also been adjusted for including a small percentage of big fortunes. After the distribution has been completed, the model assigns each agent to one of three "income levels": "high" (the top decile of the distribution), "low" (the three lowest deciles of the distribution), and "middle" (the six deciles left in between). The distribution may be differentiated for self-employed workers and wage-earners in order to calibrate the model in a more realistic way.

(ii) **Social network.** Agents are randomly linked with a number of neighbors under some constraints: each agent has a minimum of 10 neighbors, and 80% of each agent's neighbors are similar to her in terms of occupational status and income level. However, it is possible to change the value of these two constraints.

Table 1.   Income decile distribution for the Spanish population (Euros).

| | Income brackets (Euros) | | | | | |
| | Wage earners | | | Self-employed | | |
Decile	Min.	Max.	Average	Min.	Max.	Average
1	300	6,828	5,480.4	900	6,240	5,198.8
2	6,828	9,000	7,852.6	6,240	6,744	6,419.5
3	9,000	11,124	10,104.7	6,768	7,392	7,139.7
4	11,136	14,720	11,976.2	7,392	8,040	7,676.5
5	12,720	14,400	13,570.3	8,040	9,528	8,706.1
6	14,400	15,600	14,839.1	9,540	12,000	10,722.4
7	15,600	18,000	16,875.5	12,000	14,400	13,119.7
8	18,000	21,120	19,399.0	14,400	18,840	16,712.5
9	21,180	25,200	23,154.2	18,960	24,972	22,089.7
10	25,200	109,116	33,101.1	25,140	144,000	37,398.2

Note: *Source*: Household Budget Survey, 2008 (Base 2006). National Statistics Institute – INE.

3.2.2. *Exogenous parameters* (*controlled*)

  (i) **Tax rates.** The model allows the definition of different income tax rates and brackets, thus offering the possibility of empirical calibration for specific existing tax systems or even counterfactual tax policies.

 (ii) **Occupational status.** It is possible to determine the percentage of wage-earners in the population, the rest being self-employed.

(iii) **Support for progressivity in the tax system.** It is possible to determine the percentage of agents that support the principle of progressivity in the tax system, so that it may be empirically calibrated with data from attitudinal survey studies.

(iv) **Income threshold for receiving social benefits.** SIMULFIS allows to establish the income threshold which determines eligibility for a means-tested public cash benefit, so that if an agent's net income after tax is below the threshold, it is topped up to reach that level. The marginal withdrawal rate of the benefit is 100%, so that each eligible agent only receives the difference between his declared income and the minimum income determined by the threshold.

 (v) **Audit rate.** The model allows to give different values to the probability for any agent of being randomly audited.

(vi) **Amount of fines**. It is possible to determine the amount of fines as a percentage over the tax evaded. In SIMULFIS present stage there is no chance for tax evaders to be audited but not sanctioned: when a tax evader is randomly audited, then she pays the fine.

(vii) **Behavioral filters.** SIMULFIS allows to activate and de-activate two different behavioral filters (see Fig. 1): normative commitments (N) and SI. On the contrary, the other two filters are always activated, since they are necessary for the agents to make a decision: they are opportunities to evade (O) and RC.

1350007-7
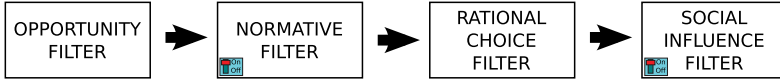
Fig. 1.   Behavioral filters.

Table 2.   Endogenous parameters and affected filters.

Updates	Affected filter
Perceived agent's audit probability	RC
Eligibility for benefits	RC & N
Tax balance (personal and in the neighborhood)	N
Perceived progressivity of the tax-benefit system	N
Neighborhood's compliance rate	SI

Note: RC = Rational choice; N = Normative; SI = Social influence.

(viii) **SI coefficient**. The strength of SI is modeled as a numerical value from 0 to 1, which is to be determined in each simulation.

3.2.3. *Endogenous parameters (generated)*

Some parameters have values that are endogenously determined by the model: their values at each period of the simulation depend on agents' decisions in the previous periods. Table 2 displays those parameters and the affected behavioral filter in each case (*see below for a detailed description of the role of these parameters*).

3.3. *Decision algorithm*

3.3.1. *Decision outcome: FOUR*

The main behavioral aim of the SIMULFIS decision algorithm is to compute the FOUR of each agent. The basic idea is illustrated in Fig. 2 with an example: taxpayers A and B have both a gross income of 100, and they both decide to hide 10 (that is 10% of their gross income); but taxpayer A had the chance to hide 50,
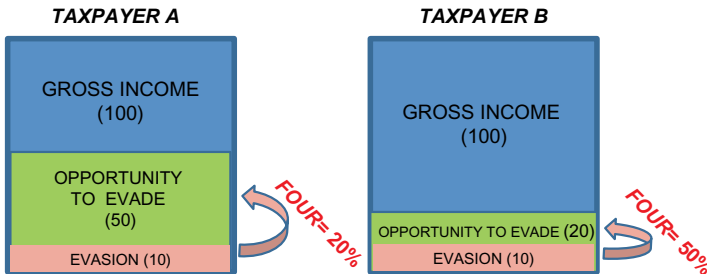
Fig. 2.   (Color online) Calculating FOUR: an example.

while taxpayer B could only hide 20. So, though in absolute terms they comply the same, in relative terms taxpayer B is making use of 50% of his opportunity to evade (FOUR$_B$ = 50%), while taxpayer A only makes use of 20% (FOUR$_A$ = 20%).

This way of modeling agents' compliance captures the realistic idea that a sizeable part of tax revenue is often simply ensured by income withholding at source, and therefore does not depend on agents' decisions at all. We think that the complication introduced in the model by computing FOUR is theoretically justified because this is a much better indicator of the intensity of agents' tax fraud efforts than the amount of money evaded or the percentage of their income they evade. As shown by our example in Fig. 2, similar percentages of income evaded may reflect very different evasion efforts, and the reverse is also true.

3.3.2. *Opportunity filter (O)*

The first behavioral filter is defined as the percentage of an agent's income she has objective chance to conceal. In order to determine some reference values for different agents' opportunities, we adopt some simple (and arguably realistic) assumptions:

  (i) Wage-earners have fewer opportunities to evade than self-employed workers, because their income is typically withheld at origin in a more substantial proportion.
 (ii) Agents with high income (the top decile of income distribution) have more opportunities to evade than the rest, because they receive income from many different sources or they have the resources, techniques and abilities needed to successfully conceal a higher proportion of it.
(iii) For similar reasons, agents with middle income have more opportunities to evade than agents with low income (the lower three deciles of income distribution).
(iv) For all agents there is some percentage of their income they cannot conceal, since the government always has some information on at least a minimum proportion of every agent's income.

Following these assumptions, Table 3 shows the reference values adopted so far in SIMULFIS for each category of agents in terms of income level and occupational status.

Table 3.   Reference values for opportunities to evade (in % of agents' gross income).

Income level	Self-employed	Wage-earners
High	80	30
Medium	60	20
Low	60	10

3.3.3. *Normative filter (N)*

The second behavioral filter aims to model agents' normative attitudes and satisfaction feelings toward the tax system's design and performance in terms of its fairness. The filter combines two elements in order to determine the level of satisfaction of each agent: (i) agents' satisfaction with the progressivity of the tax system, and (ii) agents' satisfaction with their tax balance when compared with that of their neighborhood:

(i) *Satisfaction with the progressivity of the tax system.* It is a function of:

  (a) Agents' support for the progressivity principle in the tax system (their *normative* beliefs on progressivity). This is an exogenous parameter, so the percentage of agents supporting progressivity is controlled. Agents are randomly assigned normative beliefs about progressivity according to that aggregated percentage.
  (b) Agents' perception of "real" progressivity in the tax system (their *factual* beliefs on progressivity): it is updated after each tax period. The system is perceived as progressive if the income ratio, after taxes and benefits, between the richest 10% and the poorest 10% is reduced by more than 30%.
  (c) If agents support progressivity and perceive that the system is progressive, they are "satisfied"; otherwise, they are not.

(ii) *Satisfaction with the tax balance.* Agents' satisfaction with their tax balance is determined by comparing their personal tax balance with that of their neighborhood. This method tries to capture the well-known findings of the literature on relative deprivation, which show that people's feelings of satisfaction with their endowments depend more on the comparison with their reference group than on the amount enjoyed in absolute terms [47].

  (a) Agents' personal tax balance is computed by comparing their personal tax burden $(X_i t_x)$ with the benefits they eventually receive (Z_i): agent i is a "net contributor" if $X_i t_x > Z_i$, or a "net recipient" if $X_i t_x \leq Z_i$. (See Table 4 below for the notation).
  (b) To compute their neighborhood's tax balance, agents observe whether the majority (more than 50%) of agents in their neighborhood (including themselves) are net contributors or net recipients.
  (c) If an agent is a net contributor while the majority of her neighbors are net recipients she is "unsatisfied"; otherwise, she is satisfied.

Once the two components of agents' satisfaction are determined, the effect of the normative filter (N) on compliance is modeled as a reduction of agent's concealable income resulting from their opportunity filter (O), so that:

(i) If an agent is satisfied in both senses 1 (progressivity) AND 2 (tax balance), she reduces in two thirds (66%) the proportion of income she may conceal.

Table 4.   SIMULFIS' notational guide.

Notation	Parameter
Y_i	Total (gross) income of agent i
X_i	Income declared by agent i
t_{Y_i}	Tax rate for Y_i
t_{X_i}	Tax rate for X_i
N	Total number of agents
p_i	Perceived probability for agent i of being caught if she evades
I_i^i	Audits to agent i in previous periods
I_i^v	Audits in agent i's neighborhood (including i) in the preceding period
R	Number of previous periods
V_i	Agent i's number of neighbors
θ	Fine for tax evasion
ω	SI coefficient
$UE_i(X_i)$	Expected utility of declaring X_i for agent i
M	Minimum income threshold for receiving the social benefit
Z_i^X	Social benefit received by agent i when $X_i(1 - t_{X_i}) < M$
Z_i^Y	Social benefit received by agent i when $Y_i(1 - t_{Y_i}) < M$
a_i	FOUR for agent i in period t
a_v	Median of FOUR in agents' neighborhood in the preceding periods

(ii) If an agent is satisfied only in sense 1 OR in sense 2, the reduction is in one third (33%).

(iii) If an agent is NOT satisfied in any sense, she may conceal the full percentage of income resulting from the opportunity filter (O).

3.3.4. *RC filter*

Over the percentage of their gross income resulting from filters O and N (the income agents may conceal), agents rationally maximize their net income by calculating the expected utility of a set of eleven outcomes.[g] Agents maximize their expected utility according to the following equation, which is an adaptation for the SIMULFIS model of the classical tax fraud expected utility function by Allingham and Sandmo [2]:

$$UE_i(X_i) = (1 - p_i) \sqrt[3]{(Y_i - X_i t_{X_i} + Z_i^X)}$$

$$+ p_i \sqrt[3]{(Y_i - Y_i t_{Y_i} - \theta(Y_i t_{Y_i} - X_i t_{X_i}) + Z_i^Y)}, \tag{1}$$

[g]SIMULFIS uses a discrete computational approach to determine a sequence of eleven expected outcomes in terms of agents' net income, which results from reducing concealed income by intervals of 10% from evading 100% to 0% of agents' concealable income. Since the expected utility formula we are using introduces substantive complications in relation to the classical one by Allingham and Sandmo (such as a progressive tax rate and a social benefit), this way of formalizing expected utility makes the computational working of the model easier, while ensuring the consistency of agents' decisions.

where (see notational guide in Table 4)

$$Z_i^X = M - X_i(1 - t_{X_i}); \quad Z_i^Y = M - Y_i(1 - t_{Y_i}); \quad Z_i^{X_i}, Z_i^Y \geq 0. \tag{2}$$

According to this function, an agent's decision to declare income X_i is a function of tax rates t, fine θ, her real income level Y_i, and the probability p of being caught if she evades. We assume homogeneous risk aversion by using cube roots in both addends of the equation.[h] We also include the expected social benefit, which agents compute by determining their eligibility in the immediately preceding period of the simulation. Note that when $X_i(1 - t_x) < M$ but $Y_i(1 - t_{y_i}) \geq M$, that is, when the agent is not legally eligible for benefits but she evades enough to be so, then $Z_i^y = 0$. Similarly, when $X_i(1 - t_x) \geq M$, that is, when the agent is not eligible whether she evades or not, then $Z_i^x = 0$ and $Z_i^y = 0$.

Agents' perceived probability of being sanctioned if they evade (p) is randomly distributed in the first period of the simulation and afterwards is updated endogenously as a function of the agent's audit record in all previous periods and the audit rate in the agent's neighborhood in the immediately previous period, according to the following equation:

$$p_i = \left(\frac{I_i^i}{R} - \frac{I_i^v}{V_i} \right) \Big/ 2. \tag{3}$$

It should be noted that, despite different filters and mechanisms affecting agents' final decision on compliance, RC has always some weight in the final decision (except under full SI: see footnote j). We take this as a realistic assumption, since an economic decision like tax compliance is almost always rationally considered by taxpayers, and, in most cases, assessed by experts or professionals.

3.3.5. *SI filter*

The last behavioral filter models the extent to which agents' FOUR converge to that of their neighborhood as a result of any kind of SI [21, 22, 27, 28, 54, 55, 65].[i]

---

[h]We do not use square root to avoid applying it to eventual negative numbers in the second addend (which could be the case, for example, if an agent declares a low percentage of her income and fines are very hard).

[i]The operation of SI mechanisms affecting tax evasion behavior has been recently questioned by some scholars [38] on the basis of the "privacy objection": since tax compliance is taken to be private and unobservable by peers, no SI could take place. However, as survey studies repeatedly show [40, 23], citizens usually have an approximate idea on the tax compliance level in their country, occupational category, or economic sector, its evolution in time, and its main causes; these ideas may be formed from information received through mass media, personal interaction or indirect inference (for example, shared social characteristics, when compared with economic lifestyles, may be proxies for inferences about neighbors' and peers' tax compliance). Additionally, in countries where there is low tax morale and high social tolerance toward tax evasion (such as Spain), it is usual to have access to public "street knowledge" about personal tax compliance, and to give and receive advice between neighbors and peers on how to evade. Finally, there is some literature modeling SI mechanisms triggered by estimated or revealed information on criminal and dishonest behavior [26, 34, 35].

In SIMULFIS, the strength of SI is determined by an exogenous parameter (ω) equal for all agents, ranging (0, 1) from no SI to full SI. After applying the RC filter, agents' FOUR (α_i) converge to the median FOUR in their neighborhood (α_v), according to $\alpha_i + \omega(\alpha_v - \alpha_i)$. The result of this calculation is the agent's final FOUR, which is expressible in terms of the percentage of the agent's income which is declared or evaded, and in terms of absolute amount of income evaded.[j]

3.3.6. *An example of the decision algorithm*

Figure 3 displays a numerical example of how agents' decision algorithm operates. The numbers at the upper level express percentages of an hypothetical agent's income, and how they change when the agent goes through the consecutive behavioral filters; as explained above, the opportunity and normative filters result in a maximum percentage of concealeable income, while the RC and the SI filters lead the agent to a decision as to what percentage of her income she will evade.

The numbers at the lower level express the equivalents to these two latter percentages in terms of FOUR; once the agent has gone through the RC filter, the resulting percentage is transformed in terms of FOUR (vertical descending arrow); this FOUR is compared with the agent's neighborhood's FOUR (bidirectional vertical arrow); then, the application of the SI formula (see Sec. 3.3.5 above) results in a different FOUR (diagonal arrow), which is again transformed into a percentage of income to be evaded by the agent (vertical ascending arrow). Specifically, the example works as follows:

(i) Let us assume that in a given period of a simulation, agent i after the O filter may conceal 60% of her income.
(ii) The maximum she can evade after applying the N filter is 40% of her income (for example, because she is satisfied only with respect to her tax balance but
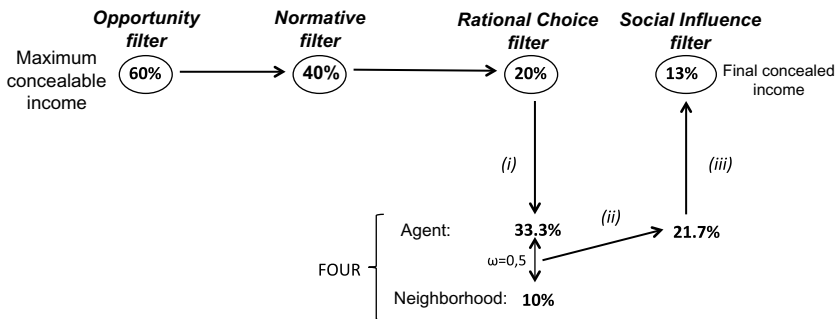
Fig. 3.   An example of the decision algorithm.

not with respect to the progressivity of the system, so she reduces in one third her opportunity to evade).

(iii) Let us assume then that after applying the RC filter, this percentage is further reduced to 20% of her income. Therefore, her FOUR (α_i) will be 33.3% (resulting from 20/60).

(iv) Let us also assume that in the previous period her neighborhood's median FOUR (α_v) was 10%. If the SI coefficient (ω) is set to 0.5, the agent's FOUR after the SI filter will be: $\alpha_i + \omega(\alpha_v - \alpha_i) = 21.7\%$.

 (v) The resulting FOUR of 21.7% is equivalent to conceal 13% of the agent's income, since she is making use of 21.7% of her initial opportunities, which were 60%, so: $21.7\% * 60\% = 13\%$. So in this example the SI filter affects the agent's compliance by reducing the percentage of income she decides to evade from 20% to 13%.

3.4. *Model dynamics*

The operation of the model is as follows: when the SIMULFIS is initialized, agents randomly receive a salary and a number of neighbors in the way described above. Then they go through the decision algorithm, and end up making a decision about how much of their income they declare, as a result of the activated behavioral filters. Their salaries are taxed and random audits and fines are executed. Then benefits are paid to those who are eligible, and endogenous parameters are updated for the next period (see Fig. 4).
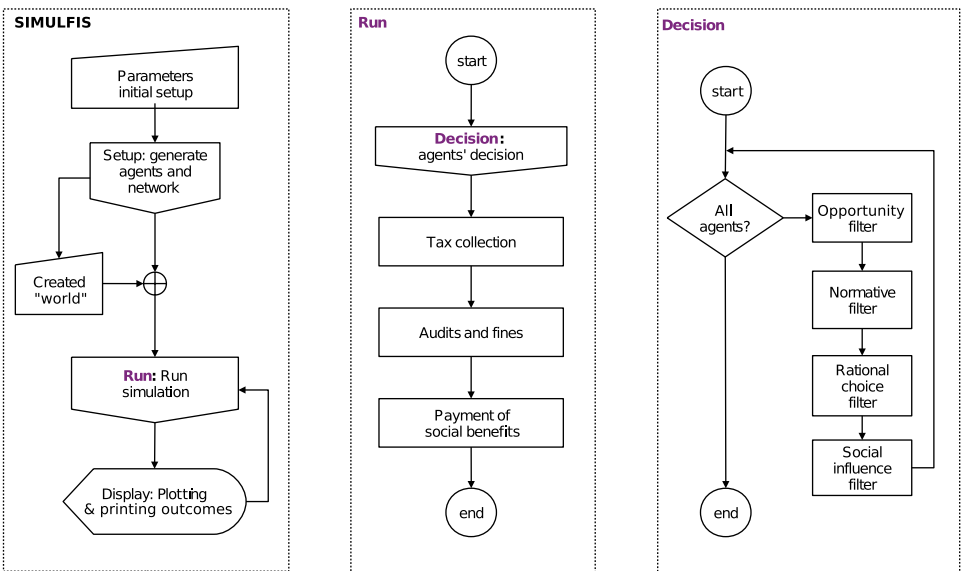
Fig. 4.   Model dynamics.

3.5. *Outcomes*

The main outcome of SIMULFIS' simulations is a set of decisions by each agent on how much income she evades at each period of a simulation, expressed in terms of agents' FOUR:

(i) Mean FOUR of each agent in all periods of a simulation (typically 100).
(ii) Mean FOUR of all agents (typically 1000) in each period of a simulation.

When agents' FOUR is converted into the equivalent amounts of evaded income in euros, we may have also outcomes such as:

(i) Mean percentage of gross income concealed by each agent in all periods of a simulation.
(ii) Mean percentage of gross income concealed by all agents in each period of a simulation.
(iii) For each agent, the absolute amount of tax evaded, which is the result of $Y_i t_{Y_i} - X_i t_{X_i}$.[k]

From individual outcomes it is possible to compute aggregated outcomes for the system, such as:

(i) Aggregated concealed income as a percentage of total income in the system.
(ii) Aggregated fiscal pressure as a percentage of total income in the system.
(iii) Aggregated absolute amount of tax evaded, which is the result of

$$\sum_{k=1}^{N}(Y_i t_{Y_i} - X_i t_{X_i}) \tag{4}$$

(iv) Aggregated tax gap: aggregated tax evaded as a percentage of total tax due, which is the result of

$$\sum_{k=1}^{N}\left[\left(\frac{Y_i t_{Y_i} - X_i t_{X_i}}{Y_i t_{Y_i}}\right)100\right]\Big/N. \tag{5}$$

Finally, all these results may be differentiated by different initial settings, categories of agents, values of a parameter, and so on, thus allowing SIMULFIS users to run controlled virtual experiments on tax compliance behavior.

4. Some Experimental Results

4.1. *Experimental design: Description of the simulations*

We run a set of simulations in order to test SIMULFIS internal validity: that is, whether the model works as theoretically expected and is reliable. The experimental design presented here aims to test specifically the different effect on tax

---

[k]Note that progressive tax rates applied to different income brackets are not necessarily the same for total gross income than for declared income, so this calculation is necessary.

compliance of different combinations of behavioral filters, under different scenarios of deterrence in terms of audits and fines. As a bridge to a more refined empirical or external validation of the model in a second stage of the project, we also analyze some economic results of the simulations when it is calibrated for the Spanish case. However, it should be noted that a complete empirical validation of the model is strongly dependent on the availability of reliable data on tax compliance and tax behavior in concrete empirical cases. Besides, although the number of parameters of the model is high, we have only manipulated three of them (behavioral filters, audits and fines), in order to achieve an acceptable equilibrium between fundamental work on social mechanisms and the attempt to fit the Spanish scenario.

The experimental design can be summarized as follows: we run 1920 simulations with 1000 agents and 100 tax periods for each simulation. We test four behavioral experimental conditions (EC), which activate different combinations of behavioral filters (recall that the opportunity filter O is always activated): in EC1 agents decide only on the basis of RC (RC filter); in EC2, RC and the normative filter (N) are both active; in EC3, RC is supplemented with the SI filter (SI); finally, in EC4, all filters are active (RC + N + SI). We also study 16 different deterrence scenarios: audit rates of 15%, 30%, 45% and 60%, with fines of 1.5, 3, 4.5 and 6 as multipliers of the amount of evaded tax. Three SI scenarios are considered, with $\omega = 0.25$, 0.50, 0.75. Each simulation is run in ten different "worlds" (different random initial assignations of neighbors and income).[1]

Some of the exogenous parameters of the model are calibrated empirically for the Spanish case, as detailed in Table 5.

4.2. *Behavioral outcomes*

A first set of experimental results have to do with the behavioral outcomes of the simulations, taking agents' FOUR as the main indicator of tax compliance. In all simulations, a robust equilibrium seems to be reached after few periods, and the system stabilizes around a certain average level of compliance in terms of agents' mean FOUR (see, for example, Fig. 6). Figures 5 and 6 show the main trends of tax compliance under different behavioral conditions and deterrence scenarios, with $\omega = 0.5$. All plots of this type show the mean FOUR of the 10 simulations executed (10 different worlds) for the entire population of agents in each round.

In Fig. 5, the plot on the left shows the (arguably) most realistic conditions in terms of deterrence. In this case, it appears that only EC2 (RC + N, red line) and EC4 (RC + N + SI, purple line) predict plausible levels of tax compliance, and the latter seems to be the optimal condition. This suggests, in line with recent literature, that RC alone is not enough to explain realistic levels of tax compliance.

---

[1]The number of simulations executed (1920) is the result of multiplying four experimental conditions by sixteen deterrence scenarios, by three SI scenarios, by ten different "worlds".

Table 5. Reference value for some exogenous parameters in SIMUL-FIS' experimental design.

Parameter	Reference value
Tax rate[a]	Less than 5050 € (0%)
	5051 to 17,360 € (24%)
	17,361 to 32,360 € (37%)
	32,361 to 120,000 € (43%)
	120,001 to 175,000 € (44%)
	More than 175,000 € (45%)
Occupational status distribution[b]	18.1% self-employed
	81.9% wage earners
Support for progressivity in the tax system[c]	80.0%
Income threshold for receiving social benefits[d]	8700 €

Note: [a]Calibrated for Spanish income tax rates and brackets (2011).
[b]Calibrated for Spain 2011 (*source*: Social Security affiliation, March 2012).
[c]Calibrated for Catalonia 2010 [52].
[d]50% of median income (poverty threshold).

Fig. 5. (Color online) Mean FOUR by deterrence conditions (2 extreme scenarios). RC = only rational choice filter activated. RC + N = rational choice and normative filters activated. RC + SI = rational choice and social influence filters activated. RC + N + SI = rational choice, normative and social influence filters activated. Audits in % and fines as multipliers of evaded tax. y-axis represents FOUR; x-axis represents time.

Fig. 6. (Color online) Mean FOUR by deterrence conditions with $\omega = 0.5$ (all scenarios). RC = only rational choice filter activated. RC + N = rational choice and normative filters activated. RC + SI = rational choice and social influence filters activated. RC + N + SI = rational choice, normative and social influence filters activated. Audits in % and fines as multipliers of evaded tax. y-axis represents FOUR; x-axis represents time.

However, an interesting fact is that as deterrence is made harder (see the right plot), EC4 (RC + N + SI) becomes suboptimal in front of EC2 (RC + N) and even in front of EC1 (RC, blue line).

Figure 6 shows this trend in an extended way across all deterrence scenarios. It is clear that harder deterrence always improves compliance (generating a lower mean FOUR), but at the same time operates a substantial change in the "optimality ordering" of the four behavioral experimental conditions, with only one exception: EC2 (RC + N) always fares better than EC1 (RC alone). This is not surprising, since the N filter was modeled so that it can only improve agents' compliance. What is unexpected, and contrary to usual theoretical expectations in the literature, is that SI may have an ambivalent relative effect depending on deterrence levels. We will return to this later.

In order to isolate the relative effect of audits and fines on agents' compliance, we compute the aggregated mean FOUR for all simulations with similar values for audits and for fines (Figs. 7 and 8). Again it is clear, and theoretically to be expected, that higher audits and fines always improve compliance, but increasing

Fig. 7. (Color online) Mean FOUR by deterrence condition (audits). RC = only rational choice filter activated. RC + N = rational choice and normative filters activated. RC + SI = rational choice and social influence filters activated. RC + N + SI = rational choice, normative and social influence filters activated. Audits in % and fines as multipliers of evaded tax. y-axis represents FOUR; x-axis represents time.
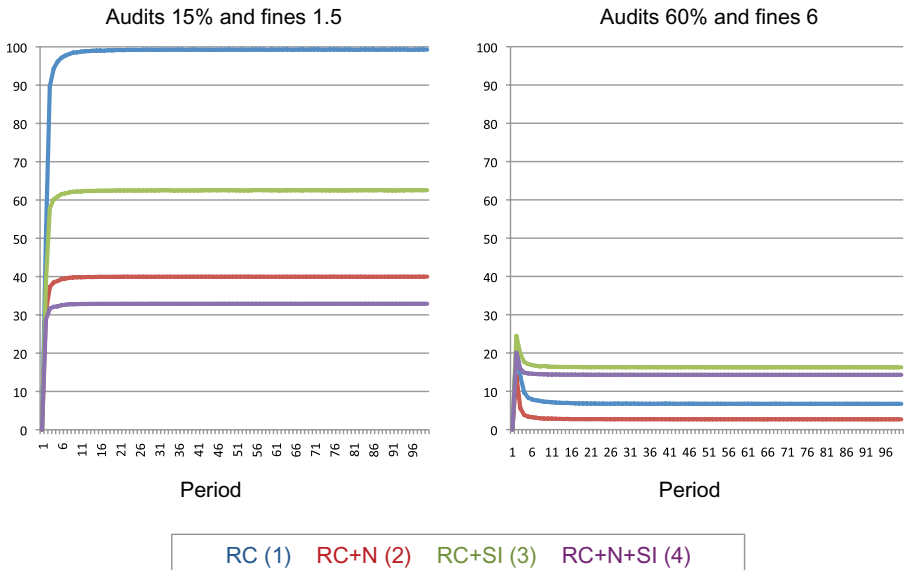

Fig. 8. (Color online) Mean FOUR by deterrence condition (fines). RC = only rational choice filter activated. RC + N = rational choice and normative filters activated. RC + SI = rational choice and social influence filters activated. RC + N + SI = rational choice, normative and social influence filters activated. Audits in % and fines as multipliers of evaded tax. y-axis represents FOUR; x-axis represents time.

audits is proportionally more effective than rising fines.[m] This outcome is in line with results obtained in most laboratory experiments [4, 31].

Figure 9 display the relative differences between mean FOUR in each experimental condition using EC1 (RC alone) as a baseline. This is a measure of how much

---

[m] In order to contrast this trend through statistical analysis, a linear regression model with FOUR as dependent variable and controlling for behavioral condition gave Beta coefficient $= -0.6$ for audits and -0.4 for fines. Similarly, in their meta-analysis of laboratory experiments in this area, Alm and Jacobson [4] find an elasticity of 0.1–0.2 for declared income/audits, but below 0.1 for declared income/fines. Note that, since SIMULFIS does not include tax inspectors as strategic agents in the model, our result is independent from the well-known claim by Tsebelis [63, 64] that higher penalties have no effect on crime.
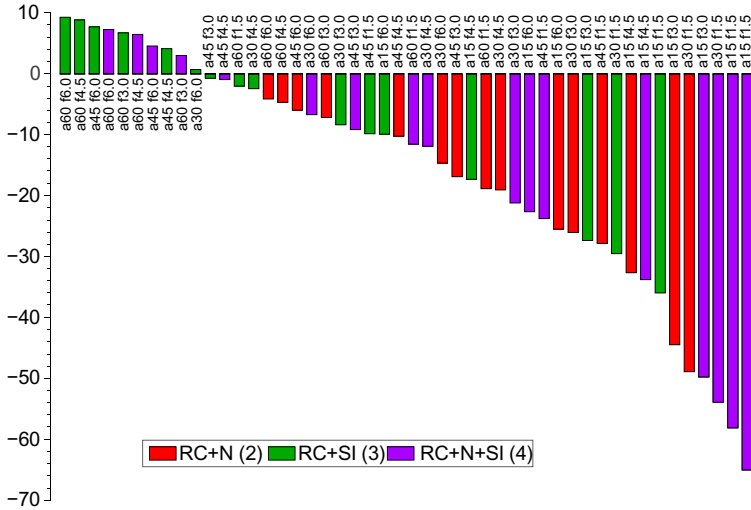
Fig. 9. (Color online) FOUR differences (baseline: RC filter). In each bar, the vertical label contains the percentage of audits and the fine multiplier; the y-axis expresses FOUR differences with the baseline. RC + N = rational choice and normative filters activated. RC + SI = rational choice and social influence filters activated. RC + N + SI = rational choice, normative and social influence filters activated.

deviation from the strict RC scenario is operated in terms of compliance by the rest of behavioral filters. It is confirmed again that N always pulls up compliance, but SI has an ambivalent effect depending on deterrence levels. However, in the majority of scenarios where a behavioral filter is added to RC, there is a decrease in FOUR (and thus compliance increases); additionally, in most cases, this decrease is proportionally more intense than the increase operated by the addition of the SI filter in some scenarios with very hard deterrence.

To see this more clearly, Fig. 10 isolates the net effect of SI on compliance, in comparison with the conditions where no SI is present. Observing the plot from the left side, it is clear that the effect of SI on FOUR is positive but decreasing as deterrence is lower, and ends up (at the right side) by being increasingly negative (and so, by improving compliance under medium and low deterrence levels).

Figures 11 and 12 confirm that all the trends mentioned so far, and especially the ambivalent effect of SI, are not substantially affected by different values of ω (the SI coefficient), although these values intensify the tendency correspondingly: a lower value of ω makes SI scenarios become suboptimal more slowly as deterrence is harder, while a higher value speeds the pattern up.

Why is this effect taking place? The reason is that SI makes tax compliance less sensitive to increased deterrence levels: since decisions are interdependent and not only based on individual cost-benefit calculations or normative attitudes, individual decisions on compliance are "adjusted" upwards or downwards depending on the neighborhood; both trends may partially cancel each other on the global mean,
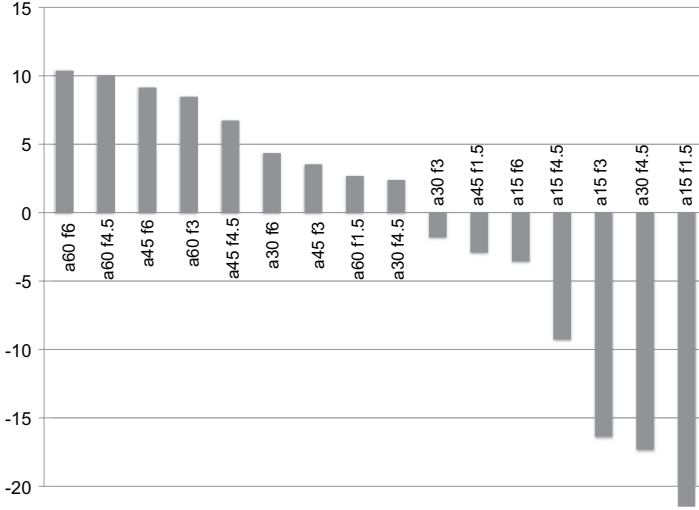
Fig. 10.   FOUR differences (baseline: conditions without SI). In each bar, the vertical label contains the percentage of audits and the fine multiplier; the y-axis expresses FOUR differences with the baseline.
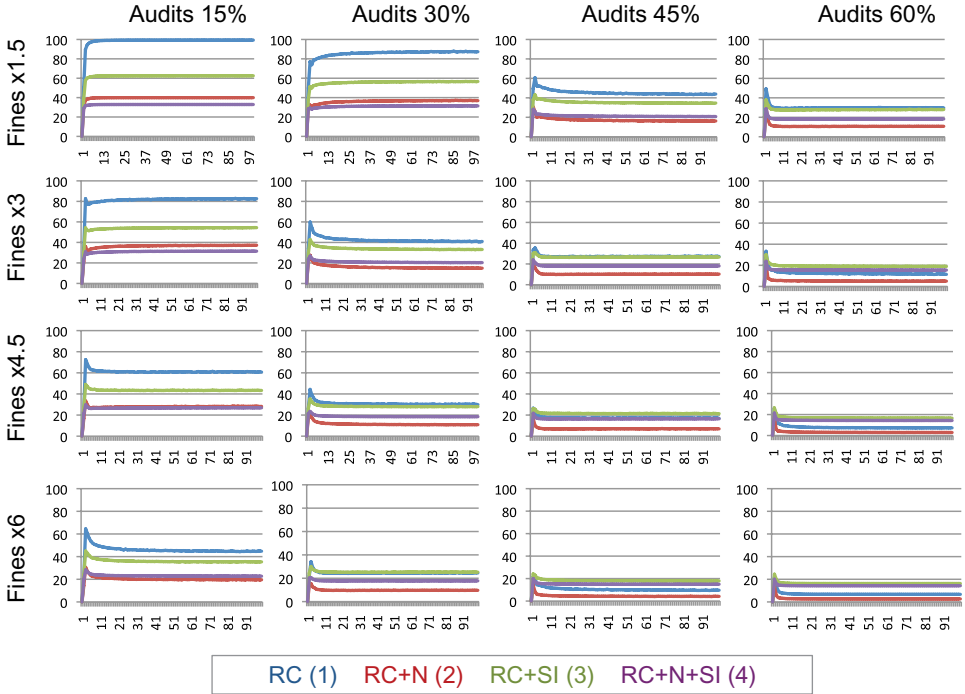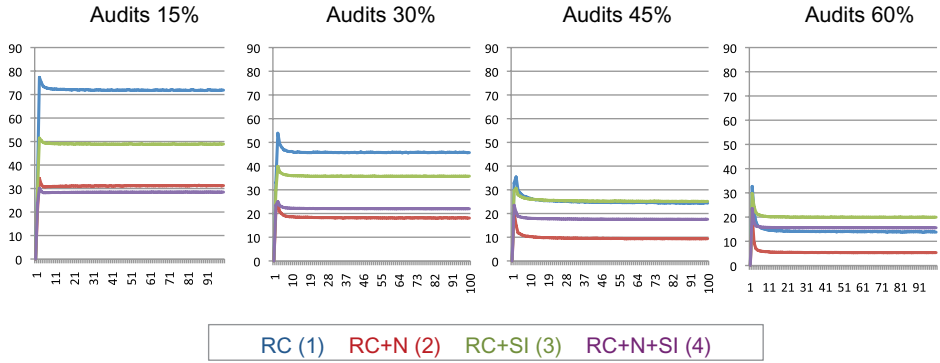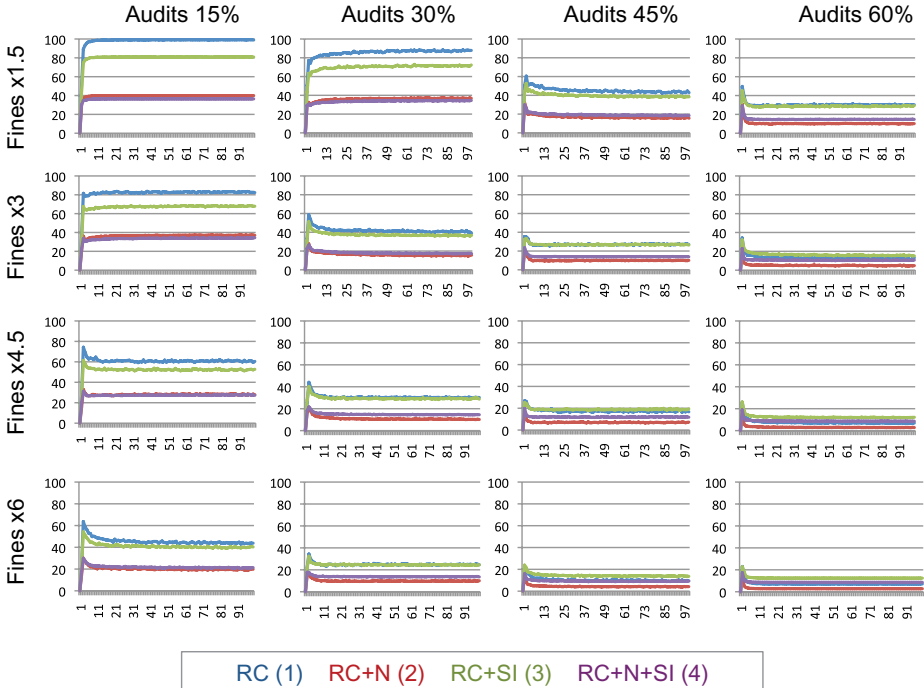

Fig. 11.   (Color online) Mean FOUR by deterrence conditions with $\omega = 0.25$. RC = only rational choice filter activated. RC + N = rational choice and normative filters activated. RC + SI = rational choice and social influence filters activated. RC + N + SI = rational choice, normative and social influence filters activated. Audits in % and fines as multipliers of evaded tax. y-axis represents FOUR; x-axis represents time.
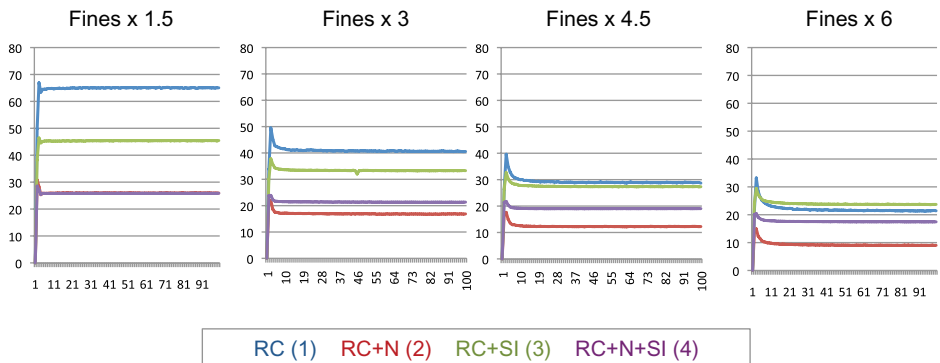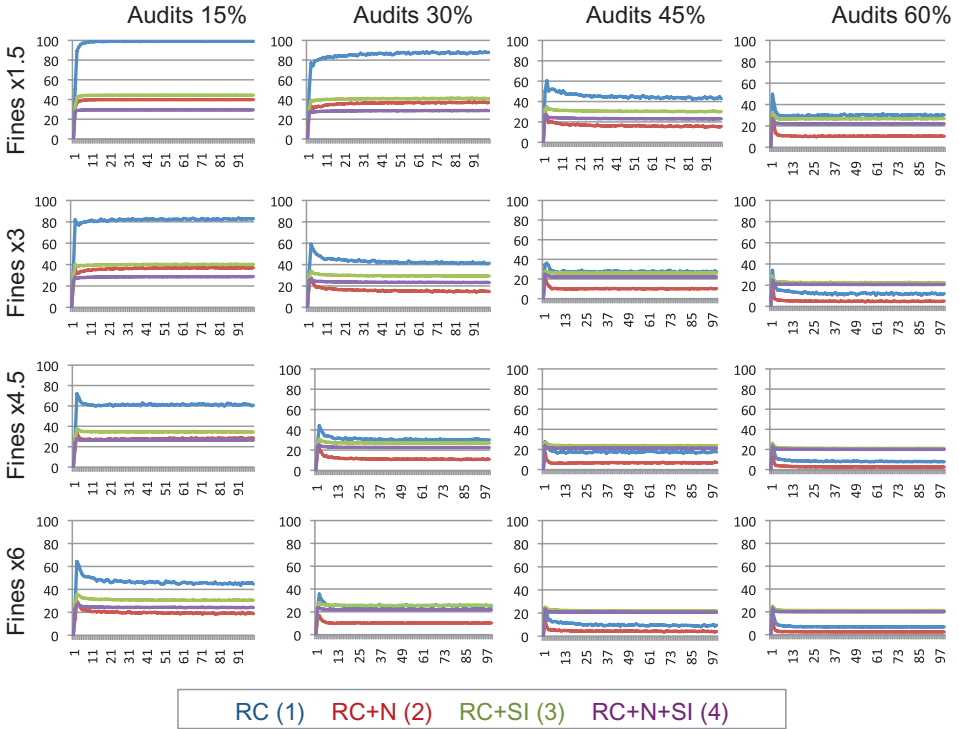
Fig. 12. (Color online) Mean FOUR by deterrence conditions with $\omega = 0.75$. RC = only rational choice filter activated. RC + N = rational choice and normative filters activated. RC + SI = rational choice and social influence filters activated. RC + N + SI = rational choice, normative and social influence filters activated. Audits in % and fines as multipliers of evaded tax. y-axis represents FOUR; x-axis represents time.

making the difference we are observing. When deterrence is hard enough, scenarios where this "adjustment" does not take place will logically fare better in terms of compliance. This effect is somehow capturing a well-known social phenomena, but one not much studied in the literature on tax compliance: agents who take into account their peers' decisions when making their own are less likely to change their behavior (or are likely to change it with less intensity) as an effect of external or hierarchical pressures from above (such as audits and fines).

4.3. *Economic outcomes*

A second set of results have to do with how much income in absolute terms do agents evade. At this stage these results have to be interpreted as a test for the plausibility and internal validity of SIMULFIS, and have not necessarily an empirical extrapolation. The outcomes presented in this section, therefore, can be understood as a bridge from theoretical-internal validation (theory-driven simulation) to the potential empirical validation of SIMULFIS (data-driven simulation). In this
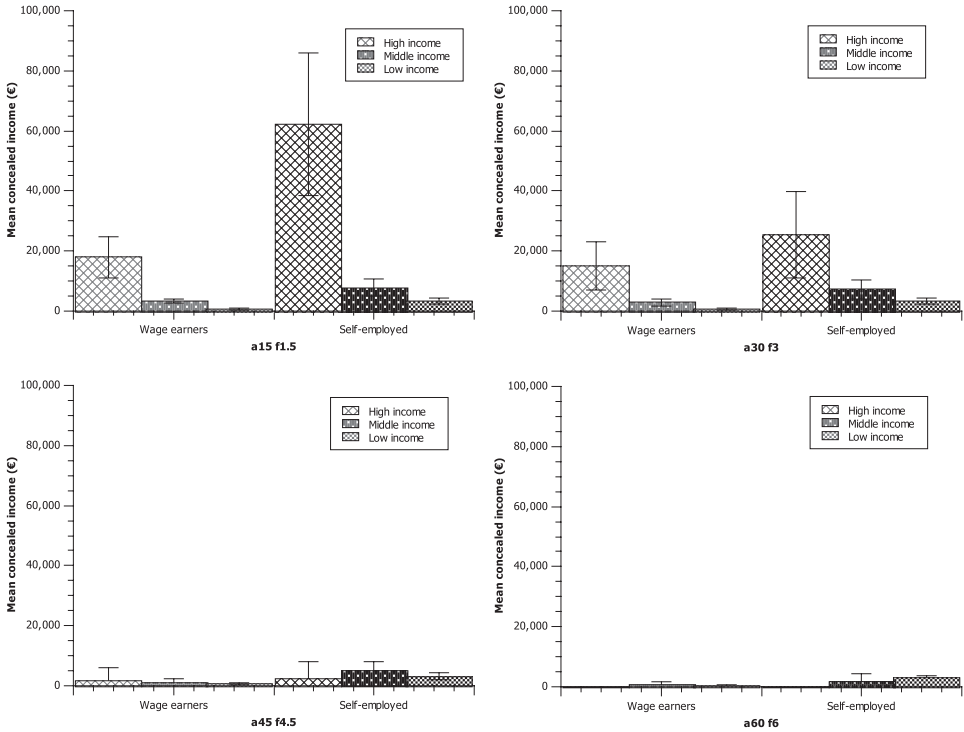
Fig. 13.   Mean concealed income ($€$) by income level and occupational status in different deterrence scenarios [Experimental condition: RC (1); audits in % and fines in multipliers of evaded income].

section the dependent variable and main indicator of aggregated tax evasion is the mean concealed or underreported income, expressed in euros.

Figures 13–16 show the mean concealed income by income level and occupational status, for the four behavioral conditions and under different deterrence scenarios.[n]

As theoretically expected, the general trend is that self-employed workers evade much more as an average than wage-earners, and that agents with high income evade much more than agents with middle and low income. However, in Fig. 13 (EC1: RC alone) we see that as deterrence is made harder, high-income agents start to evade less as an average than those with middle and low income; this is the logical effect, for rational agents, of progressive marginal tax rates combined with the fact that the amount of fines in these scenarios is more costly for high-income evaders. Interestingly, SI (Figs. 15 and 16) shows again an ambivalent effect, by boosting mean underreported income by self-employed high-income workers under hard deterrence levels, in comparison with the conditions where no SI is present (Figs. 13 and 14).

[n]For the sake of simplicity, only four deterrence scenarios are shown, which correspond to those in the diagonal of Fig. 6. In all cases, $\omega = 0.5$.
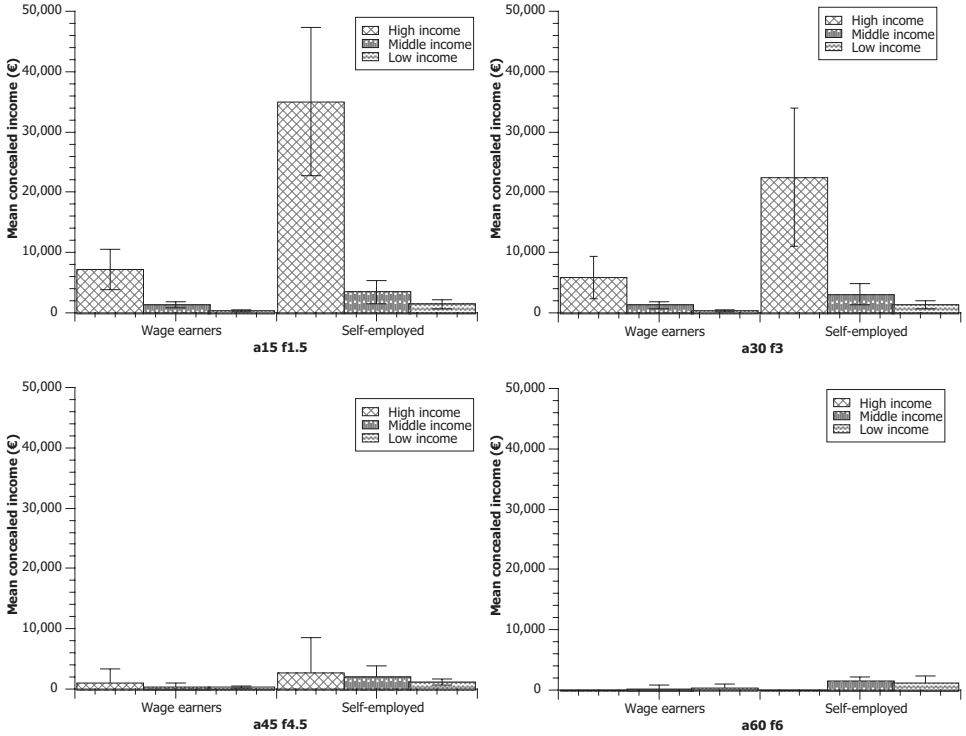
Fig. 14. Mean concealed income (€) by income level and occupational status in different deterrence scenarios [Experimental condition: RC+N (2); audits in % and fines in multipliers of evaded income].
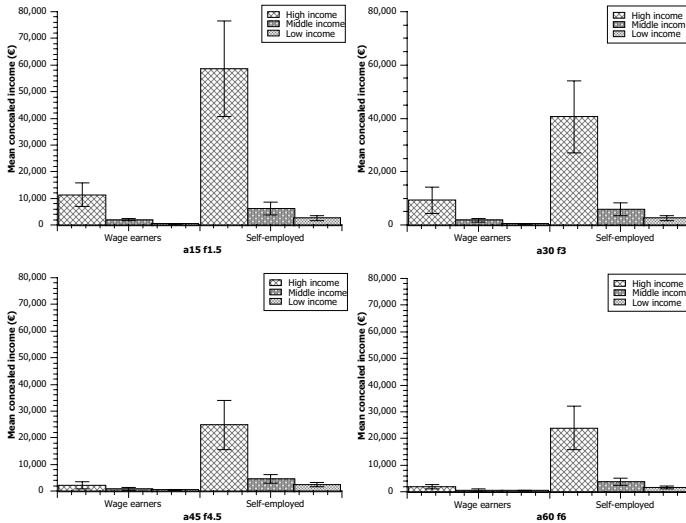
Fig. 15. Mean concealed income (€) by income level and occupational status in different deterrence scenarios [Experimental condition: RC+SI (3); audits in % and fines in multipliers of evaded income].
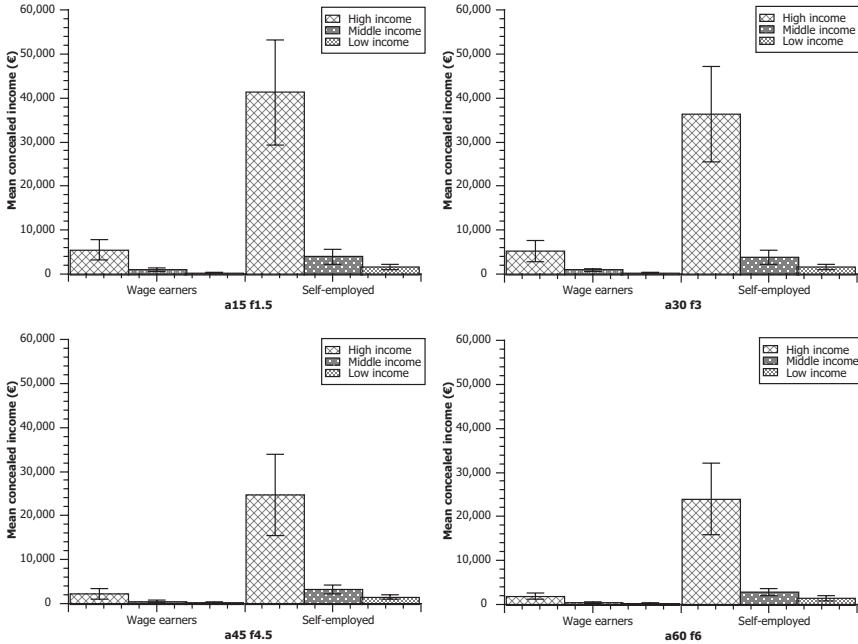
Fig. 16. Mean concealed income (€) by income level and occupational status in different deterrence scenarios [Experimental condition: RC+N+SI (4); audits in % and fines in multipliers of evaded income].
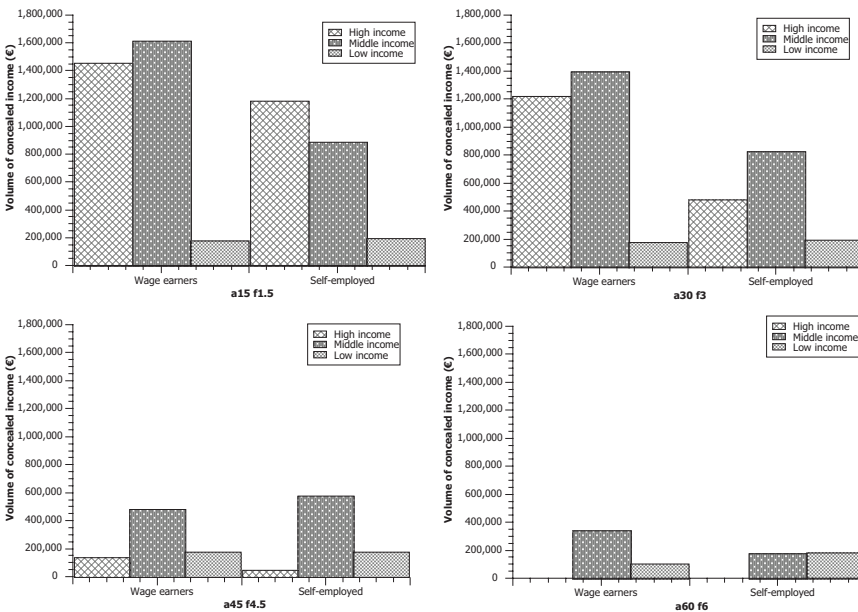
Fig. 17. Volume of concealed income (€) by income level and occupational status in different deterrence scenarios [Experimental condition: RC (1); audits in % and fines in multipliers of evaded income].
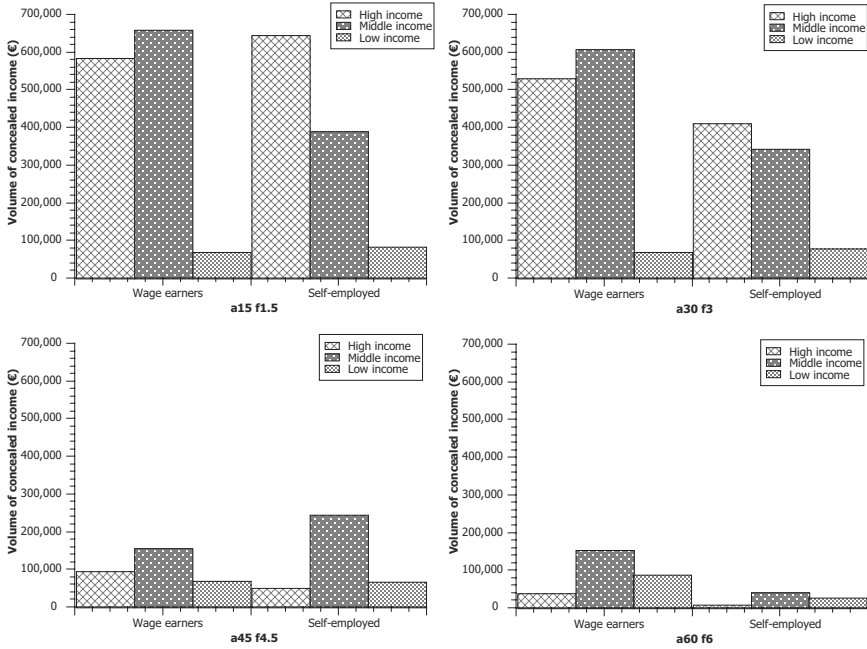
Fig. 18. Volume of concealed income (€) by income level and occupational status in different deterrence scenarios [Experimental condition: RC+N (2); audits in % and fines in multipliers of evaded income].
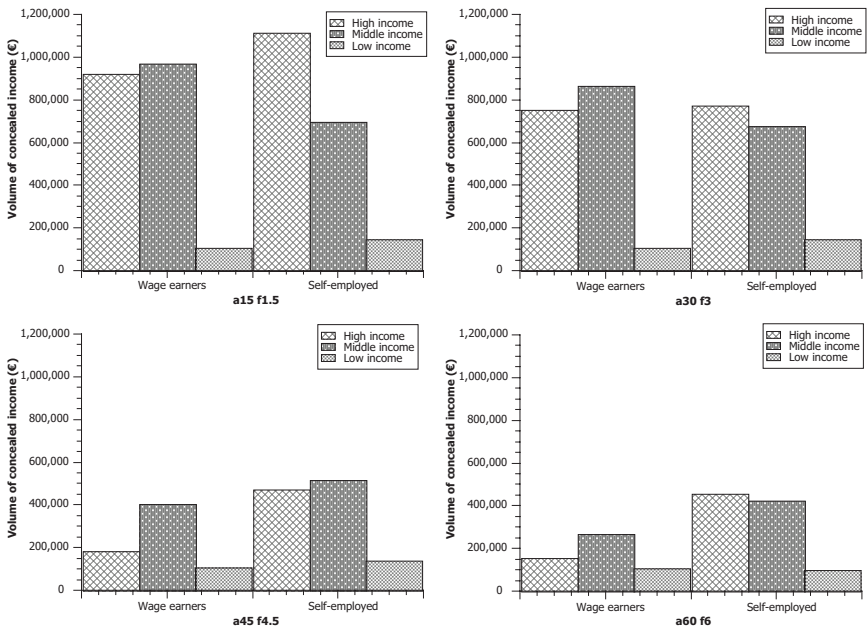
Fig. 19. Volume of concealed income (€) by income level and occupational status in different deterrence scenarios [Experimental condition: RC+SI (3); audits in % and fines in multipliers of evaded income].
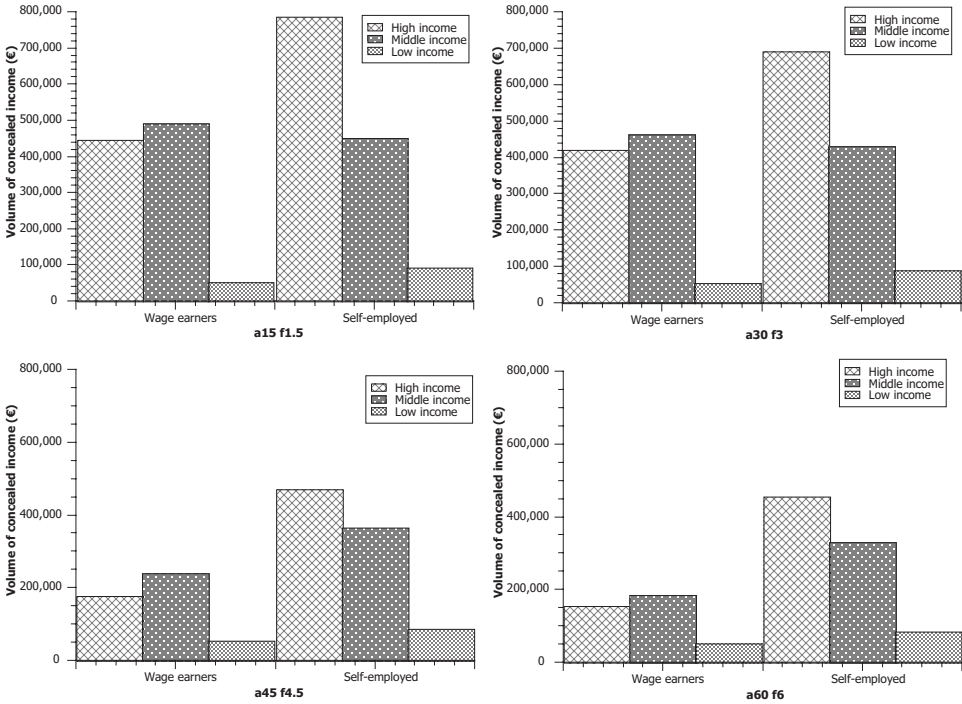
Fig. 20. Volume of concealed income (€) by income level and occupational status in different deterrence scenarios [Experimental condition: RC+N+SI (4); audits in % and fines in multipliers of evaded income].

Figures 17–20 show the aggregated volume of underreported income under the same conditions than Figs. 13–16. Another interesting result appears: though, as we saw in Figs. 13–16, high-income agents evade a higher mean income than the rest, the largest portion of concealed income in aggregated terms is to be found, in many scenarios, among middle-income wage earners, mainly because of their number. Similarly, and for the same reason, wage earners often seem to concentrate a higher volume of concealed income than self-employed agents, but the latter's portion of underreported income is still high when related to their small number. The relative effect of SI is again to raise the volume of concealed income for high-income self-employed workers.

Figure 21 gives another measure of aggregated tax evasion: the total volume of underreported income as a ratio of the total income in the system, by behavioral and deterrence conditions. An interesting point to note here is that if we rely on the abovementioned estimations of a volume of tax fraud around 20% of the Spanish GNP, then the closest scenarios to this value are EC1 (RC alone) under medium level of deterrence (which is unrealistic) and EC3 (RC + SI) under low levels of deterrence (which correspond better to Spanish real tax audits and fines). This seems to suggest that the SI filter may introduce more realism in the model than
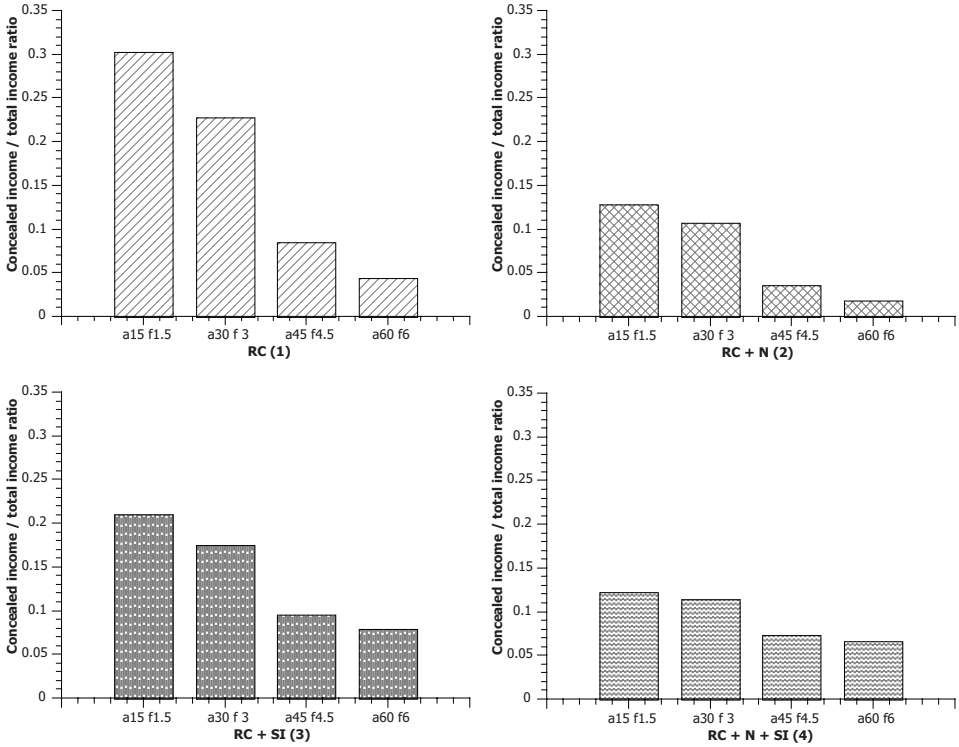
Fig. 21. Concealed income/total income ratio (by experimental condition and deterrence scenario). RC = only rational choice filter activated. RC + N = rational choice and normative filters activated. RC + SI = rational choice and social influence filters activated. RC + N + SI = rational choice, normative and social influence filters activated. Audits in % and fines as multipliers of evaded tax.

Table 6. Mean declared and underreported income gap between self-employed workers and wage earners: SIMULFIS results and estimations for Spain.

Gap between self-employed and wage earners	SIMULFIS	Spain	Source
Mean declared income (€)	−5337 €	−4875 €	GESTHA, 2009 [32]
Mean concealed income (%)	25.5%	25–30%	Martínez, 2011 [49]

the N filter, and that EC2 (RC + N) and EC4 (RC + N + SI) underestimate the level of tax fraud, while EC1 (RC alone) overestimates it.

An example of a more fine empirical comparison may be the one displayed in Table 6, which shows the relative differences between self-employed workers' and wage earners' mean underreported income according to an empirical estimation and as predicted by SIMULFIS. Since the values are broadly similar for a close time period, we dare to claim that SIMULFIS is in the right track for achieving good empirical fit in future stages of the project.

5. Conclusions and Future Research

This paper has offered a detailed description of SIMULFIS, a computational behavioral model for the simulation of tax evasion and tax compliance. We have presented the results of a first experimental design implemented to test the theoretical and internal validity of SIMULFIS, and specifically the different effect on tax compliance of different combinations of behavioral filters, under different conditions of deterrence in terms of audits and fines. The results also include the analysis of some economic outcomes which may be understood as a bridge to a more refined empirical or external validation of the model in a second stage of the project. As it was noted, a complete empirical validation of the model is strongly dependent on the availability of reliable data on tax compliance and tax behavior in empirical cases.

The main conclusions to be drawn from the analysis of these results could be summarized as follows:

(i) As suggested by theoretical literature on tax compliance, strict rational agents would produce much less compliance than it is usually estimated, except with unrealistically high deterrence levels. This strongly suggests that RC theory is not enough on its own to generate empirically estimated compliance levels through simulations and that other normative and social mechanisms are therefore necessary in any plausible model of tax compliance behavior.

(ii) Contrary to what is assumed by other agent-based models of tax evasion, SI does not always optimize compliance. In particular, it has been shown that when deterrence is strong, RC (rational choice) and RC + N (rational choice plus normative commitments) fare better in terms of compliance. The reason of this ambivalent effect of SI is that its presence, by making agents decisions' dependent on those of their peers, makes tax compliance level less sensitive to increased deterrence levels. So contrary to what Korobow *et al.* seem to assume [44], SI need not have the same directional effect on compliance independently of deterrence level. This SI effect, as well as its foundations at the micro level, would be difficult to observe and analyze without the aid of an agent-based model such as SIMULFIS.

(iii) Similarly to most experimental studies [4, 31], we find that audits are comparatively more effective than fines in order to improve tax compliance. A key factor to explain this may be the link between being audited and being fined. Further experiments performed with SIMULFIS may try to disentangle both facts in order to test whether this trend is confirmed, but the implication so far seems clear that policies to tackle tax evasion should rely more on improving the efficacy of audits, as well as their number and scope, than on raising penalties.

SIMULFIS is an agent-based model which offers many possibilities that further stages of the project will try to develop. To mention only a few, by using

SIMULFIS it is possible to design controlled experiments to test the effect of the introduction of unconditional compliers and noncompliers in the population, the micro-dynamics of the decision algorithm at the individual agent's level, the effect of different types of social networks, or the effect of different tax rates and tax policies. SIMULFIS is therefore a flexible tool designed to improve social-scientific research on tax behavior, a field that, in Kirchler's words, is "still in its infancy" [41](xv).

Acknowledgments

References

[1] Alarcón, G., de Pablos, L. and Garre, E., Análisis del comportamiento de los individuos ante el fraude fiscal: Resultados obtenidos a partir de la Encuesta del Observatorio Fiscal de la Universidad de Murcia, *Principios* **13** (2009) 55–84.

[2] Allingham, M. G. and Sandmo, A., Income tax evasion: A theoretical analysis, *J. Public Econ.* **1** (1972) 323–338.

[3] Alm, J. and Gomez, J. L., Social capital and tax morale in Spain, *Econ. Anal. Policy* **38** (2008) 73–87.

[4] Alm, J. and Jacobson, S., Using laboratory experiments in public economics, *Natl. Tax J.* **60** (2007) 129–152.

[5] Alm, J., Kirchler, E. and Muehlbacher, S., Combining psychology and economics in the analysis of compliance: From enforcement to cooperation, *Econ. Anal. Policy* (*EAP*) **42** (2012) 133–152.

[6] Alm, J. and Torgler, B., Culture differences and tax morale in the United States and in Europe, *J. Econ. Psychol.* **27** (2006) 224–246.

[7] Álvarez, S. and Herrera, P. M., Ética fiscal, Technical Report 10/04, Instituto de Estudios Fiscales, Madrid (2004), http://www.ief.es/contadorDocumentos.aspx? URLDocumento=/documentos/recursos/publicaciones/documentos_trabajo/2004_10.pdf.

[8] Antunes, L., Balsa, J. and Coelho, H., Agents that collude to evade taxes, in *AAMAS'07: Proc. 6th Int. Joint Conf. Autonomous Agents and Multiagent Systems* (ACM, New York, NY, USA, 2007).

[9] Antunes, L., Balsa, J. and Coelho, H., Tax compliance through MABS: The case of indirect taxes, in *EPIA'07: Proc. Artificial Intelligence 13th Portuguese Conf. Progress in Artificial Intelligence*, eds. Neves, J., Santos, M. F. and Machado, J. M. (Springer-Verlag, Berlin, Heidelberg, 2007).

[10] Antunes, L., Balsa, J., Respício, A. and Coelho, H., Tactical exploration of tax compliance decisions in multi-agent based simulation, in *Proc. 2006 Int. Conf. Multi-Agent-Based Simulation VII*, MABS'06 (Springer-Verlag, Berlin, Heidelberg, 2007), pp. 80–95, http://dl.acm.org/citation.cfm?id=1782774.1782785.

[11] Antunes, L., Balsa, J., Urbano, P., Moniz, L. and Roseta-Palma, C., Tax compliance in a simulated heterogeneous multi-agent society, in *Proc. 6th Int. Conf. Multi-Agent-Based Simulation*, MABS'05 (Springer-Verlag, Berlin, 2006), pp. 147–161, http://dx.doi.org/10.1007/11734680_11.

[12] Arrazola, M., de Hevia, J., Mauleón, I. and Sánchez, R., Estimación del volumen de economía sumergida en españa, *Cuad. de Información Econ.* (2011) 81–88.

[13] Balsa, J., Antunes, L., Respício, A. and Coelho, H., Autonomous inspectors in tax compliance simulation, in *Proc. 18th European Meeting on Cybernetics and Systems Research*, EMCSR 2006 (2006).

[14] Bicchieri, C., *The Grammar of Society*: *The Nature and Dynamics of Social Norms* (Cambridge University Press, New York, 2006).

[15] Bloomquist, K., Modeling taxpayers response to compliance improvement alternatives (Pittsburgh, PA, 2004), http://www.casos.cs.cmu.edu/events/conferences/2004/2004_proceedings/Bloomquist_Kim1.doc.

[16] Bloomquist, K., A comparison of agent-based models of income tax evasion, *Soc. Sci. Comput. Rev.* **24** (2006) 411–425.

[17] Bloomquist, K., Tax compliance as an evolutionary coordination game: An agent-based approach, *Public Finance Rev.* **39** (2011) 25–49.

[18] Braithwaite, V. and Ahmed, E., A threat to tax morale: The case of australian higher education policy, *J. Econ. Psychol.* **26** (2005) 523–540.

[19] Braithwaite, V., Reinhart, M. and Smart, M., Tax non-compliance among the under-30s: Among the under-30s: Knowledge, obligation or skepticism? in *Developing Alternative Frameworks for Explaining Tax Compliance*, eds. Torgler, B., Alm, J. and Martinez-Vazquez, J., Routledge International Studies in Money and Banking (Taylor & Francis, 2010).

[20] Braithwaite, V. and Wenzel, M., Integrating explanations of tax evasion and avoidance, in *The Cambridge Handbook of Psychology and Economic Behaviour*, ed. Lewis, A., Cambridge Handbooks in Psychology (Cambridge University Press, 2008), pp. 304–331.

[21] Bruch, E. E. and Mare, R. D., Neighborhood choice and neighborhood change, *Am. J. Sociol.* **112** (2006) 667–709.

[22] Centola, D. and Macy, M., Complex contagion and the weakness of long ties, *Am. J. Soc.* **113** (2007) 702–734.

[23] CIS, Encuesta sobre opinión pública y política fiscal (xxviii), Technical report, CIS (Centro de Investigaciones Sociolgicas), Madrid (2011).

[24] Cummings, R. G., Martinez-Vazquez, J., McKee, M. and Torgler, B., Tax morale affects tax compliance: Evidence from surveys and an artefactual field experiment, *J. Econ. Behav. Org.* **70** (2009) 447–457.

[25] Davis, J. S., Hecht, G. and Perkins, J. D., Social behaviors, enforcement, and tax compliance dynamics, *Account. Rev.* **78** (2003) 39–69.

[26] Diekmann, A., Przepiorka, W. and Rauhut, H., Lifting the veil of ignorance: An experiment on the contagiousness of norm violations, Discussion Papers 2011004, University of Oxford, Nuffield College (2011), http://ideas.repec.org/p/cex/dpaper/2011004.html.

[27] Durlauf, S. N., A framework for the study of individual behavior and social interactions, *Sociol. Methodol.* **31** (2001) 47–87.

[28] Durlauf, S. N., Groups, social influences, and inequality: A memberships theory perspective on poverty traps, in *Poverty Traps*, eds. Bowles, S., Durlauf, S. N. and Hoff, K. R. (Princeton University Press, New York, 2006), pp. 141–175.

[29] Elffers, H., Weigel, R. H. and Hessing, D. J., The consequences of different strategies for measuring tax evasion behavior, *J. Econ. Psychol.* **8** (1987) 311–337.

[30] Elster, J., *Explaining Social Behaviour*: *More Nuts and Bolts for the Social Sciences* (Cambridge University Press, 2007).

[31] Franzoni, L. A., Tax evasion and tax compliance, in *Encyclopedia of Law and Economics* (Edward Elgar, Cheltenham, 2007).

[32] GESTHA, III informe de la lucha contra el fraude fiscal en la agencia tributaria, Technical report, GESTHA (Sindicato de Técnicos del Ministerio de Hacienda) (2011).

[33] Gigerenzer, G., Hertwig, R. and Pachur, T., *Heuristics*: *The Foundations of Adaptive Behavior* (Oxford University Press, Oxford, 2011).

[34] Gino, F., Ayal, S. and Ariely, D., Contagion and differentiation in unethical behavior: The effect of one bad apple on the barrel, *Psychol. Sci.* **20** (2009) 393–398.

[35] Groeber, P. and Rauhut, H., Does ignorance promote norm compliance? *Comput. Math. Org. Theory* **16** (2010) 1–28.

[36] Halla, M., Tax morale and compliance behavior: First evidence on a causal link, IZA Discussion Papers 4918, Institute for the Study of Labor (IZA) (2010), http://ideas.repec.org/p/iza/izadps/dp4918.html.

[37] Hedström, P., *Dissecting the Social*: *On the Principles of Analytical Sociology* (Cambridge University Press, Cambridge, 2005).

[38] Hedström, P. and Ibarra, R., On the contagiousness of non-contagious behavior: The case of tax avoidance and tax evasion, in *The Benefit of Broad Horizons: Intellectual and Institutional Preconditions for a Global Social Science*, eds. Joas, H., Wittrock, B. and Klein, B. S. (Brill, Academic Publishers, 2010), ISBN 9789004192843 9004192840.

[39] Hofmann, E., Hoelzl, E. and Kirchler, E., Preconditions of voluntary tax compliance: Knowledge and evaluation of taxation, norms, fairness, and motivation to cooperate, *J. Psychol.* **216** (2008) 209–217.

[40] IEF, Opiniones y actitudes fiscales de los españoles en 2011: Documento de trabajo del IEF n.19/2012, Technical report, IEF (Instituto de Estudios Fiscales), Madrid (2012).

[41] Kirchler, E., *The Economic Psychology of Tax Behaviour* (Cambridge University Press, New York, 2007).

[42] Kirchler, E., Muehlbacher, S., Kastlunger, B. and Wahl, I., Why pay taxes? A review of tax compliance decisions, in *Developing Alternative Frameworks for Explaining Tax Compliance*, eds. Alm, J., Martinez-Vazquez, J. and Torgler, B., No. 59 in Routledge International Studies in Money and Banking (Routledge, London, 2010).

[43] Kirchler, E. and Wahl, I., Tax compliance inventory: TAX-I voluntary tax compliance, enforced tax compliance, tax avoidance, and tax evasion, *J. Econ. Psychol.* **31** (2010) 331–346.

[44] Korobow, A., Johnson, C. and Axtell, R. L., An agent-based model of tax compliance with social networks, *Natl. Tax J.* **60** (2007) 589–610.

[45] Levi, M., *Of Rule and Revenue* (University of California Press, Berkeley, 1988).

[46] Manzo, G., *La Spirale des inégalités: Choix scolaires en France et en Italie au XXe siècle* (Presses de l'Université Paris-Sorbonne, Paris, 2009).

[47] Manzo, G., Relative deprivation in silico: Agent-based models and causality in analytical sociology, in *Analytical Sociology and Social Mechanisms*, ed. Demeulenaere, P. (Cambridge University Press, Cambridge, 2011), pp. 266–308.

[48] María-Dolores, R., Alarcón, G. and Garre, E., Tax morale in Spain: A study into some of its principal determinants, *J. Econ. Issues* **44** (2010) 855–876.

[49] Martínez, D., How different are the Spanish self-employed workers by underreporting their incomes? Working Papers. Serie EC 2011/09, Instituto Valenciano de Investigaciones Económicas, S.A. (Ivie) (2011).

[50] Méder, Z. Z., Simonovits, A. and Vinczeb, J., Tax morale and tax evasion: Social preferences and bounded rationality, *Econ. Anal. Policy* (*EAP*) **42** (2012) 171–188.

[51] Mittone, L. and Patelli, P., Imitative behaviour in tax evasion, in *Economic Simulations in Swarm*: *Advances in Computational Economics*, eds. Luna, F. and Stefansson, B., Vol. 14 (Springer, 2000), pp. 133–158.

[52] Noguera, J. A., Guijarro, X., León Medina, F., Llacer, T., Miguel, F. J., Tapia, E., Tena-Sánchez, J. and Vinagre, M., Valors i actituds sobre justícia distributiva: Prestacions socials i fiscalitat, Technical report, Centre destudis dOpinió (CEO), Generalitat de Catalunya, Barcelona (2011), http://ceo.gencat.cat/ceop/AppJava/export/sites/CEOPortal/estudis/monografies/contingut/justiciadistributiva01.pdf.

[53] Prieto, J., Sanzo, M. J. and Suárez, J., Análisis económico de la actitud hacia el fraude fiscal en España, *Hacienda pública española* (2006) 107–128.

[54] Rolfe, M., Conditional choice, in *The Oxford Handbook of Analytical Sociology*, eds. Hedström, P. and Bearman, P. S. (Oxford University Press, Oxford, 2009), pp. 419–447.

[55] Salganik, M. J. and Watts, D. J., Social influence: The puzzling nature of success in cultural markets, in *The Oxford Handbook of Analytical Sociology*, eds. Hedström, P. and Bearman, P. S. (Oxford University Press, Oxford, 2009), pp. 315–341.

[56] Slemrod, J., Old George Orwell got it backward: Some thoughts on behavioral tax economics, *FinanzArchiv*: *Public Finance Anal.* **66** (2010) 15–33.

[57] Srinivasan, T. N., Tax evasion: A model, *J. Public Econ.* **2** (1973) 339–346.

[58] Szabó, A., Gulyás, L. and Tóth, I. J., TAXSIM agent based tax evasion simulator, *5th European Social Simulation Association Conf.* (ESSA 2008) (Brescia, Italia, 2008).

[59] Szabó, A., Gulyás, L. and Tóth, I. J., Sensitivity analysis of a tax evasion model applying automated design of experiments, in *Proc. 14th Portuguese Conf. Artificial Intelligence*: *Progress in Artificial Intelligence*, EPIA'09 (Springer-Verlag, Berlin, 2009), pp. 572–583, DOI: 10.1142/S021952591350007010.1007/978-3-642-04686-5_47.

[60] Szabó, A., Gulyás, L. and Tóth, I. J., Simulating tax evasion with utilitarian agents and social feedback, *Int. J. Agent Technol. Syst.* **2** (2010) 16–30.

[61] Torgler, B., *Tax Compliance and Tax Morale*: *A Theoretical and Empirical Analysis* (Edward Elgar, Cheltenham, UK, 2007).

[62] Torgler, B., Demir, I. C., Macintyre, A. and Schaffner, M., Causes and consequences of tax morale: An empirical investigation, *Econ. Anal. Policy* (*EAP*) **38** (2008) 313–339.

[63] Tsebelis, G., The abuse of probability in political analysis: The Robinson Crusoe fallacy, *Am. Polit. Sci. Rev.* **83** (1989) 77–91.

[64] Tsebelis, G., Penalty has no impact on crime: A game-theoretic analysis, *Ration. Soc.* **2** (1990) 255–286.

[65] Watts, D. J. and Dodds, P. S., Threshold models of social influence, in *The Oxford Handbook of Analytical Sociology*, eds. Hedström, P. and Bearman, P. S. (Oxford University Press, Oxford, 2009), pp. 475–497.

[66] Zaklan, G. and Lima, F., A multi-agent-based approach to tax morale, *Int. J. Mod. Phys. C* **19** (2008) 1797–1808.

[67] Zaklan, G., Lima, F. and Westerhoff, F., Controlling tax evasion fluctuations, *Physica A*: *Stat. Mech. Appl.* **387** (2008) 5857–5861.

[68] Zaklan, G., Westerhoff, F. and Stauffer, D., Analysing tax evasion dynamics via the Ising model, *J. Econ. Interact. Coord.* **4** (2009) 1–14.

Tax Compliance, Rational Choice, and Social Influence:
An Agent-Based Model

ABSTRACT

The study of tax behaviour is a research field which attracts increasing interest in social and behavioural sciences. Rational choice models have been traditionally used to account for that behaviour, but they face the puzzle of explaining levels of observed tax compliance which are much higher than expected. Several social influence mechanisms have been proposed in order to tackle this problem. In this article we discuss the interdisciplinary literature on this topic, and we claim that agent-based models are a promising tool in order to test theories and hypothesis in this field. To illustrate that claim, we present SIMULFIS, an agent-based model for the simulation of tax compliance that allows to combine rational choice with social influence mechanisms in order to generate aggregated patterns of tax behaviour. We present and discuss the results of a simple virtual experiment in order to show the potentialities of the model.

Introduction

Social scientists have traditionally offered two broad kinds of explanation for norm compliance: sociologists and sociological theorists have tended to rely on different socialization and internalization mechanisms in order to account for normative conformity, and they have considered the failure of those processes as the main cause of observed deviation rates (Parsons, 1951; Schütz, 1964; Habermas, 1981; Bourdieu, 1980). Economists, on their part, have relied on deterrence theories: rational individuals are expected to comply with norms when the expected utility of compliance is higher than that of non-compliance; therefore the probability and intensity of sanctions and punishments for deviants are key factors to explain the observed levels of norm conformity (Becker, 1968; Baird *et al.*, 1994; Katz 1998; Posner 1998). As an economist and sociologist, a classical thinker such as Max Weber was aware of this dual nature of compliance: on the one side, he acknowledged that individuals often act according to norms when it is in their interest to do so, and try to avoid compliance if it is not; but, on the other side, he often noted that normative reasons have their own logic, independent from plain self-interest, and that norms are not always followed in a purely instrumental fashion. Beyond social and economic theorists, a variety of subfields in the social sciences have empirically analyzed the determinant factors of compliance: criminology and the sociology of law, as well as the sociological, psychological and economic study of social norms, moral ideas and practices, or cooperation and altruism, have all provided powerful insights and evidence on these matters. In recent decades, the complexity and diversity of the explanatory factors behind norm compliance has been also incorporated into a research field which is increasingly calling social scientists' attention: tax compliance and tax evasion.

Tax evasion, usually defined as the voluntary reduction of the tax burden by illegal means (Elffers *et al.*, 1987), is a problem of huge social relevance at present times.[1] This is so, first, because tax evasion reduces the volume of resources available for the public sector. Second, since tax evasion behaviour is not equally distributed among taxpayers, it violates the principles of fairness, equality, and progressivity that the tax system ought to satisfy (IEF 2004, Murphy and Nagel, 2002). Those problems are more pressing in countries that face a high level of fiscal fraud in absolute and

(1) We will take the expressions "tax evasion" and "tax fraud" as equivalent for our purposes, though they might have slightly different meanings in part of the literature on tax compliance.

relative terms. Besides, reducing tax evasion allows to increase public resources without need to raise tax rates. This is especially interesting when one looks at the difficulties that governments face today in order to achieve public budget equilibrium and fund welfare programs.[2]

Academic researchers who aim to understand the dynamics of tax evasion and tax compliance are increasingly acknowledging the need to include psychological, social, and cultural factors in their explanatory models. Traditional explanations based on deterrence were too often linked to the strict assumptions of rational choice theory and the *homo oeconomicus* model (Allingham & Sandmo, 1972). Instead, recent studies focus, for example, on taxpayers' *tax morale* (their tolerance towards tax fraud), social norms, social interaction effects, ethical values, fairness perceptions, knowledge of the tax system, or attitudes towards government and public expenditure (Alm, 2012; Alm *et al.*, 2012; Braithwaite and Wenzel, 2008; Hofmann *et al.*, 2008; Kirchler, 2007; Kirchler *et al.*, 2010; Meder *et al.*, 2012; Torgler, 2007, 2008).

As a result of all these contributions, a number of key behavioural and sociological questions have emerged in the literature on tax compliance, which go beyond the more traditional ones related with the detection and estimation of the size of tax evasion. For example: Is rational choice theory enough to explain estimated levels of tax compliance? Do taxpayers' fairness concerns help to explain those levels? What is the effect of social influence on tax behaviour? Can we study tax evasion as an isolated individual behaviour, or are there social interaction effects behind it? It seems clear that those questions have considerable sociological interest, since the dynamics of norm compliance and deviation has always been one of the main objects of study for sociologists. Social interactions and attitudes are likely to become, in addition to purely economic ones, central concerns for all researchers involved in the study of tax compliance in the years to come.

In this article we present and describe an agent-based model designed to help to answer those questions: SIMULFIS.[3] Our main aim is not to show the empirical fit of the model's results with a particular case or a sample of cases (see ANONYMIZED), but, departing from empirically plausible initial conditions and specifications, to explore

---

(2) Murphy (2011 and 2012) estimates that the shadow economy in the European Union equals to 22,1% of its GDP (data for 2009). The tax revenue lost represents a 7,04% of EU's global GDP, which equals to 139,3% of the public deficit of all EU's countries in 2010.

(3) SIMULFIS is an acronym of the words "SIMULation" and "FIScal."

the logic of different mechanisms which may interact to produce tax behaviour, specifically rational choice and social influence (although we also partially explore the operation of fairness concerns). We will proceed as follows: first we will briefly consider rational choice explanations of tax compliance and their limitations. Second, we will discuss how social influence may enter into a field traditionally dominated by the rational choice approach, and how it may help to introduce more realism in explanatory models of tax behaviour. Third, we will focus on some attempts to build agent-based models in this field. Fourth, we will describe our model by summarizing its main features and their operation. Finally, we will present and discuss the results of a virtual experiment in order to show how SIMULFIS may help to explore the dynamics of different mechanisms of tax compliance.

The problem of tax compliance

The first economic model of tax evasion was presented four decades ago by Allingham and Sandmo (1972), soon followed by Srinivasan (1973). Those neoclassical economic models adapted Gary Becker's 'economics of crime' to the study of tax behaviour (Becker, 1968). The aim was to explain deviant behaviour (in this case, tax evasion) as rational choice: each taxpayer decides how much of her income she declares as a function of the benefits of concealing it (given a tax rate and an individual's income level) and the costs of being caught (given a probability of being audited and the amount of the fine).

Usual criticisms of rational choice theory stress its unrealistic assumptions (Boudon, 2009; Elster, 2007:24-26; Hedström, 2005: 60-66): rational individuals form their preferences and take their decisions in an isolated way, with perfect information, known levels of risk aversion, and perfect capacity to estimate expected utilities. However, in the case of tax compliance it is perhaps more acceptable than in other contexts to assume that taxpayers will generally try to estimate and approximate expected utilities of different compliance levels, and often they are assisted by professional lawyers and economists to do so. The problems of rational choice explanations of tax compliance have had more to do with the inaccuracy of their empirical predictions. In fact, the most frequent criticism against the rational choice approach in this field is that it predicts a much more higher level of tax evasion than usually observed or estimated: since audit probabilities and the amount of fines are low

in the real world, most taxpayers should rationally evade most of their income, but they actually do not (Andreoni *et al.*, 1998; Bergman and Nevárez, 2005, p. 11; Torgler, 2008, p. 1249). In order to explain observed levels of compliance in most countries, one would have to assume an unrealistic level of risk aversion among taxpayers.

The reason why a rational agent should always evade, and evade as much as he can, is intuitively easy to grasp: since in most countries the audit rates are relatively low, the corresponding low probability of being caught makes it rational to underreport income. Fines would have to be implausibly high in order to make evasion more costly than compliance (Bergman and Nevárez, 2005). Of course, this picture should be nuanced in real world conditions, since audits are not entirely random, and tax authorities often give priority to investigate those taxpayers who have been caught evading in the past. This would mean that a rational agent would have to adjust the expected utility of evasion if she has been caught once, but still the audit probability could be low (even if higher than the average), and of course all taxpayers would always cheat until they are caught once, which is not the case at all. In the same way, if tax rates are very low, the benefit of evading might decrease in comparison with that of paying, but still the rates needed to make compliance a generalized optimal strategy would be implausibly low. Besides, it has been also observed that countries with similar levels of tax enforcement and tax fraud deterrence have very different levels of tax evasion (Bergman and Nevárez, 2005). This fact seems to suggest that other factors different from deterrence and surveillance may strongly affect the behaviour of taxpayers.

One possible explanation of high tax compliance is opportunity-based (Kleven *et al.*, 2011): most taxpayers are waged employees whose income is automatically reported to the tax authorities by their employers and taxed at source, so their opportunity to underreport is low. Opportunities to evade are indeed important, and we believe that explanatory models of tax fraud should take them into account. However, even wage-earners may have some chances to evade, since getting income from other sources than salaries, participating in the shadow economy, or receiving part of the wage through channels hidden to the tax authorities, are also extended options in our economic systems.[4]

---

(4) Another possible explanation of high compliance levels would be that taxpayers strongly overestimate the odds of being audited. This could be the case for some of them, but again we would have

As a result of the abovementioned problems, research on tax evasion in the last four decades has broadened the traditional neoclassical economic model in order to explain an action (tax compliance) which in many cases appears to be 'quasi-voluntary' (Levi, 1988). Among these attempts a remarkable role is played by survey studies which try to measure and explain citizens' tax morale, understood as an 'intrinsic motivation' or 'internalised willingness' to pay taxes (Braithwaite & Ahmed, 2005; Torgler, 2007). Such studies seek to explain tax morale by taking declared tolerance towards tax evasion as a proxy, and including it as the dependent variable in regression models. Even though the results are often inconclusive, they give interesting information about some statistical correlations between tax morale and different socio-demographical variables (age, gender, marital status, educational level, or income level), as well as ideological or attitudinal variables (such as religious beliefs, patriotism, or trust in institutions; see useful overviews in Torgler, 2007 and Torgler, 2008).[5] Besides tax morale, factors such as social norms, social influence, fairness concerns, and perceptions of the distributive outcomes of the tax system are increasingly considered as likely determinants of tax compliance (Alm *et al*., 2012; Braithwaite and Wenzel, 2008; Hofmann *et al.*, 2008; Kirchler, 2007; Kirchler *et al*., 2010; Meder *et al*., 2012). All these contributions suggest that the standard economic approach alone is not able to account for a complex social phenomenon such as tax evasion.

to assume a very unrealistic and systematic bias in people's beliefs in order to explain observed levels of compliance.

(5) In some countries like Spain there are periodical surveys focused on tax attitudes such as the "Public opinion and tax policy" survey (CIS, 2011) and the "Spanish Tax Attitudes and Opinions" survey (IEF, 2012), whose data are available for exploitation and analysis. Some works following the tax morale approach have also relied on survey data (Alm and Torgler, 2006; Alm and Gómez, 2008; Alarcón, De Pablos and Garre, 2009; María-Dolores, Alarcón and Garre, 2010; Prieto, Sanzo and Suárez, 2006).

Social influence and tax compliance

The mechanisms of social influence

Rational choice models of economic behaviour often ignore that agents do not make economic decisions in a social void, but in the context of a variety of social perceptions and interactions. Specifically, traditional rational choice models of tax compliance have conceived taxpayers as socially isolated decision-makers who are only concerned with deterrence. However, 'economic' conduct is also 'social', at least in the sense that "the probability of an individual performing a given act depends upon how many others have already performed it"(Hedström and Ibarra, 2010, p. 315).

There are many mechanisms that may create social interaction effects in contexts such as taxpaying behaviour: social norms (social pressure to conform to a given rule of 'adequate' or 'correct' taxpaying conduct); social conformity (spontaneous convergence to an observed average tax behaviour); rational imitation (under conditions of uncertainty regarding the probability of being audited and caught for tax evasion, adjusting to your neighbours' level of tax compliance may be a reasonable strategy); social learning (if agents can see how others do, they can learn from them and adjust their tax compliance in order to do better themselves); strategic interaction (if tax revenue is used to create public goods that benefit everyone, taxpayers may be playing a strategic collective action game or dilemma); or fairness effects (if agents feel unequally or unfairly treated in comparison with others, they will modify their tax compliance accordingly).

The academic literature on 'social influence' processes has not always been clear in adequately distinguishing all these mechanisms, and has used very different terms to designate them (besides 'social influence', one may find expressions such as 'social contagion', 'social impact', 'social interactions', 'fads', 'behavioural cascades', 'group effects', 'bandwagon effects', 'social imitation', 'social pressure', 'social proof', 'social conformity', 'social multiplier', and other similar ones). This is in part a consequence of the fact that social influence has been studied independently by different disciplines, mainly by social psychology (see Cialdini & Goldstein, 2004 for a useful review) and sociology (Aberg & Hedström, 2011; Bruch and Mare, 2006; Centola and Macy, 2007; Granovetter, 1973; Manzo, 2013; Rolfe, 2009; Salganik and Watts, 2009; Watts and Dodds, 2009), although in recent decades some economists have also analyzed and

modelled it (Becker, 1974; Durlauf, 2001 and 2006; Durlauf and Ioannides, 2010; Glaeser *et al.*, 2003; Manski, 1993a, 1993b, and 2000; Young, 2009).

As a result of this disciplinary dispersion, a systematic taxonomy of mechanisms by which group behaviour has an effect on individual one is still missing, and processes of very different nature are often merged under the label of 'social influence' or other similar ones. For example, rational interaction mechanisms such as rational imitation, rational learning, and strategic interaction in social dilemmas often go hand in hand with non-rational ones such as normative social pressure, spontaneous conformity to the observed group behaviour, or fairness concerns. Similarly, there are different 'social influence' mechanisms as to what kind of choices they induce in the influenced individuals: while rational imitation, normative social pressure, or social conformity typically lead agents to converge to the average or the most frequent behaviour in the group, generating a pattern of 'social contagion', strategic interaction and fairness effects may often lead individuals to make different choices than their neighbours or peers (because they may have incentives to deviate from the equilibrium, or they feel that the group's behaviour contradicts fairness principles); finally, learning may lead to contagious behaviour many times, but individuals may also learn from their peers' failures or suboptimal choices how *not* to behave (see Figure 1).

In this paper we will be mainly concerned with those mechanisms of social influence that typically lead to the social contagion of a given behaviour. In this sense, assuming that agents affected by those mechanisms will converge to the average behaviour seems the most advisable way of modelling this pattern (Nordblom and Zamac, 2012; Balestrino, 2010). Similarly, Latané's (1981) theory of social impact states that all else being equal, an agent will tend to conform to the majority's behaviour and attitudes in their group. 'Social proof' or 'social validation' theory (Cialdini and Trost, 1998, p. 171) claims that people tend to view a behaviour as correct to the extent they see others performing it, because they spontaneously use the observed actions of their peers as a standard. Social psychologists have also noted the difference between this *informational* conformity (the knowledge of others behaviour spontaneously leads an individual to conform to it) and *normative* social pressure (typically associated with the enforcement of social and moral norms through feelings such as shame or guilt; see Cialdini and Goldstein, 2004, or Deutsch and Gerard, 1955).

FIGURE 1. - *Group effects on individual behaviour*

Social interaction (endogenous effects)
- Social pressure to follow social norms (normative)
- Social conformity (informational)
- Rational
  - Rational imitation under uncertainty
  - Social learning effects
  - Strategic interaction (social dilemmas)

Social contagion

Exogenous effects
- Contextual effects
- Fairness effects

Correlated effects
- Ecological effects
- Effects of shared individual characteristics

The economic literature prefers to speak of 'social interaction' effects, and distinguishes them from 'correlated effects', that is, from those patterns of social convergence that result from the fact that individuals share similar social properties or opportunity structures in the first place, so a similar action pattern may be generated from isolated decisions without need of social interaction (Manski, 2000). As noted by Manzo (2013), in previous work Manski (1993a and 1993b) had offered a more complete typology of effects which might be confounded with 'social interaction': 'ecological effects' (shared common factors in the environment, like, for example, tax regulations), 'contextual effects' (shared common social background features, like being self-employed or having high income), and 'correlated effects' (shared common individual characteristics, like similar levels of risk aversion or tax aversion).[6]

Contextual effects are also called 'exogenous effects' by Manski, because agents incorporate them from their past experience and do not change from round to round just by observing others' behaviour. They contrast with 'endogenous effects' (such as social conformity and social learning), by which behaviour may change from round to round

---

(6) Correlated and ecological effects are both included under the first label in Manski (1993a). Manski (2000) also distinguishes between constraint interactions, expectation interactions, and preference interactions, which broadly coincide with Aberg and Hedström's (2011) classification of opportunity-based, belief-based, and desire-based interactions.

depending on peers' behaviour. Fortin *et al.* (2007) add 'fairness effects' (the influence of individuals' conceptions of fairness on their behaviour) as another kind of exogenous effects. It is worth to note that the greatest part of the sociological tradition have relied exclusively on exogenous factors as a result of a predominant focus on socialization and internalization mechanisms, leaving endogenous effects underanalyzed. Figure 1 shows an integrated taxonomy of all these effects together with social interaction ones.

Social influence in tax compliance research

If social influence or social interactions effects exist in tax behaviour, their knowledge would be useful for policy objectives such as preventing tax fraud and adequately predicting the effects of tax regulations. It could be expected that social influence mechanisms in the case of tax compliance should be of the *informational* type, since tax behaviour is private and difficult to observe; in fact, some studies (Bergman and Nevárez, 2005; Torgler, 2007 and 2008) show that information about mean levels of compliance may have an effect on individuals' decisions to underreport income. However, the possibility of *normative* social pressure to comply should not be discarded: to be sure, individuals may converge to the mean level of compliance among their peers because they adjust their individual risk estimation of being audited and fined to that of the group (informational mechanism), but also because they infer that compliance at the mean group's level will not be socially disapproved (normative mechanism).

The operation of social influence mechanisms directly affecting tax evasion behaviour has been questioned by some scholars (Hedström and Ibarra, 2010) on the basis of what we might call the 'privacy objection': since tax compliance is taken to be private and unobservable by peers, no social influence could take place. However, as survey studies repeatedly show, citizens usually have an approximate idea on the tax compliance level in their country, region, occupational category, or economic sector (CIS, 2011; IEF, 2012); these ideas may be formed from information received through mass media, personal interaction, or indirect inference (for example, shared social characteristics, when compared with economic lifestyles, may be proxies for inferences about neighbours' and peers' tax compliance). Additionally, in countries where there is low tax morale and high social toleration towards tax evasion (such as Spain: Alm and Gómez, 2008; Alarcón *et al.*, 2009; CIS, 2011; IEF, 2012;), it is usual to have access to public 'street knowledge' about personal tax compliance, and to give and receive advice

between neighbours and peers on how to evade. Those studies also show a low risk that others report the authorities if they know about evasion practices. Finally, in some models social influence is triggered by estimated or revealed information on criminal and dishonest behaviour (Diekman *et al.*, 2011; Gino *et al.*, 2009; Groeber and Rauhut 2010).

It is not surprising, therefore, that the study of tax compliance increasingly considers mechanisms of social influence or social contagion: Myles & Naylor (1996), for example, introduce a social conformity payoff in their model when taxpayers adhere to the social tax compliance pattern. Hedström and Ibarra (2010) allow for an informational social contagion mechanism in their tax evasion model, based on the belief that "if they can do it, I can do it as well" (p. 321). Fortin *et al.* (2006) introduce social conformity in their econometric model of tax evasion. Nordblom and Zamac (2012) build an agent-based model with social norm conformity and personal norms. Bergman and Nevárez (2005) execute an experiment in order to test social contagion in tax compliance, and the results are positive (subjects increase or reduce compliance in accordance with what they are told that is the mean compliance level of the group). According to Torgler (2008:1251): individuals who have tax evaders as peers or friends in their personal circle are more likely to evade themselves, but he notes that social interactions are one of the most underexplored issues in the field of tax compliance (ibid: 1261).

Agent-based models of tax compliance

Manski (2000) has showed that social interaction effects are very difficult to identify and to distinguish from exogenous and correlated effects with the only aid of statistical methods. Besides, quantitative estimation of these effects, as well as establishing the direction of causality between individual and group behaviour, are problematic tasks. However, Manzo (2013) has convincingly argued that agent-based computational models are a useful tool in order to solve all those problems, since they allow to run controlled virtual experiments able to isolate and differentiate concrete social interaction mechanisms and their effects. Some researchers in the tax compliance field have also realised that survey data analysis is insufficient to test properly the causal mechanisms involved in that phenomenon, since the description of statistical correlations does not open the 'black box' of the generative causal processes that bring

about the aggregated outcomes (Hedström, 2005). That is why a growing number of studies have recently tried to explain tax evasion by adopting agent-based computational methods (Alm, 2012).

The first attempts to apply agent-based methodology to the study of tax compliance are due to Mittone and Patelli (2000), Davis *et al.* (2003), and Bloomquist (2004 and 2006); Bloomquist's model presents a number of interesting features: agents are programmed with a high number of properties, the audit probability and its effects are determined in a complex way, and the results are tested against real data. The model series *EC** (Antunes *et al.*, 2006, 2007a, 2007b, 2007c; Balsa *et al.*, 2006) are even more complex by introducing agents with memory, adaptive capacities, and social imitation. The most remarkable novelties in these models are the inclusion of tax inspectors able to decide autonomously and, above all, the explanation of non-compliance with indirect taxes through collusion between sellers and buyers. Similarly, Bloomquist (2011) deals with tax compliance in small business by modelling it as an evolutionary coordination game.

The *NACSM* model by Korobow *et al.* (2007) analyses the relationship between tax compliance and social networks. More recently, we find an important group of agent-based models in econophysics which adapt the Ising model of ferromagnetism to the tax field: instead of elementary particles interacting in different ways as a function of temperature, we have individuals behaving in different ways as a function of their level of dependence on their neighbours' behaviour. The proposals by Zaklan *et al.* (2008, 2009a and 2009b), Lima (2010), and Seibold and Pickhardt (2013) belong to this group.

The *TAXSIM* model by Szabo *et al.* (2008, 2009 y 2010) presents a particularly complex design, since it includes four types of agents (employers, employees, the government, and the tax agency). It also takes into account factors such as agents' satisfaction with public services, which depends on their previous experience and on that of their neighbours. Hedström and Ibarra (2010) have proposed a social contagion model inspired by the principles of analytical sociology in order to show how tax evasion may spread as an indirect consequence of tax avoidance's social contagiousness. Similarly, Nordblom and Zamac (2012) have also showed how an agent-based model may account for social conformity effects in order to explain observed differences in tax morale by different age groups. Hokamp (2013) includes different types of taxpayers and some novel aspects like back auditing effects (as in Hokamp and Pickhardt, 2010),

and the evolution of social norms over taxpayers' life cycle. Finally, Pellizzari and Rizzi (2013) build a model where agents pay their taxes according to a perceived level of public expenditure and some psychological variables like trust and tax morale.

In short, social simulation using agent-based models seems a promising research option in a field in which, despite the abundant literature, significant and uncontroversial results have been rare and hardly coordinated.

A new agent-based model of tax behaviour: SIMULFIS

As an illustration, we will briefly describe a new agent-based model (SIMULFIS) designed to study tax behaviour, and will show some exploratory results that may help to understand the dynamics of tax evasion.[7] The SIMULFIS project aims to provide an agent-based computational tool able to integrate rational behaviour, tax morale (including fairness concerns and normative beliefs) and social influence (understood as a social contagion mechanism) in a computational setting. The model simulates a virtual social environment where a central tax authority implements a fiscal regulation, collects taxes, executes audits and fines, and distributes tax revenues through a social benefit; only those agents with after-tax income below 50% of the median income are eligible for the benefit, and the benefit tops up their income until they reach that threshold. Agents have a random level of income and occupational status (they can be self-employed or wage-earners), the distribution of which may be empirically calibrated to emulate real cases (in the present version, the values of these parameters are both estimated for the Spanish case). All agents are members of a random or homophilic social network: in the latter case, they have a high fixed probability to share similar occupational status and income level with their neighbours.

Agents' decision algorithm is structured in the form of four 'filters' that sequentially affect their decision about how much income they report to the tax

---

(7) SIMULFIS was implemented in NetLogo v5.0.2 (Wilensky, 1999) and results were analyzed with SPSSv20. A detailed technical description of the model, as well as an application to the Spanish case, may be found in ANONYMIZED and ANONYMIZED. Several improvements have been made in the version of SIMULFIS we use here: a more fine calibration of some exogenous parameters has been done (for example, effective tax rates, audits and fines have been calculated from real data for Spain); the possibility for agents to calculate their fiscal balance (whether they are net contributors or net recipients in the system), and to compare it with that of their neighbours, has been introduced in isolation from other 'normative' mechanisms; finally, the definition of tax evasion opportunities for low-income workers captures a higher probability that they participate in the shadow economy.

authorities: the opportunity, normative, rational choice, and social influence filters (in this order). This 'filter approach' aims to capture recent developments in behavioural social science and cognitive decision theory which disfavour the usual option of balancing all determinants of decision in a single individual utility function (Bicchieri, 2006; Elster, 2007; Gigerenzer *et al.*, 2011). Hence, tax compliance is produced by several possible combinations of mechanisms, depending on what 'filters' are activated: the model allows to activate and de-activate the normative and the social influence filters; on the contrary, the other two filters (opportunities and rational choice) are always activated, since they are necessary for the agents to make a decision. Therefore, the model allows to analyze four behavioural scenarios: a strict rational choice one (RC), rational choice supplemented by normative or fairness concerns (F+RC), rational choice supplemented by social influence in the form of a social contagion mechanism (RC+SC), and, finally, a scenario where all the filters are activated (F+RC+ SC).

The decision outcome: the 'fraud opportunity use rate' (FOUR)

Since our main focus is behavioural, SIMULFIS outcomes go beyond traditional indicators for compliance (such as the amount of income evaded by agents) towards determining how much relative advantage agents take of their opportunities to evade. Thus we define agent's 'fraud opportunity use rate' (FOUR) as the main dependent variable of the behavioural experiments that SIMULFIS is able to execute (although, of course, economic data on evaded income are also computed).

The basic idea of FOUR is illustrated in Figure 2 with an example: taxpayers A and B have both a gross income of 10, and they both decide to hide 1 (that is 10% of their gross income); but taxpayer A had the chance to hide 5, while taxpayer B could only hide 2. So, though in absolute terms they comply the same, in relative terms taxpayer B is making use of 50% of his opportunity to evade ($FOUR_B$=50%), while taxpayer A only makes use of 20% ($FOUR_A$=20%).

FIGURE 2. - *Calculating 'fraud opportunity use rate' (FOUR): an example*

FOUR = ¹/₅ = 20%   FOUR = ¹/₂ = 50%
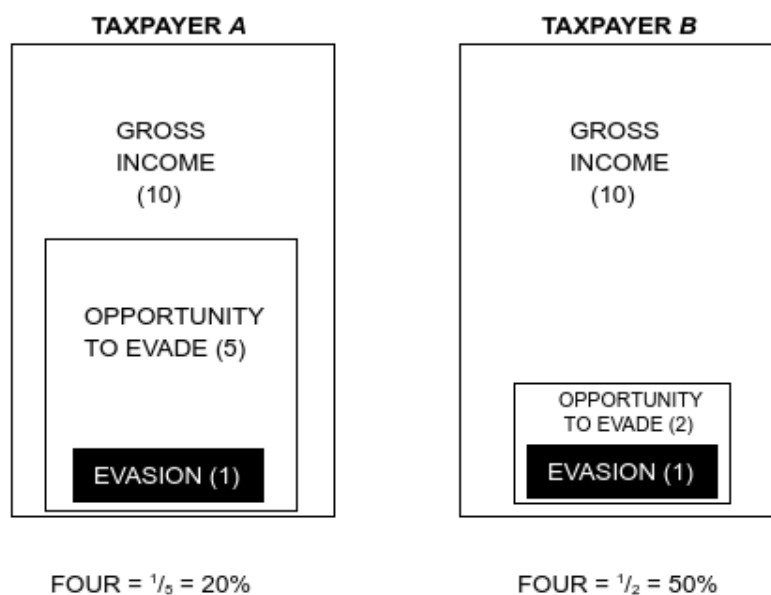
The numbers in brackets are imaginary income units

This way of modelling agents' compliance captures the realistic idea that a sizeable part of tax revenue is often simply ensured by income withholding at source, and therefore reporting it does not depend on agents' decisions at all. The complication introduced in the model by computing FOUR is theoretically justified because this is a much better indicator of the intensity of agents' tax fraud efforts than the amount of money evaded or the percentage of their income they evade. As shown by the example in Figure 2, similar percentages of evaded income may reflect very different evasion efforts, and the reverse is also true.

The opportunity filter

In SIMULFIS, contrary to what happens in other models of tax compliance, different types of agents may have different objective opportunities to evade. This is a realistic feature of the model, which contrasts with the widespread traditional ignorance of this fact in tax fraud studies (two exceptions are Robben *et al.*, 1990 and Hedström and Ibarra, 2010). An agent's opportunity to evade is defined as the percentage of her income she has an objective chance to conceal.

In order to determine some reference values for different agents' opportunities, we adopt some simple (and arguably realistic) assumptions. For example, it is reasonable to assume that self-employed workers have larger opportunities to evade

than wage-earners (since their tax is not withheld at source by tax authorities and there are no third parties who may inform about them, such as employers). We also assume that high income taxpayers (the top decile of income distribution) will have more opportunities to evade than middle and low-income ones (since the former have access to sophisticated means of tax evasion, to experts' assessment and help, and to more diversified income sources).[8] We will also assume, however, that low-income wage-earners (the lower three deciles of income distribution) have more opportunities to evade than middle-income ones, since the former have a higher probability of engaging in shadow economy and informally paid economic activities than the latter. Finally, for all agents there is some percentage of their income they cannot conceal, since the government always has some information on at least a minimum portion of every agent's income.

Following these assumptions, Table 1 shows the reference values adopted so far in SIMULFIS for each category of agents in terms of income level and occupational status.

TABLE 1. - *Reference values for opportunities to evade (in % of agents' gross income)*

Income Level	Self-employed	Wage-earners
High	80	30
Middle	60	10
Low	60	20

---

(8) Hedström and Ibarra (2010, p.326) point out that "real opportunities" of substantial tax fraud "are mainly available to those with sufficient resources" due to their capacity to hire expensive lawyers and accountants.

Fairness and the normative filter

The model includes agents' normative and factual beliefs on the fairness of the tax system. As noted before, the literature on tax compliance has emphasized the important role played by different normative perceptions and attitudes to the tax system and to taxpayers' behaviour. Conceptions of fairness, reciprocity reasons, or distributive justice principles, may influence individuals' perceptions on the acceptability of tax rates, personal tax balances, observed levels of compliance, or the degree of progressivity of the tax system (Bazart and Bonein, 2012; Traxler, 2010).

Fortin *et al.* (2007) have modelled 'fairness effects' as exogenous (see above, Figure 1), since they are taken to depend on the agents' given conceptions of fairness, which are not modified by social interaction. However, in SIMULFIS fairness effects may be modelled partly as endogenous. We define agents' perception of the fairness of their personal tax balance as an endogenous effect which may lead agents to reject the fairness of the tax system, and, therefore, to evade more. To do that, we define agents' tax balance in each round as the comparison between the tax they pay and the benefits they get, so they may be net contributors to the system or net recipients. Agents compute their neighbourhood's tax balance, by observing whether the majority of agents in their neighbourhood (including themselves) are net contributors or net recipients.[9] If an agent is a net contributor while the majority of her neighbours are net recipients she is 'unsatisfied'; otherwise, she is 'satisfied' in terms of fairness. 'Satisfied' agents reduce by one third the proportion of income they have opportunity to evade, while 'unsatisfied' ones keep all their opportunities intact; note that unsatisfied agents cannot rise their opportunities to evade, since these are objective, but just take full advantage of them, while satisfied agents are modelled as if they were partially unconditional compliers: they 'deontologically' decide to consider evasion only on a part of their concealable income.

This method of 'social comparison' allows to treat fairness perceptions as endogenously generated, and tries to capture the well-known findings of the literature on relative deprivation, which show that people's feelings of satisfaction with their endowments depend more on the comparison with their reference group than on the amount of goods enjoyed in absolute terms (Manzo, 2011). Social comparison of tax

---

(9) An agent in the model considers that a 'majority' of contributors exist in a her neighbourhood when 50% or more of her neighbours (including herself) are net contributors; otherwise, she considers there is a majority of recipients.

balances may lead agents to comply relatively less if they are unsatisfied and do not want to feel they are 'suckers'.

The rational choice filter

Once they have gone through the opportunity and the fairness filters, agents maximize their utility according to the classical Allingham and Sandmo equation (with some modifications such as progressive tax rates and the introduction of a social benefit; see Appendix I for mathematical details); in doing so, they take into account tax rates, audit rates, the amount of fines, their income level, and the benefits they may be eligible for. In SIMULFIS, agents' decision goes beyond binary or ternary choice which is typical in previous models ('evade/do not evade', 'evade more/evade less/do not evade'): they maximize a utility function to decide what percentage of their income they will conceal, and they do so by calculating the expected utility of a set of eleven outcomes, which result from hiding 100% to 0% of agents' concealable income by intervals of 10%.

The estimation of the probability of being audited includes two components: first, the audit record of the agent, which tries to capture the observed fact that agents perceived probability of being audited increases if they have been audited in the past: this incorporates an *individual learning* mechanism. Second, the audit record of the agent's neighbourhood in the last round, based on the assumption that agents have at least approximate local knowledge on audit rates; as Fortin *et al.*, 2007, note, the advantage of this assumption is its simplicity; besides, it incorporates a *social learning* mechanism.

It should be then noted that, despite different filters and mechanisms affecting agents' final decision on compliance, rational choice has always some weight in the final decision (except under full social influence, as we will see). We take this as a realistic assumption, since an economic decision like tax compliance is almost always rationally considered by taxpayers, and, in most cases, assessed by experts or professionals.

The social influence filter

SIMULFIS allows to make agents' decisions sensitive in different degrees to the behaviour of their neighbours through a factor of 'social contagion' which makes each agent partially converge to the level of compliance in her neighbourhood (in what follows we will use 'social influence' and 'social contagion' as synonimous in the description of the model). The strength of social influence is determined by an exogenous parameter (ω) equal for all agents, ranging (0,1) from no social influence to full social influence. After applying the rational choice filter, agents' FOUR (α_i) partially or totally converge to the median FOUR in their neighbourhood (α_v), according to $\alpha_i + \omega(\alpha_v - \alpha_i)$. The result of this calculation is the agent's final FOUR. Note that, when $\omega = 1$ (full social influence), the individual effect of the rational choice filter is cancelled, since all agents totally converge to the mean FOUR of their neighbourhood in the previous round; conversely, when $\omega = 0$ (no social influence), the agent keeps her FOUR resulting from the rational choice filter.

Compared with other models, SIMULFIS' main difference is the treatment of social influence as a parameter instead of a fixed factor: it is therefore possible to assign different weights to social influence in agents' decision algorithm. We also make three assumptions that are usual in other models (Myles and Naylor, 1996; Fortin *et al.*, 2007): first, that contagion takes the form of convergence to the average behaviour. Second, that agents rely on observation of previous behaviour (specifically, in the previous round); this is what Fortin *et al.* (2007:3) call "myopic expectations", but we claim that it is realistic, since there is little way of estimating a mean level of tax fraud in a simultaneous way. Third, that agents' information on others' tax compliance is most likely to be local. Finally, note that for reasons already mentioned, the mechanism behind social contagion in this case is not normative but *cognitive* or *informational*. Besides this fact, the model at its present stage does not allow to implement other mechanisms of social contagion (in particular, rational imitation); however it does allow to distinguish between our informational social contagion mechanism and other exogenous and correlated effects (see Figure 1 above).

The model dynamics

When SIMULFIS is initialised, agents randomly receive an income and are linked to a number of neighbours. First, agents are assigned an amount of income following an exponential distribution, calibrated empirically for Spanish income distribution (see Appendix II; the top of the distribution has been adjusted for including a small percentage of big fortunes); the distribution is differentiated for self-employed workers and wage-earners in order to calibrate the model in a more realistic way. Second, two types of networks are generated depending on the simulation: random and homophilic.[10]

After agents' income distribution and networks have been generated, they go through the decision algorithm, and end up making a decision about how much income they report, as a result of the activated sequential behavioural filters. Their salaries are taxed and random audits and fines are executed. Then benefits are paid to those who are eligible, and endogenous parameters are updated for the next period. For each iteration all agents are selected and decide in a different random sequence with an equiprobability distribution (see Figure 3).

---

(10) The random network topology is generated by an algorithm based on the Erdös-Rényi (1959) model, with a normal degree distribution with maximum value of 127 and minimum value of 60 (the average degree is 99.97). The homophilic network is generated by an algorithm inspired in the Watts-Strogatz (1998) model, using a mechanism by which 80% of each agent's neighbours are similar to her in terms of occupational status and income level; in this type of network, each agent has a minimum of 8 neighbours and a maximum of 28 (and the average degree is 15.66).

FIGURE 3. - *Model dynamics*

FIGURE 3. - *Model dynamics*
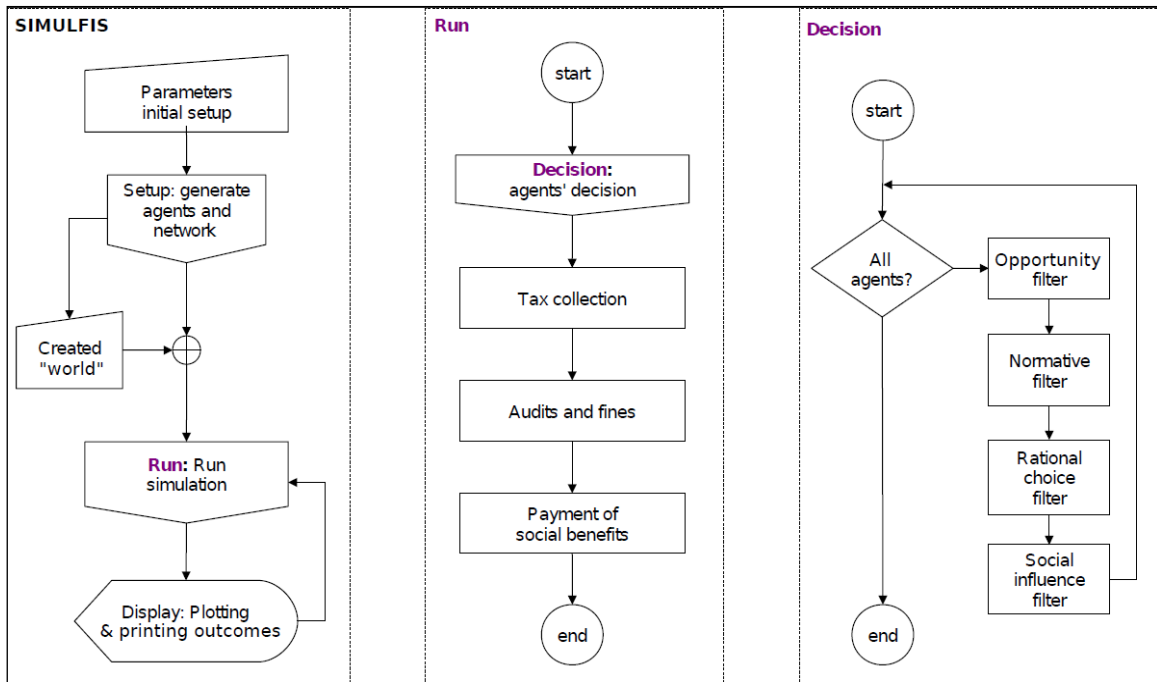
An example of the decision algorithm

Figure 4 displays a numerical example of how agents' decision algorithm operates and how their FOUR is computed. The numbers at the upper level express percentages of an hypothetical agent's income, and how they change when the agent goes through the consecutive behavioural filters; as explained above, the opportunity and normative filters result in a maximum percentage of concealeable income, while the rational choice and the social influence filters lead the agent to a decision as to what percentage of her income she will evade. The numbers at the lower level express the equivalents to these two latter percentages in terms of FOUR; once the agent has gone through the rational choice filter, the resulting percentage is transformed in terms of FOUR (vertical descending arrow, *i*); this FOUR is compared with the agent's neighbourhood's FOUR (bidirectional vertical arrow, $\omega = 0.5$); then, the application of the social influence equation results in a different FOUR (diagonal arrow, *ii*), which is again transformed into a percentage of income to be evaded by the agent (vertical ascending arrow, *iii*).

FIGURE 4. - *An example of the decision algorithm*
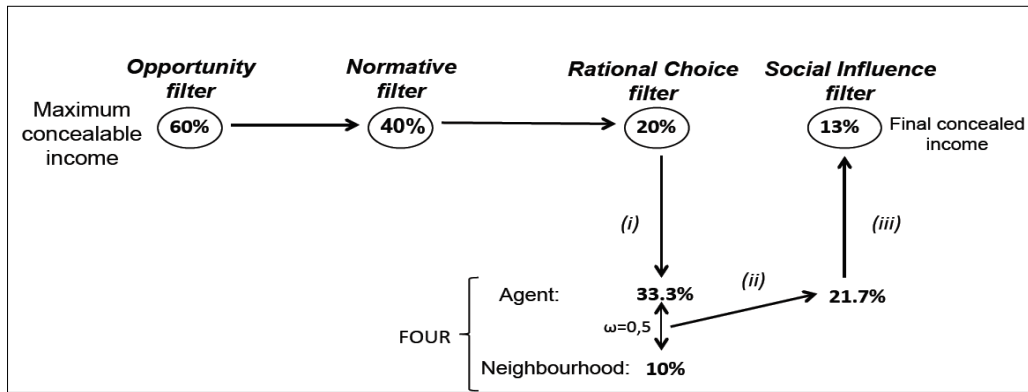
ω = Social Contagion coefficient.

Specifically, the example works as follows:

(1) Let us assume that in a given period of a simulation, agent *i* after the opportunity filter may conceal 60% of her income.

(2) The maximum she can evade after applying the normative filter is 40% of her income (because she is satisfied with her tax balance, so she reduces in one third her opportunity to evade).

(3) Let us assume then that after applying the rational choice filter (that is, after calculating expected utility following the equation presented in Appendix I), this percentage is further reduced to 20% of her income. Therefore (arrow *i*), her FOUR (α_i) will be 33.3% (resulting from 20/60).

(4) Let us also assume that in the previous period her neighbourhood's median FOUR (α_v) was 10%. If the social influence coefficient (ω) is set to 0.5, then her FOUR after the social influence filter will be $\alpha_i + \omega(\alpha_v - \alpha_i)$ = 21.7% (arrow *ii*).

(5) The resulting FOUR of 21.7% is equivalent to conceal 13% of the agent's income, since she is making use of 21.7% of her initial opportunities, which were 60%, so: 21.7% x 60% = 13% (arrow *iii*). So in this example the social influence filter affects the agent's compliance by reducing the percentage of income she decides to evade from 20% to 13%.

A simple virtual experiment with SIMULFIS

We will now present and discuss the results of a simple virtual experiment in order to show how SIMULFIS may help to explore the dynamics of different mechanisms of tax compliance. Our main aim here is not to show the empirical fit of the model to a particular case,[11] but, departing from empirically plausible initial conditions and specifications, to explore the different effect on tax compliance of different combinations of behavioural filters, under different scenarios of deterrence in terms of audits and fines.

The experimental design can be summarized as follows: we run 256 simulations with 1,000 agents and 100 tax periods for each simulation.[12] We test four behavioural scenarios, which activate different combinations of behavioural filters (recall that the opportunity filter is always activated): in RC agents decide only on the basis of rational choice; in F+RC, agents' fairness concerns about compared tax balance is added; in RC+SC, rational choice is supplemented with the social contagion mechanism; finally, in F+RC+SC, all filters are active. We also study 16 different deterrence scenarios: audit rates of 3% (a real estimation for Spain), 25%, 50%, and 75%, with fines of 1.5, 2.5, 5, and 7.5 as multipliers of the amount of evaded tax (being the two first values real estimations for Spain). In the two scenarios where the social contagion mechanism is present, three values for social influence are considered, with $\omega = 0.25$, 0.50, 0.75. All simulations are run with two types of networks: random and homophilic.

Some of the exogenous parameters of the model (effective tax rates, income distribution, the percentage of self-employed taxpayers, and the eligibility threshold for receiving benefits) have been empirically calibrated for the Spanish case. First, as said above, agents are assigned an amount of annual income following an exponential distribution. In this case, the distribution has been taken from the Spanish *Household Budget Survey* for 2008 (see Table A-II.1 in Appendix II), and it has been differentiated for self-employed workers and wage-earners in order to calibrate the model in a more

---

(11) It should be noted that a complete empirical validation of the model is strongly dependant on the availability of reliable data on tax compliance and tax behaviour in concrete empirical cases. Besides, for simplicity, the values for opportunities displayed in Table 1 are taken as fixed parameters (though they could be adjusted, they broadly approximate a realistic estimation in a country like Spain).

(12) Since previous similar experiments with SIMULFIS have shown strong stability in the resulting equilibrium (see ANONYMIZED and ANONYMIZED), in this one each parameter combination was run for one time, so more combinations could be tested in a reasonable time. Previous experiments in which each combination was replicated 10 times gave standard deviations between 0.05 and 1,86 in the values of mean FOUR.

realistic way. The top of the distribution has been adjusted for including a small percentage of big fortunes. Second, we have calculated the *effective* income tax rates from the Spanish *Income Taxpayers Sample* for 2008 (see Table A-II.2 in Appendix II), and calibrated this parameter accordingly; effective tax rates are much more realistic than nominal or marginal tax rates which are often used in other agent-based models of tax behaviour, since they capture the real percentage of their income that individuals should pay if they comply. Third, the percentage of self-employed taxpayers (18.1%) has also been empirically determined according to the data of the Spanish Social Security affiliation. Finally, the income threshold for receiving social benefits has been stablished in 8,700 euros, which represents 50% of the median in our income distribution, a plausible poverty threshold for Spain at present.

The dependent variables are agents' FOUR and the amount of income they underreport. The main results can be described as follows.

Stability

In all simulations a robust equilibrium seems to be reached after few periods (a usual fact in ABM and behavioural experiments on tax compliance), and the system stabilizes around a certain average level of compliance in terms of agents' mean FOUR.[13] Table 2 shows the final values of mean FOUR after 100 iterations under different behavioural conditions and deterrence scenarios, with $\omega = 0.5$.

---

(13) This is the reason why the results are presented in tables rather than in plots.

TABLE 2. – *Final mean FOUR by deterrence conditions and behavioural scenarios with ω = 0.5*

		Behavioural scenarios	Audits			
			3%	25%	50%	75%
Fines	1.5	RC	100,00	98,99	38,22	32,40
		F + RC	68,28	68,04	23,54	19,88
		RC + SC	57,43	56,90	26,61	24,26
		F + RC + SC	41,42	41,17	19,52	17,88
	2.5	RC	100,00	78,04	32,80	30,95
		F + RC	68,20	53,10	20,43	18,33
		RC + SC	57,41	47,09	24,49	23,58
		F + RC + SC	41,45	34,47	18,20	17,34
	5	RC	99,25	36,05	32,15	22,56
		F + RC	68,03	22,72	19,70	13,93
		RC + SC	57,00	26,21	24,12	19,35
		F + RC + SC	41,30	19,39	17,94	15,22
	7.5	RC	96,55	33,25	30,85	8,77
		F + RC	66,45	20,47	18,92	5,84
		RC + SC	55,89	24,49	23,60	12,71
		F + RC + SC	40,52	18,32	17,46	11,35

FOUR = Fraud Opportunity Use Rate. The higher the FOUR, the less agents comply. The FOUR values correspond to round 100, when equilibrium has been reached.
ω = Social Contagion coefficient.
Audits in % and fines as multipliers of evaded tax.

Behavioural scenarios:
RC = Only Rational Choice filter activated.
F+RC = Fairness and Rational Choice filters activated.
RC+SC = Rational Choice and Social Contagion filters activated.
F+RC+SC = Fairness, Rational Choice, and Social Contagion filters activated.

Rational choice overestimates tax fraud

The results confirm the theoretical implication of rational choice theory that, under low deterrence levels (such as the ones really existing), it is rational for everyone to evade, and to evade as much as possible. In Table 2, the results on the upper-left corner show the (arguably) most realistic conditions in terms of deterrence (3% for audit probability and 1.5 for fine multiplier). In this case, it appears that in the RC (rational choice) scenario all agents end up with a FOUR of 100%, which means they are taking full advantage of their opportunities to evade (the higher the FOUR, the less compliance).

FIGURE 5. - *Concealed income/total income ratio by behavioural scenario*

(audits=3% fines=1.5 ω=0.5)

ω = Social Contagion coefficient.
Audits in % and fines as multipliers of evaded tax.
Y axis represents the ratio of aggregated concealed income/total income; X axis represents time.

Behavioural scenarios:
RC = Only Rational Choice filter activated.
F+RC = Fairness and Rational Choice filters activated.
RC+SC = Rational Choice and Social Contagion filters activated.
F+RC+SC = Fairness, Rational Choice, and Social Contagion filters activated.

Although the aim of this article is not to validate the model empirically, a simple comparison of these results with the estimated volume of tax fraud in Spain may be useful. Different authors estimate that tax fraud represents around 20-25% of the Spanish GNP (Arrazola *et al.*, 2011; GESTHA, 2011; Murphy, 2011 and 2012). Figure 5 shows the results in terms of concealed income when we simulate the four behavioural scenarios under a realistic deterrence level. It seems that the scenarios where social contagion is present are closer to those estimations than the rest. Specifically, the RC+SC scenario seems to predict the most plausible level of tax compliance. This suggests that strict rational behaviour is not enough on its own to generate empirically estimated tax compliance levels.

An example of a more fine empirical comparison may consist on calculating the relative difference between self-employed workers' and wage earners' mean

underreported income as predicted by SIMULFIS, and compare it to empirical estimations of the same magnitude for Spain (Martínez, 2011). Since the values are broadly similar (the estimated real value is 25-30%, and SIMULFIS predicts 26.9% under the most realistic deterrence condition), we dare to trust that the model is in the right track for achieving good empirical fit in future stages of the project.

The effect of deterrence

Table 2 may also give us a picture of how deterrence affects tax compliance. Audits are a measure of the probability of being punished for tax evasion, and fines capture the intensity of the punishments; the sixteen different audits-fines scenarios shown in the table capture different combinations of those two components of deterrence. Understanding the relative effects of these two components of deterrence on compliance is important also for policy reasons: it has been often demonstrated that there is a trade-off between severity and probability of punishment (Kahan, 1997, pp.377ss), since raising that probability (what economists of crime call the 'certainty of conviction') is often more costly than raising the intensity of punishment, and even inefficient if the resources and efforts needed for effective surveillance are considerable, as is the case with tax supervision. With the aid of an agent-based model, it is possible to assess this trade-off: for example, the results show that different combinations of audits and fines produce equivalent compliance levels under the same or different behavioural scenarios (for instance, under the RC scenario, a combination of a fine multiplier of 5 and an audit rate of 25% is very similar to another of a fine multiplier of 1.5 and an audit rate of 50%; both produce compliance levels which are close to the ones obtained under the F+RC+SC scenario with fines multipliers of 1.5 or 2.5 and an audit rate of 25%).

From the results in Table 2 it is also clear, and theoretically to be expected, that higher audits and fines always improve compliance (always decrease mean FOUR), but increasing audits is proportionally more effective than raising fines (except when we pass from a fine multiplier of 2.5 to 5 of the evaded tax under an audit rate of 25%, where a 'phase transition' seems to take place). Interestingly, under the most realistic audit rate (3%), increasing fines does not have an effect on compliance in any behavioural scenario. Conversely, under realistic values for fines (multipliers of 1.5 and 2.5 of evaded income), increasing the audit rate has a more substantial effect under all behavioural scenarios. This may challenge the standard conception that increasing

audits is inefficient due to its high cost: as Kahan (1997) notes, when individuals do not decide in an isolated way, high-certainty/low-severity strategies may be better than the reverse due to the signal that individuals get that they will be most likely caught if they cheat. In our model, this is captured by the local way in which agents estimate the probability of being audited and punished.

In order to confirm this trend statistically, a linear regression analysis was performed taking as dependent variable the mean FOUR in the last iteration of each simulation (see Table 3); the results show that audits have a strong effect in decreasing FOUR, which more than triplicate the effect of fines in all behavioural scenarios. Similarly, in their meta-analysis of laboratory experiments in this area, Alm and Jacobson (2007) find an elasticity of 0.1-0.2 for declared income/audits, but below 0.1 for declared income/fines. The regression models also included social influence as independent variable in the two behavioural scenarios where it is activated, and the results show that it also has a negative effect on FOUR, which is higher than the effect of fines but lower than that of the audit rate.

TABLE 3. - *Results of regression analysis (beta coefficients for each behavioural scenario)*

Independent variable	Behavioural scenarios			
	RC	F+RC	RC+SC	F+RC+SC
Audits	-0,860	-0,857	-0,724	-0,751
Fines	-0,295	-0,277	-0,248	-0,245
Social contagion (ω)	-	-	-0,415	-0,328
R squared	0,827	0,842	0,758	0,732

Dependent variable: mean FOUR at last iteration.
All beta coefficients are significant at p≤0.001.
FOUR = Fraud Opportunity Use Rate. The higher the FOUR, the less agents comply.

Behavioural scenarios:
RC = Only Rational Choice filter activated.
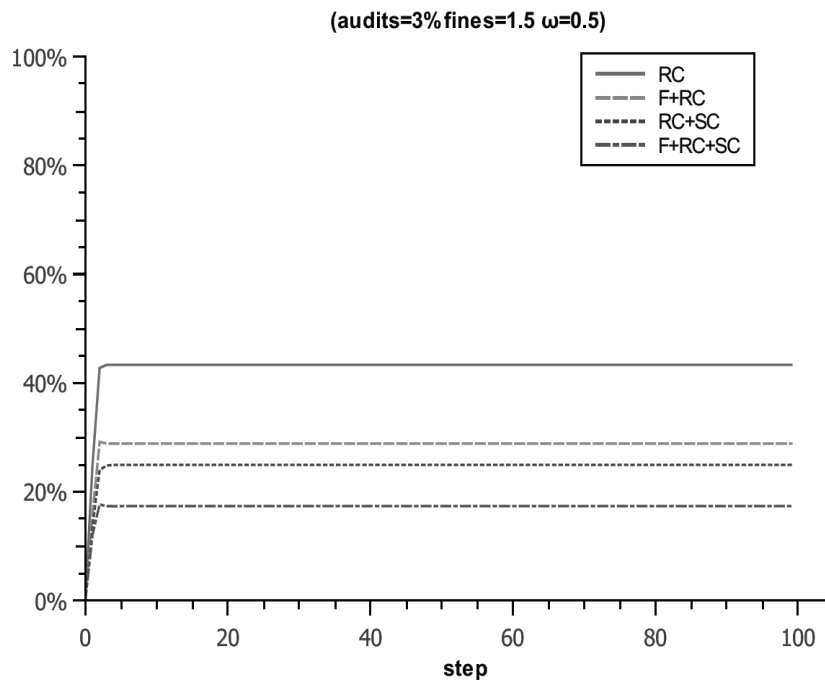F+RC = Fairness and Rational Choice filters activated.
RC+SC = Rational Choice and Social Contagion filters activated.
F+RC+SC = Fairness, Rational Choice, and Social Contagion filters activated.

Social contagion has an ambivalent effect on compliance

If we now focus on the effect of the social contagion mechanism we can see that, as confirmed by regression analysis (Table 3), in general it seems to decrease FOUR (and therefore to raise compliance). Even if social influence has low intensity (ω =

audits is inefficient due to its high cost: as Kahan (1997) notes, when individuals do not decide in an isolated way, high-certainty/low-severity strategies may be better than the reverse due to the signal that individuals get that they will be most likely caught if they cheat. In our model, this is captured by the local way in which agents estimate the probability of being audited and punished.

In order to confirm this trend statistically, a linear regression analysis was performed taking as dependent variable the mean FOUR in the last iteration of each simulation (see Table 3); the results show that audits have a strong effect in decreasing FOUR, which more than triplicate the effect of fines in all behavioural scenarios. Similarly, in their meta-analysis of laboratory experiments in this area, Alm and Jacobson (2007) find an elasticity of 0.1-0.2 for declared income/audits, but below 0.1 for declared income/fines. The regression models also included social influence as independent variable in the two behavioural scenarios where it is activated, and the results show that it also has a negative effect on FOUR, which is higher than the effect of fines but lower than that of the audit rate.

TABLE 3. - *Results of regression analysis (beta coefficients for each behavioural scenario)*

Independent variable	Behavioural scenarios			
	RC	F+RC	RC+SC	F+RC+SC
Audits	-0,860	-0,857	-0,724	-0,751
Fines	-0,295	-0,277	-0,248	-0,245
Social contagion (ω)	-	-	-0,415	-0,328
R squared	0,827	0,842	0,758	0,732

Dependent variable: mean FOUR at last iteration.
All beta coefficients are significant at p≤0.001.
FOUR = Fraud Opportunity Use Rate. The higher the FOUR, the less agents comply.

Behavioural scenarios:
RC = Only Rational Choice filter activated.
F+RC = Fairness and Rational Choice filters activated.
RC+SC = Rational Choice and Social Contagion filters activated.
F+RC+SC = Fairness, Rational Choice, and Social Contagion filters activated.

### Social contagion has an ambivalent effect on compliance

If we now focus on the effect of the social contagion mechanism we can see that, as confirmed by regression analysis (Table 3), in general it seems to decrease FOUR (and therefore to raise compliance). Even if social influence has low intensity (ω =

0,25; see Table A-III.1 in Appendix III), the introduction of the mechanism strongly (and positively) affects compliance when all deterrence levels are taken together. Social contagion exerts this effect by slowing down the growth of agent's mean FOUR after the first round, and this happens because now agents are not only influenced by deterrence, but also by their neighbours' FOUR in the previous round. The dynamics of the simulations in the initial rounds (as represented in the upper curves in Figure 6, below) may help to explain this. Since the decision agents make in the first round cannot rely on previous rounds in order to estimate the probability of being caught underreporting, this probability is randomly distributed (see Appendix I) and the resulting mean FOUR is below 100%. When agents start to update endogenously this probability, strictly rational agents simply respond to very low deterrence by raising their FOUR to 100% (where the model reaches equilibrium, as predicted by rational choice theory). By contrast, socially influenced agents, though also respond to minimum deterrence by raising their FOUR, converge to their neighbourhood's median FOUR in the initial rounds, so their mean FOUR reaches equilibrium (stops growing from round to round) in a lower value than rational agents' mean FOUR. To say it simply, social influence acts as an *authomatic brake* of the effect of deterrence on rational agents.

However, an interesting fact is that as deterrence is made harder, the comparative decrease in FOUR is proportionally less intense, until, in the lower-right corner in Table 2 (very high deterrence), scenarios with social contagion (RC+SC and F+RC+SC) become suboptimal in terms of compliance in front of those where the mechanism is absent (RC and F+RC). In other words, deterrence operates a substantial change in the 'optimality ordering' of the four behavioural scenarios, with only one exception: F+RC always fares better than RC. This is not surprising, since the F filter was modelled so that it can only improve agents' compliance. What is unexpected, and absent in usual theoretical expectations in the literature, is that social influence may have an ambivalent relative effect depending on deterrence levels. [14]

---

(14) It is worth noting that all the trends mentioned so far, and specially the ambivalent effect of social contagion, are not substantially affected by different values of the social contagion coefficient ω (see Appendix III). Additionally, the reason for the apparently dramatic decrease in the mean FOUR differences as we descend to the lower-right corner of Table 2 is due just to the fact that the intervals between the values of audits and fines tested in the simulations are not equal; particularly, there is a jump from fine multipliers of 1.5 to 2.5 that is smaller than the next ones to 5 and 7.5. However, for empirical calibration reasons we wanted to keep values 1.5 for fine multipliers and 3% for audits since they are the real estimated values for Spain.

FIGURE 6. – *An illustration of the combined effect of social contagion and deterrence levels on compliance*
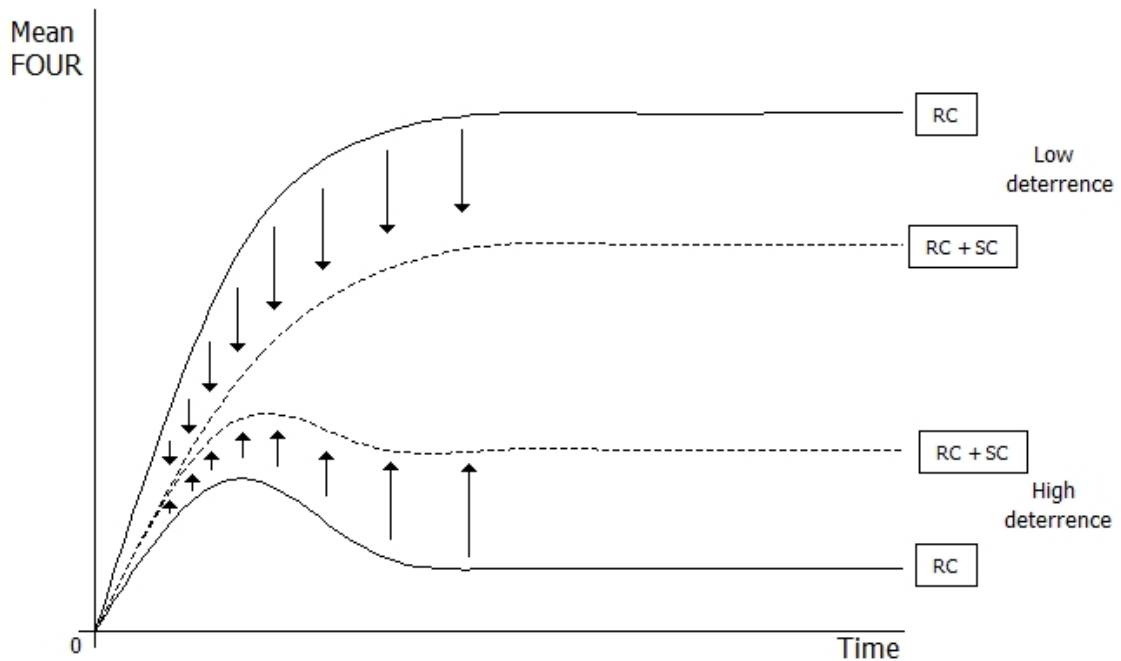
FOUR = Fraud Opportunity Use Rate. The higher the FOUR, the less agents comply.

Behavioural scenarios:
RC = Only Rational Choice filter activated.
RC+SC = Rational Choice and Social Contagion filters activated.

Why is this effect taking place? As we suggested above, social influence operates as an authomatic brake of the effect of deterrence on rational agents. When deterrence is very low, this causes an *upward* trend in rational agents' FOUR, so a brake to this trend produces a *lower* equilibrium FOUR. Conversely, when deterrence is very high, this causes a *downward* trend in rational agents' FOUR, so slowing down this trend ends up in a *higher* equilibrium FOUR. The effect of very hard deterrence on lowering FOUR is stronger on strictly rational agents than on socially influenced ones.

Figure 6 illustrates how low deterrence makes the FOUR curves grow in the initial rounds until they reach the equilibrium level and then stabilize there; while high deterrence makes them reach a peak in the initial rounds, and then go down to a low equilibrium value. These effects are extreme when agents are purely rational (decide

isolated without moderating their FOUR upwards or downwards by converging to their neighbourhood), and more moderate when agents are socially influenced.

In sum, social influence makes tax compliance less sensitive to increased deterrence levels, since decisions are interdependent and not only based on individual cost-benefit calculations or normative attitudes. This effect is somehow capturing a well-known social phenomena, but one not much studied in the literature on tax compliance: agents who take into account their peers' decisions when making their own are less likely to change their behaviour (or are likely to change it with less intensity) as an effect of external or hierarchical pressures from above (such as audits and fines). Therefore, the introduction of social influence among rational agents has not the same directional effect on compliance independently of the deterrence level (for a different result see Korobow *et al.,* 2007, p. 608). When deterrence is strong enough, even strict rational agents would comply more than socially influenced ones. This interaction effect, as well as its foundations at the micro level, would be difficult to observe and analyze without the aid of an agent-based model such as SIMULFIS.

The "social influence conception of deterrence" developed by Kahan (1997, p. 351) is close to our interpretation of this result. According to him, the effect of deterrence must be considered in relation with the power exerted by social influence: from a given point, the marginal gain in compliance achieved by higher levels of deterrence may be lower in a situation with social influence than in a situation with isolated rational agents (and the higher is the intensity of social influence, the lower this relative gain will be). In a similar way, our model shows that social contagion attenuates the net effect of deterrence on raising compliance when deterrence is high, and increases it when it is low. Consistently, in ANONYMIZED we also showed that with higher tax rates the same transition starts from a lower deterrence level.

The choice of a deterrence policy should therefore be sensitive to this fact: it should bear in mind not only what 'price' is set for tax evasion in terms of the probability and intensity of punishment (as it would do with strict isolated rational agents), but also how that policy is dynamically generating an aggregated behaviour that influences in each round the individual behaviour of each agent, and so on. A major policy implication of this fact is that sometimes it might be more effective to create a given perception of compliance than to increase deterrence. Increasing deterrence is not the only way of increasing compliance: for example, in Table 2 the introduction of social contagion under 3% of audits and a fine multiplier of 1.5 would generate a FOUR

reduction of more than 40 points departing from the rational choice scenario, while simply increasing fines does not have a substantial effect, and audits would have to be raised to 50% to find a higher FOUR reduction.

Fairness and network effects

Table 2 (as well as Appendix III) also offer a comparative picture of the relative effects on tax compliance of agents' fairness concerns (applied to their tax balance, as we saw). Of course, when the fairness filter is activated, mean compliance will always increase (that is, mean FOUR will always decrease) in comparison to the rational choice scenario: this is so because satisfied agents will always decrease their FOUR, while unsatisfied agents will just keep all their chances to evade open; however, we observe that even this very simple way of modelling fairness concerns introduces a substantial difference in terms of compliance with the rational choice scenario.

The comparison of the fairness and the social contagion mechanisms may be more informative: when social influence is low (Table A-III.1, Appendix III), the fairness scenario (F+RC) always outperforms the social contagion one (RC+SC) in terms of compliance; but when social influence is medium or high (Tables 2 and A-III.2, Appendix III), this is only true under high deterrence levels. This effect is similar to the one observed when comparing the social contagion (RC+SC) scenario with the rational choice one (RC): from a given point in terms of deterrence, social contagion stops to be optimal for compliance when compared not only with rational choice alone, but also with rational choice plus fairness concerns. An interesting implication of this is that similar compliance levels may be reached by very different combinations of mechanisms.

TABLE 4. - *Effect of the type of network on mean FOUR and underreported income*

Behavioural scenario	Network type	Mean FOUR (%)	Mann-Whitney
RC (N=32)	Homophilic	53.83	0.585
	Random	53.85	
F+RC (N=32)	Homophilic	35.73	0.432
	Random	35.67	
RC+SC (N=96)	Homophilic	34.39	0.014*
	Random	34.14	
F+RC+SC (N=96)	Homophilic	25.30	0.000*
	Random	24.97	

Finally, the fact that networks are random or homophilic seem to have a significant effect on FOUR only when social contagion is present (see Table 4). We run a Mann-Whitney test in order to determine the effect of the social network type under each behavioural scenario; results show that there are no effects under the RC and F+RC scenarios, but when the social contagion mechanism is introduced (in the RC+SC and F+RC+SC scenarios), homophilic networks raise mean FOUR in a slight but statistically significant measure.[15] This tiny variation is due to the fact that in homophilic networks the variation in mean FOUR after the operation of the social contagion mechanism is most often lower than in random networks, since more similar agents will have more similar FOUR levels; in other words: convergence to the mean FOUR of each network, operated by the social contagion mechanism, will exert less variation on pre-existing mean FOUR in homophilic than in random networks. At the same time, we already know from Table 2 and Figure 6 that it is much more frequent in our simulations that social contagion has the effect of lowering mean FOUR rather than raising it. Therefore, when networks are random, social contagion will not only exert more variation in pre-existing mean FOUR than in homophilic networks, but will also result, in the average, in a lower mean FOUR.

The small size of these variations and the fact that they only affect two out of four behavioural scenarios suggest that the effects found are quite robust no matter which network type we have. Thus, an agent-based model like SIMULFIS may be used also to control for 'correlated effects' such as that of sharing similar occupational status and income level with your neighbours. By controlling the probability of having similar peers in your neighbourhood, it can be ensured that the effect of the social contagion mechanism is genuine.

---

(15) Different N in each behavioural scenario in Table 4 are due to the fact that when social contagion is present (RC+SC and F+RC+SC) three values for the social contagion coefficient ω have been tested, so those two scenarios have three times as many cases as the others. In order to discard that this fact affected the result of the statistical test, we run the same test only with $\omega = 0,5$ (which grants the same N for all scenarios), with equal results.

Final remarks

In this article we have discussed different theoretical strategies to account for tax compliance behaviour, a research field that is attracting increasing academic attention from social scientists and is important also for policy reasons. We have argued that rational choice explanations of tax compliance face a number of important problems when trying to explain observed levels of compliance and estimated tax evasion. Different social influence mechanisms have been proposed by an interdisciplinary literature in order to improve the explanatory power of behavioural models of tax compliance, but a systematic taxonomy of those mechanisms is still lacking, and often they are underdefined. In Figure 1, above, we have suggested a tentative taxonomy that should be developed further. We have also discussed how social influence explanations may throw some light on the study of tax compliance, and how agent-based models are a very promising tool to implement and test the associated hypothesis and theories.

As an illustration of the latter, the article has presented SIMULFIS, a computational behavioural model for the simulation of tax evasion and tax compliance. We have designed a simple virtual experiment to test the different effect on tax compliance of different combinations of behavioural filters (rational choice, social contagion, and fairness effects), under different conditions of deterrence in terms of audits and fines. As it was noted, a complete empirical validation of the model is strongly dependant on the availability of reliable data on tax compliance and tax behaviour in empirical cases. However, some conclusions may be drawn from the analysis of the results: first, as suggested by the theoretical literature on tax compliance, strict rational agents would produce much less compliance than it is usually estimated, except with unrealistically high deterrence levels; this strongly suggests that rational choice theory is not enough on its own to generate empirically estimated compliance levels through simulations, and that additional social mechanisms are necessary in any plausible model of tax compliance behaviour. Second, social influence does not always optimize compliance; particularly, it has been shown that when deterrence is strong, rational and fairness-concerned agents fare better in terms of compliance. The reason of this ambivalent effect of social influence is that its presence, by making agents decisions' dependent on those of their peers, makes tax compliance level less sensitive to increased deterrence levels. This social effect, as well as its foundations at the micro

level, would be difficult to observe without the aid of an agent-based model such as SIMULFIS. Third, the model confirms the results of most experimental studies (Alm and Jacobson, 2007; Franzoni, 2007) that find audits to be comparatively more effective than fines in order to improve tax compliance.

The policy implications of these results seem clear: first, policies to tackle tax evasion should rely more on improving the efficacy of audits, as well as their number and scope, than on raising penalties. Second, a smart use of public information on tax compliance levels may be a forceful weapon to induce taxpayers to comply more. In any case, we would like to emphasize the utility of agent-based models for understanding compliance patterns and, therefore, for assessing public decisions along the many trade-offs involved in tax policy. Agent-based models are flexible tools which offer many possibilities to improve social-scientific knowledge of tax behaviour, a research field that, in Kirchler's words, is "still in its infancy" (2007, p. xv).

REFERENCES

Aberg, Y. and Hedström, P., 2011. - « Youth unemployment: a self-reinforcing process? », in **P. Demeulenaere** (eds.), *Analytical Sociology and Social Mechanisms*, Cambridge, Cambridge University Press, pp. 201-226.

Alaón, A. and Gómez-Antonio, M., 2005. - « Estimating the size of the shadow economy in Spain: a structural model with latent variables », *Applied Economics*, *37*, 9/21, pp. 1011-1025.

Alarcón, L., De Pablos and Garre, E., 2009. - « Análisis del comportamiento de los individuos ante el fraude fiscal. Resultados obtenidos a partir de la Encuesta del Observatorio Fiscal de la Universidad de Murcia », Principios, *13*, pp. 55-84.

Allingham, M.G. and Sandmo, A., 1972. - « Income tax evasion: a theoretical analysis », *Journal of Public Economics*, *1*, pp. 323–338.

Alm, J. and Gomez, J.L., 2008. - « Social Capital and Tax Morale in Spain », *Economic Analysis & Policy*, *38*, 1, pp. 73-87.

Alm, J. and Torgler, B., 2006. - « Culture differences and tax morale in the United States and in Europe », *Journal of Economic Psychology*, *27*, pp. 224-246.

Alm, J., 2012. - « Measuring, Explaining, and Controlling Tax Evasion: Lessons from Theory, Experiments, and Field Studies », *International Tax Public Finance*, *19*, pp. 54-77.

Alm, J., Kirchler, E. and Muehlbacher, S., 2012. - « Combining Psychology and Economics in the Analysis of Compliance: From Enforcement to Cooperation », *Economic Analysis and Policy*, *42*, 2, pp. 133-151.

Álvarez, S. and Herrera, P. M., 2004. - « Etica fiscal », Technical Report 10/04, Instituto de Estudios Fiscales, Madrid.

Andreoni, J., Erard, B. and Feinstein, J., 1998. - « Tax Compliance », *Journal of Economic Literature*, *36*, 2, pp. 818-860.

Antunes, L., Balsa, J. and Coelho, H., 2007a. - « Agents that collude to evade taxes », *AAMAS '07 Proceedings of the 6th international joint conference on Autonomous agents and multiagent systems*.

Antunes, L., Balsa, J. and Coelho, H., 2007b. - « Tax compliance through MABS: the case of indirect taxes », in **J. Neves, M.F.Santos and J.M. Machado** (eds.). - *Progress in artificial intelligence*, Berlin, Springer-Verlag.

Antunes, L., Balsa, J., Respício, A. and Coelho, H., 2006. - « Tactical exploration of tax compliance decisions in multi-agent based simulation », in **L. Antunes and K. Takadama** (eds.). - *Proceedings of the 2006 international conference on Multi-agent-based simulation VII*, Berlin, Springer-Verlag.

Antunes, L., Balsa, J., Urbano, P., Moniz, L. and Roseta-Palma, C., 2006. - « Tax compliance in a simulated heterogeneous multi-agent society », in **J.S. Sichman and L. Antunes** (eds.). - *Proceedings of the 2005 international conference on Multi-agent-based simulation VI*, Berlin, Springer-Verlag.

Arrazola, M., De Hevia, J., Mauleón, I. and Sánchez, R., 2011. - « Estimación del volumen de economía sumergida en España », *Cuadernos de Información Económica, 220*, pp. 81-88.

Baird, D., R. Gertner and R. Picker, 1994. - Game Theory and the Law, Cambridge, Harvard University Press.

Balestrino, A., 2010. - « Tax avoidance and the endogenous formation of social norms», *Journal of Socio-Economics*, *39*, pp. 601-609.

Balsa, J., Antunes, L., Respício, A. and Coelho, H., 2006. - « Autonomous inspectors in tax compliance simulation », *Proceedings of the 18th European Meeting on Cybernetics and Systems Research*.

Bazart, C. and Bonein, A., 2012. - « Reciprocal relationships in tax compliance decisions», *Journal of Economic Psychology*, forthcoming.

Becker, G. S. 1968. - « Crime and Punishment: An Economic Approach » *Journal of Political Economy*, 76, 2, pp. 169-217.

Becker, G. S. 1974. - « A theory of social interactions », *Journal of Political Economy*, *82*, 6, 1063-1093.

Bergman, M. and Nevárez, A., 2005. - « ¿Evadir o pagar impuestos? Una aproximación a los mecanismos sociales del cumplimiento », *Política y Gobierno*, *XII,* 1, pp. 9-40.

Bicchieri, C., 2006. - *The Grammar of Society. The Nature and Dynamics of Social Norms*, Cambridge, Cambridge University Press.

Bloomquist, K. M., 2004. - *Modeling taxpayers' response to compliance improvement alternatives*, Annual Conference of the North American Association for Computational Social and Organizational Science (NAACSOS), Pittsburgh, PA: http://www.casos.cs.cmu.edu/events/conferences/2004/2004_proceedings/Bloomquist_Kim1.doc [available on line March 2013.]

Bloomquist, K. M., 2006. - « A Comparison of Agent–Based Models of Income Tax Evasion » *Social Science Computer Review, 24*, 3/4, pp. 411–425.

Bloomquist, K. M., 2011. - « Tax Compliance as an Evolutionary Coordination Game: An Agent-Based Approach », *Public Finance Review, 39*, pp. 25-49.

Boudon, R., 2009. - *La rationalité*, Paris, PUF.

Bourdieu, P. 1980. - *Le sens pratique*, Paris, Le Minuit.

Braithwaite, V. and Ahmed, E., 2005. - «A threat to tax morale: the case of Australian higher education policy», *Journal of Economic Psychology*, *26*, pp. 523-540.

Braithwaite, V. and Wenzel, M., 2008. - « Integrating explanations of tax evasion and avoidance », in **A. Lewis** (ed.). - *The Cambridge Handbook of Psychology and Economic Behaviour*, Cambridge, Cambridge University Press, pp. 304-331.

Bruch, E. and Mare, R., 2006. - « Neighborhood Choice and Neighborhood Change », *American Journal of sociology, 112*, 3/3, pp. 667–709.

Centola, D. and Macy, M. W., 2007. - « Complex Contagions and the Weakness of Long Ties », *American Journal of Sociology, 113*, 3/3, pp. 702-734.

Cialdini, R. and Goldstein, N. J., 2004. - « Social Influence: Compliance and Conformity», *Annual Review of Psychology, 55*, pp. 591-621.

Cialdini, R.B. and Trost, M.R., 1998. - « Social influence: Social norms, conformity, and compliance", in **D. Gilbert, S. Fiske and G. Lindzey** (eds.), *The handbook of social psychology* (4th edition), vol. 2, pp. 151-192, New York, McGraw-Hill.

CIS, 2011. - « Encuesta sobre opinión pública y política fiscal (XXVIII) », Technical report, CIS (Centro de Investigaciones Sociológicas), Madrid.

Davis, J. S., Hecht, G., and Perkins, J. D., 2003. - « Social behaviors, enforcement and tax compliance dynamics », *Accounting Review, 78*, pp. 39–69.

Deutsch, M. and Gerard, H. B., 1955. - « A study of normative and informational social influences upon individual judgment », *Journal of Abnormal and social Psychology, 51*, pp. 629-636.

Diekmann, A., Przepiorka, W., and Rauhut, H., 2011. - « Lifting the veil of ignorance: An experiment on the contagiousness of norm violations », Discussion Papers 2011-04, University of Oxford, Nuffield College: http://ideas.repec.org/p/cex/dpaper/2011004.html [available on line March 2013.]

Durlauf, S., 2001. - « A Framework for the Study of Individual Behaviour and Social Interactions », *Sociological Methodology, 31*, pp. 47-87.

Durlauf, S., 2006. - « Groups, Social Influences, and Inequality: A Memberships Theory Perspective on Poverty Traps », in S. Bowles, S. Durlauf and K. Hoff (eds.). - *Poverty Traps*, Princeton, Princeton University Press, pp. 141-175.

Durlauf, S. and Ioannides, Yannis M. 2010. - « Social Interactions », *Annual Review of Economics, 2*, pp. 451-478.

Elffers, H., Weigel, R. H., and Hessing, D. J., 1987. - « The consequences of different strategies for measuring tax evasion behaviour », *Journal of Economic Psychology, 8*, pp. 311-337.

Elster, J., 2007. - *Explaining Social Behavior*, Cambridge, Cambridge University Press.

Epstein, J.M., 2006. **-** *Generative Social Science. Studies in Agent-Based Computational Modeling*, Princeton, Princeton University Press.

Erdös, P. **and Rényi, A.**, 1999. - « On Random Graphs. I », *Publicationes Mathematicae, 6*, pp. 290-297.

Fortin, B., Lacroix, G. and Villeval, M.-C., 2007. - « Tax Evasion and Social Interactions », *Journal of Public Economics, 91,* 11/12, pp. 2089-2112.

Franzoni, L. A., 2007. - « Tax evasion and tax compliance », in *Encyclopaedia of Law and Economics*, Cheltenham, Edward Elgar.

GESTHA, 2010. - *La economía sumergida alcanzó el 23,3% del PIB en 2009 por la crisis, según GESTHA*. Press release, 23/02/2010, GESTHA (Sindicato de Técnicos del Ministerio de Hacienda): http://www.gestha.es/?seccion=actualidad&num=104 [available on line March 2013.]

GESTHA, 2011. - *III Informe de la lucha contra el fraude fiscal de la Agencia Tributaria*, Technical report, GESTHA (Sindicato de Técnicos del Ministerio de Hacienda).

Gigerenzer, G., Hertwig, R., and Pachur, T., 2011. - *Heuristics. The Foundations of Adaptive Behavior* , New York, Oxford University Press.

Glaeser, E., B. Sacerdote and J. Scheinkman, 2003. - « The social multiplier », *Journal of the European Economic Association*, *1*, pp. 345-353.

Granovetter, M. (1973), "The Strength of Weak Ties", *American Journal of Sociology*, *78*, 6/6, pp. 1360-1380.

Groeber, P. and Rauhut, H., 2010. - « Does ignorance promote norm compliance? », *Computational and Mathematical Organization Theory*, *16*, pp.1-28.

Habermas, J. 1981. - *The Theory of Communicative Action (2 vols.)*, Toronto, Beacon Press, 1984.

Hedström, P. and Ibarra, R., 2010. - « On the contagiousness of non-contagious behavior: The case of tax avoidance and tax evasion », in **H. Joas and B. Klein** (eds.). - *The Benefit of Broad Horizons,* Leiden, Brill.

Hedström, P., 2005**. -** *Dissecting the Social. On the Principles of Analytical Sociology*, Cambridge, Cambridge University Press.

Hofmann, E., Hoelzl, E. and Kirchler, E., 2008. - « Preconditions of voluntary tax compliance: Knowledge and evaluation of taxation, norms, fairness, and motivation to cooperate », *Zeitschrift für Psychologie/ Journal of Psychology,* *216*, 4/4, pp. 209-217.

Hokamp, S., 2013. - « Dynamics of tax evasion with back auditing, social norm updating, and public goods provision – An agent-based simulation », *Journal of Economic Psychology*, forthcoming.

Hokamp, S. and Pickhardt, M., 2010. - « Income Tax Evasion in a Society of Heterogeneous Agents – Evidence from an Agent-based Model », *International Economic Journal*, *24*, pp. 541-553.

IEF, 2004. - *Ética fiscal*, Doc. nº10/04, Technical report, IEF (Instituto de Estudios Fiscales), Madrid.

IEF, 2012. - *Opiniones y actitudes fiscales de los españoles en 2011*, Doc. nº19/2012, Technical report, IEF (Instituto de Estudios Fiscales), Madrid.

Kahan, D.M., 1997. - « Social Influence, Social Meaning, and Deterrence », *Virginia Law Review, 83*, pp. 349-395.

Katz, A. W. 1998. - *Foundations of the Economic Approach to Law*, Oxford, Oxford University Press.

Kirchler , E., Muehlbacher, S., Kastlunger, B. and Wahl, I., 2010. - « Why Pay Taxes? A Review of Tax Compliance Decisions », in **B. Torgler, J. Alm and J. Martinez** (eds), 2010. - *Developing Alternative Frameworks for Explaining Tax Compliance, Avoidance and Evasion,* London, Routledge.

Kirchler, E., 2007. - *The Economic Psychology of Tax Behaviour*, Cambridge, Cambridge University Press.

Kleven, H. J., Knudsen, M. B., Kreiner, C. T., Pedersen, S. and Saez, E., 2011. - «Unwilling or Unable to Cheat? Evidence from a Tax Audit Experiment in Denmark », *Econometrica, 79*, 4/6, pp. 651–692.

Korobow, A., Johnson, C. and Axtell, R., 2007. - « An Agent-Based Model of Tax Compliance with Social Networks », *National Tax Journal*, *LX*, 3/4, pp. 589-610.

Latané, B. - « The psychology of social impact », *American Psychologist*, *36*, pp. 343-356.

Levi, M., 1988. - *Of Rule and Revenue*, Berkeley, University of California Press.

Lima, F. and Zaklan, G., 2008. - « A multi-agent-based approach to tax morale », *International Journal of Modern Physics C*, *19*, pp. 1797-1808.

Lima, F., 2010. - « Analysing and controlling the tax evasion dynamics via majority-vote model », *Journal of Physics: Conference Series, 246,* conference 1.

Manski, C. F., 1993a. - « Identification of Endogenous Social Effects: the Reflection Problem », *Review of Economic Studies*, *60*, 3, pp. 531-542.

Manski, C. F., 1993b. - « Identification Problems in Social Sciences », *Sociological Methodology*, *23*, pp. 1-56.

Manski, C. F., 2000. - « Analysis of Social Interactions », *Journal of Economic Perspectives*, 14, 3, pp. 115-136.

Manzo, G., 2009. - *La spirale des inégalités. Choix scolaires en France et en Italie au XX siècle*, Paris, Presses de l'Université Paris-Sorbonne.

Manzo, G., 2011. - « Relative Deprivation in Silico: Agent-based Models and Causality in Analytical Sociology », in **Demeulenaere, P.** (ed.), *Analytical Sociology and Social Mechanism*, Cambridge, Cambridge University Press, pp. 266 – 308.

Manzo, G., 2013. - « Educational Choices and Social Interactions: A Formal Model and a Computational Test », in Gunn Elisabeth Birkelund (ed.). *Class and Stratification Analysis (Comparative Social Research, Volume 30)*, Emerald Group Publishing Limited, pp.47-100.

María-Dolores, R., Alarcón, G. and Garre, E., 2010. - « Tax Morale in Spain: A Study into Some of Its Principal Determinants », *Economic Analysis & Policy*, 38, pp. 855-876.

Martínez, D., 2011. - « How different are the Spanish self-employed workers by underreporting their incomes? », Working Paper EC 2011-09, Instituto Valenciano de Investigaciones Económicas (IVIE), Valencia.

Martínez, P., Castillo, A.M. and Rastrollo, M.A., 2008. - « Los enfoques de análisis de la evasión fiscal. Una revisión actual de la investigación », *Cuadernos de ciencias económicas y empresariales, 35*.

Meder, Z. Z., Simonovits, A. and Vincze, J., 2012. - « Tax Morale and Tax Evasion: Social Preferences and Bounded Rationality », *Economic Analysis & Policy*, *42*, pp.171-188.

Mittone, L. and Patelli, P., 2000. - « Imitative behaviour in tax evasion», in Stefansson, B. and Luna, F. (eds.). - *Economic simulations in swarm: Agent-based modelling and object oriented programming*, Amsterdam, Kluwer, pp. 133-158.

Murphy, L. and Nagel, T., 2002. - *The Myth of Ownership: Taxes and Justice*, New York, Oxford University Press.

Murphy, R., 2011. - « The Cost of Tax Abuse: A Briefing Paper on the Cost of Tax Evasion Worldwide », *The Tax Justice Network*:
http://www.tackletaxhavens.com/Cost_of_Tax_Abuse_TJN_Research_23rd_Nov_2011.pdf [available on line March 2013 [available on line March 2013.]

Murphy, R., 2012. - « Closing the European Tax Gap: A report for Group of the Progressive Alliance of Socialists & Democrats in the European Parliament », Tax Research LLP:
http://www.socialistsanddemocrats.eu/gpes/media3/documents/3842_EN_richard_murphy_eu_tax_gap_en_120229.pdf [available on line March 2013.]

Myles, G.D. and Naylor, R. A., 1996. - « A Model of Tax Evasion with Group Conformity and Social Customs », *European Journal of Political Economy*, *12*, 1, pp. 49-66.

Nordblom, K. and Zamac, J., 2012. - « Endogenous Norm Formation Over the Life Cycle – The Case of Tax Morale », *Economic Analysis & Policy*, *42*, 2, pp. 153-170.

Parsons, T. 1951. - *The social system*, London, Routledge & Kegan Paul.

Pellizzari, P. and Rizzi, D., 2013. - « Citizenship and power in an agent-based model of tax compliance with public expenditure », *Journal of Economic Psychology*, forthcoming.

Posner, R. A., 1998. - *Economic Analysis of Law*, New York, Aspen.

Prieto, J., Sanzo, M.J. and Suárez, J., 2006. - « Análisis económico de la actitud hacia el fraude fiscal en España », *Hacienda Pública Española/ Revista de Economía Pública*, 177, pp. 107-128.

Robben, H.S.J., Webley, P., Weigel; R.H., Warneryd, K.E., Kinsey, K.A., Hessing, D.J., Alvira, M.F., Elffers, H., Wahlund, R., van Langenhove, L., Long, S.B., and Scholtz, J.T., (1990). - « Decision Frame and Opportunity as Determinants of Tax Cheating », *Journal of Economic Psychology*, *11*, 341-364.

Rolfe, M., 2009. - « Conditional Choice », in **P. Hedström and P. Bearman** (eds.). - *The Oxford Handbook of Analytical Sociology*, Oxford, Oxford University Press, pp. 419 - 447.

Salganik, M. J. and Watts, D. J., 2009. - « Social Influence: The Puzzling Nature of Success in Cultural Markets », in **P. Hedström and P. Bearman** (eds.). - *The Oxford Handbook of Analytical Sociology*, Oxford, Oxford University Press, pp. 315 - 341.

Schneider, F. and Buehn, A., 2012. - « The Shadow Economy and Work in the Shadow: What Do We (Not) Know? », IZA Discussion Paper No. 6423.

Schneider, F., 2012. - « Shadow Economies in Highly Developed OECD Countries: What are the Driving Forces? », IZA Discussion Paper No. 6891.

Schütz, A., 1964. - *Collected Papers II. Studies in Social Theory*, The Hague, Martinus Nijhoff.

Seibold, G. and Pickhardt, M., 2013. - « Lapse of time effects on tax evasion in an agent-based econophysics model », *Physica A*, forthcoming.

Srinivasan, T. N., 1973. - « Tax evasion: A model », *Journal of Public Economics*, *2*, 4/4, pp. 339-46.

Szabó, A. Gulyás, L. and Tóth, I. J., 2008. - « TAXSIM Agent Based Tax Evasion Simulator », 5th European Social Simulation Association Conference (ESSA 2008), Berlin, Springer-Verlag.

Szabó, A., Gulyás, L. and Tóth, I. J., 2009. - « Sensitivity Analysis of a Tax Evasion Model Applying Automated Design of Experiments », Progress in Artificial Intelligence*, Lecture Notes in Artificial Intelligence*, *5816***,** pp 572-583.

Szabó, A., Gulyás, L. and Tóth, I. J., 2010. - « Simulating Tax Evasion with Utilitarian Agents and Social Feedback », *International Journal of Agent Technologies and Systems*, *2*, pp. 16-30.

Torgler, B., 2007. - *Tax Compliance And Tax Morale: A Theoretical and Empirical Analysis*, Chentelham, Edward Elgar.

Torgler, B., 2008. - « What Do We Know about Tax Fraud? An Overview of Recent Developments », *Social Research*, *75*, 4, pp. 1239-1270.

Traxler, C., 2010. - « Social norms and conditional cooperative taxpayers », European *Journal of Political Economy*, *26*, pp. 89-103.

Watts, D. J. and Strogatz, S. H., 1998. - « Collective dynamics of 'small-world' networks », *Nature*, *393*, pp. 409-410.

Watts, D. J. and Dodds, P., 2009. - « Threshold Models of Social Influence », in **P. Hedström and P. Bearman** (eds.). - *The Oxford Handbook of Analytical Sociology*, Oxford, Oxford University Press, pp. 475 - 497.

Wilensky, U., 1999. – NetLogo. http://northwestern.edu/netlogo/. Center for Connected Learning and Computer-Based Modeling, Northwestern University. Evanston, IL.

Young, P. 2009. - « Innovation diffusion in heterogeneous populations: contagion, social influence, and social learning », *American Economic Review*, *99*, 5, 1899-1824.

Zaklan, G., Lima, F., and Westerhoff, F., 2008. - « Controlling tax evasion fluctuations», *Physica A: Statistical Mechanics and its Applications*, *387*, pp. 5857-5861.

Zaklan, G., Westerhoff, F. and Stauffer, D., 2009a. - « Analysing tax evasion dynamics via the Ising model », *Journal of Economic of Coordination and Interaction*, *4*, pp.1–14.

Zaklan, G., Westerhoff, F. and Stauffer, D., 2009b. - « A multi-agent-based approach to tax morale », *International Journal of Modern Physics C*, *19*, pp. 1797-1808.

APPENDIX I
Agent's utility function in SIMULFIS

When agents go through the rational choice filter, they maximize their expected utility according to the following equation (see notational guide in Table A-I.1), which is an adaptation for the SIMULFIS model of the classical tax evasion function by Allingham and Sandmo (1972):

$$UE_i(X_i) = (1-p_i)\sqrt[3]{(Y_i - X_i t_{X_i} + Z_i^X)} + p_i \sqrt[3]{(Y_i - Y_i t_{Y_i} - \theta(Y_i t_{Y_i} - X_i t_{X_i}) + Z_i^Y)} \quad (1)$$

TABLE A-I.1. - *SIMULFIS' notational guide*

Y_i	Total (gross) income of agent i
X_i	Income declared by agent i
t_{Y_i}	Tax rate for Y_i
t_{X_i}	Tax rate for X_i
N	Total number of agents
p_i	Perceived probability for agent i of being caught if she evades
I_i^i	Audits to agent i in previous periods
I_i^v	Audits in agent i's neighbourhood (including i) in the preceding period
R	Number of previous periods
V_i	Agent i's number of neighbours
θ	Fine for tax evasion
ω	Social influence coefficient
$UE_i(X_i)$	Expected utility of declaring X_i for agent i
M	Minimum income threshold for receiving the social benefit
Z_i^X	Social benefit received by agent i when $X_i(1-t_{X_i}) < M$
Z_i^Y	Social benefit received by agent i when $Y_i(1-t_{Y_i}) < M$
a_i	Fraud opportunity use rate (FOUR) for agent i in period t
a_v	Median of FOUR in agents' neighbourhood in the preceding periods

According to this function, an agent's decision to declare income X_i is a function of tax rates t, fine θ, her real income level Y_i, and the probability p of being caught if she evades. We assume homogeneous risk aversion by using cube roots in both addends of the equation (we do not use square root to avoid applying it to eventual

negative numbers in the second addend, which could be the case, for example, if an agent declares a low percentage of her income and fines are very hard).

We also include the expected social benefit Z, which agents compute by determining their eligibility in the immediately preceding period of the simulation. Agents are eligible when their after-tax income is below 50% of the median income, and the benefit tops up their income until they reach that threshold M. Therefore:

$$Z_i^X = M - X_i(1-t_{X_i}); Z_i^Y = M - Y_i(1-t_{Y_i}); Z_i^{X_i}, Z_i^Y \geq 0 \qquad (2)$$

Note that if $X_i(1-t_x) < M$ and $Y_i(1-t_{y_i}) \geq M$, then $Z_i^y = 0$, but when $X_i(1-t_x) \geq M$, then both $Z_i^x = 0$ and $Z_i^y = 0$.

Agents' perceived probability of being sanctioned if they evade (p) is randomly distributed in the first period of the simulation and afterwards is updated endogenously as a function of the agent's audit record in all previous periods and the audit rate in the agent's neighbourhood in the immediately previous period, according to the following equation:

$$p_i = \left(\frac{I_i^i}{R} + \frac{I_i^y}{V_i} \right) / 2 \qquad (3)$$

SIMULFIS uses a discrete computational approach to determine a sequence of eleven expected utility outcomes of equation (1), which results from reducing concealed income by intervals of 10% from evading 100% to 0% of agents' concealable income. Since the expected utility formula we are using introduces substantive complications in relation to the classical one by Allingham and Sandmo (such as a progressive tax rate and a social benefit), this way of formalizing expected utility makes the computational working of the model easier, while ensuring the consistency of agents' decisions.

APPENDIX II
Data for empirical calibration

TABLE A-II.1. – *Income decile distribution for the Spanish population (2008)*

Decile	Income brackets (euros)					
	Wage earners			Self-employed		
	Min.	Max.	Mean	Min.	Max.	Mean
1	300	6,828	5,480.4	900	6,240	5,198.8
2	6,828	9,000	7,852.6	6,240	6,744	6,419.5
3	9,000	11,124	10,104.7	6,768	7,392	7,139.7
4	11,136	14,720	11,976.2	7,392	8,040	7,676.5
5	12,720	14,400	13,570.3	8,040	9,528	8,706.1
6	14,400	15,600	14,839.1	9,540	12,000	10,722.4
7	15,600	18,000	16,875.5	12,000	14,400	13,119.7
8	18,000	21,120	19,399.0	14,400	18,840	16,712.5
9	21,180	25,200	23,154.2	18,960	24,972	22,089.7
10	25,200	109,116	33,101.1	25,140	144,000	37,398.2

Source: *Household Budget Survey* 2008. National Statistics Institute (INE).

TABLE A-II.2.- *Effective income tax rates in Spain (2008)*

Income brackets (euros)	Tax rate (%)
Less than 17,707	4,50
17,707 to 33,007	12,71
33,007 to 53,407	19,27
More than 53,407	27,35

Source: Own calculations from the *Income Taxpayers Sample* 2008 (Spanish Institute for Fiscal Studies).

APPENDIX III
Effect of different values of the social influence coefficient (ω) on mean FOUR

Tables A-III.1 and A-III.2 confirm that the trends showed in Table 2, and specially the ambivalent effect of social contagion, are not substantially affected by different values of ω (the social contagion coefficient), although these values intensify the tendency correspondingly: a lower value of ω makes SC scenarios become suboptimal more slowly as deterrence is harder, while a higher value speeds the pattern up. Note that since the only parameter variation from results showed in Table 2 is the value of ω, the scenarios affected are those where social contagion is present, and thus values corresponding to RC and F+RC scenarios do not vary.

TABLE A-III.1. - *Mean FOUR by deterrence conditions with $\omega = 0.25$*

		Behavioural scenarios	Audits			
			3%	25%	50%	75%
Fines	1.5	RC	100,00	98,99	38,22	32,40
		F + RC	68,28	68,04	23,54	19,88
		RC + SC	78,69	77,94	31,47	27,94
		F + RC + SC	54,85	54,39	21,03	18,44
	2.5	RC	100,00	78,04	32,80	30,95
		F + RC	68,20	53,10	20,43	18,83
		RC + SC	78,60	63,35	28,33	26,98
		F + RC + SC	54,80	44,05	18,93	17,61
	5	RC	99,25	36,05	32,15	22,56
		F + RC	68,03	22,72	19,70	13,93
		RC + SC	78,11	30,88	27,76	20,96
		F + RC + SC	54,63	20,74	18,44	14,38
	7.5	RC	96,55	33,25	30,85	8,77
		F + RC	66,45	20,47	18,92	5,84
		RC + SC	76,39	28,39	27,10	10,54
		F + RC + SC	53,46	19,08	17,61	8,45

FOUR = Fraud Opportunity Use Rate. The higher the FOUR, the less agents comply. The FOUR values correspond to round 100, when equilibrium has been reached.
ω = Social Contagion coefficient.
Audits in % and fines as multipliers of evaded tax.

Behavioural scenarios:
RC = Only Rational Choice filter activated.
F+RC = Fairness and Rational Choice filters activated.
RC+SC = Rational Choice and Social Contagion filters activated.
F+RC+SC = Fairness, Rational Choice, and Social Contagion filters activated.

TABLE A-III.2. - *Mean FOUR by deterrence conditions with $\omega = 0.75$*

III. Conclusiones finales

La evasión fiscal es un grave problema para la sociedad, especialmente en el caso español. En los últimos tiempos la dimensión del problema se ha amplificado, y muestra de ello es su presencia cada vez mayor en los medios de comunicación, la opinión pública y la agenda política. A nivel académico, el interés por cumplimiento fiscal también se ha intensificado, como demuestra el número creciente de artículos y monográficos dedicados a la materia.

Desde el modelo fundacional de Allingham y Sandmo (1974), los investigadores han ido reconociendo de forma progresiva que el modelo tradicional del *homo oeconomicus* es insuficiente para dar cuenta de un fenómeno tan complejo como el del fraude y que por tanto se necesitan nuevos factores explicativos. Así, las últimas cuatro décadas pueden verse como el escenario de un giro que va desde la teoría económica estándar hasta un enfoque socio-psicológico de carácter más integrador. A continuación se ofrece un breve estado de la cuestión y se expone en qué medida la presente tesis supone una contribución al conocimiento de este objeto de estudio.

a. Un niño de cuarenta años

El estudio empírico de la evasión fiscal

El estudio empírico de la evasión fiscal[1] debe enfrentarse al problema de la falta de datos fiables, pues se trata de un fenómeno que, por definición, permanece oculto. En este sentido, existe una serie de trabajos que aplican modelos econométricos sobre datos reales de incumplimiento detectado, principalmente desarrollados en los años ochenta[2], y que presentan serias limitaciones: se basan en las inspecciones realizadas, pero éstas sólo detectan una parte de las rentas ocultadas; dejan fuera todo el fraude cometido por los no declarantes; no permiten distinguir entre la evasión y el incumplimiento involuntario; y los factores no económicos tienen escasa presencia (Alm y Jacobson, 2007: nota 5). No es de extrañar, pues, que los científicos sociales, en lugar de trabajar con datos ya existentes

---

[1] El libro de Kirchler (2007) es la revisión más detallada de los hallazgos que se han producido en el estudio multidisciplinar de la evasión fiscal desde sus inicios. Por otro lado, Alm *et al.* (2012), Kirchler *et al.* (2010) y Braithwaite y Wenzel (2008) proporcionan útiles panorámicas de la cuestión. Finalmente, desde una perspectiva estrictamente económica, pueden consultarse los resúmenes de Slemrod (2007), Sandmo (2005) y Cowell (2004).

[2] Véase un repaso de estos trabajos en Martínez *et al.* (2008). Aunque en su gran mayoría emplean datos provenientes del *Taxpayer Compliance Measurement Program* de la agencia tributaria estadounidense (IRS), existen valiosas excepciones, en especial en España (Gamazo, 1994).

sobre el cumplimiento fiscal 'real', hayan preferido 'producir' sus propios datos, fundamentalmente a través de dos técnicas: los experimentos y las encuestas.[3]

Los experimentos permiten testar, en el entorno controlado de un laboratorio, el efecto que tienen determinadas variables sobre el comportamiento humano. Aunque a menudo deben hacer frente a críticas que apuntan a su falta de validez externa (véanse discusiones al respecto en Jones, 2011; Levitt, 2007; Bardsley, 2005), los resultados experimentales son una fuente de información muy valiosa para las ciencias sociales (Falk y Heckman, 2009). Desde el estudio seminal de Friedland *et al.* (1978), en el campo del cumplimiento fiscal se han llevado a cabo cientos de experimentos por parte de economistas conductuales y psicólogos (pueden hallarse reflexiones sobre la cuestión en Slemrod, 2010 y Alm y Jacobson, 2007). Este tipo de trabajos arrojan luz no sólo acerca del papel que tiene sobre la evasión fiscal parámetros de índole económica (existe un meta-análisis en Blackwell, 2010), sino también sobre la influencia de todo tipo de variables: sesgos cognitivos (Maciejovski *et al.*, 2007), aspectos de *framing* o enmarcado (Lewis *et al.*, 2009), las intenciones (Kirchler y Wahl, 2010), el esfuerzo realizado para obtener rentas (Kirchler *et al.*, 2009), el poder de decisión sobre los instrumentos disuasorios (Feld y Tyran, 2002), emociones como la vergüenza (Coricelli, 2010), y muchos otros.

Por otro lado, en la última década nos encontramos ante un voluminoso grupo de trabajos que utilizan datos provenientes de encuestas de opinión. En línea con la obra precursora de Schmölders y la "Escuela de Colonia de psicología fiscal" de los años sesenta, estos trabajos tratan de capturar las percepciones y actitudes fiscales de los ciudadanos. En concreto, estudian su *moral fiscal*, esto es, su motivación intrínseca para pagar impuestos (Braithwaite y Ahmed, 2005), normalmente mediante una variable *proxy* que mide la 'justificabilidad' del fraude fiscal (véase una revisión en Torgler, 2007). Este campo de investigación ha adquirido gran importancia, ya que la moral fiscal se ha presentado como el principal candidato a la hora de paliar el déficit explicativo que, como se ha apuntado, han demostrado los mecanismos estrictamente económicos. A nivel individual, se han encontrado correlaciones entre la moral fiscal y variables socio-demográficas como el género (Torgler y Valev, 2010) o la edad (Braithwaite *et al.*, 2010), pero también con variables ideológicas como la confianza en el gobierno (Torgler, 2003), la percepción de ineficiencia en el gasto público (Barone y Mocetti, 2011), la religiosidad

---

[3] En la última década nos encontramos también ante un creciente número de trabajos que utilizan modelos computacionales basados en agentes (véase un repaso en Noguera *et al.* (De próxima aparición). Tales trabajos, sin embargo, no se incluyen en esta sección ya que, por mucho que puedan ser calibradas con datos empíricos, se trata en esencia de herramientas de naturaleza teórica.

(Stack y Kposowa, 2006) o el patriotismo (McGregor y Wilkinson, 2012). Hay que destacar que la moral fiscal también está correlacionada con la evasión autodeclarada (Demir *et al.*, 2008) y con los niveles de cumplimiento observados en el laboratorio (Dulleck *et al.*, 2012) y, a nivel agregado, con el volumen de economía sumergida de un país (Halla, 2010). Tales asociaciones nos llevan a pensar que la moral fiscal no es únicamente un indicador actitudinal, sino que se trata además de una herramienta irrenunciable a la hora de explicar el comportamiento efectivo de los contribuyentes.

Además de estos dos grandes métodos -experimentos y encuestas-, existe un reducido grupo de estudios que se aproximan al fenómeno de la evasión fiscal desde una perspectiva cualitativa. Entre ellos destacan los trabajos de Paul Webley (Ashby y Webley, 2008; Webley *et al.*, 2006; Adams y Webley, 2001; Sigala *et al.*, 1999; ver un repaso en Webley y Ashby, 2010), y un puñado de investigaciones aisladas (Devos, 2009; Hansson, 2009; Morse *et al.*, 2009; Waller, 2006; Ahmed y Braithwaite, 2005; Williams, 2005; Hobson 2003). Aunque ofrecen algunos resultados interesantes, puede afirmarse que el alcance de las entrevistas cualitativas es especialmente modesto, como evidencia su presencia marginal en las publicaciones especializadas.

Por lo que respecta a España, cabe recordar que, a pesar del tremendo impacto de la evasión de impuestos en su economía, apenas existen una docena de trabajos académicos que traten de explicar las causas del cumplimiento fiscal y las percepciones fiscales de los españoles. Así, podemos hallar algunos estudios basados en experimentos (Fatás y Roig, 2004; Alm *et al.*, 1995), y sobre todo en datos de encuestas (De Juan, 1992 y 1995, De Juan y Truyols 1993, De Juan *et al.*, 1994), entre los que destacan los centrados en la moral fiscal (ver nota 3 de la Introducción).

Balance

Como acabamos de ver, a través de diferentes abordajes metodológicos (modelos econométricos, experimentos, encuestas y entrevistas), desde el estudio de Allingham y Sandmo (1974) se ha ido conformando un abundantísimo conjunto de investigaciones dedicadas al estudio empírico de la evasión fiscal. Ya en 1978 la agencia tributaria estadounidense elaboró una lista de 64 factores que pueden afectar al cumplimiento (Flynn, 2004: Apéndice A); si esta lista se actualizase hoy día e incorporase los hallazgos realizados por los científicos sociales desde esa fecha, el inventario sería mucho más extenso. Así, es incuestionable que el conocimiento adquirido acerca del cumplimiento fiscal en los últimos cuarenta años es muy valioso. Sin embargo, puede afirmarse que se trata de un conocimiento disperso y apenas articulado. Se diría que los investigadores,

trabajando de forma aislada, han llevado demasiado lejos las siguientes palabras de Martínez *et al.* (2008: 91):

> Es improbable que pueda esbozarse una teoría unificada sobre el comportamiento evasor que permita obtener explicaciones sobre todos los comportamientos, de todos los sujetos y, menos aún, si se busca que incorpore el gran número y variedad de comportamientos observados.

De este modo, el estudio de la evasión fiscal arroja unos resultados empíricos que son poco sólidos, fragmentarios y a menudo contradictorios (Alm, 2012; Kirchler, 2007; Niemirowski *et al.*, 2001). Para resumir el estado de la cuestión, merece la pena citar la siguiente síntesis realizada por Erich Kirchler (2007: xv) en el manual más completo hasta la fecha:

> Firstly, economic-psychological research is still in its infancy, providing merely isolated results rather than an integrative model of tax behaviour. Secondly, research on tax behaviour faces a bulk of methodological problems, vague conceptualisations of phenomena and heterogeneous operationalisation of assumed determinants of tax behaviour. Unsurprisingly, effects of determinants (or consequences) of tax behaviour were sometimes found to be strong, sometimes weak and sometimes insignificant or even in the opposite direction to expectations. Contradictory findings may be due either to methodological idiosyncrasies or to the neglect of relevant differentiating variables. Furthermore, tax behaviour has not been systematically studied in different political and tax systems, nor have cultural differences been satisfactorily explained.

En la misma dirección, James Alm afirma que, a pesar de todos los progresos, existen aún importantes lagunas en nuestra comprensión de la evasión fiscal. Quedan numerosas preguntas por responder, tanto *fundamentales* (relativas a cuestiones básicas de medición, explicación y control de la evasión) como *fronterizas* (evidencias que están lejos de ser concluyentes), y es preciso por tanto un gran esfuerzo investigador adicional (Alm, 2012:73). Consciente de esta necesidad, los artículos que componen la presente tesis han sido concebidos, por un lado, como intentos de arrojar luz sobre aspectos que no han sido convenientemente explicados por la literatura precedente y, al mismo tiempo, como señales que indiquen futuras líneas de investigación en la materia. En la siguiente sección, que es la última, se resumen estas contribuciones.

b. Aportaciones de la tesis doctoral

A continuación se enumeran, en primer lugar, las aportaciones del artículo sobre resentimiento fiscal (*RF*), después las del modelo SIMULFIS (en sus versiones *S1* y *S2*), y para finalizar las de los tres artículos en su conjunto.

Resentimiento fiscal

I.   El artículo se propone "ir más allá de las relaciones estadísticas para explorar el mecanismo responsable de ellas" (Boudon, 1976). En este sentido, presenta un grano más fino que las explicaciones habituales en el campo de la moral fiscal, en tanto que intenta abrir la caja negra de la asociación entre la tolerancia ante el fraude y la edad. Esta tarea encuentra sus únicos precedentes en los trabajos de Nordblom y Žamac (2012) y Braithwaite *et al.* (2010), aunque es la primera vez que se realiza con datos españoles.

II. RF argumenta a favor de la posibilidad de que los juicios morales sean en realidad una forma de enmascarar comportamientos basados en el autointerés. Este tipo de fenómenos psíquicos (racionalizaciones, preferencias adaptativas, etc.) han sido obviados por la literatura encargada de estudiar las actitudes frente al fraude fiscal, a excepción de los trabajos de Wenzel (2005) y Falkinger (1988).

III. Concretamente, RF considera que el factor que en origen explica la tolerancia de los asalariados ante la evasión son las oportunidades para evadir (a menos oportunidades, mayor intolerancia, y viceversa). Esta consideración está en conformidad con el trabajo de Blanthorne y Kaplan (2008), aunque es la primera vez que se aplica en el ámbito de la moral fiscal.

IV. El artículo trata de mostrar la importancia que pueden tener las emociones (en particular, el *resentimiento*) en la formación de creencias y acciones. El poder causal de las emociones ha sido poco considerado en la literatura sobre fiscalidad, con las excepciones de la obra de Murphy (e.g. Murphy y Tyler, 2008) y los experimentos de Coricelli *et al.* (2014, 2010) acerca del papel de la vergüenza, y el estudio de Christian y Alm (2014) sobre la simpatía y la empatía. En este sentido, el trabajo teórico de corte analítico llevado a cabo por Elster (2007) puede resultar muy útil de cara a futuras investigaciones.

SIMULFIS

I. El SIMULFIS es el primer modelo de simulación social basada en agentes que se desarrolla en el Estado español. Los dos artículos dedicados a este modelo forman parte de grupo de trabajos aún incipiente que, en la última década, emplean esta técnica para la investigación del comportamiento fiscal. En este sentido, resulta difícil no reconocer que la modelación basada en agentes debe erigirse como una herramienta clave para el avance de la disciplina en los próximos años (Alm, 2012:75).

II. El SIMULFIS es un modelo integral que incorpora factores explicativos pertenecientes a las principales dimensiones reconocidas por la literatura (condicionantes socioeconómicos, elección racional, justicia distributiva e influencia social) y, en este sentido, resulta más completo –y complejo- que el resto de modelos hasta la fecha.

III. Los agentes del SIMULFIS toman sus decisiones pasando por una secuencia de filtros. Este algoritmo de decisión basado en filtros recoge los últimos hallazgos de la psicología cognitiva y la ciencia social conductual (Gigerenzer *et al.*, 2011) y resulta novedoso en el área de la simulación social.

IV. Se trata de un modelo con una marcada voluntad de realismo; así, a diferencia de otros modelos, los parámetros del SIMULFIS han sido en lo posible calibrados con datos reales (para el caso español: la distribución de la renta, los tipos impositivos efectivos, el porcentaje de autónomos y asalariados, el grado de apoyo a un sistema fiscal progresivo…). Además, se ha intentado contrastar los resultados de las simulaciones con los (escasos) datos existentes sobre evasión. Esta práctica, aunque necesaria si se quiere que los modelos de simulación no sean meras construcciones teóricas, no es tan frecuente como cabría desear.

V. A nivel teórico, S2 ofrece una taxonomía única de los diferentes tipos de mecanismos de influencia social. A nivel práctico, el SIMULFIS ofrece un resultado novedoso: el efecto de la influencia social no es independiente de la intensidad de las sanciones y multas (como sí lo es, entre otros, en Korobow *et al*., 2007).

Global

I. Los tres artículos contenidos en esta tesis doctoral se plantean como un estímulo para la sociologia fiscal en España, una disciplina

insuficientemente desarrollada habida cuenta de la enorme relevancia del fraude en nuestro país. En concreto, se trata del primer estudio que trata de microfundamentar la moral fiscal de los españoles, y dos versiones de un modelo que utiliza una técnica inédita en este país como es la simulación social basada en agentes.

II. Tanto en RF como en el SIMULFIS se otorga un papel explicativo central a las diferentes *oportunidades* de evasión que tienen los contribuyentes; así, en la estela de Kleven *et al*. (2011), se presta un tratamiento diferenciado de los dos colectivos que difieren más claramente en ese punto: autónomos y asalariados. A pesar de que tal distinción resulta muy intuitiva y provechosa en términos explicativos, a la hora de emprender investigaciones empíricas la tendencia dominante ha sido, en cambio, la de adoptar un enfoque genérico y no específico de los diferentes tipos de contribuyentes.[4]

III. El marco teórico que en todo momento ha presidido la presente tesis ha sido el de la sociología analítica contemporánea y, en concreto, la denominada 'perspectiva de los mecanismos' (ver la Introducción). Este posicionamiento ha posibilitado una visión de conjunto de la tarea explicativa del fenómeno del cumplimiento fiscal, permitiendo asignar un lugar dentro del 'barco de Coleman' (figura 1 de la pág. 10) a cada uno de los mecanismos propuestos en las diferentes investigaciones. Semejante manera de proceder previene de algunos de los peligros más habituales en la literatura especializada, a saber: ofrecer mecanismos explicativos como si de mónadas aisladas se tratase, pretender abrir una 'caja negra' mediante variables explicativas que no son más que nuevas 'cajas negras', etcétera.

---

[4] Los participantes de experimentos acostumbran a ser estudiantes (Alm y Jacobson, 2007) y por tanto no tiene sentido tratar de aislar los rasgos diferenciales de autónomos y asalariados en el laboratorio. Por otro lado, los estudios de la moral fiscal se suelen basar en encuestas representativas de la población en general, y a lo sumo comparan los coeficientes de regresión de las diferentes categorías ocupacionales (Torgler, 2007). En todo caso, las excepciones a este enfoque se encuentran en trabajos que se ocupan en exclusiva de los autónomos o propietarios de pequeños negocios, como es el caso de los estudios de caso cualitativos glosados en la sección anterior (veáse un repaso en Kamleitner *et al*. 2010) o en varios trabajos de E. Kirchler (Kirchler y Forest, 2010; Kirchler y Wahl 2010; Kirchler y Maciejovski, 2001; Kirchler, 1999 y 1998).

Naturalmente, y en paralelo a estas aportaciones, los artículos incluidos en la tesis presentan una serie de limitaciones. En este sentido, puede afirmarse que tanto el mecanismo de resentimiento fiscal como el modelo SIMULFIS se encuentran en su fase inicial de desarrollo y, en consecuencia, necesitan de ulteriores investigaciones que ayuden a delimitar su plausibilidad y alcance. Esta tarea podría consistir, por un lado, en tratar de replicar sus resultados con la incorporación de nuevos datos (de otras encuestas, otros países, etc.); por el otro, cabría llevar a cabo experimentos conductuales que clarificasen el papel que ejercen sobre el cumplimiento fiscal ciertos factores cuya relevancia aquí se ha tratado de demostrar (tales como los procesos psíquicos de racionalización, las emociones o las oportunidades para defraudar) y que, sin embargo, no han recibido suficiente atención hasta la fecha. En cualquier caso, tanto por sus elementos novedosos como por su carácter preparatorio, la presente tesis doctoral pretende ser un impulso en el lento avance de la comprensión del fenómeno de la evasión fiscal, especialmente en nuestro país.

Referencias

ADAMS, C.J. y WEBLEY, P. (2001), "Small business owners' attitudes on VAT compliance in the UK", *Journal of Economic Psychology*, 22: 195-216.

AHMED, E. y BRAITHWAITE, V. (2005), "Understanding Small Business Taxpayers. Issues of Deterrence, Tax Morale, Fairness and Work Practice"*, Internacional Small Business Journal,* 23: 539-568.

ALLINGHAM, M.G. y SANDMO, A. (1972), "Income tax evasion: a theoretical analysis", *Journal of Public Economics*, 1: 323–338.

ALM, J. (2012), "Measuring, explaining, and controlling tax evasion: lessons from theory, experiments, and field studies", *International Tax and Public Finance*, 19 (1): 54-77.

ALM, J, KIRCHLER, E., MUEHLBACHER, S., GANGL, K., HOFMANN, E., KOGLER, C. y POLLAI, M. (2012), "Rethinking the Research Paradigms for Analysing Tax Compliance Behaviour," CESifo Forum, Ifo Institute for Economic Research, University of Munich, 13(2): 33-40.

ALM, J. y JACOBSON, S. (2007), "Using Laboratory Experiments in Public Economics", *National Tax Journal*, 60(1): 129-152.

ALM, J., KIRCHLER, E. y MUEHLBACHER, S. (2012), "Combining psychology and economics in the analysis of compliance: From enforcement to cooperation", *Economic Analysis and Policy*, 42: 133-152.

ALM, J., SÁNCHEZ, I. y DE JUAN, A. (1995), "Economic and noneconomic factors in tax compliance", *Kyklos,* 48: 3-18.

ASHBY, J. S. y WEBLEY, P. (2008) 'But everyone else is doing it: A closer look at the occupational taxpaying culture of one business sector', *Journal of Community and Applied Social Psychology*, 18: 194–210.

BARDSLEY, N. (2005): "Experimental economics and the artificiality of alteration", *Journal of Economic Methodology*, 12 (2): 239-251.

BARONE, G. y MOCETTI, S.(2011), "Tax Morale and Public Spending Inefficiency", *International Tax and Public Finance,* 18 (2): 1-26.

BLACKWELL, C. (2010), "A Meta-Analysis of Tax Compliance Experiments", en J.Alm, J. Martinez-Vázquez, J. y B. Torgler (eds.): *Developing Alternative Frameworks for Explaining Tax Compliance.* New York y London: Routledge.

BLANTHORNE, C. y KAPLAN, S. (2008), **"**An egocentric model of the relations among the opportunity to underreport, social norms, ethical beliefs, and underreporting behaviour", *Accounting, Organizations and Society*, 33 (7-8): 684-703.

BOUDON, R. (1976), "Comment on Hauser's Review of Education, Opportunity, and Social Inequality", *American Journal of Sociology*, 81 (5): 1175-1187.

BRAITHWAITE, V. y AHMED, E. (2005), "A threat to tax morale: the case of Australian higher education policy", *Journal of Economic Psychology*, 26: 523-540.

BRAITHWAITE, V., REINHART, M. y SMART, M. (2010), "Tax non-compliance among the under-30s: Among the Under-30s: Knowledge, Obligation or Skepticism?", en B. Torgler, J. Alm y J. Martinez (eds): *Developing Alternative Frameworks for Explaining Tax Compliance, Avoidance and Evasion.* London: Routledge.

BRAITHWAITE, V. y WENZEL, M. (2008). "Integrating explanations of tax evasion and avoidance". In A. Lewis (ed), *The Cambridge Handbook of Psychology and Economic Behaviour*. Cambridge: Cambridge University Press.

CHRISTIAN, R.C. y ALM, J. (2014), "Empathy, sympathy, and tax compliance", *Journal of Economic Psychology*, 40: 62-82.

CORICELLI, G. (2010), "Cheating, emotions, and rationality: an experiment on tax evasion", *Experimental Economics*, 13: 226–247.

CORICELLI, G., RUSCONI, E., VILLEVAL, M.C. (2014), "Tax evasion and emotions: An empirical test of re-integrative shaming theory", *Journal of Economic Psychology*, 40: 49–61.

COWELL, F.A. (2004), "Carrots and Sticks in Enforcement", en H.J. Aaron y J. Slemrod (eds), *Crisis in Tax Administration*. Washington D.C.: Brookings Institution Press.

DE JUAN, A. J. (1992): "Cómo perciben los declarantes de IRPF distintas dimensiones fiscales", Cuadernos de Actualidad, 3 (10): 294-305.

DE JUAN, A. J. y TRUYOLS, M.A. (1993): "Predisposición, habilidad y oportunidad de los contribuyentes hacia el fraude fiscal", Cuadernos de Actualidad, 4 (1): 27-36.

DE JUAN, A., M. A. LACERAS y R. MAYO (1994), "Cumplimiento fiscal voluntario de los contribuyentes españoles", *Hacienda Pública Española,* 131: 63-77.

DE JUAN, A. J. (1995): "Manifestaciones del comportamiento fraudulento en España. Análisis de causas y estrategias preventivo-correctoras", *Información Comercial Española. Revista de Economía*, 741: 55-65.

DEMIR, I., MACINTYRE, A., SCHAFFNER, M. y TORGLER, B. (2008), "Causes and Consequences of Tax Morale: An Empirical Investigation", *Economic Analysis Policy*, 38(2): 313-339.

DEVOS, K. (2009) "An Investigation Into Australian Personal Tax Evaders-Their Attitudes Towards Compliance And The Penalties For Non-Compliance", *Revenue Law Journal*, 19 (1), Article 2.

DULLECK, U., FOOKEN, J., NEWTON, C., RISTL, A., SCHAFFNER, M. y TORGLER, B. (2012), "Tax Compliance and Psychic Costs: Behavioral Experimental Evidence Using a Physiological Marker", QuBE Working Papers 001, QUT Business School.

ELSTER, J. (2007), *Explaining Social Behavior. More nuts and bolts for the social sciences.* Cambridge: Cambridge University Press. [Traducción española en ELSTER, J. (2010), *La explicación del comportamiento social.* Barcelona: Gedisa].

FALK, A. y HECKMAN, J.J. (2009), "Lab Experiments Are a Major Source of Knowledge in the Social Sciences", Forschungsinstitut zur Zukunft der Arbeit, Discussion Paper No. 4540.

FALKINGER, J. (1988), "Tax evasion and equity: a theoretical analysis", *Public Finance, 3*, 388–395.

FATÁS, E. y ROIG, J. M. (2004), "Equidad y evasión fiscal. Un test experimental", *Revista de Economía Aplicada*, 34 (12): 17-37.

FELD, L. P. y TYRAN, J.-R. (2002), "Tax Evasion and Voting: An Experimental Analysis", *Kyklos*, 55: 197–221.

FLYNN, K. E. (2004), "An Empirical Investigation into Alternative Theories Explaining Taxpayer Behavior", *Journal of the American Taxation Association*, 26 (2).

FRIEDLAND, N., S. MAITAL y A. RUTENBERG (1978), "A Simulation Study of Income Tax Evasion", *Journal of Public Economics*, 10: 107-116.

GAMAZO, J.C. (1994), "Principales trabajos empíricos en materia de evasión fiscal", *Anales de estudios económicos y empresariales*, 9: 199-218.

GIGERENZER, G., HERTWIG, R. y PACHUR, T. (2011), *Heuristics. The Foundations of Adaptive Behavior*. New York: Oxford University Press.

HALLA, M. (2010), "Tax Morale and Compliance Behavior: First Evidence on a Causal Link", *The B.E. Journal of Economic Analysis & Policy*, 12 (1): 1935-1682.

HANSSON, A. (2009), "Are small business owners more successful in avoiding taxes: Evidence from Sweden", Working Paper 2009:6, Department of Economics, Lund University.

HOBSON, K. (2003), "Championing the Compliance Model: From Common Sense to Common Action?", en V. Braithwaite (ed.), *Taxing Democracy: Understanding Tax Avoidance and Evasion*. Aldershot: Ashgate.

JONES, M.K. (2011), "External Validity And Libraries Of Phenomena: A Critique Of Guala's Methodology Of Experimental Economics", *Economics and Philosophy*, 27 (03): 247-271.

KAMLEITNER, B., KORUNKA, C. y KIRCHLER, E. (2012),"Tax compliance of small business owners: A review", *International Journal of Entrepreneurial Behaviour & Research*, 18 (3): 330 – 351.

KIRCHLER, E. (1998), "Differential representations of taxes: Analysis of free associations and judgments of five employment groups", *Journal of Socio-Economics*, 27 (1): 117-131.

KIRCHLER, E. (1999), "Reactance to taxation: Employers' attitudes towards taxes", *Journal of Socio-Economics*, 28 (2):131-138.

KIRCHLER, E. (2007), *The Economic Psychology of Tax Behaviour*. Cambridge: Cambridge University Press.

KIRCHLER, E. y FOREST, A. (2010), "Targeting occupations with varying reputations to increase tax revenue", *Journal of Socio-Economics*, 32: 283-302.

KIRCHLER, E. y MACIEJOVSKY, B. (2001), "Tax Compliance within the context of Gain and Loss Situations, Expected and Current Asset Position and Profession", *Journal of Economic Psychology*, 22(2):173-194.

KIRCHLER, E, MUEHLBACHER, S., HÖLZ, E. y WEBLEY, P. (2009), "Effort and Aspirations in Tax Evasion: Experimental Evidence", *Applied Psychology* 58, (3): 488-507.

KIRCHLER , E., MUEHLBACHER, S., KASTLUNGER ,B. y WAHL, I. (2010), "Why Pay Taxes? A Review of Tax Compliance Decisions", en B. Torgler, J. Alm y J. Martinez (eds): *Developing Alternative Frameworks for Explaining Tax Compliance, Avoidance and Evasion.* London: Routledge.

KIRCHLER, E. y WAHL, I. (2010), "Tax Compliance Inventory: TAX-I Voluntary tax compliance, enforced tax compliance, tax avoidance, and tax evasion", *Journal of Economic Psychology*, 31(3):331-346.

KLEVEN, H.J., KNUDSEN, M.B., KREINER, C.T., PEDERSEN, S. y SAEZ, E. (2011), "Unwilling or Unable to Cheat? Evidence from a Tax Audit Experiment in Denmark", *Econometrica*, 79 (3): 651–692.

KOROBOW, A., JOHNSON, C. y AXTELL, R. (2007), "An Agent-Based Model of Tax Compliance with Social Networks", *National Tax Journal*, LX (3/4): 589-610.

LEVITT, S.D. (2007), "What Do Laboratory Experiments Measuring Social Preferences Reveal About the Real World?", *The Journal of economic perspectives*, 21 (2): 153-174.

LEWIS, A. *et al* (2009), "Individual, cognitive and cultural differences in tax compliance: UK and Italy compared", *Journal of Economic Psychology*, 30 (3): 431-445.

MACGREGOR, J. y WILKINSON, B. (2012), "The Effect of Economic Patriotism on Tax Morale and Attitudes Toward Tax Compliance", en Toby Stock (ed.), *Advances in Taxation (Advances in Taxation, Volume 20)*. Bingley: Emerald Group Publishing Limited.

MACIEJOVSKY, B., KIRCHLER, E. y SCHWARZENBERGER, H. (2007), "Misperception of chance and loss repair: On the dynamics of tax compliance", *Journal of Economic Psychology*, 28: 678–691.

MARTÍNEZ, P., CASTILLO, A.M. y RASTROLLO, M.A. (2008), "Los enfoques de análisis de la evasión fiscal. Una revisión actual de la investigación". Cuadernos de Ciencias económicas y empresariales. Papeles de trabajo, Nº 35.

MORSE, S.C., KARLINSKY, S. y BANKMAN, J. (2009), "Cash Businesses and Tax Evasion", *Stanford Law & Policy Review*, 20 (1): 37-68.

MURPHY, K. y TYLER, T. (2008), "Procedural justice and compliance behaviour: the mediating role of emotions", *European Journal of Social Psychology*, 38: 652–668.

NOGUERA, J. A., MIGUEL, F. J., TAPIA, E. y LLACER, T. (De próxima aparición), "Tax Compliance, Rational Choice, and Social Influence: An Agent-Based Model", *Revue Française de Sociologie*.

NIEMIROWSKI, P., BALDWIN, S. y WEARING, A: (2001), "Chapter 18", en M. Walpole and C. Evans (eds.), *Tax Administration in the 21st Century.* St. Leonards: Prospect Media.

NORDBLOM, K. y ŽAMAC, J. (2012), "Endogenous Norm Formation Over the Life Cycle – The Case of Tax Morale", *Economic Analysis & Policy*, 42 (2): 153-170.

SANDMO, A. (2005), "The theory of tax evasion: A retrospective view", *National Tax Journal*, 58: 643-63.

SIGALA, M., BURGOYNE, C. B., y WEBLEY, P. (1999), 'Tax communication and social influence: Evidence from a British sample', *Journal of Community & Applied Social Psychology*, 9: 237-241.

SLEMROD, J. (2010): "Old George Orwell Got It Backward: Some Thoughts on Behavioral Tax Economics", *Finanzarchiv: Public Finance Analysis*, 66(1): 15-33.

STACK, S. y KPOSOWA, A. (2006), "The Effect of Religiosity on Tax Fraud Acceptability: A Cross-National Analysis", *Journal for the Scientific Study of Religion*, 45(3):325–351.

TORGLER, B. (2003), "Tax Morale, Rule-Governed Behaviour and Trust", *Constitutional Political Economy*, 14: 119– 140.

TORGLER, B. (2007), *Tax Compliance And Tax Morale: A Theoretical and Empirical Analysis*. Chentelham: Edward Elgar.

TORGLER, B. y VALEV, N.T. (2010), "Gender and Public Attitudes toward Corruption and Tax Evasion", *Contemporary Economic Policy*, 28 (4): 554–568,

WEBLEY, P., ADAMS, C.J. y ELFFERS, H (2006), "Value Added Tax compliance", en E.J. McCaffery y J. Slemrod (eds.), *Behavioral Public Finance: Toward a new agenda*. New York: Russell Sage.

WEBLEY, P. y ASHBY, J (2010): "The economic psychology of value added tax compliance", en J. Alm, J. Martinez-Vázquez, J. y B.Torgler (eds.), *Developing Alternative Frameworks for Explaining Tax Compliance*. New York and London: Routledge.

WILLIAMS, C.C. (2005), "The Undeclared Sector, Self-Employment and Public Policy", *International Journal of Entrepreneurial Behaviour and Research*, 11 (4): 244-257.

WENZEL, M. (2005)*: "*Motivation or rationalisation? Causal relations between ethics, norms and tax compliance", *Journal of Economic Psychology*, 26 (4): 491-508.