Modelling privatisation of traffic insurance in Sweden

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ABSTRACT:

This article briefly describes the methodological challenges involved in calculating the economic effects of further privatising Swedish traffic insurance. Sweden is currently reviewing its arrangements for compensation for loss of earning as a result of traffic accidents. The major component of this review is the privatisation of social insurance which currently provides for payment of the equivalent of lost earning through the public system with the balance paid through other sickness benefits and the private traffic insurance system. In the paper the development and use of the Swedish micro simulation model FASIT for analysis of traffic insurance is described. It addresses the distributional impacts of higher premiums, socioeconomic analysis of deficient premium payment among vehicle owners and a rise in costs of transfers as a result of a higher CPI. In addition, the development of a stochastic stock-flow-model for the analysis of temporal aspects of the reform is described. The use of time lags to capture the possible decrease of the costs of social insurance is also addressed.

The paper will not contain results of importance since they have not yet been reported to government.

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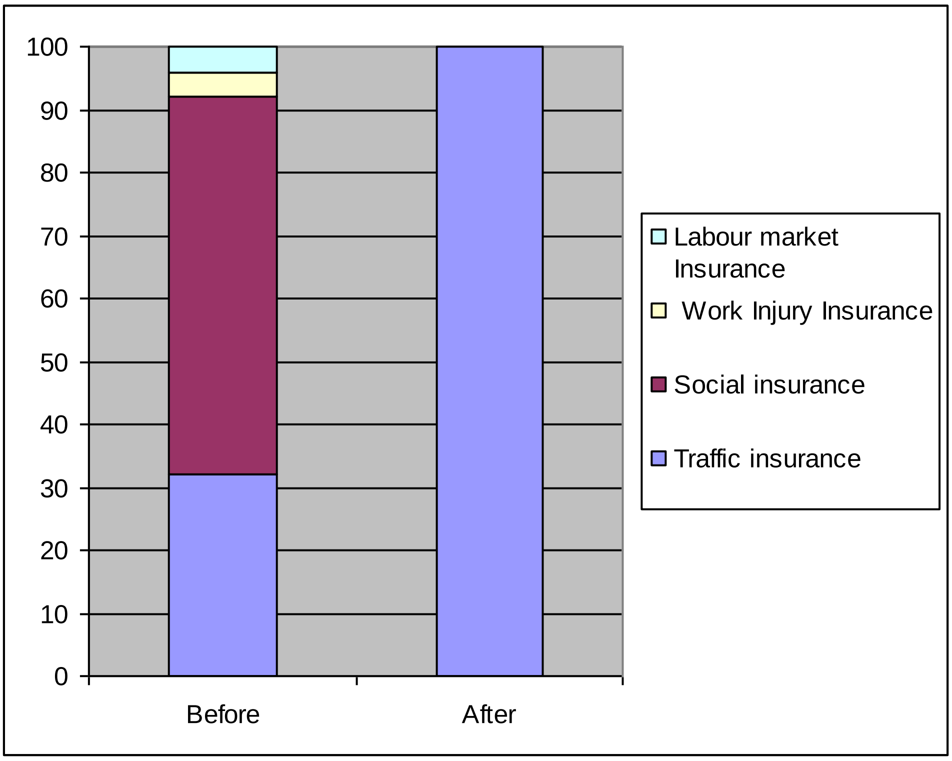
1. Background: The reform in outline

A commission is undertaking an Inquiry into the effects of reform of traffic insurance, Motor Third Party Liability (MTPL). The reform involves privatisation of income loss paid to persons as a consequence of a traffic accident. Currently employers (through sickness payment, social insurance, traffic insurance and labour market insurance, contribute to this payment, although each to a different extent. Under the reforms proposed, payments made by the social insurance (and potentially other types of insurance) will be taken over by the traffic insurance. The employers will still be responsible for their part. Depending on labour market agreements labour market insurance may, or may not, include traffic accidents. The figure below gives a schematic picture of how the parts of the income loss will, and could change as a result of a reform.



We describe four different micro data approaches for the analysis of the reform. Three of these involve the use and development of FASIT – a microsimulation model of taxes and benefits developed by Statistics Sweden. The fourth approach involves a stochastic stock-flow model developed within the inquiry.

2. Modelling proposed privatisation of traffic insurance

2.1Distributional effects of higher premiums

The increased responsibility for traffic insurance means higher premiums. The distribution across the population is analysed using the micro simulation model FASIT.

In the dataset STAR, which involves nearly a fifth of the Swedish population, and is a basis for the FASIT model there are, beside many socioeconomic variables, registered data on occupancy of cars and motorcycles on a given date.

In order to be able to undertake any distributional analysis there is a need to map the present structure of premiums paid by different categories in the population of car owners (owners include lease and other purchase arrangements).

Within the inquiry it was decided to use a type approach. The most important arguments of premiums are sex, age, region and the ratio of weight of car and motor strength. These factors are said to be the most important premium determinants. Data was collected on premiums for 150 type persons/cars from four different insurance companies for 2009. These data were merged onto the data in STAR based on the determinants of premiums.

It was assumed that the increase in individual premiums was the same as the average rise.

The model facilitates answering important policy questions about how higher premium would be distributed across individuals and households (who own a vehicle) with different incomes and whether the reforms will have a greater impact on low income households than on households with higher incomes?

Although the methods used are innovative and make the best use of available data the model is not used to analyse the impact of policy reform on small groups as it may not be representative at that level of disaggregation, particularly if the distribution analysis variables have not been captured in base data or the imputation process (for example, country of birth).

The effect is measured in disposable income after cost for traffic insurance.

2.2 Increased costs for state transfers

The average rise in premiums, considering both the income replacement insurance and increases in taxation is projected to be substantial. The increased premiums have a direct effect on CPI and potentially may flow on to increased prices in the transport sector of the economy. This will one time increase in the CPI would in turn flow on to the indexes that are the basis for many state transfers to citizens. This one time rise in CPI will increase the outlays of state transfers.

Any change to these indices and their flow on effects increasing state transfers can be simulated by FASIT.

2.3 Socioeconomic analysis of deficient premium payments

About one per cent of vehicle owners fail to pay their insurance premiums. There is concern that privatisation leading to higher premiums may lead to an increase in failure to pay car insurance premiums.

To estimate this unintended outcome, the socioeconomic characteristics of persons currently failing to pay premiums was analysed.

The STAR underpinning FASIT was merged with data on car owners who failed to pay their insurance premiums to estimate the future rates of failure to pay.

2.4 The stochastic stock-flow model

The impact of the reforms are anticipated to be non- linear over time. One important example is the time lag on the flow through to the costs of social insurance after reform. Old injuries will not be transferred to the new traffic insurance arrangements when the reforms are implemented . Thus there is a need to project how costs for social insurance decrease over time.

This calls for a microsimulation model to capture these sophisticated and interacting effects. Using the best available data, a stochastic stock-flow model was developed to analyse these features of the reform. The components of the model are:

1. An injured population for each point in time is constructed from populations 1975 onwards. The population-data is created from household-income-data with a variable indicating work income, which is used to calculate the level of income loss when injured.
2. The injured population inflow, created using a stochastic process with risks of injuries created for sex and age. The basis for these risks is data from Statistics Sweden describing injuries in 1985.
3. The risk of outflow is the combination of two risks, one of getting well and the other of dying. The risk of getting well is constructed with the above mentioned data from 1985 and the risk of dying is simply the risks of dying computed for the whole population each year between 1975 and 2007.
4. This creates a database with for central variables, the year and day within year of injury and the year and day within year of getting well or dying. These variables form the basis for distributing the time within each year spent in different injury categories. This is crucial to determine who makes the income replacement payments.
5. Finally, rules for payments before and after the reform are modelled and run against the data created.

2.5 Risks as the basis of the model

The risk of leaving the injured state, the combination of death and recovery, proved to be challenging. Of course it might be stated that it would be enough to determine the combination of these risks. In a narrow analysis that would suffice, but since the remuneration-system also involves pensions it is of interest also to determine the lifespan of injured individuals. The use of general death risk of course also constitutes a problem since it could be argued that the risk of death for injured differs from the general population. For that reason, in the absence of supporting data, sensitivity analysis was conducted for increased risk of death using a multiplier increasing the risk of deaths proportionally for every group.

Our data on the probability of recovery from injury is available on an annual basis. The challenge is that there are multiple factors associated with the rate of recovery and the recovery trajectory is not linear, especially in the first year, when there is rapid outflow from the system. Instead of trying to estimate equations over time it was decided to determine the probabilities through computer experiments also using anecdotal data on the outflow during the first year. These experiments where conducted introducing piecemeal linear segments over time In more detail the experiments meant trying to map the structure of outflow on a test dataset with different probabilities in different segments of time and then, choosing those probalities that have proven to give the best outflow structure for the model.

2.6 Data manipulations

The base data is microdata on income between 1975 and 2006. We needed to project the outcome of a reform that might take place around 2011 with the effects having a duration of several decades onwards.

As it turns out there was also need for finding ways to "preject" income data for a few decades before 1975. The reason is that the possible time span for an injured person to receive remuneration is 45 years, not counting the possible payment for pension loss. You can start having pay outs from the age 18-20 until the age of 65. If you also consider calculating what the traffic insurance is paying in income loss you will need to go even longer back.

The stochastic process traditionally used did not work well with the small samples. It was therefore decided that to change data into sets with each observation representing one individual and making projections of data into the future with population prognoses and simple multiplicative income projections until 2050. For computer time reasons large samples sizes between 20 and 50 percent where used of the data created were used for calculations.

2.7 In search of the algorithm or stochastic tinkering

In theory, the ideal situation would be an algorithm that would solve parameter values from known determinants. For at least two reasons the creation of such an algorithm is not a feasible strategy in this case. One reason is that each run of the model takes many hours. The introduction of an algorithm needing many runs of the model would be "untimely". Another reason is that the estimation of a robust algorithm is difficult to derive given the data limitations.

The data used in the stochastic stock flow model has come in many forms, from well organised micro data, over data created by the insurance industry, to more anecdotal data on the time span from injury and onwards.

The model is calibrated against a number of macro variables - number of injuries the number in stock in a certain year, and the estimated amount payed by social insurance a certain year.

3. The possible analysis with the model

The model makes it possible to analyse a variety of effects of the reform, such as the time lag in the impact of income replacement payments. Also total income loss and its parts can be computed. Another possible application of the model is a change in payments to the general pensions system. With some additional modelling, it new levels of premiums as a result of the reform could be predicted. (Present value calculations could be performed for years before the reform to be performed for years just after the reform). The model could also be used to simulate changes in behaviour that could result in changed risks for injuries or for risks of recovery.

3.1 Decrease in costs for the social insurance

The total cost for the social insurance consist of part-payments of the income loss and the administrative costs for handling the payments. Over time the total cost for social insurance will decrease since new injuries will be covered under the new traffic insurance arrangements.

The stock-flow model will give data on income loss payments each year until they have reached zero. The administrative cost will be added by imputing administrative costs per payment.

The calculations will estimate the cost decrease for social insurance and the time lags involved. They will also give a base for deciding on the level of a premium tax that is to equal the present value costs of social insurance costs that are lagging after the reform.

3.2 The total income loss

The model computes income loss over time. This makes it possible to compute the probable increase in the income loss payed by traffic insurance as a result of the reform.

3.3 The general pension system

From social insurance, a fee is payed to the general pension system. That is not the case now for traffic insurance. The stock-flow model can be used to analyse both the effects if no changes were to be made to the fees to be payed by traffic insurance and the effects if changes were made.

The stochastic model can be used to calculate the revenue effects for the pension system with and without a change in the rules on whether the traffic insurance is to pay a fee or not. The fee is for financing the general pensions.

3.4 New levels of premiums

Potentially the stock-flow model can be used for estimating the general rise in premiums as a result of the reform. The premium for one year is to be the present value cost of the injuries for that year. With some additions to the model to cover costs other than income replacement it will be possible to estimate new premiums as a result of the reform.

3.5 Changed behaviour

The Commission is to analyse the possible behavioural effects of the reform. Changed behaviour means different risks. The risks in the stock-flow model can be changed in order to calculate the effect of changed behaviour.

Two risks can be adjusted; the risk of being injured and the chance of getting well.

It can be argued that risks change when premiums change. The choice of vehicle might be effected and if premiums will be more individualised and in the direction of "pay-as-you-drive" vehicle owners will be more inclined to limit risks. The modelling challenge of course is to translate this qualitative reasoning into specific changed risks of injury. At least different scenarios can however be tested. How much will smaller or bigger changes in risks effect costs and what is the pattern of that change over time?

One possible goal of the reform is to give incentives to a better functioning of rehabilitation after a traffic accident. The idea is that the entity carrying the responsibility for insurance will be able to calculate and actually benefit from the reduced costs of more rapid or complete recovery resulting from investment in rehabilitation. Again it is not easy to quantify an effect of this kind, but scenarios can be used to calculate altered chance of getting well under different treatment options.

4. Conclusions

Modelling the proposed privatisation of Swedish traffic insurance is a new innovation for the application of microsimulation modelling. This presented many methodological challenges due to the many sources of data required, the uncertainty of the outcomes of the proposed changes. Nonetheless, the model that was developed has proven to be an effective and valuable tool to support the decision making and planning of the Commission. The Commission will hand down its final report later this year using the model to provide estimates of cost effects for different actors, as individuals/households, enterprises and different parts of the public sector.