SOME ECONOMIC ASPECTS OF INSURANCE

Settore scientifico-disciplinare SECS-P/05

DOTTORANDO RESPONSABILE DOTTORATO DI RICERCA
GIOVANNI MILLO PROF. ROMEO DANIELIS

RELATORE
PROF. GAETANO CARMECI
UNIVERSITA’ DI TRIESTE

ANNO ACCADEMICO 2008/2009
Non-life insurance consumption in Italy:
a sub-regional panel data analysis

Giovanni Millo
Research Dept., Assicurazioni Generali SpA
and DEAMS, University of Trieste

Gaetano Carmeci
DEAMS, University of Trieste

March 23, 2010

Abstract

We analyze the consumption of non-life insurance across 103 Italian provinces in 1998-2002 in order to assess its determinants, in the light of the empirical literature. Using sub-regional data we overcome an important limitation of cross-country analyses, i.e. the systemic heterogeneity due to country-specific characteristics. Individual heterogeneity is accounted for through panel data techniques. However, considering spatial units within a single market raises issues of cross-sectional or spatial dependence, either due to common nationwide and/or regional factors or to spatial proximity. We carefully assess spatial dependence, employing recent diagnostic tests, finding out that the regressors included in our specification successfully account for spatial dependence. Insurance turns out to depend on income, wealth and some demographics, as already established, but also on trust, judicial efficiency and borrowing conditions. This finding helps in explaining the gap between Central-Northern Italy and the South of the country.
1 Introduction

Insurance is widely believed to be important for the sound economic development of a country. In fact, in the economy insurers perform the functions of risk pooling, risk bearing and loss prevention. Moreover, they provide financial intermediation services by issuing (contingent) debt contracts and investing the funds until they are needed to pay the claims (Cummins and Weiss, 2000). Indeed, risk management by financial intermediaries has been recognized as a vital function for innovation and economic development as early as 1911 in Schumpeter’s “The Theory of Economic Development” (King and Levine, 1993).

Nowadays, the insurance industry as a whole accounts for a considerable slice of Gross Domestic Product (GDP) in all of the industrialized world: ten percent in Japan, about nine percent in both the United States and the European Union, where, in particular, in the United Kingdom it has reached almost sixteen percent\(^1\). Moreover, emerging markets, while starting from very low insurance revenues to GDP ratios, have recently experienced significantly faster rates of growth of their insurance sectors than industrialized countries. China, e.g., rose from 0.8 percent in 1990 to 2.9 in 2007; India from 1.5 percent to 4.6.\(^2\)

Insurance activity is usually categorized into life and non-life. The importance of life insurance is crucially dependent on the role of private pension plans in supporting, or even substituting, public welfare, so that countries relying substantially on the private sector for the provision of old age benefits typically have very large life insurance revenues to GDP ratios, as is the case for Japan, the United Kingdom, Belgium or South Korea. The non-life sector is

\(^1\)Data from Sigma, Swiss RE, relative to 2007.
\(^2\)For a survey of insurance in emerging markets, see Outreville (1990, 1996, 2000).
more evenly developed. It reaches the maximum of five per cent of GDP in the US and Switzerland, and it is generally between two and four percent in the industrialized world, between 0.5 and 1.5 percent in developing countries. A large part of non-life is in turn relative to mandatory car insurance against third party liability (MTPL), arguably the most widespread and familiar of insurance products, which accounts for about thirty percent of non-life revenue in Europe and approaches or even surpasses one half in less developed countries.

It is well known that life and non-life insurance consumption respond to different needs and are in part driven by different factors, so that they are usually analyzed separately. In this paper we focus on non-mandatory non-life insurance. Our choice is motivated by the fact that this branch of the insurance market is mostly related to the welfare- and growth-fostering roles of insurance, realized by protecting families and firms from the economic consequences of theft, fire, accidents and disease.

The main goal of the paper is to investigate the determinants of the development of the non-life insurance market for Italy. At the same time, we bring new evidence to the empirical literature on the drivers of insurance in general, which are usually analyzed on a cross-country basis, by testing the standard model from a new regional and geographical perspective.

From this point of view, the Italian case is particularly interesting for a number of reasons. On average, the Italian non-life (non-MTPL) insurance market is severely underdeveloped in comparison to the main European countries. In 2003 Italy, at 2.6 percent, had the lowest penetration of non-life insurance as a whole on GDP among the biggest European countries. Excluding motor insurance, it lagged even farther behind, at 1.0 percent of GDP. Moreover, the non-mandatory part of motor insurance, own damage, which on European average accounts for 39 percent of total motor revenue, is less than 15 percent of the total in Italy, a fact that the Comité European des Assurances describes as "a major factor in Italy's comparatively low ratio of total non-life premiums to GDP" (des Assurances, 2007). A closer look at the Italian macroregions also reveals that going from North to South the penetration ratios of non-life insurance over GDP are very different. This is unsurprising, as regional economic heterogeneity at large is particularly high in Italy, a country where the underdevelopment of Southern regions has long been standing as a fundamental social and political problem. Dealing with this particular facet of economic and financial development, the non-life insurance market, it is therefore interesting to investigate its determinants in the light of these striking regional differences.

We do so in the standard framework of the studies on insurance development, but at a different level of aggregation which has received scant attention in the literature up to now. We contend that a regional perspective on insurance development, although requiring some methodological care, can be very useful empirically because, unlike cross-country settings, it provides a testing environment which is as uniform and integrated as possible with respect to systemic

---

3 The penetration of non-life covers related to so-called "personal insurance", like accident and health, is also much higher in countries, such as Germany, where some citizens are allowed to opt out of the public health insurance scheme.

4 Due to data unavailability, in these international comparisons we separate motor from non-motor, instead of mandatory motor-TPL from the rest (including motor own damage). In the latter case the comparisons would be even less favourable, given the relatively low importance of non-mandatory motor in Italy.
factors affecting the development of insurance, such as the law, welfare state, fiscal and monetary policy, inflationary history and even religious beliefs. In a regional setting, especially in one characterized by high variance like Italy, the effect of the variables of interest can be disentangled from that of the many, and often highly collinear, systemic factors mentioned above.

We analyze the consumption of non-life insurance, measured as premiums per capita, across Italy’s 103 provinces (corresponding to NUTS-3 regions) in the period 1998-2002. For this purpose we estimate a random effects panel model, accounting for both common shocks and serial correlation in residuals. Moreover, given the high degree of spatial correlation observed in both insurance consumption and the regressors, we test for spatial correlation in the residuals using two different frameworks: Baltagi et al (2007)’s conditional LM test for spatial dependence given random effects and serial correlation, and Pesaran (2004)’s global and local CD test for cross-sectional correlation. Both tests conclude for the absence of spatial correlation, so that it results that the regressors included in the model successfully account for spatial dependence.

The rest of the paper is organized as follows: the first section presents an overview of the Italian non-life insurance market first as a whole, comparing it with those of other countries, and then from a geographical viewpoint. In the second we review the literature in order to establish the model specification, and we motivate the choice of a regional panel data perspective as a partial solution for some typical problems of cross-country studies. The next three describe the data, the model specification and the empirical findings. The conclusions follow.

2 Non-life insurance in Italy

As briefly sketched in the introduction, the Italian non-life insurance market is still underdeveloped compared to the main European countries. As we can see in Table 1, the penetration ratio (premiums/GDP) of the non-motor business is lower than those of the other four larger EU economies. The class is dominated by motor third-party liability (MTPL), accounting for more than half of non-life business. Its penetration is higher than in the rest of Europe both because of the higher number of vehicles on the road and of the steady, cost-driven increase in tariffs in the latest years. Non-mandatory classes, on the contrary, are far less developed, with total penetration that in 2003 was less than half of its major European partners.

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Life</th>
<th>Non-Life</th>
<th>Motor</th>
<th>Non-Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>13.3</td>
<td>9.1</td>
<td>4.2</td>
<td>1.3</td>
<td>2.9</td>
</tr>
<tr>
<td>France</td>
<td>9.3</td>
<td>6.0</td>
<td>3.2</td>
<td>1.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Italy</td>
<td>7.5</td>
<td>4.9</td>
<td>2.6</td>
<td>1.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Germany</td>
<td>6.9</td>
<td>3.2</td>
<td>3.7</td>
<td>1.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Spain</td>
<td>5.6</td>
<td>2.4</td>
<td>3.2</td>
<td>1.4</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Table 1: Insurance consumption in Europe as % of GDP, 2003

Mandatory car insurance, although socially important, serves a narrow purpose and demand for it is a derivative of that for cars. The domination of MTPL, accounting for roughly one half of total revenue (see Table 1), can be
seen as another sign of underdevelopment of the insurance function in the Italian financial system. It is in fact non-mandatory non-life insurance that performs most of the welfare- and growth-fostering functions described above, protecting families and firms from the economic consequences of theft, fire, accidents and disease and supporting loss prevention. Therefore we exclude MTPL from our analysis, concentrating on the rest of the sector, non-mandatory non-life, henceforth simply referred to as non-life.

As customary in the literature, and justified by the common economic reasoning, we will consider non-life as a whole. It is worth noticing that it can be roughly categorized into property (fire, theft, household damages and so on, including non-TPL motor), liability (comprising both personal and corporate third-party damages), accident and health and other classes, minor from the point of view of revenue, like legal protection which covers legal expenses, marine, aviation and transit insuring both the transported goods and the hulls of the carriers, and credit and suretyship. On the Italian market the leading class is property, at 12 percent of total non-life revenue, while the shares of non-mandatory motor, general liability and accident are all between 8 and 9 percent. Health insurance is most underdeveloped with respect to the rest of Europe, despite high private health expenditure. Marine, aviation and transit and credit and suretyship, both slightly above 2 percent, play a minor role.

The importance of insurance in the Italian economy is diversified at the geographic level. Both insurance density and penetration are much lower in the Southern part of the country. Actually, while the Italian average penetration ratio of non-life insurance over GDP is much closer to that of the European new member states (EU10) than to that of the EU15, the figure for Southern regions is about one half of the Italian average (see Table 2, where insurance penetration is disaggregated in five macroregions according to the classification of the Italian Statistical Institute).

<table>
<thead>
<tr>
<th>Region</th>
<th>% of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>North-West</td>
<td>1.4</td>
</tr>
<tr>
<td>North-East</td>
<td>1.1</td>
</tr>
<tr>
<td>Centre</td>
<td>1.1</td>
</tr>
<tr>
<td>South</td>
<td>0.6</td>
</tr>
<tr>
<td>Islands (Sicily and Sardinia)</td>
<td>0.5</td>
</tr>
<tr>
<td>(Italy)</td>
<td>1.0</td>
</tr>
<tr>
<td>(EU15)</td>
<td>2.3</td>
</tr>
<tr>
<td>(EU10)</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Table 2: Insurance consumption in Italian macroregions as % of GDP, 2003

3 Literature review

In this section we review the literature on non-life insurance demand and consumption. We first sketch the economic analysis of demand and supply, giving reasonable guesses for identifying the empirical drivers and the direction of their effect on total premium income. We then provide a brief survey of the empirical findings of cross-sectional country comparisons, of studies on household microdata and of panel analyses on sets of countries, outlining strenghts and
weaknesses of the different approaches. We also motivate the choice of a regional panel data perspective as a partial solution for multicollinearity and unobserved heterogeneity problems affecting cross-country studies.

3.1 Theoretical determinants of insurance consumption

The economic rationale for purchasing non-life insurance is to get an indemnity for future losses against paying a fixed price, the premium, today, thus transferring future wealth from an uncertain to a certain state. According to economic theory, insurance enhances welfare by transferring uncertainty from risk-averse individuals to risk-neutral ones, the insurers, who pool many risks together and manage them efficiently (see Mossin, 1968). Analogously, in an intertemporal framework, it helps stabilizing consumption paths. From an industrial perspective, while on a frictionless capital market, according to the Modigliani-Miller theorem, insurers would have no comparative advantage in diversifying risks with respect to other corporations, in the real world insurance companies can efficiently manage many low-probability risks for which contingent claim contracts would be unavailable or excessively costly, so that the purchase of insurance by the big firms is motivated by transaction and bankruptcy costs reduction (see Skogh, 1989; MacMinn and Garven, 2000).

Theoretical models of non-life insurance demand, starting from the seminal papers of Pratt (1964), Arrow (1971) and Mossin (1968), predict that for a given level of risk exposure and a given price, insurance demand is increasing with risk aversion, probability of loss and total wealth (see also Sweeney and Beard, 1992; Szpiro, 1985). Whether the propensity to insure - i.e., the desired coverage as a percentage of the wealth at stake - should increase or not, depends on the behaviour of risk aversion: Arrow shows that it increases if people are characterized by increasing relative risk aversion, Mossin gave conditions under which the opposite happens (see 3.3). Moreover, while by Mossin’s Theorem full coverage is optimal under the fair actuarial price, the degree of coverage decreases with the loadings (see Schlesinger, 2000).

The so-called “inverted economic cycle” of insurance, in which one pays first, then, in the event of loss, receives his dues, suggests that the financial rate of return, seen as an opportunity cost for those who allocate funds in an insurance policy, should be inversely related with demand. That is, self-insuring gives an opportunity-gain to invest the spared amount of the premium on financial markets, which increases along with the prevailing rate of return. However, Falciglia (1980) shows that higher market interest rates should lower insurance demand only if consumers have a decreasing risk aversion and are net savers; although these conditions seem reasonable, the relationship between interest rates and insurance demand nevertheless remains an empirical question.

As discussed by Beenstock et al (1988), the supply of insurance can be assumed to depend on the return on underwriting capital, which is in turn determined principally by the premium rate (the unit price of coverage), the probability of loss and the interest rate. Insurance supply can be hypothesized to depend positively from the premium rate and the interest rate (the latter, symmetrically to what observed above, because of the gains from investing the premiums on financial markets in the time between premium collection and

---

claims settling) and negatively from the probability of loss.

Beenstock et al (1988) conclude that the equilibrium quantity of insurance exchanged on the market should depend positively from income, and with an uncertain sign from accident probability and interest rates; and equilibrium price positively from income and loss probability, negatively from the interest rate. Hence total premiums should depend positively from income, and with an uncertain sign from both loss probability and interest rates.

3.2 Review of the empirical evidence

Many of the theoretical determinants of insurance consumption outlined above are not observable and need to be proxied. Empirical studies identify some observable counterparts to total wealth, risk exposure, probability of loss and risk aversion. Wealth is generally proxied by means of income; so is risk exposure, which is in turn related to total wealth and the level of economic activity. Loss probability may too be related to income as a measure of economic activity; urbanization has also been used for this purpose (Browne et al, 2000). Loss ratios of previous periods have also been suggested as a proxy for the probability of loss. Aspects of risk aversion may be captured by education or the age structure of the population, even though the expected sign of the effect is unclear: better educated people could be more risk-conscious and therefore purchase more insurance, or more efficient in managing and diversifying risk, which would lead in the opposite direction (see the discussion in (Browne et al, 2000)).

Studies on microdata are usually based on household income or consumer expenditure surveys. Because of data limitations, they focus mostly on some particular class of insurance, and on the probability of purchasing a policy, as in such surveys the observed equivalent of the target variable is often censored or binary. They have nevertheless provided important evidence on the link between the decision of purchasing insurance and some individual characteristics. Gruber and Poterba (1994), analyzing health insurance on a US sample, find a positive association with income, education and marriage. Guiso and Jappelli (1998) analyzing data from an Italian survey to assess the effect of non-insurable risk on insurance purchases, find that the effect of household resources, expected income, income risk, self-employment, education and urbanization on the decision to purchase casualty insurance is positive and significant, while that of age is non-linear and family size is not significant. Moreover, they find spatial heterogeneity: macroregional dummies for North and South are, respectively, significantly positive and negative. Guiso and Jappelli claim that their results support the hypothesis of decreasing absolute risk aversion. Focarelli et al (2004) investigate separately the probability of buying health and other kinds of non-life insurance. They find evidence of positive effects from income, financial wealth, education and residence in the North or Centre for both classes, while age is not significant. Male, self-employed and homeowners are more likely to have property-liability-casualty insurance, while managers are more likely to have both. Summing up, micro-level studies, while confirming the role of income, seem to bring some evidence in favour of education as a proxy for risk

---


7Their results are quite similar when regressing the amounts insured, but the role of age, macroregional dummies and education is weaker.
awareness and of urbanization or population density as positively related to riskiness. However, an alternative supply-side view could be that urban areas have a greater density of insurance agencies and so make searching for an appropriate cover less costly.

Cross-country comparisons provide a broader viewpoint, focusing on structural economic, cultural and social differences as well as the different level of economic development across countries. Beenstock et al (1988) first analyze an ample cross-section of 45 countries, finding a strong positive correlation between income and property-liability insurance revenues but without controlling for other determinants; they also estimate a more complete LSDV dynamic model on a pool of time series for 12 developed countries, finding positive effects of income and real interest rates, which last they attribute to the higher supply of underwriting capital attracted by the higher returns and dominating the opposite effect on demand. Outreville (1990) analyzes a cross-section of 55 developing countries, finding positive effects from income, as usual, and the financial development ratio. He also hypothesizes the association of low insurance development with high inflation and the prevalence of agriculture, although failing to find a statistically significant relationship; lastly, while expecting literacy to exert a positive role, he finds its coefficient to be negative and marginally significant. Grace and Skipper (1991) add developed countries to the sample, finding a positive and significant influence on non-life insurance demand by income and literacy. Islamic countries have, ceteris paribus, lower values while the share of government consumption over GDP is in turn associated with higher insurance density. They also assess the influence of a monopolistic market and other institutional differences, all going in the expected direction; and they estimate different income elasticities for developing and developed countries (identified as OECD ones), finding a higher elasticity for the latter. In contrast to Beenstock et al (1988), both these latter studies lack a satisfactory definition of market equilibrium: Outreville (1990) only specifies the demand equation, but then observes equilibrium consumption; Grace and Skipper (1991) specify a demand and supply system omitting price and they estimate it as two seemingly unrelated regressions. Therefore we believe their findings are better characterized as describing insurance consumption, rather than insurance demand as claimed by the authors. This confusion between insurance demand and equilibrium consumption, often used as synonymous, persists in some of the current literature (see e.g. Hussels et al, 2005) and is probably rooted in the underlying belief that insurance supply be very elastic with respect to price, so that the equilibrium quantity is determined mainly by demand factors.

Browne et al (2000) explicitly resort to estimating a single-equation relating (equilibrium) insurance consumption to a set of regressors, most of which are demand-related. They address the issue of heterogeneity by estimating both a pooled and a fixed effects regression\(^8\) on an unbalanced panel of 22 OECD countries over the period 1987 to 1993. The fixed effects are explicitly meant to control for “accident rates, motorization rates, alcohol consumption, capital stock and attitudes towards litigation” and any other unobservable country-specific factor.\(^9\) Unlike previous studies, they focus on the subset of motor and liability insurance, most of which is compulsory. Their findings are rather

\(^8\)They also estimate, but do not report, a random effects regression with results similar to the fixed effects one.

\(^9\)The authors are ostensibly assuming all these factors to be time-invariant.
diverse both across sectors and across the two specifications, with coefficients often changing sign, which can be seen as evidence in favour of the need to control for unobserved heterogeneity in cross country studies. Concentrating on the fixed effects results, they find income to be a positive determinant for both sectors. The effect of education is never significant and changes sign between the models; neither urbanization, employed as a proxy for risk conditions, is significant and its sign is not the expected one. An innovative aspect of their study is the use of the share of foreign-owned companies on the market as a proxy for insurance prices, according to the idea that the more competitive a market, the more foreign players will be drawn into it, putting pressure on tariffs. Nevertheless, one could well argue that foreign involvement otherwise fosters insurance development, possibly through introduction of new products or business practices; or that the direction of causality is inverse: foreign players might flock into highly developing markets. The sign of the effect turns out to be significantly negative, supporting Browne et al.’s claim, in motor insurance, but significantly positive in liability insurance, casting substantial doubt on the interpretation.\(^{10}\)

Lastly the authors claim that insurance consumption is decreasing with wealth, thus supporting the view of wealth as a substitute for coverage; and that insurance consumption turns out to be higher in common law countries\(^{11}\). Further work by Esho et al (2004), drawing on research on the effect of property rights enforcement on the development of financial markets, investigates the influence of the type of legal system on insurance, this time distinguishing between English, French, German and Scandinavian. They consider a cross-section of 44 developed and developing countries, finding the legal origin to be not significant, while controlling for the level of enforcement of property rights they find a positive effect. Because of data availability, they separately estimate a dynamic panel, finding again that the property rights enforcement index has a positive and significant effect. Notably, they include a price variable finding it to be negatively and marginally significant.

Prosperetti (1992), in what is to our knowledge the only disaggregated analysis so far on the Italian insurance market, estimated cross-section models for non-life insurance penetration and found significant effects from (among demand side drivers) per capita consumption or income and, for some classes, from added value composition (shares of agriculture and industry) and firm size. He also includes the structure of distribution (shares of big-, medium- and small-sized agencies and of brokers) as the only supply side driver, although admitting that the characterization of the supply side is incomplete, and finds positive correlation between agency size and insurance penetration.

\(^{10}\)One perhaps more convincing proxy for price is the (inverse) loss ratio, i.e. the ratio between premiums earned and claims paid for a given period, used by Outreville (1990) and Esho et al (2004), which can be seen as an ex-post estimate for the average price paid for the services of the insurer per each unit of claims paid. Yet the reasons for inclusion of a proxy for price in a reduced-form consumption equation are unclear (see the formalization by Beenstock et al 1988).

\(^{11}\)Having been forced to omit these two time-invariant variables from the fixed effects analysis, these two claims are based only on pooled models, so that the abovementioned inconsistencies between the two specifications may cast doubt on this finding.
3.3 Insurance as an inferior good?

Most of the above authors have commented on the elasticity of insurance consumption with respect to income and wealth, in the light of the long-standing debate on insurance as an inferior good. Mossin (1968) first gave conditions for this to happen: the intuition is that if the utility function is characterized by decreasing absolute risk aversion (DARA), then a higher endowment of wealth reduces risk aversion and therefore the demand for insurance. \(^{12}\) Browne et al (2000), as mentioned above, include a measure of wealth together with income in their cross-sectional specification, finding a negative effect and claiming this to be consistent with the view of wealth as a substitute for insurance.

Yet it will be difficult to infer about individual utility functions from aggregate cross-sectional data, so that individual-level data are probably the best empirical setting for testing the DARA hypothesis (see the references in Hau 2008). In a broader macroeconomic sense, the magnitude of the elasticity of insurance consumption to income is nevertheless an interesting subject for research: a value below one can be considered consistent with the hypothesis of insurance as an "inferior" good in the sense that its share in the total economy shrinks along with economic development, consistently with the view of a mature market, while an elasticity greater than one means a sector which is growing in importance. It has been argued (Enz, 2000) that the income elasticity of insurance follows a nonlinear pattern across countries with different levels of development, being higher in developing markets and falling below one in mature ones. Of the above studies, Beenstock et al (1988) and Outreville (1990) find remarkably similar elasticities of 1.37 and 1.34. Prosperetti (1992)'s estimates also translate in an elasticity of about 1.2. These results are typical of cross-sectional studies, while recent panel analyses (Esho et al, 2004) get much lower coefficients, thus suggesting that the cross-sectional results be affected by unobservable heterogeneity as will be discussed below.\(^ {13}\)

3.4 Dealing with unobserved heterogeneity

Roughly speaking, the main determinants of insurance demand can be divided into individual- or system-specific. Disposable income, wealth, age, education, type of employment, family composition and the like fall into the individual factors. Legal system, social security system, tax system, demographics, inflation, return on financial investments, exchange rate and so on fall into the system factors. The features of the social security system, e.g., play a major role in explaining health insurance: countries with extensive public coverage tend to have lower levels of life premium income. Religious beliefs, as shown by Grace and Skipper (1991), are a key determinant of insurance consumption in many countries. It is therefore difficult in cross-section analyses to disentangle the effects related to the national characteristics from those of income, age and the

\(^{12}\) Hoy and Robson (1981) examined conditions for insurance to be a Giffen good, a possibility later dismissed by Borch (1986) while the Hoy and Robson model has been generalized by Briys et al (1989) and recently by Hau (2008). Here it may suffice to loosely associate this possibility with DARA preferences.

\(^{13}\) In general, the tendency apparent from the various specifications reported in the literature is for income to be positively correlated with most other regressors, so that the more omitted variables there are, the greater the coefficient of income will result. It is therefore crucial to this end to specify a reasonably complete model.
like, especially as the levels of per-capita income, the age structure of the population, the level of education, the degree of development of the financial system and so forth tend to go together through the stages of development of a country. Multicollinearity, due to the high correlation among explanatory variables, makes parameter identification difficult.

Short panel data, characterized by a large cross-sectional dimension and a limited temporal one, can help in this respect. In fact some panel studies of the determinants of insurance have emerged in the last decade (e.g., Beck and Webb 2003, Browne et al 2000, Esho et al 2004). In spite of that, a range of methodological problems arise also in cross-country panel studies. Adding more countries to the panels means adding to the heterogeneity, in a sense incurring into the incidental parameters problem: in fact, as the geographical scope of the analysis widens, more determinants should be estimated, or more probably accounted for through fixed effects. More parsimonious random effects (RE) specifications, based on the assumption of a random draw of every country from a "homogeneous" population, are in fact often rejected by diagnostic tests14. Moreover, the problem of slope heterogeneity may become more relevant in the panel data model.

A regional study may help shed some light on the determinants of insurance consumption at the individual-specific level in an homogeneous setting as regards system-specific ones. Italy, a developed country that has nevertheless become a case study in regional (relative) underdevelopment, provides an ideal testing environment.15

4 The data

We analyze the consumption of non-life insurance across the 103 Italian provinces16 spanning the period from 1998 to 2003.

The Italian territory is highly differentiated both from the social, cultural and demographic point of view and from the more strictly economic one. The age structure of the population leans towards the older classes in the North-West and the Centre-North, while the residents in the central part of Northern Italy and in the South as a whole are youngest. The structure of the family is also very differentiated: the average number of family members is constantly decreasing with latitude. Per capita income is highest in the North and the capital, lowest in the South, with all kinds of nuances in between (Table 3). Indicators of economic development like, e.g., registered cars per capita are similarly distributed, but with a higher concentration in the North-West and Centre-North than in the north-East. Unemployment is dramatically high in the South and rather low in most regions of the North and part of the Centre. The North is most industrialized, even though the share of industry in the productive tissue of the land is high also in most of the Centre, with the notable

14 For an example in the field of insurance development, see Beck and Webb (2003), where the RE specification is accepted only on the subgroup of developing countries.

15 Guiso et al (2004a), analyzing the causal link between financial development and growth from a regional perspective, observe that the level of political, regulatory and financial integration reached within Italy can be considered an upper bound for that a set of countries will ever be able to attain.

16 Provinces correspond to level 3 in the NUTS (Nomenclature of Territorial Units for Statistics) classification by Eurostat.
exception of Rome and its surroundings. Services, most notably touristic ones, dominate in the Islands and are important in the South as a whole.

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>1st Qu.</th>
<th>Median</th>
<th>Mean</th>
<th>3rd Qu.</th>
<th>Max.</th>
<th>Gini</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhab./Km²</td>
<td>37.0</td>
<td>104.1</td>
<td>172.4</td>
<td>244.9</td>
<td>254.9</td>
<td>2647.0</td>
<td>0.46</td>
</tr>
<tr>
<td>Family size</td>
<td>2.0</td>
<td>2.4</td>
<td>2.6</td>
<td>2.6</td>
<td>2.8</td>
<td>3.1</td>
<td>0.05</td>
</tr>
<tr>
<td>Perc. aged 65+</td>
<td>12.1</td>
<td>17.1</td>
<td>19.1</td>
<td>19.5</td>
<td>21.9</td>
<td>25.3</td>
<td>0.09</td>
</tr>
<tr>
<td>Disp. income</td>
<td>8.2</td>
<td>10.7</td>
<td>14.0</td>
<td>13.4</td>
<td>15.4</td>
<td>18.8</td>
<td>0.12</td>
</tr>
<tr>
<td>Prem.p.c., nonlife</td>
<td>49.0</td>
<td>91.4</td>
<td>202.5</td>
<td>194.4</td>
<td>272.7</td>
<td>534.9</td>
<td>0.30</td>
</tr>
<tr>
<td>Pr./GDP nonlife</td>
<td>0.5</td>
<td>0.9</td>
<td>1.4</td>
<td>1.4</td>
<td>1.8</td>
<td>2.9</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Table 3: Distribution across NUTS3 regions and inequality measures of some characteristics of Italian territory, 2000

Measuring insurance consumption across provinces of different economic and demographic "size" requires resorting to some kind of relativization. As observed above, two common normalized measures are used in the literature as well as among practitioners: insurance penetration and insurance density. In the following we focus on the latter.

Insurance density is also highly differentiated across Italian provinces\textsuperscript{17}. All of the last 20 provinces in the overall ranking come from the South and Islands; all but three of the first 20 are from the North. A comparison with insurance penetration (not reported) shows that the situation is very similar\textsuperscript{18}.

A potentially important omission in the data is the relative price level, which according to common wisdom is rather diverse across Italy. Unfortunately there are no cross-sectional data available on regional purchasing power parities, but only time series of price indices. Should it turn out to be important, the omitted purchasing power variable, which is likely to be spatially correlated, would show up in the form of spatial dependence in the residuals. The alternative measure of insurance consumption does not suffer from this drawback as the purchasing powers get lost in the normalization. Therefore we estimated the models also with respect to this measure as a robustness check, finding much similar results.

Besides high spatial differentiation, insurance density shows a high degree of spatial correlation\textsuperscript{19}, as shown by a Moran plot of premiums per capita (see Figure 1; all data are for the year 2000). While most observations scatter in the high correlation region, there is also an evident cluster of low-density regions, all from the South and Islands, visually removed from the rest. The situation is much alike for most of the determinants of insurance consumption, although clustering is less apparent. The plots of disposable income, average family members and interest rate clearly indicate spatial dependence, which is

\textsuperscript{17}Data on insurance premiums are collected on a provincial basis by ISVAP, the Italian Insurance authority.

\textsuperscript{18}In other words, at a first glance heterogeneity in insurance consumption doesn’t seem to be only due to differences in available resources, since the average propensity to buy insurance out of one’s income is almost as differentiated.

\textsuperscript{19}Tests and diagnostic plots for spatial correlation as well as spatial models are based on a spatial weights matrix constructed according to the principle of queen contiguity (that is, provinces are considered neighbours if they share a common border or vertex; see LeSage 1999). According to common practice, the matrix has been row-standardized. Reggio Calabria and Messina, divided by the Messina Strait, have been considered contiguous.
confirmed by more formal statistical tests (Moran and Geary, not reported), and heterogeneity between the South and the rest of the country.

In the rest of the paper we assess whether the local disparities in explanatory factors are sufficient in explaining local variability; whether macroregional dummies are needed to account for spatial heterogeneity; and whether spatial effects are significant, and should enter a model specification.

5 The model

In this section we outline our choice of model specification motivating it in the framework of Beenstock et al (1988), who synthesize the findings of previous research formalizing a demand and supply system for the non-life insurance market based on theoretical predictions in terms of observable variables.

A major limitation of empirical studies of insurance is the unobservability of prices and quantities (see Schlesinger, 2000). In fact, the only thing observed is usually the equilibrium revenue $V = PQ$, which will be the focus of this paper
as well. Demand is assumed to depend positively on income \( Y \) (the observable counterpart of wealth) and probability of loss \( \pi \); and negatively on the interest rate \( r \) and the premium rate (the price of coverage) \( P \):

\[
Q_D = F_1(Y, \pi, r, P)
\]

Supply is hypothesized to vary positively with the interest rate, measuring the return on invested reserves, and the premium rate; negatively with the probability of loss, which can be seen as a measure of unit production cost:

\[
Q_S = F_2(r, \pi, P)
\]

Imposing the market equilibrium condition \( Q_D = Q_S \) and solving for quantity and price, Beenstock et al (1988) get equilibrium solutions for both; hence, they express total revenue \( V \) as a function of \( Y \), \( \pi \) and \( r \), where the sign of the effect is assumed positive for \( Y \) (which only shifts demand) and ambiguous for \( \pi \) and \( r \), which shift both supply and demand in opposite directions.

We follow this general scheme, specifying the model as a single-equation relationship relating insurance density to the relevant drivers for the supply and the demand side of insurance. In the model specification we include real GDP per capita, which accounts for both income and the general level of economic activity, and real bank deposits per capita, employed, as often occurs, as a proxy for the stock of wealth\(^{20}\). We expect the effect of the first to be positive, as unanimously found in the empirical literature, while that of wealth will depend on prevalence of the substitution or the wealth effect, as discussed above. The effect of the probability of loss, as observed, is ambiguous because an increase shifts both the demand and the supply curve up. We add density of inhabitants per square Km as a proxy for risk conditions, in accordance with both the literature and the applied practice.

A major difference between our setting and that of Beenstock et al (1988) is that here the rate of return on investments for insurance providers is invariant at the provincial level, because they are all nationwide players investing on the national and international financial markets, while the interest rate faced by consumers of different provinces is indeed diversified. We include the latter measured as the real interest rate on borrowing: if the hypothesis that higher interest rates lower insurance demand is true, we expect to observe a negative effect on premium income.

The density of insurance agencies per 1000 inhabitants can be seen as inversely related to the opportunity cost of searching for a suitable insurance policy. On the supply side, insurance agents are usually compensated with a percentage of premium income while the fixed costs for the insurance company are practically negligible, so the number or density of agencies should not enter the production function of the insurer. As such, we expect it to influence (positively) only the demand side of the market.

Next, to test the relevance of education as an indicator of the attitude towards risk, we include the percentage of people with second-grade schooling or\(^{20}\)We verified the appropriateness of deposits as a proxy for wealth drawing on a new database from the Bank of Italy (see Albareto et al, 2007), comparing our data on bank deposits with their estimates of household wealth for the year 1998. On a per capita, cross-region basis, the correlation between bank deposits and real assets was 0.92, with financial wealth 0.80, both significantly positive at the 1 percent level. Province-level data are not available.
Although it has been argued that better schooling may also impact the production efficiency of insurers (see Outreville, 1996), we do not consider this observation, made in the context of developing countries, to be relevant for Italy; therefore we expect schooling to have effects only on the demand side, so that if supply is reasonably well behaved then a positive effect will be indicative of a positive demand shift, and the opposite.

We also add a number of controls in order to account for socioeconomic characteristics of the land. In order to control for the diverse composition of the productive sector, possibly leading to variability in insurance needs, we add the share of value added accruing to agriculture, while the average number of family members shall account for family composition as some insurance policies, like homeowners’ insurance, are typically sold to families instead of individuals, so insurance density might be lower where families are, on average, bigger.

As observed above, there is substantial evidence that the enforcement of property rights fosters insurance development. While the legislation is homogeneous inside Italy, law enforcement is not, with huge differences between provinces in particular when it comes to the time needed to settle a case. To account for this, we include an indicator of judicial system inefficiency, measured as years needed for settling a civil case.

Lastly, following the findings by Guiso et al (2004b, 2008) regarding the importance of trust in investment decisions and financial transactions, we include survey results to the question “do you trust other Italians?” from the World Values Survey, 1999 wave in order to control for the general level of trust.

A description of the regressors included in the model follows in Table 4. Whether they have been logged or not will be apparent from the model results tables: as a general rule, though, all variables are in logs except for ratios. All monetary variates are expressed in real terms using 2000 as the base year by deflating them with the national price index; the sources cited are for the raw data; further calculations by the authors have employed population statistics from Istat.

Some summary statistics are reported in Tables 5 and 6.

### 5.1 Controlling for spatial effects

Georeferentiation enriches the dataset with the information on the relative position of the data collection units, allowing detection and characterization of spillover effects and more generally a parsimonious characterization of dependence, e.g. when the latter is regularly decaying with distance. On the other hand, the regional scale of the analysis also brings some drawbacks and requires some caution. Collective policies purchased by the firms as a mandatory cover or as a fringe benefit for their employees, most typically in the accident and health classes, are bound to one salespoint location even if they are actually insuring risks spread over a wider territory. Furthermore, mostly for big contracts negotiated by brokers but also for some distribution agreements, e.g., in

---

21 This is collected at regional level.

22 This indicator comes from the database of Guiso et al (2004b) and is relative to 1999, thus it is included as a time-invariant variable; the variability over time should be almost negligible with respect to the high cross-sectional variance.

23 This (like the previous one) is included as a time-invariant variable both due to unavailability of other waves and in the belief that such attitudes would show scant variability over a six- or seven-year horizon.
bancassurance, some big units, usually located in an important industrial or financial centre, are accountable for all business nationwide. This happens, for example, for marine insurance premiums collected by business units located in the main harbours for customers located and doing business elsewhere, or for some nationwide salesmen network whose business goes through a single agency, typically located at the company headquarters, but also in any case when the location of salespoint is different from the actual location of the insured. More generally, premium data are subject to a problem which is typical in spatial analysis, the so called aggregation bias, due to the arbitraryness of administrative boundaries with respect to the geographic dimension of economic phenomena (see Anselin, 1988). (Negative) local spatial correlation in error terms may arise if there are such cross-border spillovers. Global forms of spatial correlation can be due to the omission of spatially diffuse relevant regressors, which may reflect in a spatial structure in the errors and can be modelled including either a spatial autoregressive term in the error process or a spatially lagged dependent variable. This, as observed in Section 4, might be the case for the unobservable differences in purchasing power.

6 Empirical findings and discussion

Considering that the focus of our analysis is mainly in explaining provincial differences, so that we want to retain some cross-sectional variability to be exploited in estimation, and that some of our regressors of interest are time-invariant, a fixed effects analysis is not an option. A pure random effects model, on the converse, is inconsistent if there is any unobservable heterogeneity correlated with the regressors, which is rather likely in our case. A feasible technique, somehow intermediate between fixed and random effects, is to add subgroup dummies, usually on a geographic basis or on a development-level one (see Wooldridge, 2002, pg. 288). We include subgroup dummies at two alternative levels, macroregional or regional, which amounts to the inclusion of, respectively, 5 or 18\(^{24}\) fixed effects, in order to capture that part of the unobservable differences.

\(^{24}\)Of the 20 Italian regions, two (Valle d’Aosta and Molise) contain only one province.

<table>
<thead>
<tr>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>rgdp</td>
<td>Real GDP per capita</td>
</tr>
<tr>
<td>rbankdep</td>
<td>Real bank deposits per capita</td>
</tr>
<tr>
<td>density</td>
<td>Density of inhabitants per square Km</td>
</tr>
<tr>
<td>rirs</td>
<td>Real interest rate on borrowing</td>
</tr>
<tr>
<td>agencies</td>
<td>Density of insurance agencies per 1000 inhabitants</td>
</tr>
<tr>
<td>school</td>
<td>Share of people with second-grade schooling or more</td>
</tr>
<tr>
<td>vaagr</td>
<td>Share of value added, agricultural sector</td>
</tr>
<tr>
<td>family</td>
<td>Average number of family members</td>
</tr>
<tr>
<td>inef</td>
<td>Judicial inefficiency: years to settle a civil case</td>
</tr>
<tr>
<td>trust</td>
<td>Survey results to the question &quot;do you trust others?&quot;</td>
</tr>
</tbody>
</table>

Table 4: Description and sources of the model’s regressors
Table 5: Summary statistics; range, inequality (Gini’s coefficient) and spatial correlation tests (Moran’s I) for the year 2000.

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Italy</th>
<th>Max.</th>
<th>Gini</th>
<th>Moran</th>
</tr>
</thead>
<tbody>
<tr>
<td>rgdp</td>
<td>10051.70</td>
<td>17564.85</td>
<td>28650.07</td>
<td>0.14</td>
<td>11.64 ***</td>
</tr>
<tr>
<td>rbankdep</td>
<td>3878.30</td>
<td>8388.58</td>
<td>21981.67</td>
<td>0.20</td>
<td>8.69 ***</td>
</tr>
<tr>
<td>density</td>
<td>36.95</td>
<td>244.92</td>
<td>2646.92</td>
<td>0.46</td>
<td>1.52 .</td>
</tr>
<tr>
<td>rirs</td>
<td>2.98</td>
<td>4.99</td>
<td>7.68</td>
<td>0.10</td>
<td>10.70 ***</td>
</tr>
<tr>
<td>agencies</td>
<td>0.13</td>
<td>0.38</td>
<td>0.59</td>
<td>0.15</td>
<td>11.92 ***</td>
</tr>
<tr>
<td>school</td>
<td>34.32</td>
<td>41.85</td>
<td>50.00</td>
<td>0.05</td>
<td>11.66 ***</td>
</tr>
<tr>
<td>vaagr</td>
<td>0.27</td>
<td>3.98</td>
<td>13.03</td>
<td>0.36</td>
<td>3.68 ***</td>
</tr>
<tr>
<td>family</td>
<td>2.05</td>
<td>2.60</td>
<td>3.07</td>
<td>0.05</td>
<td>11.00 ***</td>
</tr>
<tr>
<td>inf</td>
<td>1.44</td>
<td>3.79</td>
<td>8.32</td>
<td>0.20</td>
<td>7.29 ***</td>
</tr>
<tr>
<td>trust</td>
<td>3.03</td>
<td>3.26</td>
<td>3.62</td>
<td>0.02</td>
<td>7.88 ***</td>
</tr>
</tbody>
</table>

Table 6: Macroregional averages, year 2000

<table>
<thead>
<tr>
<th></th>
<th>N-W</th>
<th>N-E</th>
<th>Centre</th>
<th>South</th>
<th>Islands</th>
</tr>
</thead>
<tbody>
<tr>
<td>rgdp</td>
<td>20475.58</td>
<td>21815.82</td>
<td>18354.19</td>
<td>12677.81</td>
<td>12368.46</td>
</tr>
<tr>
<td>rbankdep</td>
<td>10201.66</td>
<td>10514.48</td>
<td>9088.06</td>
<td>5568.43</td>
<td>5303.25</td>
</tr>
<tr>
<td>density</td>
<td>301.84</td>
<td>250.97</td>
<td>204.35</td>
<td>270.67</td>
<td>149.61</td>
</tr>
<tr>
<td>rirs</td>
<td>4.47</td>
<td>4.43</td>
<td>4.60</td>
<td>6.01</td>
<td>5.76</td>
</tr>
<tr>
<td>agencies</td>
<td>0.45</td>
<td>0.45</td>
<td>0.42</td>
<td>0.28</td>
<td>0.26</td>
</tr>
<tr>
<td>school</td>
<td>43.54</td>
<td>43.88</td>
<td>44.63</td>
<td>39.01</td>
<td>35.83</td>
</tr>
<tr>
<td>vaagr</td>
<td>3.07</td>
<td>3.38</td>
<td>3.01</td>
<td>5.36</td>
<td>5.84</td>
</tr>
<tr>
<td>family</td>
<td>2.39</td>
<td>2.48</td>
<td>2.58</td>
<td>2.85</td>
<td>2.79</td>
</tr>
<tr>
<td>inf</td>
<td>2.89</td>
<td>2.86</td>
<td>3.71</td>
<td>5.14</td>
<td>4.76</td>
</tr>
<tr>
<td>trust</td>
<td>3.32</td>
<td>3.30</td>
<td>3.24</td>
<td>3.20</td>
<td>3.19</td>
</tr>
</tbody>
</table>

heterogeneity that might be correlated with the regressors.\textsuperscript{25}

The limited time dimension of our study also allows to include time dummies, while retaining a comfortable number of degrees of freedom.\textsuperscript{26} The time dummies are meant to capture the effects of the so-called "insurance cycle", an empirically established long-term swing in prices and profitability (see the seminal paper of Cummins and Outreville (1987)) and of global shocks in general, which could possibly induce a non-spatial kind of cross-sectional dependence, as noted e.g. by Elhorst (2009).

We start the econometric analysis estimating by ML a RE model with first-order autocorrelated errors on a balanced panel data-set.

Based on the residuals of the random effects, AR(1) errors model, we proceed testing for spatial correlation in the general LM framework of Baltagi et al

\textsuperscript{25}The results for a specification where 18 regional fixed effects are included instead of the 5 macroregional ones, not reported, are quite similar and can be obtained from the authors upon request. The fact that the behaviour of the model doesn’t change substantially between the two cases is taken as evidence in favour of the robustness of our specification.

\textsuperscript{26}We are therefore assuming that the inclusion of (macro)-regional and time effects does make the residual individual effect to be uncorrelated with the regressors. One further restrictive hypothesis our model rests upon is that all regressors be strictly exogenous, which is needed for consistency of the RE estimator.
We carry out the one-dimensional conditional test for spatial error dependence (labeled C.1) for the null of no spatial correlation, assuming both first-order serial correlation of the errors and random effects. The results are based on the spatial weights matrix $W$ used in the spatial dependence analysis. The test statistic is $LM = 0.62$ (p-value: 0.4293). Hence we conclude that spatial correlation is not relevant in our model specification.

Next, we test for serial correlation in the residuals. Given the absence of spatial correlation, we run (the one-sided version of) Baltagi and Li’s test for AR(1)/MA(1) residuals conditional on random effects (Baltagi and Li, 1995) which finds strong evidence of serial correlation ($Z = 4.75$, p-value=$1.04e^{-06}$).

The ML estimates for the random effects panel data model with AR(1) errors are reported in the first column of Table 7. As far as first-order serial correlation is concerned, the estimated value is 0.53$^{27}$.

As the standard RE panel data estimator is inefficient but still consistent in case of serial correlation and heteroskedasticity, we present also the estimates for this model, reporting White-Arellano corrected standard errors (see e.g. Baltagi 1995). Moreover, in our small T, large N context, a less restrictive approach can be applied (see Wooldridge, 2002, chap. 10.4.3), i.e. the general feasible GLS estimator, which allows for time-varying variances and arbitrary serial correlation of the errors, provided that the unrestricted errors covariance matrix is constant across individuals. Both the general feasible GLS estimates and the standard RE estimates with White-Arellano robust standard errors are reported, respectively, in the second and third column of Table 7.

<table>
<thead>
<tr>
<th></th>
<th>RE-AR(1)</th>
<th>se</th>
<th>GGLS</th>
<th>se</th>
<th>RE-HC</th>
<th>se</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-0.8177</td>
<td>1.09</td>
<td>-2.6411</td>
<td>1.01</td>
<td>**</td>
<td>-0.7361</td>
</tr>
<tr>
<td>log(r(gdp))</td>
<td>0.2892</td>
<td>0.09</td>
<td>**</td>
<td>0.4913</td>
<td>0.10</td>
<td>**</td>
</tr>
<tr>
<td>log(rb ankdep)</td>
<td>0.1578</td>
<td>0.04</td>
<td>***</td>
<td>0.2366</td>
<td>0.04</td>
<td>***</td>
</tr>
<tr>
<td>log(density)</td>
<td>0.0762</td>
<td>0.02</td>
<td>**</td>
<td>0.0632</td>
<td>0.02</td>
<td>***</td>
</tr>
<tr>
<td>rirs</td>
<td>-0.0139</td>
<td>0.01</td>
<td>*</td>
<td>-0.0221</td>
<td>0.01</td>
<td>**</td>
</tr>
<tr>
<td>log( agencies)</td>
<td>0.1608</td>
<td>0.05</td>
<td>**</td>
<td>0.1936</td>
<td>0.05</td>
<td>***</td>
</tr>
<tr>
<td>school</td>
<td>0.0014</td>
<td>0.00</td>
<td></td>
<td>-0.0014</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>vaagr</td>
<td>-0.0077</td>
<td>0.00</td>
<td></td>
<td>-0.0090</td>
<td>0.00</td>
<td>*</td>
</tr>
<tr>
<td>log(family)</td>
<td>-0.1276</td>
<td>0.16</td>
<td></td>
<td>-0.1654</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>log(in ef)</td>
<td>-0.1838</td>
<td>0.07</td>
<td>**</td>
<td>-0.1727</td>
<td>0.05</td>
<td>***</td>
</tr>
<tr>
<td>log(trust)</td>
<td>1.6195</td>
<td>0.53</td>
<td>**</td>
<td>1.1184</td>
<td>0.39</td>
<td>**</td>
</tr>
</tbody>
</table>

Table 7: Model summary. The dependent variable is the log of non-life premiums per capita.

The results of the different estimators are largely consistent despite some numerical differences.$^{28}$ Per capita GDP and wealth turn out to be important determinants of insurance consumption. The elasticity on income is much lower than—and statistically different from—one, thus rejecting the view of non-life

$^{27}$A structural a-priori reason to suspect the presence of serial correlation is the existence of pluriannual contracts.

$^{28}$The results for the model with regional dummies are also generally consistent with the former, the main difference being that the coefficient for the share of the agricultural sector on GDP, while retaining the same sign, is not statistically significant any more.
insurance as a "superior" good. The effect of wealth is positive, as expected and contrary to the findings of Browne et al (2000), but the elasticity is again much lower than one, suggesting that the propensity to insure is actually decreasing with wealth.

Population density proves positive and significant, supporting the claim that it is a good proxy for risk conditions. Consistently with theoretical predictions, interest rates are significantly negatively related with insurance consumption: the cost of borrowing is a restraining factor for Italian firms and households with respect to the decision to insure, as self-insurance becomes the more attractive if credit is expensive. The density of agencies turns out as a positive driver, consistently with the view that insurance is a complicated good with a substantial cost of searching for an appropriate contract.

As for the sociodemographic controls, family numerosity plays a weak role, with a negative but not significant coefficient, and so does schooling: human capital does not seem to exert an influence on the non-life insurance market of a developed country. The share of agriculture has a small and negative coefficient, which is likely to account for the preponderance of manufacturing-related over crop-related protection needs.

Legal system inefficiency, which plagues many of Italy’s regions, has a significant negative impact on insurance. This confirms the argument that bad enforcement of property rights negatively affects people’s willingness to insure (as found by Esho et al 2004) and more generally to commit to long-term contracts, as observed by Guiso et al (2004b) analyzing financial services. For probably similar reasons as in this last paper, trust is an important positive determinant of insurance.

6.1 A further test for spatial dependence

In the previous section we have based the non-life insurance consumption analysis on a static RE panel data model with AR(1) errors and we have found that, while insurance premiums are strongly spatially correlated (see section 3.4), the one-dimensional conditional LM test for spatial error correlation proposed by Baltagi et al (2007) favours the hypothesis of no residual spatial correlation. Therefore from this point of view we might conclude that the observed spatial pattern of non-life insurance has properly been accounted for by means of the regressors.

In order to further investigate the issue, in this section we consider an alternative specification based on a dynamic panel data model. Firstly, we employ Pesaran (2004)’s CD test for global spatial dependence in order to assess the degree up to which the regressors in our maintained specification are able to control for spatial correlation.

The standard CD test is based on an average (across the sectional dimension) of sample estimates of the pairwise correlations of residuals of the separate (timewise) regressions for every sectional unit:

\textsuperscript{29}The (lagged) loss ratio of the property sector, included in an alternative specification as an ex-post estimate of risk conditions, proved not significant. See also the discussion in Section 3.2.
\[ CD = \sqrt{\frac{2T}{N(N-1)}} \left( \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right); \quad \hat{\rho}_{ij} = \frac{\sum_t c_{it} c_{jt}}{\left( \sum_t c_{it}^2 \right)^{1/2} \left( \sum_t c_{jt}^2 \right)^{1/2}} \]

The CD test is asymptotically standard Normal distributed under the null of no cross-sectional correlation.

Separate regressions are infeasible here because we have more regressors than time periods, thus we revert to a version based on fixed effects residuals, which is valid subject to the validity of the slope homogeneity constraint. The CD test relies upon the hypothesis of serially uncorrelated residuals, thus in order to eliminate first-order serial correlation we include the lagged dependent variable, in addition to the original time-variant regressors\(^{30}\).

Interestingly, while for the AR(1) panel data model with only fixed effects and time dummies we obtain a CD statistic of 9.57, thus rejecting the null at any significance level, for the full model we get \(-0.56\), with p-value of 0.5751. So the non-life AR(1) model shows evidence of global cross-sectional dependence which is satisfactorily accounted for by the covariates in the complete model.

A variant of the CD test, called \(CD(p)\) test, takes into account an appropriate subset of “neighbouring” cross-sectional units to check the null of no cross-sectional dependence against the alternative of local cross-sectional dependence, i.e. dependence between neighbours only. To do so, the pairs of neighbouring units are selected by means of a binary proximity matrix. In the original paper, a regular ordering of observations is assumed, so that the \(m\)-th cross-sectional observation is a neighbour to the \((m-1)\)-th and to the \((m+1)\)-th; nevertheless extending the \(CD(p)\) test to irregular lattices is straightforward. A binary proximity matrix is employed as a selector for discarding the correlation coefficients relative to pairs of observations that are not neighbours in computing the CD statistic. The test is defined as

\[ CD(p) = \sqrt{\frac{T}{\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} w(p)_{ij} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} w(p)_{ij} \hat{\rho}_{ij}} \left( \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} w(p)_{ij} \hat{\rho}_{ij} \right) } \]

where \( w(p)_{ij} \) is the \((i,j)\)-th element of the \(p\)-th order proximity matrix, so that if \(h, k\) are not neighbours, \(w(p)_{hk} = 0\) and \(\hat{\rho}_{hk}\) gets “killed”; this is easily seen to reduce to formula (14) in Pesaran (2004) for the special case considered in that paper.

Testing for first-order local instead of global cross-sectional correlation, the results are similar: while for the AR(1) panel data model with only fixed effects and time dummies we obtain a CD(1) statistic of 4.86, thus strongly rejecting the null of independence, for the full model we obtain \(-0.77\), with p-value of 0.4388.

Therefore, summing up, also with this dynamic model specification we conclude that the regressors included successfully explain the spatial correlation observed in non-life insurance premiums. As discussed above, we take the absence of spatial correlation in the residuals as evidence against the exclusion of potentially important, spatially diffused regressors, our major concern in this

\(^{30}\)While fixed effects estimators are inconsistent for fixed \(T\) in dynamic panel data models, Pesaran (2004, 6) shows that the CD test continues to hold also in this context, as long as the disturbances are symmetrically distributed.
respect being the omission of the unobservable differences in purchasing power (see Section 4).

7 Conclusions

In this paper we approach the empirical investigation of insurance consumption from a new perspective, an intermediate one between existing cross-country studies and microdata analyses on household income, wealth and consumption surveys. Data availability for Italian insurance premiums limits the analysis to the provincial (i.e. NUTS3) aggregation level. We concentrate on the consumption of non-mandatory non-life insurance, which is comparatively low in Italy with respect to other developed countries, and in Southern Italy with respect to the Centre and North of the country. Our goal is to assess the reasons for this underdevelopment.

In accordance with existing literature, we find a significant and positive influence of income and wealth on insurance consumption, although both elasticities are much less than one. The view of population density as a proxy for risk conditions is also supported. Trust is a positive driver in committing to such long-term, litigation-prone contracts as are policies; for similar reasons, the role of judicial inefficiency is strongly negative. Both these findings highlight the importance of a healthy social environment and of the correct enforcement of property rights on the development of the financial sector. High interest rates are found to depress non-life insurance consumption, arguably by raising the cost of borrowing and thus the opportunity-cost of insuring against self-insuring. Lastly, the effect of the density of agencies is positive, highlighting the searching cost and the value of advice in the purchase of a rather complicated contract as often are insurance policies. Southern and Insular Italy is, on average, endowed with lower levels of the positive drivers of insurance and burdened by poor judicial enforcement, tighter credit conditions and lower levels of trust: hence its relative underdevelopment.

High differentiation and strong spatial dependence among neighbouring provinces are found both for insurance consumption and for its relevant drivers. However, the residuals of the estimated random effects panel data models, which control for these determinants of insurance consumption, turn out to be cross-sectionally uncorrelated, supporting the completeness and appropriateness of the chosen specification.

In the analysis of insurance development data limitations, both those inherent the very nature of the product and those due to current statistical practice, are binding. Moreover, cross-country analyses are prone to collinearity problems. Regional data may be useful in this respect, by eliminating that part of the heterogeneity that is associated with “systemic” differences between countries. However, dealing with such data, the spatial perspective should always be controlled for, as further methodological issues arise with respect to panels or cross-sections of countries, where the relevant markets are well delimited by national boundaries.
References


Arrow K (1971) Essays in the theory of risk bearing. Markham, Chicago


Baltagi B, Li Q (1995) Testing \( ar(1) \) against \( ma(1) \) disturbances in an error component model. Journal of Econometrics 68:133–151


Pratt J (1964) Risk aversion in the small and in the large. Econometrica 32:122–136


Life insurance consumption in Italy: a sub-regional panel data analysis

Giovanni Millo
Research Dept., Assicurazioni Generali SpA
and DEAMS, University of Trieste

Gaetano Carmeci
DEAMS, University of Trieste

March 23, 2010

Abstract

We analyze the consumption of life insurance across 103 Italian provinces in 1996-2002. We assess the determinants of insurance consumption in the light of the empirical literature and of the distinctive features of our country.

Cross-country analyses of insurance development have suffered from the presence of too many idiosyncratic country-level determinants (like legal system, social security, taxation or inflation history). Panel studies in the field suffer from the curse of dimensionality as well. A regional analysis of Italy, a notoriously very diverse country, provides an environment with less unobserved heterogeneity while retaining a fair amount of variance in income, demographics etc.. Another limitation of cross-country studies of life insurance, the difficulty of observing prices, may be overcome as average policy loadings tend to be uniform across regions.

On the converse, a regional study raises issues of cross-sectional dependence, either due to common nationwide factors or to spatial proximity. We control for unobserved heterogeneity through macroregional and time fixed effects. We develop a new spatial random effects model including both spatial lags of the dependent variable and spatial and serial correlation in the errors; we estimate it by maximum likelihood through an algorithm implemented in the R language.

Life insurance turns out to depend on economic development, savings and some demographics, as expected, but also on the general level of trust and the density of the distribution network. Life insurance is negatively correlated with education, supporting the view that better education fosters financial risk taking.
1 Introduction

Insurance activity is usually categorized into life and non-life. Life insurance “serves to guarantee a periodic revenue or a capital to dependents of the policy-holder (the spouse, the children, sometimes the parents or any other person) in case of his death, or to himself, in case he survives” (Villeneuve, 2000). In other words, there are two main functions, defined by the two opposite “risks” related to uncertainty about the duration of human life: protection of dependents from the untimely death of the income earner, and protection of the lifetime income of the latter from the so-called “survival risk”, i.e. living longer than the accumulated resources can provide for. Therefore life insurance has a role in supporting, or even substituting, public welfare. In fact, countries relying substantially on the private sector for the provision of old age benefits typically have very large life insurance revenues to GDP ratios, as is the case for Japan, the United Kingdom, Belgium or South Korea. A third function of life insurers is related to their role of institutional investors. As such, they help the efficient allocation of resources by investing the technical reserves associated with insurance activity. The financial component of life insurance is actually very important, because the time span of contracts is so long that the accumulated reserves reach substantial amounts. At one extreme, some of the activity that goes under the label of life insurance is purely financial and not bound to the duration of human life at all: the risk insurers are supposed to manage is, in this case, that on investment returns.

The importance of insurance in the Italian economy is heterogeneous both at the sectoral and at the geographic level. Unlike what happens with non-life insurance, the Italian life insurance market is comparatively well developed by European standards (see Millo & Carmeci, 2010), but striking regional differences persist, the South of the country being generally underdeveloped with respect to the North and Centre. Given the important function it performs, widely recognized in the literature (see King & Levine, 1993), it may be useful to investigate the determinants that lead to the current situation. Therefore, in this paper we analyze the consumption of life insurance in Italy across its 103 provinces in the period 1996-2001. We aim at describing the different levels of
development in the Italian insurance market at the provincial level and assessing the determinants of insurance consumption, in the light of the empirical literature on the subject and of the strong regional heterogeneity in economic and socio-demographic characteristics which is a well-known feature of our country.

Our work is introduced by sketching the main results in insurance demand theory, focusing on which are expected to be the main drivers of consumption and realizing that some are difficult to observe. A brief survey of existing empirical literature highlights data limitations to joint modeling of supply and demand and provides a further basis for selecting the relevant information set. Discussing the limitations of cross-country aggregate studies, especially those where developing countries make for a big part of the sample, we motivate the choice of a sub-regional perspective as a means of eliminating some sources of variation that tend to overshadow all others and that are potentially prone to multicollinearity. Our sample of Italian provinces is homogeneous as regards systemic characteristics, yet it has enough variability to allow the identification of other determinants of insurance consumption. Moreover, some drivers that are problematic to define and observe (e.g., prices) can be omitted from the empirical analysis because they do not vary over provinces.

We discuss the problems of heterogeneity in space and time and spatial and serial correlation which are likely to affect our sample, and propose a novel estimator to cope with them. Combining: the general analysis of Anselin (1988) on maximum likelihood estimation of spatial models; the work of Case (1991) on models with both spatially autoregressive errors and a spatially lagged dependent variable; and analytical results from Baltagi et al. (2007) on the coexistence of random effects, spatial and serial error correlation in the errors of a panel model, we propose a general specification encompassing all these features and we develop an algorithm for maximum likelihood estimation. The latter is implemented in the R language and applied to our data.

Our results support most of the previous findings of the literature, but compared with previous aggregate studies we are able to highlight the influence of the dependency ratio and decompose it into that of the young (which is influential in our setting) and that of the old (which is not). We assess the importance of supply factors and of some environmental variables, finding that: the density of insurance agencies has a substantial positive effect but that of bank counters has none; and that the general level of trust is supportive of life insurance consumption, while the efficiency of justice, unlike what happens in the non-life sector (see Millo, 2010) is not influential. Lastly, thanks to our encompassing specification we are able to discriminate between spatial correlation in the dependent variable and in the errors, only finding evidence of the latter.

In the next section we review the literature in order to define the subject and then to sketch previous empirical findings providing the foundation for our work. In the third section we describe our dataset and motivate our choice of regressors. In the fourth we succinctly formalize the model based on the work of Beenstock et al. (1986) and discuss the reasons for suspecting the presence of heterogeneity and correlation in space and time. The fifth section presents the random effects specification with spatially lagged dependent variable and serially and spatially correlated errors; then outlines the estimation method; lastly, discusses the results. The last section concludes.
2 Literature review

In the words of Villeneuve (2000) "life insurance serves to guarantee a periodic revenue or a capital to dependents of the policyholder (the spouse, the children, sometimes the parents or any other person\(^1\) in case of his death (term life), or to himself, in case he survives”. Thus, while the primary rationale behind the purchase of term life lies with the bequest motive, buying an endowment policy or an annuity is mainly an investment choice, and is therefore best viewed as a problem of saving and asset allocation.

In the unifying framework first developed by Yaari (1965) and Hakansson (1969), the demand for life insurance is attributed to a person’s desire to bequeath funds to dependents and provide income for retirement. In the case of term life, according to the extension of this scheme by Lewis (1989), it is also a function of the number, personal characteristics and preferences of the beneficiaries, that is, in most cases, of family composition.

The primary function of life insurance can therefore be characterized as "income" protection, meaning either "income of one’s dependents" against premature death of the insured, or "lifetime income of the insured" in the case of lower earnings, e.g. after retirement. Beenstock \(\text{et al.}\) (1986) term the first life protection and the second income protection. They add another function which is typical of insurance: pure saving, the element not related to human life but only to the investment yield. These categories roughly correspond in standard practice to term life, annuities and pensions and capitalization, although distinctions are blurred in the life products that are actually sold. Most endowment policies sold in Italy, for example, have an important term life component, entitling the beneficiaries to payment of its face value upon death of the insured (such policies, combining a saving plan with life protection, are usually called whole life).\(^2\)

<table>
<thead>
<tr>
<th>Class</th>
<th>Premiums</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Class1</td>
<td>27740</td>
<td>28.6</td>
</tr>
<tr>
<td>2 Class3</td>
<td>26560</td>
<td>27.4</td>
</tr>
<tr>
<td>4 Class5</td>
<td>8335</td>
<td>8.6</td>
</tr>
<tr>
<td>5 Class6</td>
<td>128</td>
<td>0.1</td>
</tr>
<tr>
<td>6 Total Life</td>
<td>62780</td>
<td>64.7</td>
</tr>
<tr>
<td>7 Total Life + Non-Life</td>
<td>96992</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 1: Composition of life insurance revenue by class in Italy, 2000. Classes are reported according to the Italian classification; they correspond approximately to traditional endowment and annuities (plus term life, accounting for less than 3 percent of total) in class 1, unit- and index-linked policies in class 3, capitalization (life-independent endowment) in class 5, pension plans in class 6.

A summary of the existing empirical literature can be found in Beck & Webb (2003) who synthesize the phenomenon as follows: \(^{\text{the consumer maximizes}}\)

\(^1\)One big selling point of life insurance in Italy is that it is excluded from the law on statutory bequest.

\(^2\)For an overview on the actual composition of life insurance sold in Italy, see Table1, whence it may be seen that there is no clear correspondence between the theoretical functions of life insurance and the classification.
lifetime utility subject to a vector of interest rates and a vector of prices including insurance premium rates. This framework posits the demand for life insurance to be a function of wealth, expected income over an individual’s lifetime, the level of interest rates, the cost of life insurance policies (administrative costs), and the assumed subjective discount rate for current over future consumption."

Studies on microdata (usually household income or consumer expenditure surveys) have emerged in recent years, both in Italy and abroad, focusing mostly on the probability of purchasing an insurance policy (see, e.g., Walliser & Winter (1999), Showers & Shotick (1994)). The Italian market has been analyzed in a number of recent papers drawing on data from the Bank of Italy’s Survey on Household Income and Wealth (SHIW). Michielin & Billari (2004) analyze term life and pension insurance in the same probit fashion, finding that the decision to buy pensions policies is positively influenced by income, residence in the North (and, to a lesser extent, in the Centre) and, in a non-linear way, by age; term life purchase is positively correlated with family size, education, self-employment, income and home ownership, while urbanization and macroregion of residence are deemed insignificant. Analogously, Cannata, Menegato and Millo (in Cannata et al. (2004)) find evidence of positive correlation of term life ownership with income and number of children, while the coefficients for age, number of family members excluding children, financial wealth and residence in the South are significantly negative; for endowment policies, the effect of income, education and marriage are positive; of children and other family members, not significant; of age, residence in the South and, notably, (other forms of) financial wealth, negative. Ventura (2007) estimates Tobit models for term life and pensions insurance, finding positive effects of income, wealth, age, education and town size, which might be related with the structure of distribution.

Cross-country comparisons face a number of additional problems, first of all the need to proxy individual variables like personal income and wealth, by observable aggregates: GDP and aggregate disposable income are usually employed for this purpose. One also has to carefully control for systemic differences between countries, which often “eat up” all the cross-sectional variability, as is the case for some social security systems outsourcing old-age welfare to the private sector, which gives rise to the world’s biggest life insurance markets in terms of penetration over GDP (south Africa, the United Kingdom, Japan and South Korea). In general, the features of the social security system play a major role in explaining life insurance: countries with extensive public coverage for old age use to have lower levels of life premium income, so that comparisons between countries with different social security systems is often not meaningful unless the heterogeneity is controlled for, e.g. by exploiting time variation in a panel setting, although the time variation is often very small with respect to the cross-sectional one. An inflation-ridden past history in turn depresses public trust in traditional savings products, such as many kinds of life policies: Outreville (1996), in an extensive study of life insurance markets in developing countries, considers the expected inflation rate and the presence of a monopolistic market structure and of barriers to entry of foreign competitors, unsurprisingly observing a negative effect (on inflation, see also Beck & Webb (2003) and the case of Brazil in Babbel (1981)). Religious beliefs, as shown by Grace & Skipper (1991) and Browne & Kim (1993), are another key determinant of the low insurance consumption in many countries, especially Islamic ones. Browne & Kim (1993) find a positive relationship between life insurance consumption
and income, literacy and the type of legal system. Beck & Webb (2003) add also the degree of development of the banking sector, finding a positive effect on the subsample of developing countries. Possibly for the reasons given above (see also the discussion in Hussels et al. (2005)), education, young dependency ratio, life expectancy and the size of social security do not prove significant in their setting.

Beenstock et al. (1986) analyze life insurance in 10 industrialized countries over 12 years. As expected, they find a positive income elasticity, but the latter varies a lot between countries. They also find positive effects from life expectancy, age and the dependency ratio, and a significantly negative effect of social security payments. They also motivate a feature which is often observed in econometric models of insurance consumption: residual serial correlation. They carefully choose the model’s regressors based on the above decomposition into life protection, income protection and saving. A priori, they postulate that demand for life protection depends on life expectancy, parental dependency, age, the price of insurance, the general price level and the level of social security transfers received by the population; supply from insurance price, life expectancy, the real rate of interest, age and the price of pension products (because capacity-constrained insurers face a trade-off between supplying life or pension insurance). In their framework, the demand for pensions in turn depends on income, life expectancy, the price of pension policies, the general price level, parental dependency and social security payments; supply from prices of both insurance categories (for reasons given above), age and the real rate of interest. Lastly, supply of and demand for the saving element of insurance depend on aggregate saving and on a vector of interest rates. From Beenstock et al. (1986)’s empirical analysis, premiums turn out to depend positively from disposable income, life expectancy, proportion of population with dependents, age of the former, dependency ratio; and negatively from social security payments. Saving is omitted, while the interest rate is not significant.

We now turn to the description of the dataset we use, which is based on the formalization in Beenstock et al. (1986), augmented by some variables which proved significant in other studies, and of course omits those invariant at national level\textsuperscript{3}.

\textsuperscript{3}Time variation of cross-sectionally invariant characteristics will be accounted for through time fixed effects, see 4.

\textsuperscript{4}See the more extensive discussion in Millo & Carmeci (2010), 3.4.

3 The data

We draw on Italian data collected at the provincial level over the years 1996-2001. In doing so, we take advantage from the regulatory, fiscal, monetary and, to some extent, cultural uniformity within the country in order to identify the effect of all those factors which, as observed above, are usually overshadowed by country-level heterogeneity\textsuperscript{4}.

Beenstock et al. (1986)’s analysis is the basis for our model specification. We observe aggregate disposable income, and we add bank deposits per capita as a proxy for saving. We proxy life expectancy with average age and use two measures of dependency, splitting the ratio of non-working-age people into younger (under 14) and older (over 65) and dividing the total by the labour force (15-64).
We consider three different kinds of social security payments: old age pensions, pensions to surviving spouses and inability transfers. The general price level is unfortunately unobservable, as in Italy there are no comprehensive price statistics at provincial level. Yet the role of inflation in cross-country surveys is in distinguishing countries where a long history of inflation has permanently discouraged long-term commitments to saving products from those where it has not: in this respect we are confident that Italy’s provinces can be considered perfectly homogeneous and the general price level discarded from our analysis. Regarding the price of insurance, in the equilibrium analysis of Beenstock et al. (1986) the focus is on equilibrium revenue; yet the price of pensions enters the supply function of life protection suppliers and the reverse. In general, as Schlesinger (2000) notes, “it is often difficult to determine [even] what is meant by the price and the quantity of insurance. [...] the fundamental two building blocks of economic theory have no direct counterparts for insurance”. Here the difficulty of (defining and) observing the “price” of insurance coverage, a key limitation of cross-country studies, may be considered irrelevant as products are designed on a nationwide basis and therefore average policy loadings can be taken as uniform across provinces, if not for some possible composition effects. Both interest rates on saving products and the return rates insurers are able to obtain from investing their reserves are determined on a national or international basis, so that we can safely consider them cross-sectionally invariant in our setting.

With respect to Beenstock et al. (1986)’s specification, we add two supply-side variables: the densities of the two main distribution channels, bank counters and insurance agencies, with respect to population. Rather than by Beck & Webb (2003)’s finding on bank development, which regards developing countries, this inclusion is motivated by the widespread belief that life insurance be “sold rather than bought”, meaning that the ability of salespeople is a powerful force in shaping demand (see Bernheim et al., 2003). A more technical, although less credible explanation could be that selling points density reduces the cost of searching for an appropriate policy: yet the high standardization of life products and the diffusion of selling points are so high that searching costs might well be negligible. In this light we also add education, which might capture the degree of financial sophistication and risk awareness of the population, and the general level of trust based on survey data. Education is less likely to be relevant as a measure of human capital in the insurers’ production function, as claimed by Outreville (1996) and Beck & Webb (2003), considering that production takes place at the national level. Finally, an index of judicial inefficiency (average length of civil trials) is added, consistently with the findings of La Porta et al. (1998) on the influence of the legal environment on financial development and the importance of contract enforcement in financial transaction (see Millo, 2010).

In the following, we refer to the (then-) 103 Italian administrative units called...
Table 2: Distribution channels of Life insurance

<table>
<thead>
<tr>
<th>Channel</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Tied agents</td>
<td>25.6</td>
<td>22.1</td>
<td>20.3</td>
<td>18.1</td>
</tr>
<tr>
<td>2 Brokers</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.7</td>
</tr>
<tr>
<td>3 Post</td>
<td>2.1</td>
<td>4.6</td>
<td>5.1</td>
<td>7.2</td>
</tr>
<tr>
<td>4 Company staff</td>
<td>8.4</td>
<td>8.1</td>
<td>8.5</td>
<td>10.3</td>
</tr>
<tr>
<td>5 Banks</td>
<td>51.9</td>
<td>53.4</td>
<td>51.5</td>
<td>52.4</td>
</tr>
<tr>
<td>6 Financial promoters</td>
<td>10.6</td>
<td>10.8</td>
<td>13.6</td>
<td>10.8</td>
</tr>
<tr>
<td>7 Others</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
</tr>
</tbody>
</table>

province, corresponding to level 3 in the NUTS (Nomenclature of Territorial Units for Statistics) classification by Eurostat. We also refer to macroregions, which divide the territory into 5 aggregates: North-West, North-East, Centre, South and Islands. Life insurance density takes much different values across Italian provinces, being generally lower in the South of the country. All of the last 20 regions in the overall ranking come from the South and Islands; all but one of the first 20 are northern regions. Besides high spatial differentiation, insurance density shows a high degree of spatial correlation\(^7\), as shown by a Moran plot of premiums per capita (see Figures 1 and 2; all data are for the year 2000). While most observations scatter in the high correlation region, there is also an evident cluster of low-density regions, all from the South and Islands, visually removed from the rest.

The situation is much alike for most of the possible determinants of insurance consumption, although clustering is less apparent. The plots clearly indicate spatial dependence, which is confirmed by more formal statistical tests (Moran and Geary, not reported), and heterogeneity between the South and the rest of the country.

Summary statistics are reported in Tables 3 and 4.

4 The model

A description of the regressors included in the model follows in Table 5. Whether they have been logged or not will be apparent from the model results tables: as a general rule, though, all variables are in logs except for ratios. All monetary variates are expressed in real terms using 2000 as the base year by deflating them with the official national price index from Istat, the Italian statistical institute; the sources cited are for the raw data; further calculations by the authors have employed population statistics from Istat.

In Beenstock et al. (1986)’s formalization, total premium income \(V\) for the three categories of life insurance products “life protection” \((V_1)\), “pension plans” \((V_2)\) and “saving” \((S)\) can be expressed as

\(^7\)Tests and diagnostic plots for spatial correlation as well as spatial models are based on a spatial weights matrix constructed according to the principle of queen contiguity (that is, provinces are considered neighbours if they share a common border or vertex; see LeSage 1999). According to common practice, the matrix has been row-standardized. Reggio Calabria and Messina, divided by the Messina Strait, have been considered contiguous.
Figure 1: Moran plots (each variable plotted against its spatial lag). Data are relative to the year 2000. Symbols and colour codes for macroregions are: ○ North-West; △ North-East; ◊ Centre; + South; × Islands.
Social security payments per capita  Insurance agencies per 1000 inhab.

Bank deposits per capita  Bank counters per 1000 inhab.

Figure 2: Moran plots (each variable plotted against its spatial lag). Data are relative to the year 1999. Symbols and colour codes for macroregions are: ○ North-West; △ North-East; ◇ Centre; + South; × Islands.
Table 3: Summary statistics; range, inequality (Gini’s coefficient) and spatial correlation tests (Moran’s I) for the year 2000.

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>Italy</th>
<th>Max.</th>
<th>Gini</th>
<th>Moran</th>
</tr>
</thead>
<tbody>
<tr>
<td>ryd</td>
<td>8232.91</td>
<td>13420.02</td>
<td>18838.51</td>
<td>0.12</td>
<td>12.45 ***</td>
</tr>
<tr>
<td>rbankdep</td>
<td>3878.30</td>
<td>8388.58</td>
<td>21981.67</td>
<td>0.20</td>
<td>8.69 ***</td>
</tr>
<tr>
<td>family</td>
<td>2.05</td>
<td>2.60</td>
<td>3.07</td>
<td>0.05</td>
<td>11.00 ***</td>
</tr>
<tr>
<td>odeprat</td>
<td>16.22</td>
<td>26.78</td>
<td>36.54</td>
<td>0.10</td>
<td>9.40 ***</td>
</tr>
<tr>
<td>ydeprat</td>
<td>13.55</td>
<td>20.30</td>
<td>28.79</td>
<td>0.11</td>
<td>12.92 ***</td>
</tr>
<tr>
<td>socialsec</td>
<td>1026.69</td>
<td>2103.23</td>
<td>6218.51</td>
<td>0.21</td>
<td>9.70 ***</td>
</tr>
<tr>
<td>partrate</td>
<td>35.47</td>
<td>47.85</td>
<td>58.08</td>
<td>0.05</td>
<td>9.48 ***</td>
</tr>
<tr>
<td>school</td>
<td>34.32</td>
<td>41.85</td>
<td>50.00</td>
<td>0.05</td>
<td>11.66 ***</td>
</tr>
<tr>
<td>inef</td>
<td>1.44</td>
<td>3.79</td>
<td>8.32</td>
<td>0.20</td>
<td>7.29 ***</td>
</tr>
<tr>
<td>trust</td>
<td>3.03</td>
<td>3.26</td>
<td>3.62</td>
<td>0.02</td>
<td>7.88 ***</td>
</tr>
<tr>
<td>bankcount</td>
<td>0.22</td>
<td>0.52</td>
<td>1.01</td>
<td>0.20</td>
<td>11.81 ***</td>
</tr>
<tr>
<td>agencies</td>
<td>0.13</td>
<td>0.38</td>
<td>0.59</td>
<td>0.15</td>
<td>11.92 ***</td>
</tr>
</tbody>
</table>

Table 4: Macroregional averages, year 2000

\[
V = P_1 Q_1 + P_2 Q_2 + S
\]

where, according to the equilibrium solutions in their paper and considering our choice of regressors,

\[
V_1 = F_1 (\text{ryd, family, odeprat, ydeprat, partrate, socialsec})
\]

\[
V_2 = F_2 (\text{ryd, odeprat, socialsec})
\]

\[
S = F_3 (\text{rbankdep})
\]

plus the control variables.

Like Beenstock et al. (1986), we are not able to observe the three components separately: see comments to Table 1 above. Therefore we will estimate one model for \(V_1 + V_2 + S\) as a whole.
Besides the choice of regressors, our setting poses a number of further specification problems, mostly related to heterogeneity and dependence in time and space. In the following we try to assess whether the local disparities in explanatory factors are sufficient in explaining local variability; whether macroregional dummies are needed to account for spatial heterogeneity; and whether spatial effects are significant, and should enter a model specification.

4.1 Heterogeneity and correlation in space and time

To control for unobserved heterogeneity in space we add both macroregional fixed effects and provincial random effects. As Wooldridge (2002) notes, this is a sort of middle ground between FE and RE analysis, a way of dealing with regressor-related heterogeneity while retaining most of the efficiency of a random effects estimator. Anyway, adding provincial fixed effects would not be an option in this setting, where cross-sectional variability is the main focus of the study and some regressors are very persistent or even time-invariant altogether. The limited time dimension of our study also allows to include time dummies to account for time shifts of all those theoretically influential factors which have been omitted because they are cross-sectionally invariant, like policy loadings (the "price" of insurance) and investment returns.

Consistent with the idea that the different degree of insurance penetration throughout the Italian territory may be due to unobservable, spatially correlated factors as well as to (observable) differences in resources and needs, we expect to find some evidence of global spatial effects. If, on the contrary, the non-spatial specification were able to fully account for the observed variability, this would bring evidence in favour of the view that less developed regions are such simply because of budget constraints and lower insurance needs. This would not rule out the possibility of local spatial effects due to aggregation biases of some kind: for example, due to the overlapping of administrative boundaries with operational areas of the sales force or any other kind of cross-border purchase.

Lastly, as Beenstock et al. (1986) observe, serial correlation is very likely to be an issue because of the considerable slice of recurring payment policies.

<table>
<thead>
<tr>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>ryd</td>
<td>Real per capita disposable income</td>
</tr>
<tr>
<td>rbankdep</td>
<td>Real bank deposits per capita</td>
</tr>
<tr>
<td>family</td>
<td>Average number of family members</td>
</tr>
<tr>
<td>socialsec</td>
<td>Real per capita social security payments</td>
</tr>
<tr>
<td>partrate</td>
<td>Labour participation rate of people aged 15-64</td>
</tr>
<tr>
<td>rirs</td>
<td>Real interest rate on borrowing</td>
</tr>
<tr>
<td>agencies</td>
<td>Density of insurance agencies per 1000 inhabitants</td>
</tr>
<tr>
<td>school</td>
<td>Share of people with second-grade schooling or more</td>
</tr>
<tr>
<td>inef</td>
<td>Judicial inefficiency: years to settle a civil case</td>
</tr>
<tr>
<td>trust</td>
<td>Survey results to the question &quot;do you trust others?&quot;</td>
</tr>
</tbody>
</table>

Table 5: Description and sources of the model’s regressors
5 Model estimation and results

The peculiar features of our problem require the estimation of a model with random effects and both serial and spatial correlation in the idiosyncratic error. Moreover, the nature of the spatial correlation is unclear and therefore it is not possible to choose a priori between the two common specifications of spatial lag (where the dependent variable premultiplied by a spatial contiguity matrix is added to the right-hand-side regressors) and spatial error, where it is the idiosyncratic error term that is spatially lagged. Case (1991), in her study on Indonesian rice farming, estimates a model nesting both specifications (sometimes referred to in the literature as the spatially autoregressive (and) error model, or SAREM) in order to discriminate via a Wald test.

Building on the general approach of Anselin (1988) and on analytical results from Baltagi et al. (2007), we augment Case’s SAREM specification with an autoregressive term in the remainder of the idiosyncratic error.

5.1 Maximum likelihood estimation of the SAREM-AR(1) model

Maximum Likelihood (ML) estimation with a general error covariance matrix has been outlined in Magnus (Magnus (1978), see also Anselin et al. (2007)). If the error is distributed as $N(0,\Omega)$ then the log-likelihood is

$$\log L = (C) - \frac{1}{2} \ln |\Omega| - \frac{1}{2} e' \Omega^{-1} e$$

Particularizing this likelihood w.r.t. the case at hand and adding a spatial filter if needed provides a general framework for ML estimation of the models of interest.

Anselin (1988), the classic reference on spatial econometric model estimation by ML, outlines the general procedure for a model with spatial lag, spatial errors and possibly nonspherical residuals as follows. Let us restrict, for the moment, to one cross-section and let our model, in matrix notation, be

$$\begin{align*}
y &= \psi W_1 y + X \beta + u \\
u &= \lambda W_2 u + \eta
\end{align*}$$

with $W_1, W_2$ proximity matrices, $\eta \sim N(0,\Omega)$ and, in general, $\Omega \neq \sigma^2 I$.

Two special cases of this general model are often found in applied literature: if $\lambda = 0$ one has the spatial autoregressive (SAR) model , while if $\psi = 0$ the spatial (autoregressive) error (SEM) model. Both usually include the hypothesis of spherical errors: $\Omega = \sigma^2 I$.

Introducing the standard simplifying notation

$$\begin{align*}
A &= I - \psi W_1 \\
B &= I - \lambda W_2
\end{align*}$$

the model becomes

$^a$The following notation expressing a spatial lag model as $Ay = X \beta + e$ or, equivalently provided $A$ is invertible, $y = A^{-1}(X \beta + e)$ is well known in the literature as “spatial filtering” representation.
\[ Ay = X\beta + u \]
\[ Bu = \eta \] (3)

If there exists \( \Omega \) such that \( e = \Omega^{-\frac{1}{2}}\eta \) and \( e \sim N(0, \sigma^2_e I) \), and \( B \) is invertible, then

\[ u = B^{-1}\Omega^{\frac{1}{2}}e \]

and the model (2) can be written as

\[ Ay = X\beta + B^{-1}\Omega^{\frac{1}{2}}e \]

or, equivalently,

\[ \Omega^{-\frac{1}{2}}B(Ay - X\beta) = e \]

with \( e \) a "well-behaved" error.

Still following Anselin, making the estimator operational requires the transformation from the unobservable \( e \) to observables. Expressing the likelihood function in terms of \( y \) requires calculating the Jacobian of the transformation \( J = \det \left( \frac{\partial e}{\partial y} \right) = |\Omega^{-\frac{1}{2}}BA| = |\Omega^{-\frac{1}{2}}||B||A| \). These determinants are to be added to the log-likelihood, which becomes

\[ \log L = -\frac{N}{2} \ln \pi - \frac{1}{2} \ln |\Omega| + \ln |B| + \ln |A| - \frac{1}{2} e' e \]

where the difference w.r.t. the usual likelihood of the classic linear model is given by the terms of the Jacobian (which is \( J = 1 \) in that case, see Greene (2003), B.41).

The likelihood is thus a function of \( \beta, \psi, \lambda \) and parameters in \( \Omega \). The overall errors' covariance \( B'\Omega B \) can in turn be scaled, without loss of generality, and written as \( \Omega^{-\frac{1}{2}}B'\Omega B = \sigma^2_e \Sigma \). This likelihood can be concentrated w.r.t. \( \beta \) and the error variance \( \sigma^2_e \) substituting \( e = \left[ \sigma^2_e \Sigma \right]^{-\frac{1}{2}} (Ay - X\hat{\beta}) \)

\[ \log L = -\frac{N}{2} \ln \pi - \frac{N}{2} \sigma^2_e - \frac{1}{2} \ln |\Sigma| + \ln |A| - \frac{1}{2\sigma^2_e} (Ay - X\hat{\beta})' \Sigma^{-1} (Ay - X\hat{\beta}) \]

and a closed-form GLS solution for \( \beta \) and \( \sigma^2_e \) is available for any given set of spatial parameters \( \psi, \lambda \) and scaled covariance matrix \( \Sigma \)

\[ \hat{\beta} = (X'\Sigma^{-1}X)^{-1}X'\Sigma^{-1}Ay \]
\[ \hat{\sigma}^2_e = \frac{(Ay - X\hat{\beta})'\Sigma^{-1}(Ay - X\hat{\beta})}{N} \] (4)

so that a two-step procedure is possible which alternates optimization of the concentrated likelihood and GLS estimation.

A panel model with \( N \times T \) observations can be described in this framework, with proximity matrices which, stacking observations by time, become \( I_T \otimes W \), where \( W \) is the proximity matrix for a cross-section and \( \otimes \) is the Kronecker product, so that e.g. the spatial filter on \( y \) becomes \( A = I_{NT} - \psi(I_T \otimes W_1) \). The distinctive features of a random effects panel with serially and spatially correlated errors concentrate in the errors’ covariance matrix \( \Sigma \).
Introducing serial correlation in the remainder of the error term, together with spatial correlation and random effects, Baltagi et al. (2007) specify the model errors as the sum of an individual, time-invariant component and an idiosyncratic one which is spatially autocorrelated and has serial correlation in the remainder:

\[
\begin{align*}
y &= X\beta + u \\
u &= (I_T \otimes \mu) + \epsilon \\
\epsilon &= \lambda(I_T \otimes W_2)\epsilon + \nu \\
\nu_t &= \rho\nu_{t-1} + \epsilon_t
\end{align*}
\]

Using the following simplifying notation:

\[
\begin{align*}
J_T &= \nu' \\
J_T &= J_T/T \\
E_T &= I_T - \bar{J}_T
\end{align*}
\]

where \(\bar{J}\) is a vector of ones, and

\[
\begin{align*}
\alpha &= \sqrt{\frac{\nu'}{1-\rho}} \\
d^2 &= \alpha^2 + (T - 1) \\
V_\rho &= \frac{1}{1-\rho^2}V_1 \\
V_1 &= \begin{bmatrix}
1 & \rho & \rho^2 & \ldots & \rho^{T-1} \\
\rho & 1 & \rho & \ldots & \rho^{T-2} \\
\vdots & \vdots & \vdots & \ddots & \vdots \\
\rho^{T-1} & \rho^{T-2} & \rho^{T-3} & \ldots & 1
\end{bmatrix}
\]

\(\Sigma\) and its inverse and determinant can be expressed as

\[
\Sigma = \phi(J_T \otimes I_N) + V_\rho \otimes (B'B)^{-1}
\]

\[
\Sigma^{-1} = V_\rho^{-1} \otimes (B'B) + \frac{1}{1-\rho^2}V_1\left[(\nu' J_T V_\rho^{-1}) \otimes [d^2(1-\rho^2)\phi I_N + (B'B)^{-1}]^{-1} - B'B\right]
\]

\(|\Sigma| = |d^2(1-\rho^2)\phi I_N + (B'B)^{-1}| \cdot |(B'B)^{-1}|^{T-1} / (1-\rho)^N\]

and the likelihood is:

\[
\begin{align*}
\log L &= -\frac{NT}{2}\pi - \frac{NT}{2} \ln \sigma^2 + \frac{N}{2} \ln(1-\rho^2) - \frac{1}{2} \ln|d^2(1-\rho^2)\phi I_N + (B'B)^{-1}| \\
&\quad + (T-1)\ln|B| + T\ln|A| - \frac{1}{2\sigma^2} u'\Sigma^{-1}u
\end{align*}
\]

Optimizing this likelihood through the two-step procedure described above, we get the \(\beta\) parameter estimates reported in Table 6 and the spatial lag and error covariance parameters shown in Table 7. Standard errors are based on the GLS step, calculated at optimal values of \(\psi, \phi, \rho\) and \(\lambda\), for the \(\beta\)s and on the numerical estimates of the Hessian for \(\psi\) and the parameters of the error covariance. On computational aspects of the whole procedure, see Millo & Piras (2010).

5.2 Discussion of estimation results

As expected, disposable income is a very significant positive driver of life insurance consumption. Regarding dependency indicators, the only significant one is the young dependency ratio: the presence of young dependents fosters life
## Table 6: Model summary. Significance stars are: '.' = significant at 10 percent; '* = 5 percent; '** = 1 percent; '***' = 0.1 percent. Standard errors are based on the GLS step at optimal values of $\psi, \phi, \rho$ and $\lambda$.

| Estimate | SE | t-value | Pr($>|t|)$ |
|----------|----|---------|-----------|
| (Intercept) | -7.6980198 | 2.3001543 | -3.3467 | 0.0008177 *** |
| log(rwd) | 1.3825600 | 0.2167085 | 6.3798 | 1.773e-10 *** |
| log(rbankdep) | 0.2062532 | 0.0779137 | 2.6472 | 0.0081161 ** |
| log(family) | 0.3784031 | 0.3458818 | 1.0940 | 0.2739442 |
| odeprat | -0.0020569 | 0.0061114 | -0.3366 | 0.7364425 |
| ydeprat | 0.0199744 | 0.0102030 | 1.9577 | 0.0502654 . |
| log(socialsec) | -0.0650205 | 0.0723793 | -0.8983 | 0.3690093 |
| log(partrate) | -0.0719362 | 0.1746940 | -0.4118 | 0.6804975 |
| log(school) | -0.6512380 | 0.2389303 | -2.7256 | 0.0064177 ** |
| log(inef) | -0.0123371 | 0.0574212 | -0.2149 | 0.8298818 |
| log(trust) | 1.1541126 | 0.5216587 | 2.2124 | 0.0269397 * |
| log(bankcount) | 0.0051353 | 0.0701285 | 0.0732 | 0.9416250 |
| log(agency) | 0.1595364 | 0.0722005 | 2.2096 | 0.0271309 * |

## Table 7: Error variance parameters (top, see Equation 5) and spatial autoregressive coefficient (bottom). Significance stars are: '.' = significant at 10 percent; '* = 5 percent; '** = 1 percent; '***' = 0.1 percent. Standard errors are based on estimates of the numerical Hessian.

| Estimate | SE | t-value | Pr($>|t|)$ |
|----------|----|---------|-----------|
| $\phi$ | 0.609047 | 0.239695 | 2.5409 | 0.01106 * |
| $\rho$ | 0.592829 | 0.055500 | 10.6817 | < 2.2e-16 *** |
| $\lambda$ | 0.403670 | 0.090207 | 4.4749 | 7.644e-06 *** |

| Estimate | SE | t-value | Pr($>|t|)$ |
|----------|----|---------|-----------|
| $\psi$ | -0.15015 | 0.10546 | -1.4237 | 0.1545 |

insurance purchases. On the contrary, neither the share of the elderly nor the labour force participation rate or the average number of family members seem to play a role. Social security expenditure, which should in theory substitute for income protection, is negative but not significant: the effect of public welfare seems statistically not discernible in a homogeneous setting, contrary to what happens in cross-country comparisons.

Our proxy for aggregate saving, the per capita amount of bank deposits, is significantly positive and seems therefore to capture the effect on the saving-related part of life premiums.

The behaviour of supply-side regressors is diverse: while the density of bank counters is not significant at all, that of insurance agencies proves an important positive factor, contrary to the current trend towards the preeminence of bancassurance in life distribution. It seems that tied agents are still a very important force in shaping the market.

As for the other controls, judicial inefficiency is insignificant, consistently with the lesser amount of litigation involving life contracts with respect to non-life ones (see Millo, 2010), while trust is a positive driver, as also found by Guiso.
et al. (2004) in their analysis of financial development.

The effect of education on insurance has actually been debated, as some see it as positively related to risk aversion, others to the willingness and the capacity to manage risks. In our setting the schooling variable proves negative and significant at the 1 percent level. A tentative explanation could be that better educated people are able to better diversify their portfolios, holding a greater variety of (possibly riskier) assets, thus reducing the slice of safe assets as life insurance.

The model shows strong serial correlation in the errors (0.6), as expected, and weaker evidence of a random effects structure: the variance of the individual error component is estimated at 60 percent of the idiosyncratic error variance. As for the spatial parameters, the Wald test for spatial lag versus spatial error correlation implicit in the encompassing model favours the second, which is significant and substantial (0.4), while the spatial lag coefficient is not significantly different from zero.

6 Conclusions

We approach the empirical investigation of life insurance consumption in Italy from a sub-regional perspective. The highest disaggregation level for which data are available is that of provinces, allowing for 103 data points which we observe over the years 1996-2001.

This setting allows analyzing some of the determinants of insurance development in an environment which is highly integrated in other respects (legal, religious, monetary, fiscal) and free from the systemic differences which may overshadow some relationships of interest in cross-country studies. Moreover, some specification issues (most notably, the measurement of insurance prices) turn out to be irrelevant because there is no variation at the cross-sectional level, and the common time variation can be easily accounted for.

An overview of the literature on insurance consumption provides the foundation for our model specification. Three economic functions of life insurance are identified: protection of dependents in case of death, protection of one’s own income stream in case of survival, and pure saving. Based on this, we identify appropriate explanatory variables and proceed to a descriptive analysis, showing evidence of spatial dependence and heterogeneity.

We discuss some methodological issues arising from considering data from observational units inside an integrated market instead than from different countries, i.e. spatial correlation, and from peculiar features of insurance, such as serial correlation. Together with the need to allow for individual random effects, these issues force us to develop a new maximum likelihood estimator for random effects panels with spatial lags, spatial and serial correlation, which we do elaborating on the work of Anselin (1988), Case (1991) and Baltagi et al. (2007).

Consistently with previous evidence, we find significant positive influences of disposable income and of bank deposits (as a proxy for savings). The ratio of young dependents to people of working age captures the need for life protection, while the substitution effect of social security payments is not significant. The positive coefficient of the density of the distribution network and that of trust (as defined by Guiso et al. (2004)) point to important supply effects, to some extent
validating the common wisdom that “insurance is sold, not bought”. Lastly, the
effect of the education level of the population turns out negative, a somewhat
puzzling finding that can be tentatively attributed to the role of education in
fostering financial diversification towards riskier kinds of saving products and
away from the steady and moderate returns that characterize most life policies.

References

Anselin, L. 1988. *Spatial Econometrics: Methods and Models*. University of
California, Santa Barbara: Kluwer Academic Publisher.


Baltagi, B.H., Song, S.H., Jung, B.C., & Koh, W. 2007. Testing for serial corre-
lation, spatial autocorrelation and random effects using panel data. *Journal of Econometrics*, 140(1), 5–51.

Beck, T., & Webb, I. 2003. Economic, demographic and institutional determi-

Beenstock, M., Dickinson, G., & Khajuria, S. 1986. The determinants of life pre-

Bernheim, B.D., Forni, L., Gokhale, J., & Kotlikoff, L.J. 2003. The mismatch
between life insurance holdings and financial vulnerabilities: evidence from

Browne, M.J., & Kim, K. 1993. An International Analysis of Life Insurance

Assicurazioni Generali. Chap. 11.

953–965.

Grace, M., & Skipper, H. 1991. *An analysis of the demand and supply determi-
nants for non-life insurance internationally*. Tech. rept. Center for Risk Man-
agement and Insurance Research, Georgia State University, Atlanta Georgia
USA.


The Law’s delay: Judicial system inefficiency and the demand for non-life insurance

Giovanni Millo
DiSES, University of Trieste and Research Dept., Assicurazioni Generali SpA

March 23, 2010

Abstract

Civil trials take far too long in Italy compared to other countries. Inefficiency of civil law in enforcing property rights is recognized as a limiting factor for economic development at large and for that of financial markets in particular. Of the three main elements of judicial inefficiency: unfair judgment, costly procedures and lengthy procedures, we concentrate on the third analyzing its relevance for the insurance contract. We contend that the duration of civil trials is an important obstacle to non-life insurance, because it reduces the present value of the contingent claim held by the insured in case of litigation. Thus we expect non-life insurance consumption to be lower, all other things being equal, where judicial procedures are slower. We test our hypothesis on two datasets: a provincial panel dataset for the years 1998-2002 and a household survey comprising three waves for the years 1989, 1991 and 1993. We estimate a number of alternative specifications on the aggregate data, and probit and tobit models on household data, finding significant negative effects of judicial inefficiency on insurance consumption in both settings. We conclude that the excessive length of civil trials is a depressing factor for the development of the Italian non-life insurance market.
1 Introduction

Among the many fardels that in the words of Hamlet\(^1\) make for a weary life, “the law’s delay” is particularly evident in contemporary Italy, where it has been at the heart of the political debate for some time. Here we are concerned with the effects on a particular economic sector: insurance.

The quality of law enforcement has been recognized as a fundamental feature of any economic system as early as in Montesquieu’s *L’Esprit des Lois* and Smith’s *Wealth of Nations* (Djankov et al., 2003) and in modern contract theory since the work of North (1993) on transaction costs. As he put it, “[contract enforcement] is ‘the single most crucial determinant of economic performance, and the key difference that separates First from Third-World economies. The ability to enforce contracts through time and space is the central underpinning of an efficient market’.” Modern contract theory recognizes that economic transactions are often characterized by imperfect information and contract incompleteness, and subject to enforcing costs. In such a situation, the institutions are responsible for reducing the uncertainty in economic transactions and the associated costs. The more complex, interdependent, specialized and based on international and intertemporal exchange an economic system is, the higher these costs: according to North (1993), in the United States in 1986 45 percent of GDP was spent for enabling and securing transactions, instead of purchasing goods and services; this figure stood at only 25 percent a century before. Transactions extending through space and time are the more affected.

There is a considerable amount of research on the effects of the quality of the legal system on various aspects of economic and financial development, such as firm ownership and firm size (Laeven & Woodruff, 2007), resource allocation (Claessens & Leaven, 2003) or the firms’ ability to raise capital: see the pioneering work of La Porta et al. (1997) on legal protection and equity and debt markets, and (Modigliani & Perotti, 2003) on its influence on the choice of

---

\(^1\)Act III, Scene I.
equity versus bank credit. Levine (1998) shows the positive dependence of bank development from creditor rights enforcement, which he in turn traces back to the legal origin of the country.

A recent strand of literature analyzes the influence of transaction costs on the credit system from the point of view of trust, which reduces the likelihood of litigation (Guiso et al., 2004, see) finding a positive influence of trust and social capital on financial development. On the cost side, Laeven & Majnoni (2005) show how judicial system efficiency can lower the cost of credit, as measured by lending spreads, while Fabbri & Padula (2004) find that the likelihood of being credit-constrained is higher in provinces where the efficiency of justice is lower.

The positive growth effects of financial development have been extensively documented in the literature (see e.g. Levine, 1998). Less attention has been devoted in the literature to the influence of the type of legal system and on the level of protection of property rights on insurance development. Browne et al. (2000) argue that the common law system has driven people to overconsume liability insurance. They find evidence that (motor and liability) insurance consumption is higher in common-law countries. (Esho et al., 2004) analyze a panel of 44 developed and developing countries, finding evidence of positive correlation between property-casualty insurance consumption and the property rights index of Knack & Keefer (1995), a measure of corruption, the rule of law, bureaucracy, the risk of contract repudiation and that of expropriation.

Esho et al. (2004) motivate the influence of rights enforcement on insurance on two grounds. Firstly, “since insurance policies may be viewed as analogous to risky corporate debt”, enforcement may be needed in case the insurance company proves insolvent. Secondly, because “the enforcement of property rights creates an economic incentive to acquire and insure property” by protecting it from damage or expropriation and allowing the owner to buy and sell it securely. Yet in advanced economies the insolvency of an insurance company is a rare event, albeit not impossible as witnessed by a number of well-known cases. Moreover, while the argument sounds plausible as regards some developing countries, it is unlikely that a citizen of the developed world chooses not to acquire insurable properties because of fear of (unlawful) expropriation: rather, he might be induced to acquire and insure it, thus justifying the positive influence of theft rates Esho et al. (2004) find in their model. This argument is made by Esho et al. (2004) themselves, who leave open the question of the expected sign of the effect.

We choose instead to draw our attention to the issue of policy-level litigation, which is relatively common and likely to enter the decision making process of the prospective insured. We concentrate on an issue on which to our knowledge there has not been any previous research: the specific effect of the time-inefficiency of the judicial system on the demand for non-life insurance. We contend that the possibility of facing an uncertain, but plausibly long trial duration in order to receive one’s dues can be a deterrent to the purchase of an insurance contract; and we test our hypothesis on data from Italy, a developed country where property may be considered comparatively secure and the outcomes of trials relatively fair and unbiased, but where the duration of the trials themselves has reached unsustainably high levels.

Italy is a civil law country, with laws regulating criminal and civil offenses separately. Nevertheless, the problem of trial length affects both branches of the judicial system. According to the enforcing contracts index calculated by
the World Bank in its 2008 Doing Business report, Italy ranks 169th of 181 countries. The efficiency of judicial enforcement can be decomposed along three main dimensions: fairness of judgment, trial length and cost of the procedure (see e.g. Marchesi, 2008). Fairness is difficult to measure, while Common law countries fare generally worse as far as procedural costs are considered (see Marchesi, 2008); but, with a recent estimate putting the average time to collect on a bounced check at 1210 days, Italy clearly stands out of the rest of Europe and most of the Western World as far as the length of trials is concerned. The European Court of Justice recently stimulated the Italian Parliament in passing a law which indemnifies citizens whose trials took too long to complete, which the Parliament ultimately did (so-called Legge Pinto) thus implicitly recognizing the economic damage associated with this aspect of judicial inefficiency (VV.AA., 2006, see).²

In the following section, we outline the theoretical grounds underpinning the hypothesis that time-inefficiency of justice be a limiting factor for insurance development. Then we describe the two levels of our empirical analysis: provincial aggregates and microeconomic survey data. In the fourth section we describe the model specification at the two levels, we comment on the models’ results and we assess the latter with the help of some diagnostic evidence. The last section concludes summing up the research question and results.

2 The economic consequences of litigation in non-life insurance

Non-life insurance contracts (policies) exchange a contingent indemnity for future losses against payment of a fixed price, the premium, today; thus the insured buys a service transferring part of his future wealth from an uncertain to a certain state.

Non-life insurance is a financial contract which is likely to produce obligations extending over long time spans, often many years or even several decades; such obligations are conditional on future events, and are exchanged against lump sums or recurring payments. The wealth of possible future states of nature and the multiplicity of damages insured goods are subject to, for how carefully specified contracts (policies) may be, make insurance considerably prone to litigation, and in fact legal disputes between the insurer and the claimant are fairly common. Poor enforcing of property rights, and in particular an ill-functioning legal system, may therefore impose a considerable cost burden to both the claimant and the insurer.

In the case of financial services, protecting property rights means essentially enforcing the claims of creditors. In the field of bank credit the main problem lies in repossessing collateral on the banks’ part and thus the beneficiary of the property rights to be protected is on the supply side: hence the price and rationing effects observed in previous research. Insurance inverts the usual economic cycle, reclaiming an advance payment in exchange for a contingent, future claim. Therefore the claim for future payments to be enforced rests on the demand side, and bad enforcement can be supposed to affect this side the

²Ironically, the law turned out to be insufficiently funded, thus giving birth to further litigation between the State and the claimants.
The present value of any given policy (the fair premium) can be seen as the expected value of the future claim discounted by an actuarial factor (the probability of damage occurring and thus of receiving the indemnification) and by a financial one, related to the distance in time between payment of the premium and collection of the claim (see the standard model of insurance demand, e.g., in Ehrlich & Becker (1972)). Assuming that the insured is honest and will file a claim only if a real damage occurred, then uncertainty about the outcome and timing of a possible litigation detracts from the actuarially expected value of the claim by reducing the probability of actually being indemnified, which in a perfect world is one, by the probability of the court to reach the wrong decision. The delay in reaching a verdict in turn shifts the payment forward in time, thus reducing the present value of the claim by a financial discounting factor. While to some extent one could expect these additional factors to be reflected in equilibrium prices, the likelihood and length of litigation can be assumed to be directly proportional to the amount of legal expenses the losing party is bound to incur. These are bound to act like a sort of (random) tax, detracting from the surplus of both sides and thus reducing the quantity of insurance exchanged in equilibrium. For all these reasons, bad (meaning: late and uncertain) enforcement of property rights can be expected to curb insurance consumption. In fact, descriptive evidence seems to point at a clearly positive relationship for both developed and developing countries alike: see Figure 2, where the index of property rights protection of Djankov et al. (2003) is plotted against non-life insurance penetration.

The literature identifies some influences of the legal system on insurance development. Browne et al. (2000) and Esho et al. (2004) find a positive influence of a measure of protection of property rights on insurance development. This result, which regards a sample of developed countries, holds for the non-life sector, not for the life one: which was to be expected, as life contracts are generally much simpler and determined by relatively unambiguous events, like life or death of a well-specified person. The authors interpret this finding as better protection of rights fostering the acquisition of potentially insurable property, while in the light of the above argument one might contend that for any given level of property endowment a good enforcement of rights raises the probability of actually receiving a righteous claim in a reasonable time.

The same research controls for the type of legal system of the countries involved, but does not find any significant effect despite the Common Law system being generally considered more litigation-prone. Hence we might gather that not the probability of litigation itself, but rather that of an endless and expensive trial and of an unjust verdict reduces the appeal of buying a contingent claim against future damages.

One might argue that a longer trial should lead to more careful ascertaining of the truth or, on the opposite, that the evidence loses quality as time passes by. In an asymmetric contention as often an insurance-related trial is, where at least in personal lines the financial and time resources of the insurer use to be much bigger than the claimant’s, for an overlong trial to shift the balance of justice in favour of the insurer is a concrete possibility. Leaving these arguments in the realm of speculation, in the following we concentrate on the observables, suspending our judgment about a possible correlation between trial length and the reaching of a correct verdict and focusing instead on the empirical relationship.
between trial length and the consumption of non-life insurance.

Firstly we will investigate the subject in an aggregate perspective, drawing on a panel of Italian provinces observed over five years, in the light of the empirical literature on insurance consumption in cross sections of states. In this setting it will not be possible to disentangle demand and supply effects, as only equilibrium premium revenue will be observed. Then we will analyze the demand for non-life insurance by households on micro-level survey data, augmenting the database by the provincial level of judicial inefficiency.

### 3 The data

In this section we describe the datasets used with particular regard to the judicial inefficiency and insurance data. As far as the other control variables are concerned, we only report some summary statistics while referring to Millo & Carmeci (2010) for a more extensive treatment.
3.1 Territorial units in Italy

The Italian statistical office (Istat) uses to subdivide the country into five macroregions: North-West, North-East, Centre, South and Islands. In all plots these will be identified by the following symbols and colour codes: ○ North-West; △ North-East; ◊ Centre; + South; × Islands.

Disaggregating further, Italian territory is divided in 20 regions and, since 1992 and up to 2008\(^3\), 103 provinces and 8100 communalities. We analyze aggregates at the provincial level, the highest level of disaggregation for which insurance data are available, using regional data in case of unavailability\(^4\).

Data are standardized by population where relevant.

3.2 Insurance

We analyze the consumption of non-life insurance across the 103 Italian provinces\(^5\) spanning the period from 1998 to 2003.

As customary in the literature, and justified by the common economic reasoning, we consider non-life as a whole after excluding mandatory motor third-party liability. Non-MTPL non-life (henceforth non-life tout court) can be categorized into property (fire, theft, household damages and so on, including non-TPL motor), liability (comprising both personal and corporate third-party damages), accident and health and other classes, minor from the point of view of revenue, like legal protection which covers legal expenses, marine, aviation and transit insuring both the transported goods and the hulls of the carriers, and credit and suretyship.

3.3 Judicial system inefficiency

As already stated, judicial system inefficiency is measured by the average time needed to settle the first degree of a civil case. This measure was computed, and is kindly provided, by Guiso et al. (2004) based on data from the Italian Ministry of Justice. As in Italy civil trials undergo three degrees of judgment (lower court, appeals court and a third one dealing exclusively with formal aspects), this measure is an optimistic assessment of the real time to settlement.

The first degree trial length, henceforth (judicial) inefficiency, varies widely across Italian provinces, from a minimum of 1.4 years in Siena (Tuscany) to a maximum of 8.3 years in Enna (Sicily). Moreover, inefficiency does not follow a purely geographic gradient and varies considerably inside macroregions as well, although being on average much higher in the South of the country (see Figure 3.3 and Table 2).

The statistical association between inefficiency and insurance density is apparent from the scatterplots in Figure 2 (whence we also see the benefit of taking logs for reducing dispersion and linearizing the relationship). In the following we answer the question whether this evident relationship holds when controlling for other determinants of insurance in a multiple regression model.

\(^3\)Four new provinces have been created in the region of Sardinia in 2008, and three in 2009 in, respectively, Lombardy, Marche and Apulia. In the meantime, public debate on abolishing provinces altogether goes on.

\(^4\)This will be the case with two control variables

\(^5\)Provinces correspond to level 3 in the NUTS (Nomenclature of Territorial Units for Statistics) classification by Eurostat.
Figure 2: Scatterplots of insurance density (premiums per capita, euro) vs. average trial length (years) in value and in logs. Data are relative to the year 1999. Symbols and colour codes for macroregions are: ○ North-West; △ North-East; ◊ Centre; + South; × Islands.
3.4 Control variables

A description of the regressors included in the model follows in Table 1. Whether they have been logged or not will be apparent from the model results tables: as a general rule, though, all variables are in logs except for ratios. All monetary variates are expressed in real terms using 2000 as the base year by deflating them with the national price index; the sources cited are for the raw data; further calculations by the authors have employed population statistics from Istat.

<table>
<thead>
<tr>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>rgdp</td>
<td>Real GDP per capita</td>
</tr>
<tr>
<td>rbankdep</td>
<td>Real bank deposits per capita</td>
</tr>
<tr>
<td>density</td>
<td>Density of inhabitants per square Km</td>
</tr>
<tr>
<td>rirs</td>
<td>Real interest rate on borrowing</td>
</tr>
<tr>
<td>agencies</td>
<td>Density of insurance agencies per 1000 inhabitants</td>
</tr>
<tr>
<td>school</td>
<td>Share of people with second-grade schooling or more</td>
</tr>
<tr>
<td>vaagr</td>
<td>Share of value added, agricultural sector</td>
</tr>
<tr>
<td>family</td>
<td>Average number of family members</td>
</tr>
<tr>
<td>trust</td>
<td>Survey results to the question &quot;do you trust others?&quot;</td>
</tr>
</tbody>
</table>

Table 1: Description and sources of the model’s control variables

Some summary statistics are reported in Table 2.

<table>
<thead>
<tr>
<th>Description</th>
<th>Italy</th>
<th>N-W</th>
<th>N-E</th>
<th>Centre</th>
<th>South</th>
<th>Islands</th>
</tr>
</thead>
<tbody>
<tr>
<td>rgdp</td>
<td>17146.64</td>
<td>19988.18</td>
<td>21175.99</td>
<td>18058.79</td>
<td>12339.03</td>
<td>12114.11</td>
</tr>
<tr>
<td>rbankdep</td>
<td>9033.00</td>
<td>11207.13</td>
<td>11088.21</td>
<td>9813.53</td>
<td>5923.58</td>
<td>5781.58</td>
</tr>
<tr>
<td>density</td>
<td>244.28</td>
<td>300.78</td>
<td>249.93</td>
<td>203.27</td>
<td>270.72</td>
<td>149.91</td>
</tr>
<tr>
<td>rirs</td>
<td>4.68</td>
<td>4.14</td>
<td>3.91</td>
<td>4.48</td>
<td>5.55</td>
<td>5.74</td>
</tr>
<tr>
<td>agencies</td>
<td>0.42</td>
<td>0.49</td>
<td>0.48</td>
<td>0.46</td>
<td>0.31</td>
<td>0.31</td>
</tr>
<tr>
<td>school</td>
<td>40.60</td>
<td>42.15</td>
<td>42.10</td>
<td>43.51</td>
<td>37.98</td>
<td>35.09</td>
</tr>
<tr>
<td>vaagr</td>
<td>4.25</td>
<td>3.21</td>
<td>3.51</td>
<td>3.22</td>
<td>5.97</td>
<td>6.06</td>
</tr>
<tr>
<td>family</td>
<td>2.62</td>
<td>2.40</td>
<td>2.50</td>
<td>2.61</td>
<td>2.88</td>
<td>2.79</td>
</tr>
<tr>
<td>inef</td>
<td>3.79</td>
<td>2.89</td>
<td>2.86</td>
<td>3.71</td>
<td>5.14</td>
<td>4.76</td>
</tr>
<tr>
<td>trust</td>
<td>3.26</td>
<td>3.32</td>
<td>3.30</td>
<td>3.24</td>
<td>3.20</td>
<td>3.19</td>
</tr>
</tbody>
</table>

Table 2: Summary statistics; range, national and macroregional averages for the year 1999.

3.5 Household Income and Wealth survey data

We also draw on a microeconomic dataset taken from the 1989, 1991 and 1993 waves of the Survey of Household Income and Wealth conducted by the Bank of Italy on a representative sample of about 8000 households and elaborated (and kindly provided) by Guiso et al. (2004), who added information on the province of residence of the household. We consider the two types of insurance included in the survey questions, property-casualty and health, pooling the three waves,
as done in Guiso et al. (2004), given the homogeneity of the questionnaires. We end up with 24497 data points, of which respectively 21723 (property-casualty) and 22860 (Health) have no insurance. The dataset is augmented with judicial inefficiency (same as in the provincial dataset) and GDP per capita.

4 The models

In this section we model the influence of judicial inefficiency on insurance at two different levels: provincial aggregates and household-level data.

The measure of judicial inefficiency in 1999 will be inserted in all models as a time invariant regressor, as done by Guiso et al. (2004). This is justified by the inherent high persistence of the phenomenon, where time variability is dominated by the cross-sectional one.

4.1 Aggregate models

The aggregate model on provincial data is specified as a log-linear equation relating per capita insurance consumption to the average duration of civil cases and controlling for a number of relevant determinants based on the insurance literature: real GDP and real bank deposits per capita, population density, the real interest rate on borrowing, the density of insurance agencies per one thousand inhabitants, the share of inhabitants holding at least a secondary school qualification, the share of value added accruing to agriculture, the average number of family members and the average level of trust.\footnote{For a thorough discussion of the control variables, Millo & Carmeci (2010, see).}

Where appropriate, we add time fixed effects to take into consideration the possibility of common factors affecting all cross-sectional units alike in a given time period: this is likely to capture the influence of the cyclical swing in profitability known in the literature as the insurance cycle (Cummins & Outreville, 1987, see).

At the cross-sectional level, we tackle individual heterogeneity between macroregions by adding four fixed effects for North-West, North-East, South and Islands and adding random provincial effects. As discussed in Millo & Carmeci (2010), provincial fixed effects are not an option given that our regressor of interest is time-invariant.

We estimate two different variants of panel models, taking into consideration the positive result of a screening test for serial correlation in the residuals (not reported). A random effects plus macroregional and time dummies model (henceforth RE), controlling for unobserved individual heterogeneity, is estimated together with a White-Arellano covariance matrix (Arellano, 1987) which allows consistent inference in the presence of arbitrary heteroskedasticity and serial correlation in the residuals. Alternatively, we estimate the same specification by maximum likelihood, allowing for an autoregressive term of order one (AR(1)) in the errors. We also estimate an unrestricted feasible generalized least squares specification (GGLS) allowing for arbitrary heteroskedasticity and serial correlation inside every province, but constraining the error covariance structure to be the same across provinces (see Wooldridge, 2002, chap. 10.4.3).

These three specifications are likely to deliver the best combination of efficiency and robustness in this setting; yet for the sake of robustness we also
estimate a number of alternative specifications. First, for comparison purposes, we perform ordinary least squares (henceforth OLS) estimation on the cross-section of the data for the year the legal inefficiency variable refers to: 1999. Then, in order to take advantage of the degrees of freedom we will pool all observations for the five years together and estimate the model by OLS, adding time fixed effects for every year but 1998 to take into account common shocks and macroregional fixed effects for every macroregion but the Centre (POOLED OLS), again estimating a White-Arellano covariance matrix for diagnostic purposes. Lastly, we estimate a so-called between model (BE) on time-averaged variables: this specification is robust to the influence of unobserved, time-varying heterogeneity (Coakley et al., 2006) and, reducing the panel to a cross-section, it is immune from error autocorrelation issues. The BE estimator is considered appropriate for capturing long-term relationships (Baltagi, 2005); therefore in this case, the BE specification shall be able to control for the effects of the above mentioned insurance cycle.

<table>
<thead>
<tr>
<th></th>
<th>RE</th>
<th>RE-AR(1)</th>
<th>GGLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-0.7361</td>
<td>-0.8177</td>
<td>-2.6441</td>
</tr>
<tr>
<td>log(inef)</td>
<td>-0.1830</td>
<td>**-0.1838</td>
<td>**-0.1727</td>
</tr>
<tr>
<td>log(rgdp)</td>
<td>0.3394</td>
<td>**0.2892</td>
<td>**0.4913</td>
</tr>
<tr>
<td>log(rbankdep)</td>
<td>0.1467</td>
<td>**0.1578</td>
<td>***0.2366</td>
</tr>
<tr>
<td>log(density)</td>
<td>0.0728</td>
<td>***0.0762</td>
<td>***0.0632</td>
</tr>
<tr>
<td>rirs</td>
<td>-0.0201</td>
<td>*-0.0139</td>
<td>*-0.0221</td>
</tr>
<tr>
<td>log(ages)</td>
<td>0.1887</td>
<td>***0.1608</td>
<td>**0.1936</td>
</tr>
<tr>
<td>school</td>
<td>-0.0018</td>
<td>0.0014</td>
<td>-0.0014</td>
</tr>
<tr>
<td>vaagr</td>
<td>-0.0082</td>
<td>*-0.0077</td>
<td>*-0.0090</td>
</tr>
<tr>
<td>log(family)</td>
<td>-0.2075</td>
<td>-0.1276</td>
<td>-0.1654</td>
</tr>
<tr>
<td>log(trust)</td>
<td>1.4608</td>
<td>**1.6195</td>
<td>**1.1184</td>
</tr>
</tbody>
</table>

Table 3: Model summary. The dependent variable is the log of non-life premiums per capita.

<table>
<thead>
<tr>
<th></th>
<th>Pooled OLS</th>
<th>1999 OLS</th>
<th>BE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-5.0309</td>
<td>**-5.2226</td>
<td>*-4.4068</td>
</tr>
<tr>
<td>log(inef)</td>
<td>-0.1043</td>
<td>*-0.1359</td>
<td>*-0.0946</td>
</tr>
<tr>
<td>log(rgdp)</td>
<td>0.6789</td>
<td>***0.6796</td>
<td>***0.6460</td>
</tr>
<tr>
<td>log(rbankdep)</td>
<td>0.4156</td>
<td>***0.3498</td>
<td>***0.4174</td>
</tr>
<tr>
<td>log(density)</td>
<td>0.0398</td>
<td>*0.0400</td>
<td>0.0328</td>
</tr>
<tr>
<td>rirs</td>
<td>-0.0632</td>
<td>**-0.0770</td>
<td>*-0.0939</td>
</tr>
<tr>
<td>log(ages)</td>
<td>0.2238</td>
<td>*0.1978</td>
<td>0.2240</td>
</tr>
<tr>
<td>school</td>
<td>-0.0041</td>
<td>0.0018</td>
<td>-0.0042</td>
</tr>
<tr>
<td>vaagr</td>
<td>-0.0030</td>
<td>-0.0045</td>
<td>-0.0014</td>
</tr>
<tr>
<td>log(family)</td>
<td>-0.1753</td>
<td>-0.1688</td>
<td>-0.2109</td>
</tr>
<tr>
<td>log(trust)</td>
<td>0.5109</td>
<td>0.9932</td>
<td>0.4289</td>
</tr>
</tbody>
</table>

Table 4: Continued: Model summary. The dependent variable is the log of non-life premiums per capita.
Dealing with provincial data, care shall be taken to control for possible spatial correlation in the models’ residuals, lest inference be biased by the wrong standard errors. While referring to Millo & Carmeci (2010) for an extensive diagnostic treatment of the same models, here we limit ourselves to some brief observations. Most important, the RE specification passes the Baltagi et al. (2007) test for absence of spatial effects, while the treatment of the GGLS estimator as regards this issue is not established in the literature and therefore we suspend our judgment. Serial correlation in the errors As for the other models, we report only a visual assessment under the form of Moran plots. It is apparent that while the residuals of the POOLED OLS still show a certain degree of spatial association, the cross-sectional ones on both 1999 data and on time averages (BE) do not seem to pose any concern in this regard.

Another important visual information conveyed by the horizontal dimension of the Moran plots is that on spatial heterogeneity of the residuals. With the possible exception of the POOLED OLS model, the plotting symbols pertaining to the five different macroregions are scattered evenly across the vertical line at zero, showing no evidence of the model over- or underestimating one particular region.

The influence of judicial inefficiency is consistently and significantly negative across all specifications. Hence we conclude that the law’s delay is an important limiting factor for the development of the non-life insurance market.

4.2 Microdata models

The empirical findings based on the aggregate model are necessarily limited to insurance consumption, the equilibrium outcome of the interplay of supply and demand. While based on the above arguments we expect trial length to affect principally the demand side, this cannot be confirmed empirically by the aggregate analysis. In order to validate the above findings from a different perspective, we consider a dataset made pooling three consecutive waves of the Survey on Household Income and Wealth by the Bank of Italy, relative to the years 1989, 1991 and 1993, augmented at the provincial level by judicial inefficiency and some controls, as done by Guiso et al. (2004).

Moreover, as the households can be considered price-takers in this setting, the following analysis can be expected to properly capture the effects of the level of judicial inefficiency prevailing in the province of residence on individual demand.

Following a number of survey-based studies on the financial behaviour of households (see, one for all, Guiso & Jappelli 1998) and in particular the thorough analysis of Ventura (2007), we estimate a tobit model for each of the two observable categories of non-life insurance, property-liability (excluding motor third-party liability) and health, and one for the total. Given the large share of households with no insurance in the sample, which is 88.7 percent in property-casualty and 93.3 percent in health, we precede the analysis with a probit estimation of the drivers to the decision to insure.

For both models we estimate a relationship linking insurance demand to linear and quadratic terms of income \( y \), wealth \( w \), age and education; the model is augmented with judicial inefficiency \( ine_f \), which also enters with both a linear and a quadratic term, in order to control for possible nonlinearities in the
Figure 3: Moran plots of model residuals (each residual plotted against its spatial lag): a cloud close to the diagonal indicates spatial association. Symbols and colour codes for macroregions are: O North-West; △ North-East; ◊ Centre; + South; × Islands.
effect on insurance purchasing decisions. The demand for insurance of individual
\(i\) (living in province \(p\)) in year \(j\) is therefore:

\[
D_{ij} = D(y_{ij}, y_{ij}^2, w_{ij}, w_{ij}^2, age_{ij}, age_{ij}^2, educ_{ij}, inef_p, inef_p^2, GDP_{pj}, d_j)
\]

where both to account for the general level of economic activity and to be
sure not to pick up any spurious effect, we control for provincial GDP per capita
and add time fixed effects (again following the work of Guiso et al. 2004).

<table>
<thead>
<tr>
<th></th>
<th>Prop-Liab</th>
<th>se</th>
<th>Health</th>
<th>se</th>
<th>Total</th>
<th>se</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-1.9273</td>
<td>0.18</td>
<td>***</td>
<td>-2.2435</td>
<td>0.22</td>
<td>***</td>
</tr>
<tr>
<td>(y)</td>
<td>0.0215</td>
<td>0.00</td>
<td>***</td>
<td>0.0189</td>
<td>0.00</td>
<td>***</td>
</tr>
<tr>
<td>(y^2)</td>
<td>-0.0896</td>
<td>0.01</td>
<td>***</td>
<td>-0.0751</td>
<td>0.01</td>
<td>***</td>
</tr>
<tr>
<td>(w)</td>
<td>0.9101</td>
<td>0.08</td>
<td>***</td>
<td>0.5530</td>
<td>0.10</td>
<td>***</td>
</tr>
<tr>
<td>(w^2)</td>
<td>-0.1173</td>
<td>0.02</td>
<td>***</td>
<td>-0.0943</td>
<td>0.03</td>
<td>**</td>
</tr>
<tr>
<td>(age)</td>
<td>0.0243</td>
<td>0.01</td>
<td>***</td>
<td>0.0471</td>
<td>0.01</td>
<td>***</td>
</tr>
<tr>
<td>(age^2)</td>
<td>-0.0003</td>
<td>0.00</td>
<td>***</td>
<td>-0.0006</td>
<td>0.00</td>
<td>***</td>
</tr>
<tr>
<td>(educ)</td>
<td>0.0115</td>
<td>0.00</td>
<td>***</td>
<td>0.0227</td>
<td>0.00</td>
<td>***</td>
</tr>
<tr>
<td>(inef)</td>
<td>-0.3012</td>
<td>0.05</td>
<td>***</td>
<td>-0.2064</td>
<td>0.06</td>
<td>***</td>
</tr>
<tr>
<td>(inef^2)</td>
<td>0.0182</td>
<td>0.01</td>
<td>**</td>
<td>0.0151</td>
<td>0.01</td>
<td>*</td>
</tr>
<tr>
<td>(d89)</td>
<td>-0.0575</td>
<td>0.03</td>
<td></td>
<td>-0.6558</td>
<td>0.04</td>
<td>***</td>
</tr>
<tr>
<td>(d91)</td>
<td>0.0193</td>
<td>0.03</td>
<td></td>
<td>-0.6674</td>
<td>0.03</td>
<td>***</td>
</tr>
<tr>
<td>(GDP)</td>
<td>0.0197</td>
<td>0.00</td>
<td>***</td>
<td>0.0083</td>
<td>0.00</td>
<td>***</td>
</tr>
</tbody>
</table>

Table 5: Probit models for probability of insurance. Legal system inefficiency
is specified as a linear and a quadratic term.

<table>
<thead>
<tr>
<th></th>
<th>Prop-Liab</th>
<th>se</th>
<th>Health</th>
<th>se</th>
<th>Total</th>
<th>se</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-0.9911</td>
<td>0.02</td>
<td>***</td>
<td>-1.3579</td>
<td>0.02</td>
<td>***</td>
</tr>
<tr>
<td>(inef) (2.7, 3.5)</td>
<td>-0.1643</td>
<td>0.03</td>
<td>***</td>
<td>-0.1064</td>
<td>0.03</td>
<td>**</td>
</tr>
<tr>
<td>(inef) (3.5, 4.4)</td>
<td>-0.3048</td>
<td>0.03</td>
<td>***</td>
<td>-0.2274</td>
<td>0.03</td>
<td>***</td>
</tr>
<tr>
<td>(inef) (4.4, 8.3)</td>
<td>-0.5445</td>
<td>0.03</td>
<td>***</td>
<td>-0.2923</td>
<td>0.04</td>
<td>***</td>
</tr>
</tbody>
</table>

Table 6: Probit models for probability of insurance. Legal system inefficiency
is specified as one dummy for each quartile of the distribution.

The indicator of judicial inefficiency turns out to be a significant negative
determinant of insurance demand, both for the property-liability and for the
health sector. The negative effect is evident both on the decision to enter the
insurance market and on the quantity of cover purchased. The effect is nonlinear
and tends to decline with higher levels of inefficiency, as is confirmed by the
two alternative specifications considered, one imposing a quadratic form to the
relationship and the other allowing for arbitrary effects from different degrees
of judicial inefficiency.
Table 7: Tobit models for quantity of insurance. Legal system inefficiency is specified as one linear and one quadratic term.

<table>
<thead>
<tr>
<th></th>
<th>Prop-Liab se</th>
<th>Health se</th>
<th>Total se</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-2.0307 0.19</td>
<td>-3.4382 0.34</td>
<td>-2.0968 0.21</td>
</tr>
<tr>
<td>y</td>
<td>0.0204 0.00</td>
<td>0.0285 0.00</td>
<td>0.0266 0.00</td>
</tr>
<tr>
<td>y2</td>
<td>-0.0654 0.01</td>
<td>-0.1116 0.02</td>
<td>-0.0881 0.01</td>
</tr>
<tr>
<td>w</td>
<td>1.1525 0.08</td>
<td>1.0390 0.14</td>
<td>1.4586 0.09</td>
</tr>
<tr>
<td>w2</td>
<td>-0.1575 0.02</td>
<td>-0.1599 0.04</td>
<td>-0.1948 0.02</td>
</tr>
<tr>
<td>age</td>
<td>0.0215 0.01</td>
<td>0.0675 0.01</td>
<td>0.0342 0.01</td>
</tr>
<tr>
<td>age2</td>
<td>-0.0003 0.00</td>
<td>-0.0009 0.00</td>
<td>-0.0004 0.00</td>
</tr>
<tr>
<td>educ</td>
<td>0.0082 0.00</td>
<td>0.0325 0.01</td>
<td>0.0185 0.00</td>
</tr>
<tr>
<td>inef</td>
<td>-0.2887 0.05</td>
<td>-0.3192 0.08</td>
<td>-0.3870 0.06</td>
</tr>
<tr>
<td>inef2</td>
<td>0.0171 0.01</td>
<td>0.0248 0.01</td>
<td>0.0279 0.01</td>
</tr>
<tr>
<td>d89</td>
<td>-0.0046 0.03</td>
<td>-0.9381 0.06</td>
<td>-0.3659 0.04</td>
</tr>
<tr>
<td>d91</td>
<td>0.0638 0.03</td>
<td>-0.9147 0.05</td>
<td>-0.2927 0.03</td>
</tr>
<tr>
<td>GDP</td>
<td>0.0181 0.00</td>
<td>0.0126 0.00</td>
<td>0.0200 0.00</td>
</tr>
<tr>
<td>Log(scale)</td>
<td>0.0852 0.02</td>
<td>0.4254 0.02</td>
<td>0.2948 0.01</td>
</tr>
</tbody>
</table>

Table 8: Tobit models for quantity of insurance. Legal system inefficiency is specified as one dummy for each quartile of the distribution.

<table>
<thead>
<tr>
<th></th>
<th>Prop-Liab se</th>
<th>Health se</th>
<th>Total se</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-1.2949 0.03</td>
<td>-2.3985 0.07</td>
<td>-1.3296 0.03</td>
</tr>
<tr>
<td>inef in (2.7, 3.5)</td>
<td>-0.1731 0.03</td>
<td>-0.1445 0.06</td>
<td>-0.1925 0.04</td>
</tr>
<tr>
<td>inef in (3.5, 4.4)</td>
<td>-0.3586 0.04</td>
<td>-0.3976 0.06</td>
<td>-0.4729 0.04</td>
</tr>
<tr>
<td>inef in (4.4, 8.3)</td>
<td>-0.6189 0.04</td>
<td>-0.4897 0.06</td>
<td>-0.6767 0.05</td>
</tr>
</tbody>
</table>

5 Conclusions

Based on the consideration that, on average, Italian courts of law fare particularly badly concerning the aspect of time efficiency and on the high variance surrounding this average result, we test the hypothesis that the duration of civil trials be an important negative factor for the development of the non-life insurance market.

We motivate the impact of judicial inefficiency in the general framework of non-life insurance demand as possibly shifting forward in time the payments deriving from a contingent claim that the insured has paid for in advance. As such, we postulate that the effect be highest on the demand side.

We test our hypothesis on two datasets: a provincial panel dataset for the years 1998-2002 and a household survey comprising three waves for the years 1989, 1991 and 1993.

On the first we estimate a number of alternative specifications with different degrees of robustness against individual and time heterogeneity and serial correlation; we control for residual spatial correlation in the residuals, concluding that there is none. All models give evidence of negative effects of judicial inefficiency on insurance consumption.

At the microdata level, we estimate probit models to explain the decision
to purchase insurance and then tobit models on the (left-censored) quantity of insurance for those households that actually enter the market. We do so for the two categories of non-life insurance available in the survey: property-casualty and health, and for the total of the two. We try two different specifications, one adding a linear and a quadratic term for inefficiency, the other with dummies allowing for arbitrary effects for the four quartiles of the distribution of inefficiency. All models show a significantly negative influence of judicial inefficiency, slightly decreasing in intensity as values become bigger.

We conclude that the excessive length of civil trials is a depressing force for the development of the Italian non-life insurance market.

References


