Culture, financial crisis and the demand for property and accident and health insurance in the OECD countries: An assessment

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ABSTRACT

We study how the cultural characteristics and the global financial crisis (GFC) impacted the non-life insurance expenditure in the OECD countries in the period 2000-2013 where we focus on the property and accident and health insurance markets. Our system Generalized Method of Moment (GMM) estimations reveal that in addition to the traditional economic and legal factors, the cultural characteristics such as long-term orientation, individualism, masculinity, and uncertainty avoidance played an important role in determining the expenditure on these insurance products across the OECD countries. However, in the presence of the GFC, the impacts of the cultural factors have dissipated. Furthermore, per capita income, which has long been regarded as one of the most important drivers of demand for non-life insurance in the literature, failed to explain the spending on accident and health insurance during the GFC. The paper provides valuable information for not only various constituents of the insurance sector but also policy makers in the OECD countries.

Key words: culture, economic freedom, OECD countries, non-life insurance.
JEL classifications: G00; G22; O16
Version 1: July 13, 2016
Word count: 15,800

I. Introduction

Non-life insurance, which consists mainly of property insurance, accident and health insurance, motor insurance and general liabilities insurance, plays an important role in socio-economic activities. Its contribution to economic growth has been analysed and discussed in the economics literature (Patrick 1966; Arena 2008; Lee 2011). In practice, the worldwide total non-life insurance premiums reached US$2,048.59 billion in 2013 and occupied 2.62% of world GDP, 82.02% of which was incurred by the Organisation for Economic Co-operation and Development (OECD) countries (Swiss Re 2016). A number of papers have discussed the determination of non-life insurance expenditure across countries and have pointed out the roles played by a number of socio-economic factors such as per capita income, economic freedom and the legal system (Outreville 1990; Browne et al. 2000; Esho et al. 2004; Elango and Jones 2011; Feyen et al. 2011; Lee and Chiu 2012; Park and Lemaire 2012; Trinh et al. 2016). However, most of these earlier studies have used aggregated data across different insurance products. As argued by Esho et al. (2004) and Park and Lemaire (2012), adding up the insurance premiums leads to a loss of information due to the heterogeneity in both the characteristics of and the spending on insurance products[1]. As such, there is a need for policy makers, firms, researchers and customers to revisit the issue but using disaggregated non-life insurance data.[2]

In this paper, we aim to uncover factors driving the development of the property insurance and accident and health insurance markets in the OECD countries in the period 2000-2013, where the development of these markets is proxied by the corresponding insurance consumption levels. We choose as our sample the OECD countries due to both the data availability (in particular insurance data at the product level) as well as the similarity in the level of development of these countries. We also focus our analysis on culture and the global financial crisis (GFC), which are relatively new factors in this literature, and adopt a dynamic system Generalized Method of Moment (GMM) estimation strategy which allows us to address the problem of endogeneity caused by reverse causality among the endogenous regressors (see section 3). To the best of our knowledge, this is the first paper that examines the drivers of expenditure on property insurance and accident and health insurance in the OECD countries through the lens of such a comprehensive econometric framework.

Browne et al. (2000) has been the only related paper thus far to have examined the non-life insurance consumption in the OECD countries using disaggregated data at the product level. Focusing on the period 1987-1993, Browne et al. studied the determinants (mainly economic and demographic factors) of the demand for motor insurance and general liability insurance. Many other important non-life insurance products, in particular the property insurance and accident and health insurance, however, were not considered in their study. As can be seen from Figure 1, the shares of property insurance and accident and health insurance in the aggregated insurance spending in the OECD countries in 2013 were 48% and therefore studying the factors that have driven the development of these markets deserve

[1] For other fields, Orcutt et al. (1968), Garrett (2003) and Ferrer et al. (2006) stated disadvantages of using aggregating data as follows: (1) using the aggregated data before analysis may discard information; (2) using aggregation can result in misleading conclusions regarding the economic behaviour of individuals; (3) disaggregated models yields better performance.
[2] A valid illustration for the loss of information when using aggregated data is that the aggregated non-life insurance spending of individuals in the Netherlands in 2012 was 4.5 times higher than that of Finland. In the same period, the disaggregated data show that on average, individuals in the Netherlands spent 48 times more on accident and health insurance than those in Finland, whereas the average spending on other non-life insurance products (such as motor insurance and property insurance) was similar in both countries.

attention. At the same time, as depicted in Figures 2, 3, and 4, the trends on aggregated non-life insurance spending in many OECD countries as well as spending on property insurance and accident and health insurance have changed significantly since 2007, the year when the GFC started. It is therefore relevant to study the impact of the GFC in the development of the non-life insurance market.

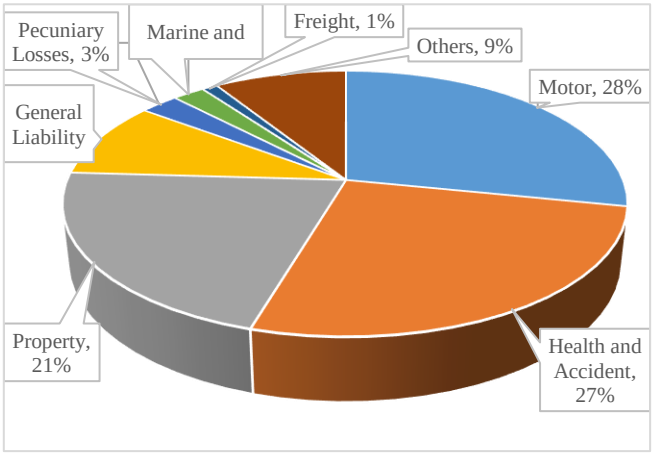

Figure 1. The share of premiums per capita across products in 2013 (%).

Source: Computed by the authors based on OECD Insurance Statistics (OECD 2015a)

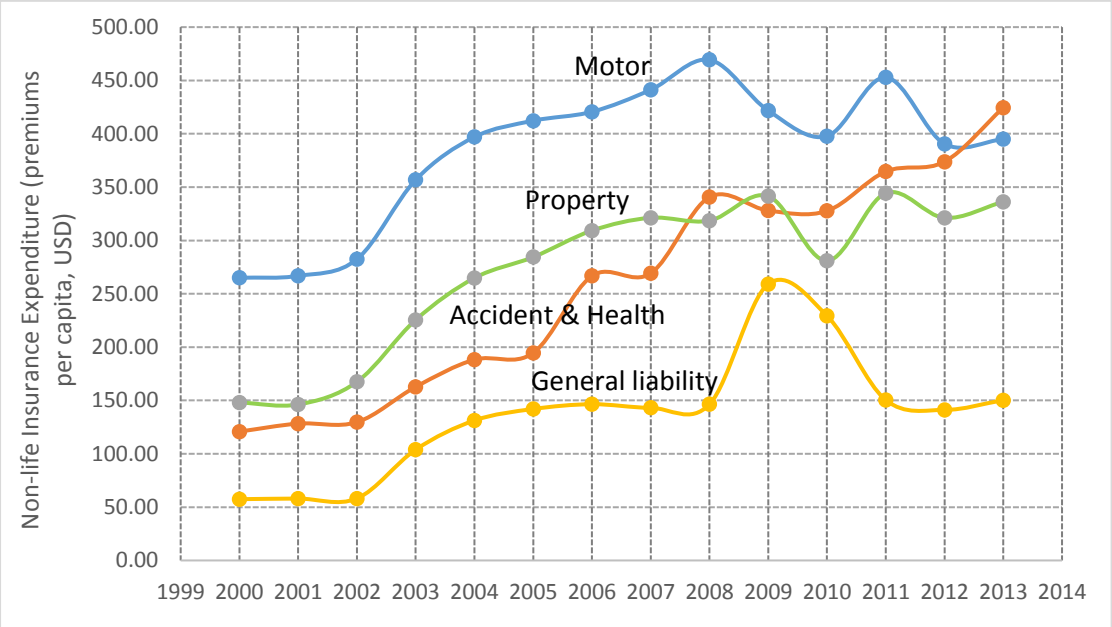

Figure 2. Average non-life insurance expenditure of the 19 OECD economics affected by the GFC across various products, 2000-2013 (in USD).

Source: Non-life insurance expenditure: computed by the authors based on OECD Insurance Statistics (various years).

The dataset obtained from the OECD Insurance Statistics also reveals that the trends of expenditure on property insurance and accident and health insurance have varied widely across some of the OECD countries, in particular in Canada, the United States, the United Kingdom, the Netherlands, and France in the period 2000-2013. For example, there was a sharp rise in expenditure in accident and health

insurance in Canada (about 27% higher than in 2002) due to the Etobicoke gas explosion in Ontario (Swiss Re 2016). In contrast, expenditure on property insurance in the U.K. dropped about 3% and 10% in 2008 and 2010, respectively, due to a strong competition and softening of prices in property insurance market (Swiss Re 2016). These provide strong motivations for this paper.

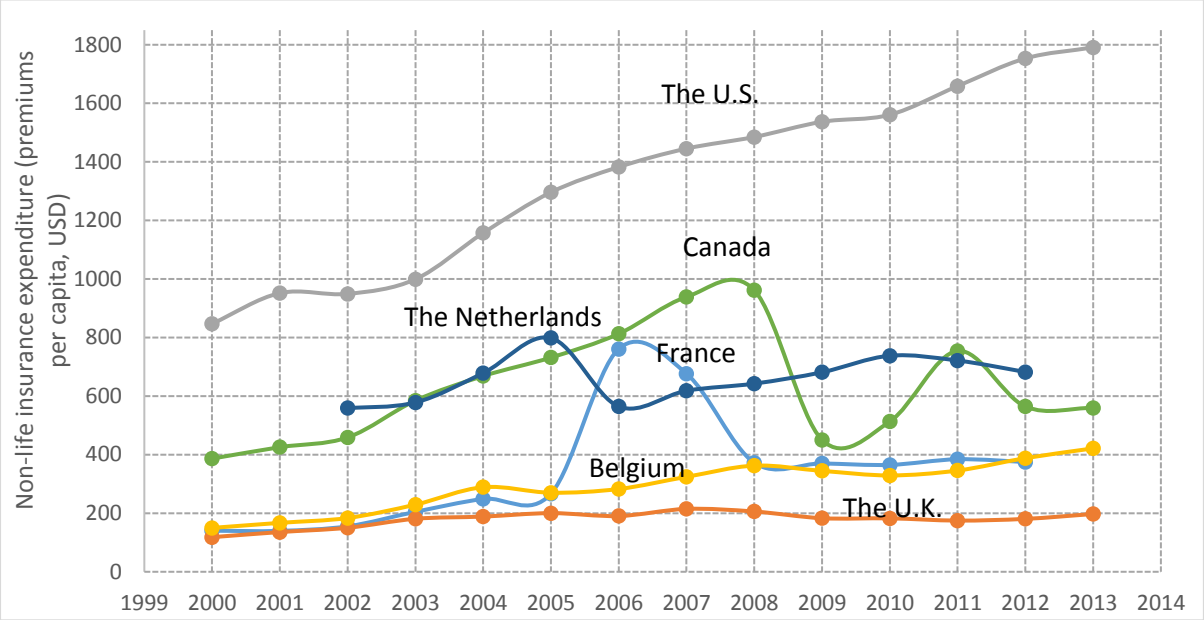

Figure 3. Average accident and health insurance expenditure across the selected countries in the OECD economics, 2000-2013 (in USD).

Source: Non-life insurance expenditure: computed by the authors based on OECD Insurance Statistics (various years).

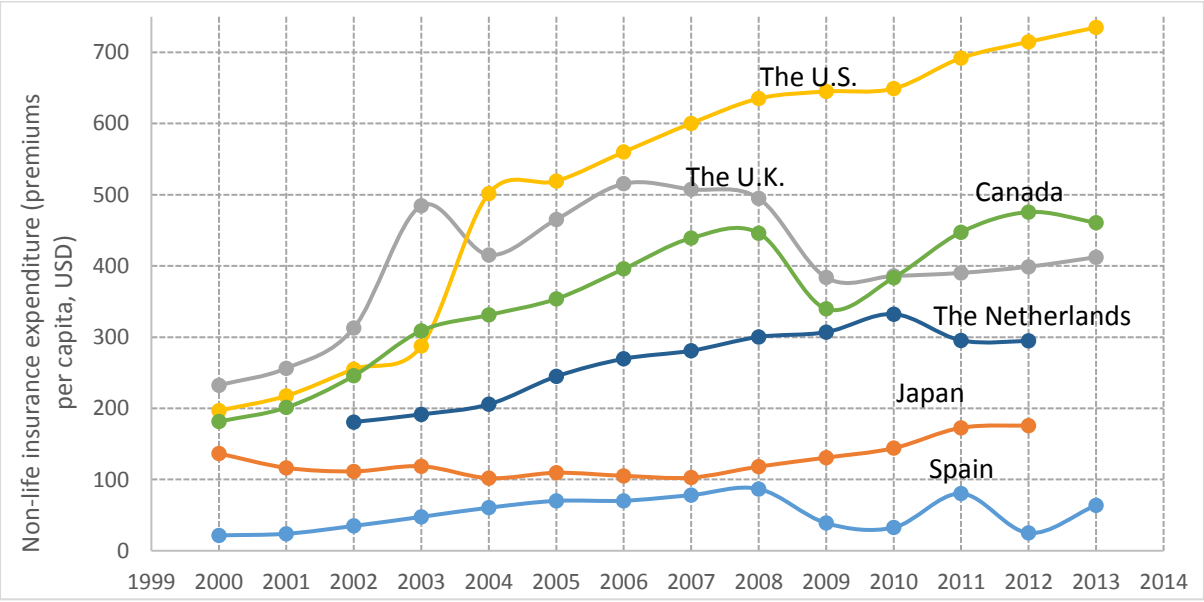

Figure 4. Average property insurance expenditure across the selected countries in the OECD economics, 2000-2013 (in USD).

Source: Non-life insurance expenditure: computed by the authors based on OECD Insurance Statistics (various years).

Apart from choosing specific factors and markets that have been lacking in the related studies (on the determinants of non-life insurance expenditure – see the next section), we also contribute to the literature by applying a comprehensive econometric model for our dynamic panel data analysis. Most of the related papers have used either cross-sectional data models or simple panel data models (Browne et al. 2000; Elango and Jones 2011; Lee and Chiu 2012; Park and Lemaire 2012 and Trinh et al. 2016) to identify the socio-economic factors that influence non-life insurance. However, a dynamic panel data model that includes the one-year-lagged non-life insurance expenditure may be more appropriate in this context, because non-life insurance expenditure arguably depends on past expenditure.[3] Furthermore, the endogeneity problem, which may be caused by omitted variables of economic freedom and the reverse causality between per capita income and non-life insurance expenditure, has been often ignored in previous studies. Feyen et al. (2011) is the only paper to have adopted the system GMM estimation in their analysis of the determinants of non-life insurance premiums. However, they did not treat per capita income as an endogenous regressor and did not include cultural factors as well as financial crisis in the study[4]. Additionally, results of the Hansen test in Feyen et al.'s paper reject indicates that some of instruments may not be valid. These limitations will be resolved in our paper.

Our key findings are as follows. First, in addition to the traditional economic and legal factors, we have found strong evidences for the important roles played by the cultural characteristics such as long-term orientation, individualism, masculinity, and uncertainty avoidance in determining the spending on property insurance and accident and health insurance across the OECD countries (see Appendix Table A1 for the definitions of the variables included in the paper). Second, in the presence of the GFC, the impact of the cultural factors mostly disappeared. Third, per capita income, which has long been regarded as one of the most important drivers of demand for non-life insurance in the literature, failed to explain the spending on accident and health insurance during the GFC. Fourth, lagged insurance expenditure consistently explained current insurance expenditure regardless of the GFC and insurance products. These findings suggest that non-life insurance policies in the OECD countries, in particular the compulsory accident and health insurance, play an important role in the development of the non-life insurance market. The paper therefore provides valuable information for not only various constituents of the insurance sector but also policy makers in the OECD countries.

The rest of the paper is organized as follows. In the next section, a literature review on the determinants of non-life insurance expenditure is provided. Section 3 introduces the empirical model, data, and hypotheses, followed by results and discussions of results in Section 4. Finally, some concluding remarks are provided in Section 5.

II. Literature Review

The empirical study of Sherden (1984) was considered as the first paper to examine the impacts of factors on non-life insurance expenditure. This was followed by studies of Outreville (1990), Browne et al. (2000), Esho et al. (2004), Feyen et al. (2011), Elango and Jones (2011), Park and Lemaire (2012),

[3] Some non-life insurance products such as accident and health insurance, and property insurance only have a waiver of waiting period conditions for renewals of existing policyholders.
[4] Per capita income may have a reverse causality with non-life insurance expenditure. This will be discussed further in next sections.

and Trinh et al. (2016). Basically, determinants of non-life insurance expenditure, based on previous studies, can be grouped into the following factors.

Economic factors

Per capita income (per capita GDP): the positive impact of per capita income on non-life insurance expenditure has been found by most previous papers such as Beenstock et al. (1988), Outreville (1990), Browne et al. (2000), Esho et al. (2004), Feyen et al. (2011), Elango and Jones (2011), Park and Lemaire (2012), and Trinh et al. (2016). However, the magnitudes of coefficients may be biased due to the endogeneity caused by casual effect between per capita income and non-life insurance expenditure, which has been often ignored by earlier papers.

Economic freedom

Basically, there have been five major surveys that measure economic freedom on a systematic basic: (1) the Fraser institute's economic freedom index, (2) Freedom house's economic freedom indicators, (3) the Heritage foundation's indices of economic freedom, (4) the international institute for management development (IMD), and (5) the world economic forum (WEF). However, IMD and WEF will be of more value to business executives because of its emphasis on forecasting growth for developed countries. Meanwhile the economic freedom indexes of Fraser Institute, Freedom house and Heritage foundation are aimed at policymakers and provide valuable information about economic institutions in both developed and underdeveloped countries. Furthermore, almost all indicators, which are used by the Fraser Institute, Freedom house and Heritage, are based on necessary conditions for economic growth. (Hanke and Walters 1997).

The economic freedom index of Fraser institute, which includes five major areas: size of government, legal system and property rights, sound money, freedom to trade internationally and regulation, is used in the literature because of the following reasons. First, Berggren (2003) stated that a large number of variables of the economic freedom index of Fraser institute were derived from secondary sources, therefore, it was easy to verify them. Second, according to Gwartney and Lawson (2003), the index of economic freedom of Heritage Foundation/Wall Street Journal is of less value to researchers in case of analysing the effect of changing economic freedom across time periods. In addition, Indexes of Heritage Foundation/Wall Street Journal are both less precise and less transparent than those of the Fraser Institute. Third, Doucouliagos and Ulubasoglu (2006) claimed that almost all researchers (33 out of 52 papers) used the economic freedom index of the Fraser Institute because it was the most comprehensive in terms of time span. Haan et al. (2006) critically discussed the economic freedom index of the Fraser institute and concluded that indicators of the economic freedom index of Fraser institute are both useful and reliable because of their clear description. Finally, Justesen (2008) used the economic freedom index of Fraser institute because it covered a large number of countries over a long-term period. Similarly, the benefits of economic freedom were also comprehensively analysed by Berggren (2003) and Rode and Coll (2012).

In previous papers, Park et al. (2002) argued that lowering the degree of restrictions on entry into markets will increase the competition of the insurance market. Elango and Jones (2011) used six indicators of Heritage rather than the summary of economic freedom index to investigate the determinants of demand for non-life insurance in emerging markets from 1998-2008 and found a

positive effect of financial freedom and negative impact of business freedom on demand for non-life insurance. Recently, Trinh et al. (2016) have found that economic freedom index of Fraser institute has a highly positive impact on non-life insurance expenditure in both developed and developing countries.

Demographic factors

The study of Esho et al. (2004) used urbanization as a proxy for loss probability and found a positive impact on non-life insurance expenditure. Similarly, Browne et al. (2000) and Park and Lemaire (2012) used urbanization in their studies and found an insignificant impact on demand for non-life insurance. Particularly, Trinh et al. (2016) have found that urbanization has a negative impact on non-life insurance expenditure in developed countries but it has a positive effect in developing countries.

Sociol factors

Browne et al. (2000), Esho et al. (2004), and Trinh et al (2016) used education, which is used as a proxy for risk aversion, in their studies. Browne et al. (2000) found an insignificant impact of education on non-life insurance expenditure while Esho et al. (2004) found a significant positive effect. Trinh et al. (2016) found a negative impact on non-life insurance expenditure in developed countries and a positive effect in developing countries.

Cultural factors

Park et al. (2002) used the former four cultural variables of Hofstede (uncertainty avoidance, individualism, masculinity, and power distance) to examine the effect of socio-cultural variables on insurance expenditure (both for life and non-life sectors). Park et al. found a positive impact of masculinity on insurance expenditure. In non-life insurance sector, the studies of Park and Lemaire (2012) and Trinh et al (2016) examined the effects of culture on non-life insurance consumption. Park and Lemaire (2012) found that in emerging countries with a low power distance value and high in individualism and uncertainty avoidance, demand for non-life insurance had a higher growth than other developing countries that had equal levels of income. Trinh et al. (2016) followed Park and Lemaire (2012) in using the former four cultural variables of Hofstede et al. (2010) and in addition included the fifth and sixth cultural variables of Hofstede which were introduced in a later stage by Hofstede et al. (2010) (long-term orientation and indulgence) and another cultural variable of Minkov (2011) (hypometropia). Trinh et al. found that some of these cultural variables such as hypometropia, long-term orientation, and indulgence are key drivers in explaining expenditure on non-life insurance in developed and developing countries.

Legal system factors

Park and Lemaire (2012) found that common law has a positive impact on demand for non-life insurance while Trinh et al. (2016) found an insignificant effect on non-life insurance expenditure. Previous papers found that Islamic law has a negative impact on demand for non-life insurance (Park and Lemaire 2012; Trinh et al. 2016) and life insurance (Browne and Kim 1993; Ward and Zurbruegg 2002). Kwon (2007) claimed that there are some restrictions for non-life insurance companies caused by Islamic principles in financial services, such as no depreciation of property, no deductibles, and no coinsurance and therefore limit certain forms of insurance (Ward and Zurbruegg 2002).

The effect of the global financial crisis

Mckibbin and Stoeckel (2009) argues that there are three main shocks that capture the GFC: the bursting of the housing bubble in the United States, a sharp rise in the equity risk premium, and a reappraisal of risk by households causing them to discount their future labour income and increase savings and decrease consumption. Ivashina and Scharfstein (2010) showed that new loans to large borrowers and new lending for real investment fell during the peak of the financial crisis of 2008. Naude (2009) mentioned that the U.S. and EU, who were experiencing the most substantial economic slowdown, were at the epicentre of the global financial crisis. In addition, countries with looser credit market regulation and higher income suffered the most from the crisis (Rose and Spiegel 2011). Furceri and Mourougane (2012) found that financial crises in the OECD countries have a negative and persistent effect on potential output. Furceri and Mourougane indicated that about 1.5-2.4% on average of potential output may have declined because of the effects of financial crises, which come mainly from the hit on capital and potential employment. For health care expenditure, Morgan and Astolfi (2015) investigated the impact of the GFC on health care spending across the OECD countries and found that most OECD countries have had a slowdown of health spending growth since 2009.

Harrington (2009) stated that the insurance sector played an important role on the periphery of the crisis. Financial rating agencies publicized downgrades of leading "monoline" mortgage and bond insurers because of their significant losses. Harrington also found that the systemic risk in the non-life insurance is relatively low compared with banking because of the non-life insurers' great amounts of capital. Therefore, the need for broad government guarantees to prevent potential spread of the crisis in the non-life insurance sector was less than in banking. Kamiya et al. (2014) found that the banking crisis has a negative impact on non-life insurance consumption while Yu (2015) concluded that the performance of the insurance companies during the GFC in the US were affected severely due to risk of bankruptcy. Recently, Trinh et al. (2016) found that the global financial crisis has an influence on the direction of socio-economic determinants of non-life insurance expenditure, especially in developed countries.

Table A12 in Appendix provides the summaries of results of determinants of the non-life insurance expenditure.

III. Hypotheses, Data and Empirical Model

Hypotheses

Based on the literature survey, we suggest a number of hypotheses to be tested as below:

H_1: *the higher the degree of lagged non-life insurance expenditure across products, economic freedom, per capita income, education, urbanization, bank development, individualism, uncertainty avoidance, and hypometropia in a country, the higher is the expenditure on aggregated non-life, property, and accident and health insurance products in the OECD countries.*

H_2: *the higher the degree of indulgence, long-term orientation, masculinity, and power distance in a country, the lower the expenditure on aggregated non-life, property, and accident and health insurance products in the OECD countries.*

H_3: *Common law has a positive effect on the expenditure on aggregated non-life, property, and accident and health insurance products in the OECD countries.*

H_4: *the global financial crisis (GFC) has a negative impact on the expenditure on aggregated non-life, property, and accident and health insurance products in the OECD countries.*

Data and Variables

Data

Our study uses an unbalanced panel data covering all 34 OECD countries for the period from 2000 to 2013 (see Table A2 for the list of these countries). Non-life insurance panel dataset, which is disaggregated into property insurance and accident and health insurance, is taken from various issues of OECD Insurance Statistics. We also obtain annual data for an extensive number of explanatory variables from various databases, which are described in Table A1 in Appendix. Following the literature in non-life insurance sector, we take natural logarithm of the non-life insurance's dependent variables, and per capita income, while keeping other variables at their level values for comparing our results with earlier papers.

Variables

Dependent variable: our study uses density of non-life insurance, which is calculated as the ratio of gross written premiums to total population, provided by OECD Insurance Statistics as a main proxy for non-life insurance expenditure. We use this variable due to its reflecting the spending of individual's average amount for each non-life insurance product. Furthermore, disaggregating non-life insurance data into property and accident and health insurance, which has been ignored in previous papers, helps avoid a loss of information. Table A1 in Appendix provides summarily definitions for each product of non-life insurance.

Independent variables: we use the following independent variables: economic freedom, per capita income, bank development, education, urbanization, global financial crisis, culture, and legal system.

Methodology

The reverse causality problem

Most all previous papers have found a bi-directional relationship between non-life insurance and economic growth. Patrick (1966) claimed that economic growth may generate more demand for financial services and lead to the development of these services, which has also contributed to the growth of the economy. Ward and Zurbruegg (2000), Lee (2011), Pradhan et al. (2015), and Alhassan and Biekpe (2016) provide the evidence of a bi-directional causal relationship between non-life insurance development and economic growth in both the short run and long run. As such, using per capita income in our paper as main explanatory variable may cause a reverse causality problem between this variable and non-life insurance expenditure. To check this problem in the sample of the OECD countries, our paper carries out the instrumental variables (IV) model.

Empirical model: followed Brückner (2013), we use instrumental variables (IV) regression to examine the relationship between per capita income and non-life insurance expenditure. The empirical model is suggested as follows[5]:

$$\Delta\log(INS_{i,t}) = \alpha_i + b_t + c\,\Delta\log(INC_{i,t}) + e_{i,t} \quad (1)$$

$$\Delta\log(INC_{i,t}) = h_i + i_t + k\,\Delta\log(INS_{i,t}) + u_{i,t} \quad (2)$$

where : $\Delta \log(INS_{i,t})$ is the log-change of non-life insurance expenditure for country I in year t ; $\Delta \log(INC_{i,t})$ is the log-change of per capita income for country I in year t; a_i, h_i are country fixed effects that capture long-run (unobservable) differences across countries; b_t, i_t are year fixed effects; $e_{i,t}$, $u_{i,t}$ are error terms.

Estimation strategy: a good instrument should correlate with the key independent variable but not with the main dependent variable. To estimate the impact of per capita income on non-life insurance expenditure, we use CO_2 emissions (CO2, metric tons per capita) and gross fixed capital formation (GCF, % of GDP) as instrumental variables in the two-stage least square IV (2SLS-IV) estimation[6].

$$\Delta \log(INS_{i,t}) = \alpha_i + b_t + c\,\Delta \log(INC_{i,t}) + e_{i,t}$$

Similarly, we use temperature (TEM, ^{0}C) and merchandise trade (MER, % of GDP) as instrumental variables in the 2SLS-IV estimation to estimate the impact of non-life insurance expenditure on per capita income[7].

$$\Delta \log(INC_{i,t}) = h_i + i_t + k\,\Delta \log(INS_{i,t}) + u_{i,t}$$

A system GMM model for the determinants of the non-life insurance expenditure

This paper uses the system GMM estimator developed by Holtz-Eakin et al. (1988), Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). We consider the following regression equation:

$$\ln INS_{i,t} = \alpha \ln INS_{i,t-1} + \beta_1 \ln INC_{it} + \beta_2 EFI_{it} + \beta_3 BSD_{it} + \beta_4 EDU_{it} + \beta_5 URB_{it} + \beta_6 CUL_i + \beta_7 LSY_i + \phi D_{time} + \varepsilon_{i,t} \quad (3)$$

where: $\ln INS_{it}$ is the natural logarithm of non-life insurance expenditure (density) for country i in year t; EFI_{it} is index of economic freedom for country i in year t; $\ln INC_{it}$ is the natural logarithm of per capita GDP for country i in year t; BDV_{it} is the bank development for country i in year t; EDU_{it} is school enrolment, tertiary (% gross); URB_{it} is urbanization for country i in year t; CUL_i is an array of cultural variables (Hofstede and Minkov) that are time invariant, only vary across countries; LSY_i is an array of dummy variables (Common law) that vary across countries. D_{time} is an time invariant array of annual

[5] Excluding other explanatory variables in the equation may lead to a biased magnitude of coefficients; we, however, followed the literature by only including non-life insurance and per capita income variable to examine their relationship.

[6] Narayan et al. (2016) have found a significant relationship between per capita income and CO2 emissions. Krkoska (2001) also showed that higher gross fixed formation leads to greater economic growth.

[7] Some previous papers found significantly effects of temperature on mortality (such as Curriero et al. 2002; Deschenes and Greenstone 2007) and on crime (such as Field 1992; Jacob et al. 2007). These impacts may affect the risk aversion of customers in spending non-life insurance products. Elango and Jones (2011) found that merchandise trade has a positive impact on non-life insurance expenditure.

dummy variables used to control the effect of time on non-life insurance expenditure; α, β_1 to β_7, and ϕ are vectors of coefficients, and ε_{it} is the error term for country i in year t.[8]

Equation (3) can be written using shorter notations as follows:

$$y_{i,t} = \alpha y_{i,t-1} + \beta \mathbf{X}_{it} + \mu_i + \varepsilon_{i,t} = \alpha y_{i,t-1} + \beta \mathbf{X}_{it} + \eta_{i,t} \quad (4)$$

where μ_i represents time-invariant country specific factors such as CUL_i and LSY_i while **X** is the vector of explanatory variables other than the lagged non-life insurance expenditure or its components (i.e. property insurance or accident and health insurance expenditure)[9]. Note that by definition $\mu_i + \varepsilon_{i,t} \equiv \eta_{i,t}$.

Since $y_{i,t-1}$ is likely to be correlated with μ_i and consequently with the error term $\eta_{i,t}$, estimating (4) by OLS yields biased coefficient estimate of the lagged value of the dependent variable, $y_{i,t-1}$. In order to eliminate this source of endogeneity problem we can apply the differencing operation to equation (4) in order to eliminate the country-specific effect μ_i and obtain the following equation:

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta(\mathbf{X}_{it} - \mathbf{X}_{i,t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (5)$$

Note that under the assumption that the error term, ε, is not serially correlated and that the explanatory variables, $\mathbf{X}_{i,t-s}$ where $s \geq 2$, is exogenous to the future realizations of the error term equation (5) can be estimated by the GMM dynamic panel estimator using the following two moment conditions:

$$E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \text{ for } s \geq 2 \text{ and } t=3,\ldots, T, \quad (6)$$

$$E[\mathbf{X}_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \text{ for } s \geq 2 \text{ and } t=3,\ldots, T. \quad (7)$$

Note that moment conditions (6) and (7) mean that we use lagged values of the dependent variable and the lagged values of the explanatory variables as our instruments. Since it is our purpose in this paper to estimate the effects of both time variant and time-invariant factors such as cultural variables and common law variable the evident shortcoming of estimating equation (5) by using the two moment conditions (6) and (7) is that regression (5) in differences already eliminates these time-invariant explanatory variables. Another shortcoming of using the two moment conditions (6) and (7) to estimate equation (3) that is also pointed out by Blundell and Bond (1998) is that lagged levels of explanatory variables can be weak instruments for the regression in differences.

In order to address these shortcomings we follow Arellano and Bover (1995) and Blundell and Bond (1998) to combine the two moment conditions (6) and (7) from regression (5) in differences with the following two moment conditions from regression (4) in levels:

$$E[(y_{i,t-s} - y_{t,t-s-1})(\mu_i + \varepsilon_{i,t})] = 0 \text{ for } s=1 \quad (8)$$

$$E[(\mathbf{X}_{i,t-s} - \mathbf{X}_{t,t-s-1})(\mu_i + \varepsilon_{i,t})] = 0 \text{ for } s=1 \quad (9)$$

Moment conditions (6) to (9) are used in the GMM procedure to obtain consistent estimates of both time-variant and time-invariant explanatory variables of **X** and μ_i.

Following the literature, we first take natural logarithm of the non-life insurance's dependent variables, and per capita income, while keeping other variables at their level values. This is because we mainly

[8] In our results, we do not show the estimated coefficients on the year dummy variables because the effects of time are not the focus of this study.
[9] **X** can also include time dummy for GFC as later we estimate the effect of GFC on non-life insurance expenditure.

concentrate on the sign of coefficients of our explanatory variables on the dependent variables. Additionally, this allows us to compare our results directly with previous studies. Second, as explained in literature section, we extend models (3) above by adding banking crisis variable, which is proxied for the global financial crisis (GFC), to examine the effect of the GFC on non-life insurance expenditure in the 19 OECD countries happened the GFC.

As our estimation strategy, in addition to the system GMM estimator, we also use the pooled OLS and IV regressions to show the differences about the magnitude and sign of coefficients between OLS, IV regressions and the system GMM estimator due to the endogeneity problem. Our estimate strategy is as follows: first, we run the pooled OLS regression. Then we apply two-stage least squares (2SLS) estimators using instrumental variables including trade openness, CO_2 emissions, and gross fixed capita formation variables as main instrumental variables (IV) to account for endogeneity[10]. Next, the system GMM estimator is applied to overcome disadvantages of the OLS regressions including the causality and omitted variables[11]. Using too many lagged instruments in system GMM estimator may yield a p-value of 1 of Hausen or Sargan test and lead to rejecting the null hypothesis implausibly. This may cause biased coefficient estimates and fail to check the validity of instruments. Therefore, the number of instruments need to be reduced to deal with this problem (Bowsher 2002; Roodman 2009b). Following Roodman (2009b), we reduce the quantity of instruments by using higher orders and/or collapsing of lags of instruments as our main group of instruments for system GMM estimator. Valid instrumental variables must fail to reject the null of hypotheses of the specification tests. In this paper, we carry out the one-step system GMM estimators using xtabond2 in STATA designed by Roodman (2009a).[12]

Specification tests

We employ two specification tests to evaluate the consistence of the system GMM estimator. The first test is the test of overidentifying restrictions or the validity of the instruments. We apply the Hansen/Sargan test for checking the joint validity of the instruments. The instruments are valid if this test accepts the null hypothesis of the validity of the instruments. The second test is the test of second-order serial correlation. To support the estimated model, both the test of overidentifying restrictions and second-order serial correlation must be fail to reject the null hypothesis. For IV estimation, we use two tests: (1) Sargan test for checking validity of the instruments, (2) Weak identification test. Instruments are weak if the first F value of this test is smaller than 10.

[10] Followed the literature, these instruments, which have a correlation with per capita income and economic freedom and may not correlate with non-life insurance expenditure, are used to address the endogeneity problem.
[11] We apply Stata command "Xtabond2" developed by Roodman (2009a).
[12] We use the system one-step GMM estimator because it helps us to examine time-invariant variables as cultural ones. Furthermore, using two-step estimator may be less reliable than one-step estimator (Bond 2002) and may lead to biased parameters and standard errors in term of a small sample (Windmeijer 2005).

IV. Results and discussions

The reverse causality problem

The impact of per capita income on the non-life insurance expenditure

Results in Table 1 show the baseline two-stage least square (2SLS) estimates of the impact that per capita income has on non-life insurance expenditure. Column (1) in Table 1 presents the first-stage estimates that link CO2 emission and gross fixed capital formation to per capita income. Results in column (1) show that these two instruments have a significant impact on per capita income and yield a first-stage F-statistic of about 18.38. Column (2) in Table 1 is the least squares (LS) estimates of the impact that per capita income has on non-life insurance expenditure. This column is used for comparison purposes with other second-stage estimates presented in columns (3)-(5). Results in column (2) show that per capita income has a significant effect on non-life insurance. Nevertheless, the LS estimates in column (2) cannot taken if the causal effect between non-life insurance expenditure and per capita income exits. In order words, if non-life insurance expenditure also has a significantly impact on per capita income, the results in column (2) will be biased. Column (3) therefore presents the 2SLS estimate using the CO2 emission and gross fixed capital formation as excluded instruments. The results in second-stage estimate in column (3) show that the impact of per capita income on non-life insurance expenditure is significantly positive. The p-value of the Sargan test on the overidentification restrictions reported in column (3) does not reject the hypothesis. This indicates that the instruments are uncorrelated with the second-stage error. The magnitude of the coefficient in the 2SLS regression in column (3) is smaller than that in the LS estimates in column (2) proves that the results of the LS estimates are biased. This finding also supports by the Hausman test which rejects the hypothesis that the LS estimate is equal to the 2SLS estimate. Columns (4) and (5) in Table 1 show 2SLS estimates when the instruments are included to the right-hand side of the regression. These regressions estimate directly the effect of the instruments on non-life insurance expenditure conditional on per capita income. As can be seen, the coefficients on the CO2 emission and gross fixed capital formation have a small size and insignificant impact on non-life insurance expenditure. This supports for the validity of the instruments.

Table 1. The impact of per capita income on the non-life insurance expenditure

	ΔlnINC		**ΔlnINS**		
	(1)	(2)	(3)	(4)	(5)
	LS	LS	2SLS	2SLS	2SLS
ΔlnINC		0.980***	0.946***	1.007***	0.738
		(0.068)	(0.222)	(0.262)	(0.529)
ΔlnCO2	0.199***			-0.054	
	(0.077)			(0.121)	
ΔlnGCF	0.314***				0.084
	(0.061)				(0.194)
Durbin-Wu-Hausman/Hausman test for endogeneity, p-value	–	0.000	0.000	–	–
Sargan test for overidentification restrictions of the instruments (p-value)	–	–	0.659	–	–
First stage, F-stat.	–	–	18.38	26.53	6.81
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	297	387	297	297	297
Country	34	34	34	34	34

*Notes: ***, **, and * indicate the parameters are significant at the 1%, 5%, and 10% level, respectively. All variables are in natural logarithms.*

The effect of non-life insurance expenditure on per capita income

Similarly, we also carry out regressions in columns (1)-(5) of Table 2 based on the baseline 2SLS estimates that link the non-life insurance expenditure to per capita income. The results in column (3) of Table 2 using the temperature and merchandise trade as excluded instruments show that non-life insurance expenditure has a significant impact on per capita income. The first-stage F-statistic of about 29.56 proves the strength of the instruments. The p-value of the Hausman test shows that the different coefficients between the LS and 2SLS estimate is significant. In addition, the insignificant coefficients of the instruments that are added to the regressions in column (4) and (5), together with the p-value of Sargan test in column (3), support that the instruments are valid.

In summary, results of columns (4) in Table 1 and Table 2 show that there is a reverse causality between non-life insurance expenditure and per capita income[13]. Based on the coefficients of non-life insurance expenditure and per capita income in column (4) of both Table 1 and Table 2, we find that the LS estimates of the effect that per capita income on non-life insurance expenditure is upward biased[14]. This finding is consistent with previous papers such as Ward and Zurbreuugg (2000) and Lee (2011). In addition, results based on 2SLS-IV regressions also show that the influence of per capita income on non-life insurance expenditure is greater than the impact of non-life insurance expenditure on per capita income. This finding is consistent with the results in Table A5 in Appendix and the study of Lee (2011). As such, in our regression, there are two endogenous variables including economic freedom and per capita income that need to be addressed in the main regression.[15]

Table 2. The effect of non-life insurance expenditure on per capita income

	ΔlnINS		**ΔlnINC**		
	(1)	(2)	(3)	(4)	(5)
	LS	LS	2SLS	2SLS	2SLS
ΔlnINS		0.363***	0.868***	0.875**	0.698*
		(0.0253)	(0.096)	(0.099)	(0.405)
ΔlnTEM	0.063			-0.011	
	(p-value=0.124)				
	(0.041)			(0.031)	
ΔlnMER	-0.714***				-0.126
	(0.095)				(0.294)
Durbin-Wu-Hausman/Hausman test for endogeneity, p-value	–	0.000	0.000	–	–
Sargan test for overidentification restrictions of the instruments (p-value)	–	–	0.719	–	–
First stage, F-stat.	–	–	29.56	56.94	2.38
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	347	387	347	347	347
Country	34	34	34	34	34

[13] For robustness checking, we also found a reverse causality between non-life insurance expenditure and per capita income using the panel unit-root tests, the panel error-correction–based cointegration tests of Westerlund, Pedroni's cointegration tests, and panel causality test results (Persyn and Westerlund 2008). Due to length saving, we only include Table of the panel causality test results in Appendix A5.

[14] From Eq. (1) and (2), we have the covariance between the log-change of per capita income and the error term as follow: $Cov(\Delta log(INC_{i,t}), e_{i,t}) = (c/(1-c.k))$. If $Cov(\Delta log(INC_{i,t}), e_{i,t}) > 0$ (<0), the OLS estimates are expected to be larger (smaller) than the IV and GMM estimates.

[15] We also checked the reverse causality problem caused by economic freedom. Results in Table A6, and Table A7 based on IV regression show that economic freedom has a significant impact on non-life insurance expenditure. Finding in Table A8 based on panel causality test support this result. In order words, economic freedom may not cause the reverse causality problem in short-run. However, Trinh et al. (2016) found that economic freedom may cause the endogeneity problem due to omitted variables. Therefore, we treat economic freedom variable as endogenous variable because our sample countries are relevant to the sample of developed countries in the study of Trinh et al. (2016).

*Notes: ***, **, and * indicate the parameters are significant at the 1%, 5%, and 10% level, respectively. All variables are in natural logarithms*

Determinants of non-life insurance expenditure in all OECD countries

We investigate the impact of socio-economic determinants on both aggregated non-life insurance and the non-life insurance expenditure across products including property insurance and accident and health insurance based on pooled OLS, IV regression, and the system GMM estimator. The results are reported in Table 3. The results of statistic tests and running regressions will be discussed in turn.

Statistic tests

Results of statistic tests in Table 3, 4, and 5 show that instrumental variables used in the system GMM estimator are not correlated with the residuals because the p-values of Sargan and Hansen tests do not reject the joint null hypothesis. In order words, these instruments are valid. Additionally, the p-values of Arellano-Bond test for AR(2) in columns (1c) in Table 3, 4, and 5 indicate that the errors in the difference equation do not exhibit second-order autocorrelation. For IV regression, the p-values of Sargan test in columns (1b) in Table 3, 4, and 5 show that instruments in IV regressions are valid. However, these instrument are not strong because the values of the first F in the weak identification test are close to 10.

From the above analysis, we can choose the system GMM estimator as a baseline model to solve the endogenous problems caused by the reverse causality and omitted variables. Findings based on the system GMM estimation in Table 3, 4, and 5 prove that the influences of various factors on non-life insurance expenditure differ greatly among products. These differences will be discussed in turn.

Aggregated non-life insurance expenditure

Findings in Table 3 based on the system GMM estimator indicate that the estimated coefficients of cultural variables are insignificant. A possible explanation for this may be due to contribution of different non-life insurance products that lead to an ambiguous effect. This will be discussed in next section. Our empirical results show that the one-year-lagged aggregated non-life insurance expenditure, economic freedom, and per capita income have a statistically significant positive impact on non-life insurance expenditure. These results are consistent with our hypothesis H_1 and support the studies of Outreville (1990), Browne et al. (2000), Park et al. (2002), Esho et al. (2004), Chui and Kwok (2008), Elango and Jones (2011), Feyen et al. (2011), Park and Lemaire (2012), and Trinh et al. (2016). There can be no doubt that spending on non-life insurance products in the prior year may induce people to increase expenditure on these products in later stage. This is because using non-life insurance products continuously may help people to get further benefits such as reducing the renewal costs and waiving the waiting periods. More economic freedom and higher per capita income, which increase both wealth and the value of risky properties, may induce people to increase their spending on non-life insurance products. However, the positive coefficient of per capita income in our paper is inconsistent with the study of Kamiya et al. (2014). A possible explanation may be that Kamiya et al. used pooled OLS and fixed-effects regressions as the baseline and this may yield biased results due to the endogeneity problem caused by per capita income.

Interestingly, the bank development and urbanization have a significantly negative impact on aggregated non-life insurance expenditure. These results are consistent with the results of Trinh et al. (2016) and may be explained in the context of our study as follows. The negative impact of bank development on non-life insurance expenditure can be due to a decline in the level of investments during

and after the GFC. Furceri and Mourougane (2012) and Rioja et al. (2014) showed that there is a reduction in the level of investment when having a shock to bank lending (or credit supply) during the GFC. In addition, Demirgüç-Kunt et al. (2006) claimed that banks have a tendency to shift away from higher-risk and higher-return investments towards safer activities during the post-crisis period. As a result, a decline in investments may lead to a decrease in non-life insurance expenditure. The negative sign of coefficient of bank development in our study may arise due to the dominant effect of bank development in the post-crisis period compared to that in the pre-crisis period, which will be explored later in this section. The negative coefficient of urbanization in the OECD countries can be due to people living in the higher urban areas feeling more secure than people living in less urbanised areas. Lall and Deichmann (2010) claimed that urban hazard risks can be reduced with everyday city management by many solutions such as maintenance of public services, smart land use management, and increased supply of formal housing in safe areas. Furthermore, Kohara (2001) showed that individuals living in urban areas even if they may suffer less from loss of income compared with rural residents, their expenditure for related non-life insurance products may still decline. Finally, the impact of common law on aggregated non-life expenditure is positive. This result supports the hypothesis H_3 and provides an evidence that creditors' rights and shareholders in common law countries are protected better than that of other countries (see La Porta et al. 1998; Park and Lemaire 2012)

Table 3. Determinants of aggregated non-life insurance expenditure in the OECD countries

	OLS (1a)	IV (1b)	System GMM (1c)
Lagged lnINS	0.9098***	0.981***	0.6584***
	(0.0192)	(0.044)	(0.1382)
EFI	0.0314	0.231***	0.2120*
	(0.0233)	(0.069)	(0.1253)
LnINC	0.1096***	-0.145	0.6815***
	(0.0326)	(0.098)	(0.2219)
BDV	-0.0001	-0.000*	-0.0006**
	(0.0001)	(0.000)	(0.0003)
EDU	-0.0002	-0.001	-0.0048
	(0.0006)	(0.001)	(0.0031)
URB	-0.0014	-0.001	-0.0086*
	(0.0010)	(0.001)	(0.0049)
IND	-0.0129	0.128	-0.0816
	(0.0602)	(0.087)	(0.2225)
IDV	0.0331	0.087	-0.0139
	(0.0508)	(0.063)	(0.2719)
LTO	0.1003*	-0.073	0.2985
	(0.0566)	(0.089)	(0.1886)
MAS	-0.0999**	-0.203***	-0.3528
	(0.0457)	(0.070)	(0.2168)
UAI	0.0430	-0.038	0.2624
	(0.0522)	(0.068)	(0.2335)
PDI	0.0354	0.063	0.3078
	(0.0449)	(0.061)	(0.1968)
HPM	0.0051	-0.103**	0.0095
	(0.0196)	(0.041)	(0.0865)
CML	0.0619*	-0.096	0.2553*
	(0.0334)	(0.060)	(0.1363)
Observations	295	247	295
R-squared	0.9924	0.990	0.978
Weak identification test (1st F)		11.53	–
Sargan test (p-value)		0.458	0.141
Hansen test (p-value)		–	0.674
Arellano-Bond test for AR(2) in differences (p-value)		–	0.974

*Note: *,**, and *** indicate significance at the 10%, 5% and 1% level, respectively. Numbers in brackets show standard errors. Constant and year fixed effects are included but not reported here. Number of instruments of GMM estimator are reduced by using higher orders and/or collapsing of lags of instruments in order to satisfy the specification tests.*

Property insurance expenditure

We turn now to discuss the determinants of property insurance expenditure in the OECD countries. Similar to the cases of aggregated non-life, results in Table 4 based on the system GMM estimator show that the impacts of the one-year-lagged property expenditure, economic freedom, and per capita income on property insurance expenditure are positive and support hypothesis H_1. Notably, bank development, education, and urbanization have a negative impact on property insurance expenditure and inconsistent with the hypothesis H_1. These contradictions can be explained as follows. Similar to the case of aggregated non-life insurance, the negative sign of coefficient of bank development may be due to a decline in property sales caused by a drop in investments during the post-crisis period and thus a decrease in non-life insurance expenditure. Furthermore, the negative influence of bank development may be driven by the effect of the global financial crisis since 2007. The significant negative impact of the banking crisis on non-life insurance consumption was found in a related study by Kamiya et al. (2014). Trinh et al. (2016) also found significant changes in the determinants of non-life insurance expenditure during GFC. In addition, Rose and Spiegel (2011) claimed that countries with looser credit market regulation and higher income suffered the most from the crisis. The impacts of the GFC on non-life insurance expenditure will be discussed later.

Interestingly, the impact of education on property insurance expenditure in the OECD countries is significantly negative. This is inconsistent with our hypothesis H_1 but supports the finding based on OLS regression of Zhu et al. (2011) and Outreville (1990). Our hypothesis suggests that a higher educated individual should have to a higher awareness of risks and spend more on property insurance. However, highly educated people may also avoid risks by installing equipment such as fire extinguishers, smoke detectors, and security cameras and managing risks themselves as a part of the self-insured plan before purchasing property insurance. Hence, their properties may have a low risk rather than others and thus their spending on this product may be low. According to Swiss Re (2016), high natural catastrophes losses, which can be covered in property insurance policies, may lead to a rise of price of property insurance. This may affect negatively the demand for this product. For example, Australia experienced a 6% fall in property insurance expenditure in 2009 due to a rise of premium rates after major losses arising from weather events in particular the Victoria bush fire in early 2009 (Swiss Re 2016). Additionally, Outreville (1990) also argued that higher education might not impact on non-life insurance expenditure at the earlier stage of development but does later. Another explanation is that education has a high correlation with some of other explanatory variables such as masculinity and this may yield biased results[16].

Regarding urbanization, the results in Table 4 indicate that urbanization has a negative impact on property insurance expenditure. This finding is inconsistent with hypothesis H_1 and may be that people living in areas with higher urbanization in the OECD countries may spend less on non-life insurance products expenditure due to more security in urban areas explained earlier, although these areas may be affected more serious by economic and financial crisis than other areas. Another possible explanation is that a drop in property sales in areas with a high degree of urbanization where there is a high concentration of properties may be more serious than a drop in proper ty sales in a less urbanizing area especially during the GFC. For example, the expenditure on property insurance in Spain in 2010

[16] We examine this problem by dropping masculinity variable and undertaking a regression using the system GMM estimator. Results show that the estimated coefficient of education variable becomes insignificant.

decreased by 12% due to the weak economic conditions during the GFC (OECD Insurance Statistics, 2015a; Swiss Re 2016).

For cultural variables, Table 4 show some interesting results. The positive impact of individualism on property insurance expenditure is consistent with hypothesis H_1 and supports the aggregating data-based study of Park and Lemaire (2012), and Trinh et al. (2016) These results may arise because individuals living in higher individualism countries such as the U.S., the U.K., and the Netherlands are wealthier and they may spend more on non-life insurance products (Hofstede 1983). Furthermore, Park and Lemaire (2012) claimed that people living in countries with higher individualism may tend to have more non-life insurance products to protection.

Similar to the case of accident and health insurance, the empirical results in Table 4 also prove that long-term orientation has a positive influence on property insurance expenditure. This finding is inconsistent with our hypothesis H_2 and the result of Trinh et al. (2016). A possible explanation may be that individuals in the OECD countries may choose property insurance covering all damages or loss of property caused by fire, storm, natural forces, land subsidence, and theft due to the desire to protect their family and support their optimistic outlook oriented towards the future. Our empirical finding also shows that masculinity has a significant negative effect on property insurance expenditure. This result is consistent with hypothesis H_2 and suggests that men in high masculine countries may focus on their material success, such as career and business, while women may focus on looking after of their family and as such, the family unit may consume less on property insurance expenditure given the limited income and specific roles of men and women[17] (Hofstede et al. 2010). Finally, the positive sign of coefficient of uncertainty avoidance in term of property insurance is consistent with hypothesis H_1 and support the aggregated non-life-based findings of Park and Lemaire (2012). People in the OECD countries may be willing to buy property insurance to avoid uncertain situations.

[17] Non-life insurance expenditure in some of OECD countries with a high masculinity index was lower than that of countries with a low masculinity index. For instance, Slovakia had a masculinity index which was 7.9 times higher than that of the Netherlands, however, the Netherlands' non-life insurance expenditure was 16.8 times higher than that of Slovakia in 2011.

Table 4. Determinants of property insurance expenditure in the OECD countries

	OLS (1a)	IV (1b)	System GMM (1c)
Lagged lnINS	0.8801***	0.911***	0.8651***
	(0.0311)	(0.049)	(0.0442)
EFI	0.0949	0.059	0.1054*
	(0.0627)	(0.178)	(0.0611)
LnINC	0.1803**	0.112	0.2201**
	(0.0707)	(0.159)	(0.1080)
BDV	-0.0006**	-0.000	-0.0006**
	(0.0002)	(0.000)	(0.0003)
EDU	-0.0039**	-0.002	-0.0043**
	(0.0016)	(0.002)	(0.0021)
URB	-0.0090***	-0.009***	-0.0099**
	(0.0026)	(0.003)	(0.0039)
IND	0.2256	0.242	0.2307
	(0.1555)	(0.207)	(0.1629)
IDV	0.6694***	0.687***	0.7105***
	(0.1595)	(0.181)	(0.2296)
LTO	0.2754*	0.269	0.2988*
	(0.1480)	(0.171)	(0.1525)
MAS	-0.3331***	-0.246	-0.3546***
	(0.1121)	(0.171)	(0.1245)
UAI	0.3426**	0.286**	0.3756**
	(0.1386)	(0.142)	(0.1699)
PDI	0.0552	0.108	0.0707
	(0.0999)	(0.106)	(0.0621)
HPM	-0.0074	0.012	-0.0042
	(0.0483)	(0.093)	(0.0370)
CML	0.1185	0.067	0.1306
	(0.0823)	(0.120)	(0.0862)
Observations	274	230	274
R-squared	0.9708	0.973	0.942
Weak identification test (1st F)		9.45	–
Sargan test (p-value)		0.863	0.145
Hansen test (p-value)		–	1.000
Arellano-Bond test for AR(2) in differences (p-value)		–	0.181

*Note: *,**, and *** indicate significance at the 10%, 5% and 1% level, respectively. Numbers in brackets show standard errors. Constant and year fixed effects are included but not reported here. Number of instruments of GMM estimator are reduced by using higher orders and/or collapsing of lags of instruments in order to satisfy the specification tests.*

Accident and health insurance expenditure

We next analyse the results for determinants of accident and health insurance expenditure in the OECD countries. As can be seen from Table 5, finding based on the system GMM estimator prove that the estimated coefficient of the one-year-lagged accident and health insurance expenditure is significantly positive. This result is consistent with hypothesis H_1 and the result of aggregated non-life insurance, and suggest that using this product in earlier year may induce people to increase spending on it in later year. For example, to be covered for pre-existing conditions in medical expenses, which are one of the benefits of accident and health insurance, policyholders must satisfy the waiting period conditions. This may not apply for renewed policyholders, who have enrolled yearly. According to the Kaiser Family Foundation (2012), insurers may have the right to deny enrolment to those individuals with their pre-existing conditions, which are health problems or medical conditions that existed before individuals use health insurance policies. Insurance companies may also charge such individuals higher premiums but the waiting period conditions must be applied. In the U.S., applicants for health insurance are required to have at least 18 months of past health insurance coverage and the number of coverage gap days

cannot be less than 63 days. The study of Chatterji et al. (2016) found that expanding coverage options for pre-existing conditions for children in the U.S. may raise the job mobility of their parents. Additionally, buying accident and health insurance yearly may also help people to reduce the renewal costs.

Interestingly, economic freedom has a negative effect on accident and health insurance expenditure. This result is inconsistent with hypothesis H_1 and can be explained by the quality of the national health care systems in OECD countries, which are primarily publicly funded by government through taxation. Miller et al (2014) claimed that the performance of healthcare services in high economic freedom countries may increase[18]. National insurance plans in the OECD countries may cover the following benefits: treatment by health professionals, and treatment and accommodation in a public hospital. They, therefore, may help people to cover health risks and decrease spending on accident and health insurance. The finding in Table 5 also indicates that per capita income has a positive influence on accident and health insurance expenditure. This result is consistent with hypothesis H_1 that higher income per capita increases accident and health insurance expenditure.

For the cultural effects, the empirical results in Table 5 based on the system GMM estimator support the view that long-term orientation has a positive influence on accident and health insurance expenditure and inconsistent with our hypothesis H_2. This finding may be explained as follows. In societies with high long-term orientation, people have an optimistic outlook oriented toward the future. They are encouraged to be thrifty and invest in education, this together with the duty of financial support for their parents (Hofstede et al. 2010). As such, non-life insurance products regarding accident and health insurance may be more relevant to those with an optimistic outlook and who wish to take care of their family. In order words, individuals in the OECD countries may choose accident and health insurance as a way to protect their dependents against risks. In the life insurance sector, Park and Lemaire (2011) also found that long-term orientation has a significantly positive effect on the demand for the aggregated life insurance.

Finally, common law has a positive effect on accident and health insurance expenditure. This finding supports the hypothesis H_3 and can be explained as follows. The right of having a health policy of parents to cover pre-existing conditions for their children is well protected by some of the OECD countries with the common law system. The policy makers may issue policies to protect the right of having a health insurance policy of parents whether or not their children have pre-existing conditions. In order words, their children would be covered by the insurance policy even that these children have the chronic illness, cancer or disability. These policies may induce people to increase the spending on accident and health insurance. For example, in the U.S., the Patient Protection and Affordable Care Act (ACA), enacted in March 2010, requires all private health insurance companies to not to increase the premium surcharges or not to refuse to enrol children due to their pre-existing conditions. Prior to ACA, the Consolidated Omnibus Budget Reconciliation Act of 1985 (COBRA) and the Health Insurance Portability were also designed to ensure the quality of health insurance coverage for workers when moving to other companies (Chatterji et al. 2016).

[18] Health care providers in Netherlands provide services 24 hours a day, 7 days a week by medical professionals (Bjornberg 2015).

Table 5. Determinants of accident and health insurance expenditure in the OECD countries

	OLS (1a)	IV (1b)	System GMM (1c)
Lagged lnINS	0.9559***	0.957***	0.9115***
	(0.0153)	(0.026)	(0.0395)
EFI	-0.0197	0.020	-0.1358*
	(0.0528)	(0.184)	(0.0752)
LnINC	0.1066**	0.062	0.3114*
	(0.0528)	(0.163)	(0.1619)
BDV	0.0000	0.000	0.0000
	(0.0002)	(0.000)	(0.0003)
EDU	-0.0002	0.000	-0.0009
	(0.0013)	(0.002)	(0.0024)
URB	-0.0016	-0.002	-0.0038
	(0.0020)	(0.002)	(0.0031)
IND	0.0829	0.089	0.0773
	(0.1267)	(0.153)	(0.2531)
IDV	-0.0861	-0.079	-0.1080
	(0.1095)	(0.120)	(0.1480)
LTO	0.1003	0.109	0.2909*
	(0.1165)	(0.194)	(0.1702)
MAS	-0.0491	-0.030	-0.0662
	(0.0900)	(0.137)	(0.0959)
UAI	0.1663	0.130	0.3346
	(0.1131)	(0.150)	(0.2254)
PDI	-0.1461*	-0.135	-0.1254
	(0.0871)	(0.095)	(0.1166)
HPM	0.0523	0.049	0.1297
	(0.0428)	(0.105)	(0.0815)
CML	0.0511	0.026	0.1742*
	(0.0682)	(0.115)	(0.1044)
Observations	286	238	286
R-squared	0.9862	0.986	0.985
Weak identification test (1st F)		6.53	–
Sargan test (p-value)		0.431	0.411
Hansen test (p-value)		–	1.000
Arellano-Bond test for AR(2) in differences (p-value)		–	0.584

*Note: *,**, and *** indicate significance at the 10%, 5% and 1% level, respectively. Numbers in brackets show standard errors. Constant and year fixed effects are included but not reported here. Number of instruments of GMM estimator are reduced by using higher orders and/or collapsing of lags of instruments in order to satisfy the specification tests.*

According to OECD Insurance Statistics (2015a), the contribution of non-life insurance market of the U.S. to the OECD countries in 2013 was 61.3% (the largest). This dominance means that the determinants of non-life insurance expenditure in the OECD countries may be driven by those in the U.S. To check this issue, we investigate the impacts of determinants of non-life insurance in the OECD countries excluding the U.S. Results using the system GMM estimator are reported in Table 6 and show some interesting points as follows. The determinants of aggregated non-life insurance expenditure in the OECD countries such as education, urbanization, masculinity, and common law may be driven by these variables in the U.S. Notably, the insignificant coefficients of economic freedom, long-term orientation, and common law on accident and health insurance expenditure in the case of the U.S.-excluded OECD countries indicate that impact of these factors in the U.S may dominate the OECD countries. Finally, results on the determinants of property insurance expenditure in the OECD may not be impacted by those in the U.S.

Table 6: Determinants of non-life insurance expenditure in the OECD countries (all sample countries and all sample countries excluding the U.S, system GMM)

	Aggregated non-life		Accident and Health		Property	
	All sample	Excluded the U.S.	All sample	Excluded the U.S.	All sample	Excluded the U.S.
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Lagged lnINS	0.6584***	0.6924***	0.9115***	0.8637***	0.8651***	0.8666***
	(0.1382)	(0.1417)	(0.0395)	(0.0574)	(0.0442)	(0.0441)
EFI	0.2120*	0.3066***	-0.1358*	-0.0793	0.1054*	0.1122*
	(0.1253)	(0.1099)	(0.0752)	(0.0856)	(0.0611)	(0.0625)
LnINC	0.6815***	0.5855**	0.3114*	0.2899*	0.2201**	0.2127*
	(0.2219)	(0.2368)	(0.1619)	(0.1494)	(0.1080)	(0.1120)
BDV	-0.0006**	-0.0007**	0.0000	0.0003	-0.0006**	-0.0006**
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)
EDU	-0.0048	-0.0058**	-0.0009	-0.0018	-0.0043**	-0.0043**
	(0.0031)	(0.0028)	(0.0024)	(0.0021)	(0.0021)	(0.0021)
URB	-0.0086*	-0.0082	-0.0038	-0.0030	-0.0099**	-0.0099**
	(0.0049)	(0.0055)	(0.0031)	(0.0035)	(0.0039)	(0.0040)
IND	-0.0816	-0.0411	0.0773	0.1983	0.2307	0.2390
	(0.2225)	(0.1951)	(0.2531)	(0.3044)	(0.1629)	(0.1620)
IDV	-0.0139	-0.0457	-0.1080	-0.1923	0.7105***	0.7106***
	(0.2719)	(0.2498)	(0.1480)	(0.1393)	(0.2296)	(0.2335)
LTO	0.2985	0.2164	0.2909*	0.2477	0.2988*	0.2970*
	(0.1886)	(0.1901)	(0.1702)	(0.1698)	(0.1525)	(0.1546)
MAS	-0.3528	-0.4112*	-0.0662	-0.2158	-0.3546***	-0.3574***
	(0.2168)	(0.2386)	(0.0959)	(0.1514)	(0.1245)	(0.1268)
UAI	0.2624	0.2245	0.3346	0.2563	0.3756**	0.3764**
	(0.2335)	(0.2281)	(0.2254)	(0.2306)	(0.1699)	(0.1784)
PDI	0.3078	0.3148	-0.1254	-0.1366	0.0707	0.0713
	(0.1968)	(0.2054)	(0.1166)	(0.1321)	(0.0621)	(0.0614)
HPM	0.0095	-0.0465	0.1297	0.0372	-0.0042	-0.0059
	(0.0865)	(0.1074)	(0.0815)	(0.1076)	(0.0370)	(0.0478)
CML	0.2553*	0.1848	0.1742*	0.0709	0.1306	0.1310
	(0.1363)	(0.1243)	(0.1044)	(0.1114)	(0.0862)	(0.0904)
Observations	295	283	286	274	274	262
R-squared	0.978	0.978	0.985	0.984	0.942	0.969
Sargan test (p-value)	0.141	0.347	0.411	0.386	0.145	0.168
Hansen test (p-value)	0.674	1.000	1.000	1.000	1.000	1.000
Arellano-Bond test for AR(2) in differences (p-value)	0.974	0.821	0.584	0.579	0.181	0.186

*Note: *,**, and *** indicate significance at the 10%, 5% and 1% level, respectively. Numbers in brackets show standard errors. Constant and year fixed effects are included but not reported here. Number of instruments of GMM estimator are reduced by using higher orders and/or collapsing of lags of instruments in order to satisfy the specification tests.*

Determinants of non-life insurance expenditure in the 19 GFC-affected OECD countries

The impact of GFC on non-life insurance expenditure

We turn now to discuss the determinants of non-life insurance expenditure in the 19 GFC-affected OECD countries. To examine how the GFC affects non-life insurance expenditure, we extend the main regression by adding the GFC variable, where we use a banking crisis dummy variable as a proxy for the GFC. We apply the extended model to investigate the impact of the GFC on the non-life insurance expenditure in the 19 OECD countries (see the list in Table A4 in Appendix), which have been affected severely by the GFC since 2007.

As can be seen from Table 7, the GFC variable in the 19 GFC-affected OECD countries has a negative impact on aggregated non-life and property expenditure and consistent with hypothesis H_4. This result provides evidence that discounting the future labour income of individuals and investments caused by the GFC may reduce non-life insurance expenditure. Additionally, decreasing potential output in these countries during the GFC is also a reasonable explanation for a decline in non-life insurance expenditure.[19]

[19] Furceri and Mourougane (2012) found a negative effect of financial crises in the OECD countries on the potential output.

Table 7. Determinants of non-life insurance expenditure in the 19 GFC-affected OECD countries (the system GMM estimator)

	Aggregated non-life	Accident and Health	Property
	(1)	(2)	(3)
Lagged lnINS	0.8578***	0.8230***	0.6138***
	(0.0506)	(0.0646)	(0.1211)
EFI	-0.0465	-0.1928**	0.0260
	(0.0890)	(0.0778)	(0.1856)
LnINC	0.2651**	0.5501***	0.5320**
	(0.1081)	(0.2125)	(0.2359)
BDV	-0.0001*	-0.0002	-0.0010*
	(0.0001)	(0.0002)	(0.0006)
EDU	-0.0011	-0.0042	-0.0059
	(0.0011)	(0.0032)	(0.0046)
URB	-0.0028	-0.0059	-0.0126***
	(0.0021)	(0.0041)	(0.0049)
GFC	-0.0381**	-0.0320	-0.0505*
	(0.0154)	(0.0508)	(0.0291)
IND	0.0008	-0.2448	0.8717*
	(0.1893)	(0.4282)	(0.4866)
IDV	0.0125	-0.3384	0.4467
	(0.1190)	(0.2839)	(0.4195)
LTO	0.1505	0.5130*	0.6304
	(0.1138)	(0.2656)	(0.4118)
MAS	-0.0080	-0.2129	0.0052
	(0.0488)	(0.1700)	(0.2000)
UAI	-0.0081	-0.0285	-0.1987
	(0.0802)	(0.2381)	(0.2456)
PDI	0.0860	-0.0641	0.8989***
	(0.0635)	(0.1559)	(0.1662)
HPM	0.1111	0.4842**	0.3314
	(0.0916)	(0.2004)	(0.2084)
CML	0.0193	0.0666	-0.0358
	(0.0383)	(0.1215)	(0.1400)
Observations	150	151	137
R-squared	0.990	0.987	0.952
Sargan test (p-value)	0.253	0.407	0.143
Hansen test (p-value)	1.000	1.000	1.000
Arellano-Bond test for AR(2) (p-value)	0.745	0.174	0.709

*Note: *,**, and *** indicate significance at the 10%, 5% and 1% level, respectively. Numbers in brackets show standard errors. A constant and year fixed effects are estimated but not reported here. Number of instruments of GMM estimator are reduced by using higher orders and/or collapsing of lags of instruments in order to satisfy the specification tests.*

Determinants of non-life insurance expenditure in the 19 GFC-affected OECD countries before and during the GFC

To examine how the GFC has changed the way the various factors affect the non-life insurance expenditure in the 19 GFC-affected OECD countries, we divide the data into sub-periods before the crises (2000-2006) and during the crises (2007-2013). Findings based on the system GMM estimator in Table 8 show the following interesting results.

The significant positive impacts of the one-year-lagged non-life insurance expenditure during the GFC are found. This finding is consistent with hypothesis H_1 and provides evidence that the prior development of non-life insurance may be the key driver in explaining non-life insurance expenditure in the later stage and may not be affected by the GFC. Our empirical results also suggest that economic freedom has a significant impact on non-life insurance products before the GFC but that is insignificant during the GFC. To explain for this result, we find the positive of per capita income on non-life

insurance expenditure products, apart from accident and health insurance, before and during the GFC. There can be no doubt that the effect of per capita income may dominate that of economic freedom during the GFC, where people may have lost their jobs or have to reduce their expenses due to decreased income.

With regards to bank development, there is an insignificant impact on aggregated non-life and property insurance expenditure before the GFC but a significant negative impact in explaining expenditure on these products during the GFC. This may be due to the fact that some banks worldwide were bankrupted during the GFC. The insignificant impacts of education on aggregated non-life, accident and health, and property insurance expenditure during the GFC are found and can be due to domination of per capita income during the GFC.

Results in Table 8 also show that urbanization has a positive impact on aggregated non-life insurance expenditure before the GFC while it has a negative effect in explaining expenditure on this product during the GFC. The negative effect of urbanization on aggregated non-life insurance during the GFC may be attributed to the negative impact of urbanization on property insurance expenditure. A possible explanation for this is that during the GFC the property sales in higher urbanization may reduce more than that in less urbanized areas and hence expenditure on property insurance may decline.

For cultural variables, the results in Table 8 indicate that indulgence, individualism, masculinity, power distance, and hypometropia do not explain expenditure on aggregated non-life and property insurance during the GFC while long-term orientation has a significantly positive impact on property insurance expenditure during the GFC. Spending on non-life insurance expenditure in the OECD countries during the GFC, apart from accident and health insurance, may be dominated by other factors such as per capita income, bank development, and urbanization. Notably, the positive effect of long-term orientation indicates that expenditure on property insurance may not be impacted by the GFC.

For the legal system, our empirical results find that common law in the selected OECD countries has a positive impact on aggregated insurance expenditure during the GFC while it has insignificant effect on other products. This finding can be due to attribution of other insurance product such as general liability insurance and third party liability of motor insurance, which may be compulsory. The result provides evidence that protecting the rights of creditors and investors in common law OECD countries may induce people to increase expenditure on non-life insurance expenditure, in particular during the GFC.

Table 8. Determinants of non-life insurance expenditure in the 19 GFC-affected OECD countries before and during the GFC (system GMM)

	Aggregated non-life		Accident and Health		Property	
	2000-2006	2007-2013	2000-2006	2007-2013	2000-2006	2007-2013
	(1a)	(1b)	(3b)	(3b)	(4a)	(4b)
Lagged lnINS	0.2361	0.9075***	0.5675***	0.8249***	0.6975***	0.4774**
	(0.2980)	(0.0788)	(0.1835)	(0.1389)	(0.0663)	(0.2222)
EFI	0.4129*	0.0828	0.7190*	0.1638	-0.3469*	0.0681
	(0.2206)	(0.0660)	(0.3787)	(0.2917)	(0.1871)	(0.4601)
LnINC	1.1402**	0.2104*	1.2560*	0.4882	0.4008**	0.6151**
	(0.5295)	(0.1248)	(0.6556)	(0.4537)	(0.1689)	(0.2754)
BDV	-0.0002	-0.0002*	-0.0029***	-0.0003	0.0008	-0.0020**
	(0.0003)	(0.0001)	(0.0010)	(0.0004)	(0.0005)	(0.0010)
EDU	-0.0057**	-0.0000	-0.0241***	0.0009	0.0037	-0.0161
	(0.0023)	(0.0012)	(0.0087)	(0.0041)	(0.0037)	(0.0103)
URB	0.0083**	-0.0036*	-0.0189**	-0.0037	-0.0025	-0.0310**
	(0.0033)	(0.0018)	(0.0091)	(0.0037)	(0.0030)	(0.0123)
IND	-1.2520*	0.1512	-0.0761	-0.4351	-0.0329	1.5660
	(0.6890)	(0.1884)	(1.3739)	(0.4570)	(0.2960)	(1.0582)
IDV	0.2093	0.0426	0.5817	-0.4888	-0.1161	0.6164
	(0.3354)	(0.1133)	(0.8509)	(0.3403)	(0.2791)	(0.7293)
LTO	-0.5080	0.1116	0.6471	0.3737	0.2498	1.8894*
	(0.4646)	(0.0750)	(1.2317)	(0.3471)	(0.2592)	(1.0939)
MAS	-0.3512***	-0.0505	-1.7627***	-0.3415	0.4064*	-0.4180
	(0.1165)	(0.0669)	(0.6159)	(0.2968)	(0.2103)	(0.5070)
UAI	-0.3382	0.1862*	0.3100	-0.1188	-0.4444**	0.3770
	(0.3410)	(0.1042)	(0.5499)	(0.2913)	(0.1809)	(0.8320)
PDI	-0.4410***	0.0597	0.3499	-0.0609	0.3767***	0.9244
	(0.1707)	(0.0749)	(0.5321)	(0.1714)	(0.1449)	(0.5647)
HPM	0.1809	0.0152	0.2041	0.3022	0.4170**	0.7472
	(0.3279)	(0.0726)	(0.6960)	(0.4047)	(0.2096)	(0.5705)
CML	-0.2137	0.0640**	-0.0905	0.0237	0.0914	0.3369
	(0.1350)	(0.0320)	(0.3777)	(0.1226)	(0.0870)	(0.2816)
Observations	80	70	83	68	77	59
R-squared	0.991	0.987	0.971	0.993	0.975	0.927
Sargan test (p-value)	0.116	0.522	0.757	0.354	0.248	0.117
Hansen test (p-value)	1.000	1.000	1.000	1.000	1.000	1.000
Arellano-Bond test for AR(2) (p-value)	0.330	0.211	0.078	0.122	0.170	0.436

*Note: *,**, and *** indicate significance at the 10%, 5% and 1% level, respectively. Numbers in brackets show standard errors. A constant and year fixed effects are estimated but not reported here. Number of instruments of GMM estimator are reduced by using higher orders and/or collapsing of lags of instruments in order to satisfy the specification tests.*

Economic and policy implications

Our findings provide many useful implications for both non-life insurance companies and governments in the OECD countries.

The first implication refers to choosing potential markets. Some interesting socio-economic results of this paper can be used to help multinational non-life insurance companies choose the location of potential markets. A valid illustration for this is that the OECD countries with lower degrees of economic freedom such as Slovenia, Turkey, and Mexico might be chosen as a potential market for developing accident and health insurance. Another illustration is that multinational non-life insurance firms can choose locations in the OECD countries with lower degree of urbanization such as Slovenia, Slovakia, and Poland to expand products of property insurance. With regards to cultural factors, multinational non-life insurance can promote sales of property insurance in the OECD countries with higher degree of individualism and lower degree of masculinity such as Netherlands, Denmark, and Norway. Additionally, the OECD countries with higher degree of long-term orientation such as South

Korea, Belgium, and Germany can be chosen as potential markets to sell products of property and accident and health insurance.

The second implication concerns the policies that maybe applied during the GFC and that may affect development of non-life insurance sector. For example, governments in the OECD countries should implement policies to support low-income individuals who may be impacted seriously by the GFC so that they can continue to use the related non-life insurance products, especially compulsory ones, including social security.

The final implication refers to economic freedom in the OECD countries. Governments may foster increased expenditure on non-life insurance products including property insurance by adopting liberal policies such as encouraging low tariff rates, low government spending, high effective enforcement of the law and security of property rights.

5. Conclusion

The roles played by cultural factors in the development of property and accident and health insurance markets have been overlooked in the literature. We investigate this issue using a panel dataset on the OECD countries. The system GMM estimations have been performed to overcome problems of endogeneity caused by omitted variables and reverse causality between income and expenditure. We find strong evidences for the impacts of cultural factors, along with economic and legal factors, on spending on insurance. However, the presence of the GFC has nullified many of those impacts, particularly those on health insurance expenditure. In contrast, non-life insurance expenditure in the past significantly affects subsequent spending regardless of the GFC. Indeed, our results reconfirm the importance of compulsory health insurance policy in many OECD countries as an effective mechanism to sustain demand for health insurance during the GFC.

The paper is among a few that have attempted to examine disaggregated insurance data in the OECD countries at the product level. Its findings provide many useful economic and policy implications, especially in regards to the development of the property and accident and health insurance markets. Our empirical results can be used as a reference to support multinational non-life insurance firms in seeking a potentially new market or expanding existing markets in the OECD countries. They also assist policy makers in these countries to design better frameworks for the development of the insurance market in the future.

Acknowledgements

We thank Chris Doucouliagos, Pedro Gomis Porqueras, Ha Vu, Prasad Bhattacharya, Shuddha Rafiq, Gary Tian, Sagarika Mishra, and participants of seminars at Deakin University for many helpful comments.

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APPENDIX
Table A1. Definitions and sources of data

Variable	Hypothesis	Description	Abbreviation	Data of source
Aggregated non-life insurance expenditure		Total non-life insurance gross written premiums per capita, US dollars	INS	OECD Insurance Statistics
Property insurance expenditure		Total property gross written premiums per capita, US dollars (covering for property, business interruption…)	PRO	OECD Insurance Statistics
Accident and health insurance expenditure		Total health gross written premiums per capita, US dollars (covering for medical expenses, death due to disease or accident, income loss…)	HEL	OECD Insurance Statistics
Economic freedom index	+	It is a chain-linked index of Fraser Institute, calculated based on 5 areas: (1) size of government, (2) legal system and property rights, (3) access to sound money, (4) freedom to trade internationally, and (5) regulation. The index ranges from 0 to 100 with higher values indicating more freedom.	EFI	Fraser Institute
Per capita income	+	Per capita GDP at market price in US dollars	INC	OECD Insurance Statistics
Bank development	+	Banks' assets to GDP (%).	BDV	Helgilibrary
Education	+	School enrolment, tertiary (% gross).	EDU	WDI, World bank
Urbanization	+	Urban population (% of total)	URB	WDI, World bank
Global financial crisis		Banking crisis dummy, value = 1 if banking crisis occurred otherwise = 0.	GFC	GFDD, World bank
Indulgence	-	It stands for a society that people have the right to enjoy life and have fun. It is an index ranging from 0 to 100 with higher values indicating more happiness, leisure, and enjoying life.	IND	Hofstede et al. (2010) and Minkov (2011)
Individualism	+	It refers to societies in which the attachment between individuals is loose. It is an index ranging from 0 to 100 with higher values indicating lower level of developing human relationship.	IDV	
Long-term orientation	-	It refers to a positive, dynamic, and future oriented culture linked with four 'positive' Confucian values. It is an index ranging from 0 to 100 with higher values indicating more national pride, the preservation of family values and traditions, and saving.	LTO	
Masculinity	-	It regards to societies that social gender roles are clearly distinct. In these societies, men focus on their material success, such as career and business, whereas women focus on improvement the quality of their family. It is an index ranging from 0 to 100 with higher values indicating more masculinity.	MAS	
Uncertainty avoidance	+	It refers to a society that people feel threatened by uncertain situations and they want to avoid these matters. It is an index ranging from 0 to 100 with higher values indicating more uncertainty avoidance.	UAI	
Power distance	-	It measures the interpersonal power or influence between the boss and subordinates and/or the degree of inequality among people in a society. It is an index ranging from 0 to 100 with higher values indicating more inequality, power distance.	PDI	
Hypometropia	+	It stands for a society that has high national murder rates and acceptance of the mortal risks. It is an index ranging from 0 to 1000 with higher values indicating more serious violence and murder rate.	HPM	
Common law	+	Dummy variables with value=1 for countries with a Common Law (Common Law dummy) and value =0 otherwise.	CML	

Instrumental variables: the degree of trade openness (% of GDP) and life expectancy at birth (years) (data source: WDI)

Table A2. Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Log of density of aggregated non-life insurance (lnINC)	436	6.49	1.05	3.30	8.30
Log of density of property insurance (lnPRO)	403	4.75	1.28	1.34	7.49
Log of density of accident and health insurance insurance (lnHEL)	301	3.16	2.19	-3.91	7.20
Economic freedom index (EFI)	476	7.55	0.53	5.2	8.76
Log of income per capita (lnINC)	473	10.16	0.72	8.03	11.63
Education (EDU)	402	62.38	17.79	9.81	113.98
Bank development (BDV)	470	267.22	397.90	38.49	3072.6
Urbanization (URB)	476	76.29	11.44	49.87	97.54
Global financial crisis (GFC)	408	0.21	0.41	0	1
Indulgence (IND)	448	0.53	0.18	0.16	0.97
Individualism (IDV)	462	0.60	0.21	0.12	0.91
Long-term orientation (LTO)	462	0.52	0.21	0.21	1.00
Masculinity (MAS)	448	0.52	0.24	0.08	1.10
Uncertainty avoidance (UAI)	448	0.68	0.22	0.23	1.12
Power distance (PDI)	448	0.49	0.19	0.11	1.04
Hypometropia (HPM)	434	1.33	0.61	0.18	3.22
Common law (CML)	476	0.21	0.40	0	1

Table A3. List of OECD economies

Australia	Japan
Austria	Luxembourg
Belgium	Mexico
Canada	Netherlands
Chile	New Zealand
Czech	Norway
Denmark	Poland
Estonia	Portugal
Finland	Slovakia
France	Slovenia
Germany	South Korea
Greece	Spain
Hungary	Sweden
Iceland	Switzerland
Ireland	Turkey
Israel	United Kingdom
Italy	United States

Source: OECD Insurance Statistics (2015a)

Table A4. List of 19 OECD economies affected by the GFC since 2007

Austria	Luxembourg
Belgium	Netherlands
Denmark	Portugal
France	Slovenia
Germany	Spain
Greece	Sweden
Hungary	Switzerland
Iceland	United Kingdom
Ireland	United States
Italy	

Source: GFDD, World bank (2015b)

Table A5. Panel causality test results

Dependent variable	**Source of causation (independent variable)**					
	Short run		Long run	Joint (short run/long run)		ECT
	ΔINS	ΔINC	ECT	ΔINS, ECT	ΔINC, ECT	coefficients
ΔINS	-	0.5396***	0.6765***	-	0.5396***	-0.5519***
ΔINC	0.5063***	-	1.6388***	0.5063***	-	0.0559

*Notes: *** indicates the parameters are significant at the 1% level. Results show that there is a bi-directional causal relationship between non-life insurance density and income per capita in both the short run and long run.*

Table A6. The impact of economic freedom on the non-life insurance expenditure

	ΔlnEFI		**ΔlnINS**		
	(1)	(2)	(3)	(4)	(5)
	LS	LS	2SLS	2SLS	2SLS
ΔlnEFI		0.995***	13.460***	1.139	24.479**
		(0.307)	(4.773)	(3.061)	(11.558)
ΔlnTRA	-0.041**			0.010	
	(0.020)			(0.011)	
ΔlnLIFE	0.525**				-10.782
	(0.239)				(7.823)
Durbin-Wu-Hausman/Hausman test for endogeneity, p-value	–	0.714	0.000	–	–
Sargan test for overidentification restrictions of the instruments (p-value)	–	–	0.016	–	–
First stage, F-stat.	–	–	4.081	3.608	4.260
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	356	390	356	356	356
Country	34	34	34	34	34

*Notes: ***, **, and * indicate the parameters are significant at the 1%, 5%, and 10% level, respectively. All variables are in natural logarithms.*

Table A7. The effect of non-life insurance expenditure on per capita income

	ΔlnINS		ΔlnINC		
	(1)	(2)	(3)	(4)	(5)
	LS	LS	2SLS	2SLS	2SLS
ΔlnINS		0.027***	0.018	0.025	-0.147
		(0.008)	(0.023)	(0.023)	(0.162)
ΔlnTEM	0.063			-0.011	
	(0.041)			(0.007)	
ΔlnMER	-0.714***				-0.122
	(0.095)				(0.118)
Durbin-Wu-Hausman/Hausman test for endogeneity, p-value	–	0.378	0.531	–	–
Sargan test for overidentification restrictions of the instruments (p-value)	–	–	0.145	–	–
First stage, F-stat.	–	–	29.56	56.94	2.38
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	347	390	347	347	347
Country	34	34	34	34	34

*Notes: ***, **, and * indicate the parameters are significant at the 1%, 5%, and 10% level, respectively. All variables are in natural logarithms*

Table A8. Panel causality test results

Dependent variable	**Source of causation (independent variable)**					
	Short run		Long run	Joint (short run/long run)		ECT
	ΔINS	ΔEFI	ECT	ΔINS, ECT	ΔEFI, ECT	coefficients
ΔINS	-	-0.988 *(p-value=0.285)*	3.538***	-	-0.988	-0.408***
ΔEFI	0.001 *(p-value=0.965)*	-	0.310***	0.001	-	0.056

*Notes: *** indicates the parameters are significant at the 1% level*

Table A9: Aggregated non-life insurance correlation matrix

	LnINS	Lagged lnINS	EFI	LnINC	BDV	EDU	URB	GFC	IND	IDV	LTO	MAS	UAI	PDI	HPM	CML
LnINS	1.00															
Lagged lnINS	0.99	1.00														
EFI	0.71	0.69	1.00													
LnINC	0.94	0.94	0.65	1.00												
BDV	0.64	0.65	0.49	0.59	1.00											
EDU	0.41	0.41	0.31	0.42	-0.05	1.00										
URB	0.37	0.37	0.35	0.42	0.09	0.21	1.00									
GFC	0.27	0.30	-0.07	0.26	0.34	0.08	-0.06	1.00								
IND	0.34	0.35	0.30	0.37	0.30	-0.13	0.41	0.07	1.00							
IDV	0.49	0.49	0.56	0.44	0.31	0.11	0.38	0.12	0.27	1.00						
LTO	-0.03	-0.03	0.01	-0.02	0.04	0.08	0.17	-0.03	-0.46	-0.21	1.00					
MAS	-0.21	-0.20	0.01	-0.19	-0.06	-0.37	-0.20	0.03	-0.04	0.07	0.06	1.00				
UAI	-0.48	-0.48	-0.56	-0.43	-0.29	-0.15	-0.21	-0.07	-0.45	-0.62	0.18	0.06	1.00			
PDI	-0.54	-0.53	-0.60	-0.53	-0.35	-0.35	-0.24	-0.03	-0.31	-0.50	0.10	0.19	0.58	1.00		
HPM	-0.02	-0.02	0.21	-0.05	-0.04	-0.17	0.11	-0.02	0.47	0.27	-0.45	-0.24	-0.45	-0.16	1.00	
CML	0.36	0.36	0.55	0.28	0.23	0.20	0.20	0.06	0.43	0.55	-0.50	0.19	-0.59	-0.41	0.33	1.00

Table A10: Property Insurance correlation matrix

	LnPRI	Lagged lnPRI	EFI	LnINC	BDV	EDU	URB	GFC	IND	IDV	LTO	MAS	UAI	PDI	HPM	CML
LnPRI	1.00															
Lagged lnPRI	0.98	1.00														
EFI	0.66	0.66	1.00													
LnINC	0.85	0.86	0.65	1.00												
BDV	0.58	0.59	0.52	0.61	1.00											
EDU	0.28	0.29	0.27	0.43	-0.03	1.00										
URB	0.33	0.35	0.40	0.48	0.29	0.17	1.00									
GFC	0.28	0.30	-0.04	0.25	0.34	0.10	-0.03	1.00								
IND	0.31	0.32	0.23	0.36	0.30	-0.15	0.43	0.07	1.00							
IDV	0.65	0.64	0.56	0.43	0.33	0.10	0.43	0.14	0.20	1.00						
LTO	-0.07	-0.06	0.14	0.05	0.23	0.07	0.15	0.00	-0.44	-0.13	1.00					
MAS	-0.17	-0.17	0.02	-0.23	-0.11	-0.45	-0.15	0.04	-0.09	0.09	0.16	1.00				
UAI	-0.49	-0.49	-0.54	-0.38	-0.17	-0.12	-0.23	-0.04	-0.35	-0.61	0.05	0.03	1.00			
PDI	-0.54	-0.55	-0.54	-0.55	-0.35	-0.36	-0.35	-0.08	-0.25	-0.49	0.03	0.27	0.44	1.00		
HPM	0.07	0.05	0.19	-0.06	-0.06	-0.17	0.13	-0.02	0.45	0.24	-0.43	-0.23	-0.46	-0.14	1.00	
CML	0.39	0.39	0.50	0.25	0.07	0.18	0.29	0.10	0.38	0.56	-0.41	0.14	-0.53	-0.29	0.34	1.00

Table A11: Accident and Health Insurance correlation matrix

	LnAHI	Lagged lnAHI	EFI	LnINC	BDV	EDU	URB	GFC	IND	IDV	LTO	MAS	UAI	PDI	HPM	CML
LnAHI	1.00															
Lagged lnAHI	0.99	1.00														
EFI	0.52	0.51	1.00													
LnINC	0.81	0.81	0.66	1.00												
BDV	0.61	0.61	0.52	0.61	1.00											
EDU	0.32	0.32	0.26	0.43	-0.03	1.00										
URB	0.34	0.35	0.34	0.43	0.14	0.16	1.00									
GFC	0.31	0.34	-0.04	0.27	0.36	0.10	-0.02	1.00								
IND	0.45	0.45	0.26	0.38	0.31	-0.13	0.40	0.06	1.00							
IDV	0.26	0.26	0.58	0.45	0.32	0.13	0.43	0.14	0.20	1.00						
LTO	-0.06	-0.07	0.07	-0.02	0.05	0.05	0.16	-0.03	-0.44	-0.12	1.00					
MAS	-0.33	-0.32	0.03	-0.22	-0.04	-0.45	-0.19	0.05	-0.08	0.10	0.12	1.00				
UAI	-0.24	-0.23	-0.57	-0.41	-0.28	-0.13	-0.16	-0.04	-0.38	-0.59	0.11	-0.01	1.00			
PDI	-0.42	-0.41	-0.56	-0.56	-0.38	-0.36	-0.28	-0.07	-0.28	-0.49	0.08	0.24	0.49	1.00		
HPM	0.04	0.03	0.21	-0.05	-0.05	-0.16	0.16	-0.03	0.44	0.22	-0.39	-0.22	-0.42	-0.14	1.00	
CML	0.25	0.25	0.52	0.30	0.28	0.16	0.16	0.12	0.39	0.54	-0.47	0.18	-0.58	-0.35	0.31	1.00

Table A12. Summaries of results of determinants of the non-life insurance expenditure

	Non-life insurance											
	Trinh et al. (2016)	Kamiya et al. (2014, working paper)				Park & Lemaire (2012)	Elanggo & Jones (2011)	Feyen et al. (2011)	Esho et al. (2004)	Browne et al. (2000)		Outreville (1990)
Dependent variable												
Aggregated data	Yes	Yes				Yes	Yes	Yes	Yes	Yes		Yes
Disaggregated data	No	3 products				No	No	No	No	2 products		No
Independent variables		Non-life (OECD)	Motor (High-Income)	Property (High-Income)	Liability (High-Income)					Motor (OECD)	Liability (OECD)	
Economic freedom	+						+/-					
Income per capita	+	-	-			+	+	+	+	+	+	+
Bank development	+	Insig.	Insig.					+*				
Education	Insig.					Insig.	Insig.		+	Insig.	-	-
Urbanization	+					Insig.			+	Insig.	-	
Bank crisis		Insig.[a]	Insig.[b]	+[c]	Insig.[d]							
Indulgence	Insig.											
Individualism	Insig.					+						
Long term-orientation	-											
Masculinity	-					Insig.						
Uncertainty avoidance	Insig					+			Insig.			
Power distance	+					-						
Hypometropia	Insig.											