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The review and analysis of compulsory insurance

Abstract

This paper provides a comprehensive review of different type of compulsory insurance implemented in the United States of America and the world; it reviews and analyzes effects of compulsory insurance on individuals and the society, based on theoretical studies and empirical evidence; and it explores what we can learn to better develop and implement compulsory insurance. The paper also develops a theoretical model that may be used to analyze whether individuals and/or public will accept/support a proposed compulsory insurance.

Through this review and analysis of the compulsory insurance, the paper has also identified some areas that need further theoretical and empirical studies. The results from this study will be very valuable to countries, particularly developing countries like China, that plan to implement some kind of compulsory insurance.

Keywords: insurance, compulsory insurance, mandatory insurance.

Introduction

Universal health insurance proposed by US President Obama and approved by the Congress in 2010 has generated hot and wide debates. People questioned whether such a mandatory health insurance requirement was constitutional and necessary; whether that will raise the insurance cost; and whether that will negatively affect the whole healthcare market and particularly its competition. Although the US Superior Court has made the favorable rule so the universal healthcare reform will be implemented in the US from 2013, many are still worried about its negative effects.

One way to study the potential effects of such universal health insurance is to look at the similar mandatory healthcare policy implemented in Europe and other countries. Alternatively, one may look at the other compulsory insurance and its positive and negative effects already implemented in the US as well as in other countries. Then one can better understand the necessity and potential problems of implementing such compulsory insurance.

This paper reviews and studies the compulsory insurance implemented in the US and the world; it reviews and analyzes the effects of compulsory insurance on individuals and the society, based on theoretical studies and empirical evidence; it explores what we can learn to better develop and implement compulsory insurance. In addition, the paper reveals some areas that need further theoretical and empirical studies related with the compulsory insurance.

The results from this study will be very valuable to countries, particularly developing countries like China, that plan to implement some kind of compulsory insurance. The insurance industry in many developing countries is not well developed. Its total

insurance premiums per capita are very low, and there are very few types of insurance lines. Also, there is very limited type of compulsory insurance. These countries can learn from developed countries on what types of compulsory insurance will be necessary and the first most important, and what potential problems there will be. So they can develop priority plans to implement the compulsory insurance and more importantly take precautions to solve the relevant potential problems.

The rest of the paper is organized as follows. Section 1 provides a comprehensive review of different type of compulsory insurance, based on who mandates it and who will pay for. Section 2 discusses positive and negative effects of compulsory insurance on individuals and the society. Section 3 develops a theoretical model that can be used to analyze whether individuals and/or the public will accept a proposed compulsory insurance. Section 4 discusses what types of theoretical and empirical studies are further needed in order to better understand effects of compulsory insurance. The final section concludes the paper.

1. A comprehensive review of different types of compulsory insurance adopted in the US and world

Compulsory insurance, also called mandatory insurance, is the government or agent's regulation that requires individuals and/or organizations to buy a minimum level of the relevant insurance coverage, such as mandatory bank deposit insurance and mandatory universal health insurance. There are different levels of governments who issued such mandates, including the federal and state/local governments. The agents can be like Homeowners Association and Professional Associations such as CPA and Bar Associations. Also, there are different types of insurance, including life/health and property/liability insurance. Combining these two factors, one has the following summary.

Table 1. Compulsory insurance mandated by the federal, state/city or special agent/organization

	Federal mandatory	State/city mandatory	Special agent/ organization mandatory
Life/health	Social Security; universal health insurance; Medicare; unemployment insurance	Medicaid; annuity; workers compensation insurance; disability income insurance	Annuity; mandatory health insurance
Property/liability	Federal deposit insurance; flood/disaster insurance; terrorist insurance; pollution insurance; shipping compulsory insurance	Flood/disaster insurance; commercial/general liability insurance; autoinsurance; Insurance Guarantee Funds	Professional liability insurance (like medical malpractice, errors & omissions insurance); comprehensive auto insurance for auto-loans; homeowners' insurance; title insurance

The effects of compulsory insurance on the insurance markets and people's acceptance will depend on who will pay for it. The following table/matrix distinguishes different type of compulsory insurance in terms of who mandated and who will pay for.

Here are some examples about who will pay for the compulsory insurance. Unemployment insurance is mandated by the federal government and paid mainly by the federal and state governments; the social security is mandated by the federal government and paid by both employers and employees. Medicaid is mandated by each state in the US and mainly paid by the state; workers compensation is mandated by the state and mainly paid by the employers; states have mandatory retirement plans (annuity) for its public employees and that will be paid by both employers and employees; professional liability insurance is mandated by the relevant associations and paid by the employers; and comprehensive auto insurance is mandated by the special agent and paid by the insured (auto-loan borrowers). Basic auto-liability insurance is mandated by states and paid by insureds. In addition, universal health insurance will be paid by both employers and employees in most cases but may be subsidized/fully-paid by the state and federal governments for low income people.

Table 2. Compulsory insurance and insurance premium payment

	Federal mandatory	State/city mandatory	Special agent/ organization required
Paid by Federal	Unemployment insurance	N.A.	N.A.
Paid by state/city	Unemployment insurance	Medicaid	N.A.
Paid by employers	Social security	Workers compensation, Annuity	Professional liability insurance
Paid by insured	Social security	annuity, auto insurance	Comprehensive auto insurance

2. A review and analysis of the effects of compulsory insurance

The purposes for implementing compulsory insurance are different. One purpose is to better protect the citizens of a country now and/or in the future. The social security, Medicare, annuity, and univer-

sal healthcare are all for this purpose. The second purpose is to better protect the third parties. Most liability-related compulsory insurance like mandatory professional liability and auto-liability insurance is for this purpose. The third motivation is to help solve the insurance market failure problem. There is no need to implement compulsory insurance if there is a necessary and sufficient private insurance market to cover the relevant risk. However, due to the adverse selection or moral hazard or social risk, the private insurance market fails. Then, there is a potential need for the government to implement such compulsory insurance. Compulsory natural disaster insurance and environment pollution insurance are for this purpose. The fourth purpose is to establish the public's confidence for the relevant industry. The Federal Deposit Insurance and State Insurance Guarantee Fund are for this purpose.

There are many studies on compulsory insurance, particularly studies on mandatory health insurance and its effects since health insurance involves more people and its effects are more profound. In fact, more countries in the world adopt universal health insurance than other types of compulsory insurance, besides auto-liability insurance. Here, we analyze its effects of compulsory insurance on the welfares, coverage and quality, availability and competition, affordability, taxes and government spending, adverse selection, moral hazard, portfolio selection and substitutes, social risk and externalities, and legal rights.

2.1. Welfare effects. Compulsory insurance affects an individual, organization and society's welfare. It can negatively affect someone's welfare but raise the others' welfare. As a whole society, a good policy is the one that will raise the whole society's welfare although that someone may be worse off. Also, there are short-term and long-term effects and direct and indirect effects. Imposing basic auto-liability insurance may hurt some low income people since their spending on the other items will be immediately and significantly lowered but in the long run, that could benefit them. For example, if such a person is hit by the other low income person, without mandatory auto insurance, the victim will obtain no com-

pensations while with the mandatory auto insurance (assume that all have the mandatory basic liability insurance), the victim will obtain necessary compensations.

Indirect welfare effects include the burdens of taxes on individuals associated with the compulsory insurance and possible changes of the probabilities of the covered incidents. The changes of quality of the covered care can also indirectly affect people's welfare.

Assume that individuals are the expected utility maximizers as defined in the following problem:

$$Max.E(U) = E(U(W)) = qU(W_0 - pY - L + Y) + (1 - q)U(W_0 - pY), \quad (1)$$

where W_0 is the initial wealth, L is the loss if the accident happens; q is the probability of the incident/loss; Y is the decision variable of the coverage level; p is the premium per coverage.

The above model/problem is for the individual's insurance selection without the mandatory regulation. Assume that Y^* is the optimal choice from the above problem; then if $Y^* = L$, the individual selects the full-coverage; if $Y^* = 0$, the individual selects no coverage. On the other hand, the individual will be partially covered if $0 < Y^* < L$.

It is obvious that mandatory insurance will not affect individuals with full-coverage and their direct welfare if other factors are not changes such as costs. But the mandatory insurance will affect individuals with no insurance or the ones with partial coverage. Assume that the mandated coverage is Y_m ; then individuals with $Y^* < Y_m$ will be affected by this new regulation since they will be required to buy more insurance coverage than the optimal level derived from (1). Obviously these individuals will be worse off with the compulsory insurance.

However, the actual welfare effect on individuals will be more complicated. With compulsory insurance, the insurance premium p may be changed. One may assume the premium to be lower, i.e. $p_m < p$, where p_m is the new premium with the compulsory insurance. $p_m < p$ is possible because large pools of all insureds will lower the average risk and attract more insurers into the market competition. Then the individual will be worse off only if

$$qU(W_0 - p_m Y_m - L + Y_m) + (1 - q)U(W_0 - p_m Y_m) < qU(W_0 - p Y^* - L + Y) + (1 - q)U(W_0 - p Y^*). \quad (2)$$

Furthermore, there may additional tax burdens T_m to individuals associated with the implementation of the compulsory insurance; then the individual will be worse off only if

$$qU(W_0 - p_m Y_m - L - T_m + Y_m) + (1 - q)U(W_0 - T_m - p_m Y_m) < qU(W_0 - p Y^* - L + Y) + (1 - q)U(W_0 - p Y^*). \quad (3)$$

Whether compulsory insurance can make people better off is a complicated issue. Akerlof (1970) conjectured that compulsory health insurance will be desirable to the whole society on the cost-benefit base. Schlesinger (1986) examined the effect of compulsory insurance on consumers' welfare using a state claims approach. Feldstein (2005) explored the social benefits of the social insurance such as the social security and unemployment insurance. Since it is difficult to estimate an individual's utility function, there is little real evidence whether any implemented compulsory insurance made individuals better or worse off. Also, the tax burden effects associated with the mandate are difficult to estimate.

Alternative approach of the welfare effects of compulsory insurance is to look at the Pareto efficiency—whether compulsory insurance will lead to the Pareto improvement, someone being better off without making the others worse off. Pauly (1974) stated that compulsory insurance will lead to the a Pareto improvement if the low-risk individuals chose the level of compulsory insurance; Johnson (1977) argued that compulsory insurance may result in a Pareto improvement even if high-risk individuals choose the level of compulsory insurance. Wilson (1977) noted that compulsory partial coverage insurance which permits private insurance companies to sell supplementary insurance may lead to Pareto improvement over the Nash equilibrium. Bovenberg and Sørensen (2004) examined the welfare effects of compulsory savings accounts in an inter-temporal model with uncertainty, endogenous involuntary unemployment and retirement decisions, credit constraints, and heterogeneous agents and found that the introduction of (early) retirement and unemployment accounts generates a Pareto improvement by enabling the government to provide lifetime income insurance and liquidity insurance in a more efficient manner. However, Rothschild and Stiglitz (1976) and Spence (1978) showed that if there is a Nash equilibrium in a competitive insurance market, compulsory insurance which does not permit voluntary supplementary insurance will not lead to a Pareto improvement.

2.2. Coverage and quality. The second effect of the compulsory insurance is the coverage change. The purpose of implementing the mandatory insurance is to cover all relevant people and/or risk. The universal health insurance is to cover all people's health care; and mandatory auto insurance is to ensure that all auto drivers have the minimum liability insurance. The coverage change can also be for

previously insured people, i.e. whether these previously insured people will have more or less coverage after the mandate.

The main problem of implementing the mandate is its enforceability. Some mandates are easier to be enforced such as bank deposit insurance, workers compensation insurance and professional liability insurance. The others like auto insurance are more difficult to do so. Although all US states require that auto owners buy basic liability insurance and they are required to show such insurance evidence for vehicle registrations, there are still millions uninsured motorists in the US (Insurance Research Council, 2006). The relevant issue of the enforceability is the penalty for the violators. A mandate without appropriate penalty to the violators will not be enforceable (Congressional Budget Office, 2010). Another issue on the enforceability is its cost. In order to enforce the regulation, the government or the agent needs to establish an enforcement office and that could be very costly.

Even with the same mandate, it can be easily enforced to one group of people but may have its difficulty to do so to the other groups. For example, the social security insurance premium payment is easy to be collected through payrolls but will be difficult to collect that to the self-employed people.

There are some studies regarding coverage effects of the compulsory insurance. Auerbach et al. (2010) examined whether health insurance mandates increase coverage through synthesizing perspectives from health, tax, and behavioral economics and discussed conditions in which the coverage will be increased. Goch (2001) investigated mandatory auto-insurance law and its effects in South Carolina and concluded that the law brought more insurers to South Carolina's private-passenger auto market, but the numbers of uninsured drivers have continued to grow. Kolstad and Kowalski (2010) found that Massachusetts' mandatory insurance implemented in 2006 reduced its uninsurance rate by about 5%. Miller (2012) concluded that Massachusetts's compulsory healthcare improved children's health coverage.

The additional issue is the quality of coverage and services. With the mandate, whether the quality of the coverage and services are better or worse. On the one hand, quality can be improved since insurers with large pools of insureds can well diversify its risk and take advantages of the law of large numbers. So they will be more profitable and will be able to provide better quality of coverage and services. On the other hand, there is the limit of available services such as hospitals and doctors at the given time period, the quality of the services may be worse when there are so many people now are seek-

ing for the same services. That is what we often observe with universal health care. Patients are waiting in the long-lines for being treated in doctor offices and hospitals. Furthermore, the treatment times may be significantly reduced.

2.3. Availability and competition. It is expected that more insurers will be available and so there will be more market competition with compulsory insurance. This is true because that the mandate will pool all people and/or risk together and so to lower the average risk; and particularly that will eliminate or at least lessen the adverse selection problem. As a result, more insurers will be willing to offer insurance and enter into the market competition. Consequently the insurance market will be more competitive. Goch (2001) found that the numbers of insurers were increased to 204 from the original 94 in 2 years after the mandatory autoinsurance law was implemented in South Carolina.

However, not all mandates will lead to more competitions and more availability of insurance. For example, Medicare recipients often encounter their difficulties to have their doctors because many doctors do not accept the Medicare payment. Many auto insurers do not want to participate in some states' auto insurance markets. The main reason for such less accessibility and competition is the insurance premium. Governments, federal and states, often limit insurance premiums for such mandatory insurance and payments to the insurers also are often too slow with many paper-works. As a result, insurers and relevant service providers are not interested in participating in such compulsory insurance and its related services.

2.4. Affordability. One important issue of the compulsory insurance is whether it can improve the affordability to the insureds. That is one main purpose of implementing the mandates.

Rosenberg et al. (2010) explored stakeholder perspectives on what is affordable health care. Affordability involves people's willingness to pay and the ability to pay. These are two different measurements and issues as Glied (2009) pointed out. When the insurance premium is lower, more people will be willing to buy the coverage, but they may still be unable to pay given their low income/wealth. Some people have enough wealth/income to pay for the insurance, but they may be unwilling because of either their un-trust of the insurance policies or the adverse selection or their heuristic preferences (Ericson and Starc, 2012). Therefore, in order to improve the affordability through compulsory insurance, it needs to lead more people willing to pay and having the ability to pay.

People's willing to pay is also related with the necessity of the type of product/service. For food and houses,

people tend to be willing to pay if they are able to pay; but for healthcare, many people tend to be unwilling to pay even though they are able to pay (Gundersen and Gruber, 2001; Glied, 2009; Thalman, 1998).

Will compulsory insurance actually improve the affordability? There are limited empirical studies on that and its empirical evidence is also mixed. Massachusetts evaded employer healthcare mandates because of affordability problems (Grubber, 2008). Cogan et al. (2010) argued that employer-sponsored insurance premiums in Massachusetts grew faster than the nation as a whole after its healthcare reform in 2006. But Graves and Bruber (2012) found that non-group insurance premiums grew much slower in Massachusetts after its reform than other states.

Some compulsory insurance has affordability exemptions that allow certain group of people to be exempted from buying the insurance. For example Massachusetts developed the affordability schedule, based on incomes and premium costs that declared who would be exempted from the mandate since the state had the shortage of the funds to subsidize low and moderate-income people. In countries like Germany and the Netherlands, the affordability exemption allowed people whose incomes are above the normatively determined threshold not to buy public insurance or to remain uninsured.

2.5. Taxes and government spending. Associated with the implementations of compulsory insurance mandated by the government such as universal health insurance and auto-liability insurance, the relevant governmental spending will be increased so taxes will be raised. This is true because implementing the regulation needs personnel and the budgets. It is true also because the many mandates usually require some kind of subsidies from governments to individuals and businesses. For example, the universal health insurance that has been implemented in Massachusetts and will be implemented in the whole US requires the government's subsidies to low and moderate-income people and to small businesses.

Enforcing governmental regulation is costly. US Office of Management and Budget estimated that the total cost of administrating and enforcing federal regulations for fiscal year 2012 will amount to more than \$57 billion (in 2005 dollars). This represents a 10.5 percent increase in just two years. It has been estimated that the universal healthcare plan will cost the US government about \$150 billion a year. Canada and most European countries' tax rates are much higher than in the US because these countries implement mandatory universal health insurance and its governments spend significant amount of budgets on that.

Higher government spending and taxes will have direct and indirect effects on individuals and businesses. Paying more taxes will reduce consumers' spending on other items so negatively affect consumers' welfare and even their living standards. Higher taxes raise the business cost and make businesses less profitable, or even lead to the failures of many businesses.

Higher government spending also has indirect negative effects. Huge government spending usually leads to huge government's deficits since there is some limit to raise the required taxes in the given time period (Chetty et al., 2009). That will raise inflation and interest rate. As a result, consumers and businesses are further hurt.

2.6. Adverse selection. The most serious problem in insurance is the adverse selection. Particularly with the asymmetric information, that may lead to the failure of the insurance markets as Arrow (1963) and Akerlof (1970) demonstrated in their seminal works. Although insurance companies have developed numerous ways to lessen this kind of problems such as using the pre-medical exams, smoking or not, and demographic data as well as deductibles and co-payments, the adverse selection still is a challenging problem in the insurance market (Ville-neuve, 2003). As a result, insurance companies do not want to do business unless they are allowed to charge extremely high premiums and the consumers and especially the good ones like the ones with good health or good driving records may not want to buy insurance. Given the fact that many states in the US have passed the regulation and do not allow the insurance companies to use some demographic information such as zip codes to charge premiums, the adverse selection problem has become more serious. The possible solution is to make the relevant insurance mandatory, such as mandatory auto liability insurance and universal health insurance.

The condition of using mandatory insurance to solve the adverse selection problem is to pool all people together and all of them will buy the insurance. However, the actual effectiveness of such mandates in this aspect is mixed. Although all states in the US require compulsory auto-liability insurance, there are still many million American drivers without basic liability insurance coverage (Insurance Research Council, 2006). In terms of other types of compulsory insurance such as universal health insurance or mandatory disaster insurance implemented in other countries, the coverage situations are much better.

Whether compulsory insurance can better solve the adverse selection problem depends on the enforcement of the mandates and who will pay for the in-

insurance. As discussed in the previous sections, some mandates are easier to be enforced such as the social securities and workers compensations; but the others will be more difficult to do so. This will be especially true if insureds need to pay directly to the insurers like the case in autoinsurance. People may buy autoinsurance and then cancel the coverage immediately after they have renewed the vehicle licenses.

The empirical importance of adverse selection is debatable. However, Hackmann et al. (2012) did find evidence of adverse selection in Massachusetts's health insurance and estimated that the implementation of mandatory healthcare reduced the annual average hospital cost for the insured population by about \$124 per person, approximately 3 percent of the average insurance premium for employer-sponsored health insurance.

In empirical studies adverse selection is usually indistinguishable from moral hazard, and the expected correlation of high risk and high demand for insurance is seldom observed. This is true possibly because of the effects of other factors such as income/wealth as well as insurance companies' screening of the insureds.

2.7. Moral hazard. Moral hazard is a potential problem in insurance (Marshall, 1976; Doherty and Smetters, 2005). With compulsory insurance, the situation could be worse. Insureds with mandatory natural disaster insurance may not take protective measures such as appropriate building materials and provisions against backwater flooding. Injury workers may stay home longer than necessary when they are covered by the workers compensations. Unemployed people may not actively look for jobs as long as they are able to receive unemployment insurance payment. Autodrivers may be less careful on roads when there is a mandatory insurance. A study by Douthat et al. (2005) found that requiring insurance coverage may lead drivers to take a cavalier attitude toward road safety.

Such a moral hazard problem will be more serious if the insurance premium is independent from the insureds' risk and losses/expenses like the case in universal health insurance. A study by Sepehri et al. (2006) argued that compulsory health insurance led to easy hospital admissions and longer hospital stays of patients. In Taiwan, several studies also found that people visited doctors and hospitals much more frequently with the universal health insurance even though many times such visits may not be necessary.

Companies may change its behaviors too under compulsory insurance. Banks may be less careful in its businesses with deposit insurance (Clair, 1984; Grossman, 1992). Insurance companies could be more risk-taking under insurance guarantee funds

(Lee et al., 1994). Pearsons (2003) investigated different types of moral hazard problems in liability insurance, including ones with insurers and underwriting agents.

2.8. Portfolio selection and substitutes. Additional effect of compulsory insurance is how that will affect people's selections of other products/consumptions and so change people's portfolios. With the mandate, individuals must buy the relevant insurance, then they will spend less on other products and services.

Schulenburg (1986), Schlesinger and Doherty (1985), and Schlesinger (1986) examined the effect of compulsory insurance on demand for other voluntary insurance. Briys et al. (1988) indicated that with compulsory insurance, individuals may choose partial coverage (not full) for the other voluntary insurance even if the voluntary insurance premium is actuarially fair. Hogan and Aubey (1984) studied compulsory crop insurance and allocative efficiency in agriculture, and argued that even an ideal compulsory insurance scheme would lead to the misallocation of resources. Ericson and Starc (2012) found that when people are forced to buy unsubsidized health insurance, the majority of them chose to buy the Silver Plan (the minimum one required by the mandate).

For businesses, mandates will raise its costs of operations, lower its profit margins and that may even drive out its businesses. Many small businesses were closed because they could not afford so many mandates and its costs.

2.9. Social risk, externalities and public goods. Compulsory insurance will be desirable when it is related with some social risk. A social risk is a correlated risk with big potential losses, i.e. many groups and people may be directly affected simultaneously. As a result, conventional insurance fails since the business insurance is built on the law of large numbers and individual risk's independence. Private insurance could not cover social risks but insuring such risks are still desirable; then it should be the government's responsibility to be involved in developing and providing the relevant insurance coverage. Such insurance can be voluntarily based but many businesses or individuals mostly will not be willing to pay for that since they expect the government to help them recover from the disaster. As result, the only feasible way is to implement the compulsory disaster insurance as some countries have been doing.

Browne and Hoyt (2000) conducted an empirical study of the demand for flood insurance and found that flood damages remain largely uninsured losses

despite the efforts of governmental programs that in many cases make insurance available at below fair market cost. They stated that disaster relief efforts crowd out the purchase of flood insurance. Insley (2002) examined flood risks to homes in California and concluded the importance of pooling to the possible coverage. Schwarze and Wagner (2004) demonstrated why mandatory insurance is necessary against natural disasters in Germany. Feldstein (2005) showed the necessity of social insurance such as unemployment insurance and social security and further demonstrated economic principles in order to benefit the whole society.

Given the climate changes and increases of natural disasters, such compulsory disaster insurance will become increasingly necessary. Whitmore (2000) examined the limitations of conventional insurance and suggested to use compulsory environmental liability insurance as a means of dealing with climate change risk.

Compulsory insurance will also be necessary if there are negative externalities of the potential risk. Some countries implement compulsory pollution insurance to protect the public from pollutions caused from some businesses. A company itself does not have motivation to buy such pollution insurance. A private insurer will not be willing to participate in such insurance business because of potential problems of adverse selection and moral hazard. Therefore, to solve the insurance market failure problem and to better protect the public, a mandatory pollution insurance will be needed.

In this case, such a compulsory pollution insurance can be viewed as a public good which is desirable by all public, including businesses but no one wants to pay for that since the nature of a public good – non-rivalry, non-excludable, indivisible, non-rejectable (Chen, 2010). A compulsory insurance to cover this kind of risk will be valuable if its total social benefits exceed its relevant costs. Kerr et al. (2009) conducted a cross-national study of governance social insurance and suggested to use that as an alternative to tort liability compensation.

2.10. Legal rights. Implementing any compulsory insurance will involve legal and rights issues. Some compulsory insurance requires individuals to buy and pay for the mandated insurance such as universal health care and auto liability insurance. That will affect the individuals' rights not to buy such coverage. The second type of legal and rights issue is the relationship between the federal and state/local governments, i.e. whether the federal government has its right to force the states to implement the mandate. In other words, whether a state has its right and authority to implement its own insurance policy, different from the federal mandate.

Germany was not able to pass its proposed compulsory natural disaster insurance mainly because of the concern of the states' rights in the matter (Schwarze and Wagner, 2007). The universal health care plan passed by the US Congress is also facing challenges in the US Superior Court by some states and individual rights groups.

Another relevant legal and rights issue is whether all individuals have the basic rights to have access to some protections/services such as healthcare. Most developed countries have had universal healthcare systems/plans because they believe that having healthcare protection/service is the basic human rights in the modern world. So governments should provide it when its economy can afford to that. It is very interesting to notice that the US is the most developed country in the world and has the largest economy; but the US has not implemented the universal healthcare plan yet although it plans to do so now.

The US Superior Court has ruled that the proposed universal healthcare reform is constitutional. Its reason is that although the US government does not have the right to force all people to buy health insurance, it does have the authority to impose penalty to individuals who are affordable to buy coverage but do not buy that since such a penalty is considered as a kind of tax.

3. Individual and public's acceptance of the compulsory insurance

As discussed in the above sections, there are different types of effects of compulsory insurance. A compulsory insurance can have positive effects to solve adverse selection problems, but that may cause more serious moral hazard problems. It can help low income people afford to and get basic healthcare but may force others to pay more taxes.

In order for a government to implement a compulsory insurance, it must be widely accepted by the public. The public's acceptance depends on whether they feel that they will benefit. That will also rely on the expected costs. Germany failed to pass its proposed compulsory natural disaster insurance. US President Clinton made strong efforts and wanted to pass a universal health care plan but failed.

But the public's opinions can be changed over time. Education and good promotion and communications to the public about the importance and necessity of a proposed compulsory insurance are crucial. President Obama successfully passed his proposal to offer universal healthcare to all Americans.

It is important to understand the public's views on a proposed compulsory insurance. Particularly, in many states and countries, any compulsory insur-

ance must be passed by the relevant legislations. Therefore, the public opinion will decide whether such a mandate will be passed and implemented.

Here we examine main factors affecting individual and/or public's acceptance of the compulsory insurance. Furthermore, we develop a theoretical model to incorporate all of these factors together.

Main factors and its notations:

1. Benefits from the mandatory insurance coverage (B_i).
2. Direct costs of buying the insurance (C_i).
3. Potential taxes imposed to the individuals/the public (T_i).
4. Potential penalty and the possibility/probability of the penalty for not compliance with the mandatory (P_i).
5. Individual's wealth/income (W_i).
6. Individual's risk attitude (A_i).
7. Cross-substitution (S_i). Given the income, spending on others will be lower when an individual is forced to buy the insurance.

Here i indicates the i^{th} person. Here, we only list some directly measurable factors and variable. Other factors and effects such as availability and moral hazard are not included.

3.1. A theoretical model. A Logit model can be used to integrate all of the above factors. This kind of the Logit model has been widely used in the stud-

ies of bankruptcy/ insolvency of the banks/insurers (Chen et al., 2001).

$$L = 1 \text{ if } F = F(X) = F(B_i, C_i, T_i, P_i, W_i, A_i, S_i, E_i) > 0; \tag{4}$$

$$L = 0 \text{ otherwise,}$$

where E_i is the error term for individual i and L is the acceptance of the mandatory insurance with 1 as accepting and 0 rejecting; $F(X)$ is a function of factors affecting the acceptance of a compulsory insurance. The individual or the public will accept/support a proposed compulsory insurance policy, i.e. $L = 1$, if he/she concludes that $F(X)$ is larger than the pre-set constant number such as zero (the change of this constant number will not affect the theoretical analysis since $F(X)$ will include a constant term (intercept) in the model); otherwise, the individual/public will reject the proposal, i.e. $L = 0$.

Since these specified factors/variable change over time, one may add additional time factor in the model to have the dynamic panel data. President Clinton's universal healthcare efforts/plan failed, but President Obama's one succeeded mainly because the public's opinion has been changed overtime as well as other reasons.

3.2. Expected signs of the coefficients in the model.

The following table summarizes the expected signs of the coefficients of the relevant factors/variables.

Table 3. Effects of factors on the acceptance of compulsory insurance

Name of factor	Coefficient	Expected sign	Explanations
Benefit from compulsory	B_i	>0	More benefits, more likely accept the mandate
Associated cost	C_i	<0	Higher cost, less likely accept the mandate
Tax increases	T_i	<0	Higher taxes, less likely accept the mandate
Potential penalty	P_i	<0	Higher penalty, less likely accept the mandate
Individual welfare/Income	W_i	<0	Richer people, less likely accept the mandate
Individual risk attitude	A_i	<0	Higher risk taking, less likely accept the mandate
Cross-substitutions	S_i	<0	More serious substitution effects, less likely accept the mandate

4. Areas for further theoretical and empirical studies

Through this paper's comprehensive review, it seems that there have been many theoretical and empirical studies on compulsory insurance. But in general, our understanding of the subject is still limited; particularly the majority of the previous studies focused on the single effect of the compulsory insurance on individuals and the society and the comprehensive effects are not well addressed. For example, a compulsory insurance can lessen the adverse selection problem but may worsen the moral hazard problem; then what will be the combined effects? Overall positive or negative?

Secondly, the public's opinions and acceptances on some proposed compulsory insurance like the US

universal healthcare plan changed overtime. So far there is no theoretical or empirical study to explain what caused such dramatic changes. And how to develop a comprehensive model to capture and explain such or other changes of the public's views about the compulsory insurance?

There are also lacks of comparisons of similar compulsory insurance. For example, many countries require basic auto-liability insurance. But each country's enforcement practice is different. Even in the same country, each state may practice it differently. There are no comparison studies on which enforcement practice is more effective in terms of reducing the uninsured motorists and which one is more cost-effective.

Empirical studies on compulsory insurance are not as many as theoretical studies and furthermore,

most empirical studies had the limited samples. Rarely there are empirical studies based on the national data.

Also, one may collect relevant data and conduct an empirical study based on the model developed in section 3. One can further test whether the whole model is significant and whether each coefficient in the model is significant. Then, one can analyze whether a specific compulsory insurance will be accepted by the majority of the public/group based on the regression results.

Conclusions

This paper aims on better understanding compulsory insurance. It provides a comprehensive review and analysis of compulsory insurance, particularly its effects on individuals and the society, based on theoretical studies and empirical evidence; it explores what we can learn to better develop and implement compulsory insurance.

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The paper gives a theoretical model to understand whether an individual or the public will accept/support a proposed compulsory insurance. In addition, the paper reveals some areas that need further theoretical and empirical studies related with the compulsory insurance.

Acknowledgement

This paper was presented at the annual conference of the Asian Pacific Risk and Insurance Association, Seoul, July, 2012. It was also presented at the University of the West. Authors want to thank participants of the conference/seminar for their valuable comments. Authors also would like to thank Professor John Marshall at University of California, Santa Barbara, for his most valuable and detailed comments and corrections and acknowledge the financial supports received from the University of the West, USA and Fudan University, China. But all possible errors are authors.

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