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Use of medical services in Chile: How sensitive are the results to different econometric models?

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Abstract

Background: We compared different econometric specifications to model the use of medical services in Chile, focussing on visits to general practitioners and specialist physicians.

Methods: The evaluated models are the Poisson, Negative Binomial, Zero Inflated Poisson and Negative Binomial, two-step Hurdle model, sample-selection Poisson, and Latent Class model. These models were estimated using Chilean data for the years 2009 and 2015, separated by gender.

Results: Unlike previous literature that supported the use of the latent class model, our results show that the latent class model is not always the model with the best goodness of fit. Furthermore, the model with the best fit is not necessarily the model with the best predictive power. For instance, depending on the year and medical services, either the latent class model or the sample-selection Poisson model performs better than the other models. The results also show that the selection of the econometric model may have implications for the estimated influence that variables such as age, income, or affiliation to the public versus private sector have on the use of medical services.

Conclusion: Using Chilean data, we have tested that the selection of an econometric method to model the use of medical services is not a problem with a unique answer. We recommend performing a sensitivity analysis of goodness of fit and predictive power between gender, healthcare services,

or different years of datasets in future applications to be sure about the best model specification in each context.

KEYWORDS
determinants of health utilization, econometric model, general practitioner visits, specialist physician visits

Highlights

- Unlike previous literature that supported the latent class model, our results show that the latent class models do not always have the best goodness of fit
- The selection of the econometric model may have important policy implications
- Health Status self-perception is one of the most critical determinants in the use of medical services
- The Chilean geography and the structure of the Chilean health system play an essential role in reducing or increasing the utilization of medical services

1 | BACKGROUND

People use medical services to preserve or improve their health because health status is a highly valued asset and a prerequisite for daily activities. However, equitable and efficient access to medical services is a significant challenge for many health systems worldwide, and it is one of the main objectives of health policy at a global scale.[1,2] In Chile, for instance, equitable access to health services was the eighth goal defined by the Chilean Ministry of Health for the decade 2011–2020, and it was the primary goal of a noteworthy effort towards health reform that has been applied in Chile since 2005 (Explicit Guarantees System [GES]).[3]

However, as the utilization of medical services increases, the costs for families as well as for the public and private health sectors also increase, representing a critical trade-off for policymakers and those in charge of managing health systems. In this respect, understanding the factors that drive the use of different medical services and the best way to model their use statistically is relevant in developing health policies. To assure the supply of medical services and fully cover the current and future demand at a national level, public and private health systems must appropriately estimate future usage.

Moreover, the use of medical services differs among countries because their health insurance schemes are different. Comparisons of estimations of medical services utilization across developed nations have suggested that using heterogeneous models estimated separately by country is the preferred specification against a set of homogeneous models with different degrees of heterogeneity among countries.[4]

In this regard, Chile is a notable study case. The health insurance scheme in Chile is formed by a mixture of two contribution-based sectors, the public (called the National Health Fund; FONASA) and the private system (ISAPRE). Within the public sector, there are four types of beneficiaries (groups A, B, C, and D); and two kinds of attention (institutional and free-choice). Groups A and B are either indigents or poor, and their social contributions are entirely or largely publicly subsidised (through general taxation). Institutional attention (in public hospitals and primary care units) is free for those in groups A and B, but has a 10% and 20% copayment for those in groups C and D. The free-choice type of attention is available only to groups B, C and D and in this case, FONASA pays only a fixed-amount per attention (it varies by specialty and provider). The remaining cost is paid by the patient.[5] Most of the population

belongs to FONASA, and the percentage of participation has increased from 65% in 2000 to 76% in 2015.[5] Incentives in the systems in terms of medical use differ. Although most ISAPRE beneficiaries do not have restrictions on their insurance schemes to access specialist physicians and exams (e.g., x-rays, echographia) based in private clinics and hospitals, most FONASA users are restricted to using congested public facilities.[6]

Regarding utilization of medical services in Chile, a critical overall increase in some services has occurred (irrespective of FONASA or ISAPRE affiliation). For instance, between 2000 and 2015, general practitioner visits increased by 135%, and emergency room visits increased by 151%, but for other services, the increase has been smaller, for example, specialist physician visits increased only 32%. Several reasons can be given for the increase in the utilization of healthcare services over time. First, healthcare is a normal good (i.e., their income-elasticity is positive) which means that, in periods of economic growth, demand increases.[7] Second, supply has increased, especially in the public health sector. Resources allocated to healthcare increased significantly during this period. For instance, in the case of FONASA, transfers from the Government (which cover 65%–70% of total expenditures) increased 48% in real terms from 2009 to 2014 (last year available) (https://www.fonasa.cl/sites/fonasa/documentos). Third, though not easy to measure, utilization in the private sector may be related to payment schemes used by ISAPRE. Fee-for-service payments are related to demand-induced mechanisms that can artificially increase use. This is more evident for some services, such as specialists, exams, scans and x-rays, etc.[8]

At a global scale, the utilization of medical services, its social and individual determinants, and its dynamics has been widely studied in the literature. Atella, Brindisi, Deb, Rosati[9] analysed data for Italy; Andersen, Newman[10] for the United States; Cumming, Stillman, Liang, Poland, Hannis[11] for New Zealand; Skordis-Worrall, Hanson, Mills[12] for South Africa; Balabanova, McKee, Pomerleau, Rose, Haerpfer[13] for the former Soviet Union; Mocan, Tekin, Zax[14] for China; Kohn, Liu[15] for the United Kingdom; and Gonçalves, Weaver[16] for Switzerland. For developing countries and especially in Latin America, studies have been conducted but, in general, the evidence is limited: studies have been developed by the World Health Organization[17] for Bolivia; Lewallen, Courtright[18] included several Asian and African developing countries focussed on cataract surgical services; Wallace, Gutiérrez[19] considered access to medical services only for older adults in four Latin American countries regarding (Argentina, Chile, Cuba, and Uruguay); and Wang, Alva, Wang, Fort[20] for 38 developing countries focussed on maternal health.

In the case of Chile, studies have addressed different dimensions of health inequality, such as sex differences[21-24]; the evolution of inequality levels for a variety of medical services[25,26]; and inequalities in the use of medical services for different age groups.[27] Cabieses, Cookson, Espinoza, Santorelli, Delgado[28] also addressed the relationship between inequalities in access to the GES reform, concluding that this policy has helped reduce inequality levels.

Most of these papers working with Chilean data have identified the determinants of the use for medical services and/or inequalities regarding such use using different econometric specifications. But none of them have proposed reasons for using one specification over the rest. Notably, only a few researchers[26,27,29] have acknowledged and considered that variables for the use of medical service visits are countable (i.e., a nonnegative integer with a discrete distribution highly concentrated at zero).

In general, the traditional approaches for modelling this type of data have used Poisson, or negative binomial (NB) models,[30,31] which jointly model participation decisions (whether to visit a physician or not) and intensity of use (total number of visits). Another approach extends the Heckman selection model to count data.[31,32] Nevertheless, some evidence suggests that it is better to model the participation decision and the intensity of use separately[33] because of the large number of zeros in the intensity of use. The global literature suggests some approaches to achieve this goal, such as the zero-inflated Poisson and NB models, latent class models, and two-stage hurdle models.[4,33,37] These studies have shown that misspecification in the function modelling use of medical services may have had undesired consequences in policies based on their results. Nevertheless, there is no "preferred universal specification," and other studies have shown that the evaluation of different econometric models must be conducted on a case-by-case basis.[4,37]

The main objective of this paper is to compare the results in the determinants of the use of several healthcare services in Chile by using different econometric specifications. From an econometric perspective, we differentiate

our study from the global literature that has compared two-part models (hurdle models) and latent classes models[4,36] by including the sample selection Poisson model (SSP) (Tobit type II for count data) suggested in the literature of health economics. The list of the models compared is as follows: Poisson, NB, Poisson zero-inflated, NB zero-inflated, hurdle, sample-selection Poisson, and latent class (Poisson and NB). We evaluate the model's capacity to explain variance in the dependent variable through the Akaike information criteria (AIC) and Bayesian information criteria (BIC), well-known goodness of fit measures. Furthermore, we also evaluate how accurate the models are in terms of prediction using the Root of Mean Square Error (RMSE) in a cross-validation process. Which of the two approaches is more appropriate depends on the researcher's interests. Although in our case, the more appropriate model will be the one with the best goodness of fit, we still present predictions because of their usefulness in policymaking.

Another objective is to discuss the determinant factors behind the use of healthcare services in Chile, focussing on the partial effects of individuals' characteristics. The focus of this analysis is on two healthcare services: general practitioner and specialist visits. Two years (2009 and 2015) are considered a means of evaluating the robustness of the results. We differentiate the analysis according to gender because it allows the generation of information separately according to the different types of user needs. We believe this analysis is one of the few of this type applied to developing country data, and as such, is a contribution to the literature.

Unlike previous literature that supported the use of the latent class model, our results show that the latent class models do not always have the best goodness of fit. According to our estimates based on Chile data, it depends on the type of medical services and the year of the data. In addition, our results show that the model with the best fit is not always the model with the best predictive power. Again, depending on the year and medical services, either the latent class model or the sample-selection Poisson model performs better than the other models. The results also show that the selection of the econometric model may have implications for the estimated influence that variables such as age, income, or affiliation to the public versus private sector have on the use of medical services. Therefore, we recommend performing a sensitivity analysis of goodness of fit and predictive power in future applications. In addition, there is an opportunity for future research about whether our conclusions might be generalized to other developing economies.

2 | METHODS

The models used in this paper are extensively (and separately) described in the literature[30,31,36,38,39]; therefore, we present a summary of each model. These empirical models respond to the theoretical models that have been developed by Zweifel, Felder, Meiers,[40] Grossman,[41] and Grossman[42] for health economics.

2.1 | Poisson model

The dependent y_i variable (visits to a physician) follows a Poisson distribution with a λ_i mean defined as a function of the explanatory variables (regressors) x_i given by:

$$\Pr(Y_i = y_i) = e^{-\lambda_i} \frac{{\lambda_i}^{y_i}}{y_i!}, \quad y_i = 0, 1, 2, \ldots \tag{1}$$

where $\lambda_i = E(y_i|x_i) = Var(y_i|x_i) = \exp(x_i\beta)$; therefore, the likelihood function is given by $lnL = \sum_{i=1}^{n} -\lambda_i + y_i * (x_i\beta) - lny_i!$.

2.2 | Negative binomial model (NB)

The Poisson model does not consider the existence of unobserved heterogeneity that causes overdispersion (conditional variance is greater than the conditional mean). This concern can be solved by introducing an unobservable individual effect into the conditional mean of the Poisson model:

$$ln\lambda_i = x_i'\beta + \varepsilon \tag{2}$$

where $\exp(\varepsilon)$ follows a gamma distribution with a mean of one and variance α. The NB density is

$$f(y_i) = \Pr(Y_i = y_i) = \frac{\Gamma(\theta + y_i)}{\Gamma(\theta)y_i!}v_i^{\theta}(1 - v_i)^{y_i} \tag{3}$$

Where $v_i = \theta/(\theta + \lambda_i)$, $\theta = 1/\alpha$, and $\Gamma(.)$ is the gamma function.

Thus, the variance of the random variable y_i is $var[y_i] = E[y_i](1 + \alpha E[y_i])$. The additional α parameter allows the mean to differ from the variance. This way to parametrise the variance function is known as the NB2 model. There is another parametrisation, which assumes linearity in the variance function, and it is known as the NB1 model.[43] Even though it is feasible to estimate the use of medical services through NB1,[36] NB2,[4] or both,[44] we estimated both but decided to report only the NB2 model because the use of NB1 did not change the ranking (AIC, BIC) of the estimated models and because the NB2 model has become more common in the literature.[45]

2.3 | Zero-inflated models (ZIP-ZINB)

If we hypothesised that there are two groups of individuals, the non-users of medical services and the potential users, the estimation of the zero-inflated Poisson or the zero-inflated NB models are appropriate. These models estimate the conditional probability that a person belongs to one of the two groups denoted by q_i, conditioned on a vector of explanatory variables denoted by z_i:

$$q_i = Pr(y_i = 0) = F(z_i'\delta) \tag{4}$$

where $F(z_i'\delta)$ is the cumulated distribution function. The Poisson or NB model is used to estimate the demand for potential users. The mean of the distribution will be conditioned by another group of explanatory variables x_i, $\lambda_i = \exp(x_i'\beta)$. Defining $f(.)$ as the density function of the Poisson or NB, the following distribution is obtained for individuals who use medical services:

$$Pr(y_i = 0) = q_i + (1 - q_i)f(y_i = 0) \tag{5}$$

$$Pr(y_i = j) = (1 - q_i)f(y_i = j)$$

2.4 | Hurdle model

Unlike the zero-inflated model, the hurdle model indicates that decisions about the use of medical services are the result of two separate processes. The first part specifies the decision to visit a physician (yes/no), and the second part specifies decision models using the positive values of the dependent variable for people who receive some medical

attention. Theoretically, modelling the use of medical services in this manner responds to a supply and demand relationship between these services that considers the existence of supplier-induced demand.[40]

The use of medical services is broken down into two random components: $y_i > 0$ and $y_i|y_i > 0$ and a specific probability for each component. The prediction of these two models, the probability of some sort of a medical visit $\Pr(y_i > 0|x_i)$ and the expected number of visits, conditioned on any visit $E(y_i|y_i > 0, \ x_i)$, are used to predict the mean number of visits $E(y_i|x_i)$:

$$E(y_i|x_i) = \Pr(y_i > 0|x_i)E(y_i|y_i > 0, x_i) \tag{6}$$

For a sample of *n* individuals, *N* observations have some number of medical visits, and (n − N) individuals have not consulted with a doctor. The probability for each of the N participants is as follows:

$$L = \Pr(y_i > 0|x_i) * f(y_i|y_i > 0, x_i) \ \text{ with } \ i = 1, \ldots, N \tag{7}$$

The probability of (n − N) is $L = \Pr(y_i = 0|x_i)$

The likelihood function is given by

$$L = \prod_{i=1}^{N} \Pr(y_i > 0|x_i) * f(y_i|y_i > 0, x_i) * \prod_{i=1}^{n-N} \Pr(y_i = 0|x_i) \tag{8}$$

We estimate two hurdle models using a logit model for the participation decision and a Poisson and negative binomial distribution for the second (intensity) decision.

2.5 | Poisson model with sample selection

This model is based on the censored normal regression model, which jointly models the decision of utilization and intensity of use, with a control equation for potential selection bias (given that the utilization of medical services is a decision taken by individuals and, thus, not random). Non-random selection of the sample is a very common problem in econometrics and has been analysed for continuous variables because of the seminal article by Heckman.[46] In health economics, this phenomenon is also combined with a nonnegative integer-dependent variable and the influence of multiple zero observations.[31,47] Therefore, if we suspect the presence of sample selection, it is recommended to use an appropriate econometric model that corrects this bias. A count data sample selection model was introduced in the literature by Terza,[32] who describes a full information maximum likelihood estimation and a two-step estimation. In our case, y_i is the number of visits to a general practitioner (GPV) or visits to a specialist physician (SV), and we assume a Poisson distribution, x_i denotes the explanatory variables, and s_i is the switching variable with z_i covariates. Then, s can take values of 0 or 1, and y_i is only observed when s takes a value equal to 1. The expected y_i conditional to x_i is as follows:

$$E(y_i|x_i, \varepsilon_{1i}) = \lambda_i = \exp(x_i\beta + \varepsilon_{1i})$$

And s_i as a binary indicator function is as follows:

$$s_i = \begin{cases} 1 & if \ \ z_i\alpha + \varepsilon_{2i} > 0 \\ 0 & otherwise \end{cases}$$

Therefore, the expected y_i when observed is

$$E(y_i|x_i, z_i, s_i = 1) = \exp(x_i\beta + \varepsilon_{1i})\frac{\Phi(z_i\alpha + \rho\sigma)}{\Phi(z_i\alpha)}$$

Notably, if ρ is not statistically different from zero, we have the common expression of λ_i. Finally, the probability of y_i conditional to x_i is

$$Pr(y_i = \mathrm{n}|x_i) = \int_{-\infty}^{\infty} \Pr(y_i = \mathrm{n}|x_i, \varepsilon_1)\phi(\varepsilon_1/\sigma)d\varepsilon_1$$

This model can also be extended to the NB distribution, which has recently been included in packages such as Stata and R. However, the model is very sensitive to the specification and does not always converge. We estimated the model using the *heckpoisson* command in STATA 15 that, with sample selection, allows overdispersion (we attempted to estimate the negative binomial version using a R software[48] but it did not converge).

2.6 | Latent class model

The latent class or the so-called finite mixture model assumes that the population is divided into C classes in the proportions $\pi_1, \ldots, \pi_c$, where $\sum_{j=1}^{c} \pi_j = 1, 0 \leq \pi_j \leq 1, j = 1, ..., C$. The density of the finite mixture at points C for the observation *i*, with $i = 1...n$, is determined as follows[35,36]:

$$f(y_i|.) = \sum_{j=1}^{c} \pi_j f_j(y_i|.) \tag{9}$$

In which, the term on the right corresponds to the sum of the product of each π_j probability and the density of the component (subpopulation) $f_i(y_i|.)$. The distribution of the component at point C is defined as an NB:

$$f_i(y_i|.) = \frac{\Gamma(y_i + \psi_{ji})}{\Gamma(\psi_{ji})\Gamma(y_i + 1)}\left(\frac{\psi_{ji}}{\lambda_{ji} + \psi_{ji}}\right)^{\psi_{ji}}\left(\frac{\lambda_{ji}}{\lambda_{ji} + \psi_{ji}}\right)^{y_i} \tag{10}$$

where $j = 1, ..., C$ is the latent class, $\lambda_{ji} = \exp(x_i\beta_j)$, and $\psi_{ji} = \left(\frac{1}{\alpha_j}\right)\lambda_{ji}^{k}$.

We used two classes or subpopulations: infrequent users and frequent users, subsequently. The use of medical services in each component is characterised by the mean and low variance and by the mean and high variance.

2.7 | Selection criteria

We use the Akaike information criteria (AIC = −2LogL + 2K) and the BIC (BIC = −2LogL + Klog(N)), where LogL is the logarithmic value of the likelihood function, K corresponds to the number of parameters in the model, and N is the sample size. The choice criteria dictate that we chose the model with the lowest AIC or BIC (Note that previous literature has used the Voung statistical test[49] to choose between the NB and the zero-inflated NB models. Nevertheless Wilson[50] has pointed out that this is incorrect. Therefore we use the AIC and BIC to compare all models.[51]).

To evaluate the predictive power of models we follow Deb, Trivedi,[36] and Jiménez-Martín, Labeaga, Martínez-Granado.[4] That is, we performed a cross-validation analysis to evaluate whether our findings are the result of model overfitting[4] and to compare the prediction power of the evaluated models. We randomly split the sample into a training (70%) and a hold-out sample (30%) and compare three criteria: AIC, log-likelihood, and Root of Mean Square Error (RMSE). The training sample is used for estimation of parameters and estimation of log-L, AIC, and RMSE, while

the hold-out sample, given the estimated parameters, is used to evaluate the same three criteria. This process was repeated 30 times given the time requirement involved in the comparison of three models (hurdle negative binomial, latent class negative binomial, and sample-selection Poisson) at the same time.

3 | DATA

We estimate all the models using data from the years 2009 and 2015 of the Chilean Socio-Economic Characterisation Survey (CASEN). This survey is carried out every two or three years since 1990 by the Ministry of Social Development and it is publicly available. According to the official methodological manuals, two are the main goals of this instrument: (1) to know the situation of households and population, especially those in poverty and those groups defined as a priority by the social policy in relation to socioeconomic and sociodemographic variables; (2) to estimate the coverage, targeting and distribution of the fiscal expenditure of the main social programs of national scope (http://observatorio.ministeriodesarrollosocial.gob.cl/casen-multidimensional/casen/metodologia.php). The sample design can be characterised as probabilistic and stratified according to geographic area and population size both in urban and rural areas. The population that is represented in the sample corresponds to private housing and households and people who live there. The sample size was around 71.000 and 83.000 households in 2009 and 2015, respectively.

To estimate all the models in two different years, 2009 and 2015, allows us to evaluate the robustness of our findings and the changes in the determinant of healthcare use over time. The sample includes adults aged between 18 and 75 years because the literature has suggested treating the groups aged under 18 years and adults aged over 75 years separately because of their differences in the use of medical services.[52-54] We also differentiated the analysis according to gender, because men and women have different types of user needs. The dependent variables are the number of SV and the number of GPV over the last 3 months. The explanatory variables include dummies for groups of age (baseline level 18–34 and 35–44, 45–54, 55–64, and 65–75), dummies for educational levels (elementary, secondary, and college as baseline), dummies for labour activities (employed is the baseline level, retired, unemployed, student, housework, inactive), dummies for ethnic groups, rural area, marital status (married or cohabitant), and a set of dummies controlling for the region where people reside. We also considered as explanatory variables income and health status. In general, one would like to include a variable that measures the standard of living of households such as total expenditure, asset index[55] or family income. In our case, the CASEN survey contains variables that allow measuring with great detail the household income but not the other two indicators (total expenditure and assets). Furthermore, to take into account that households' needs do not grow proportionally with each additional family member due to economies of scale in consumption (for instance, electricity, water consumption or housing space, etc), "equivalence scales" are often considered.[56] We follow O'Donnell et al.,[55] and adjusted aggregated household incomes by size and age of their members to obtain a measure of income per adult equivalent.

On the other hand, the variable in the CASEN survey "health status" is captured by a self-reported health status variable (1 for good or very good and 0 otherwise) and a variable indicating the presence of any physical limitation. It could be interesting to control by the number of chronic diseases, as it is well documented that this variable in conjunction with disability status and self-reported health status are the main components of the physical health status.[57-59] However, the survey does not provide enough information on chronic diseases. Table A1 in the appendix shows the descriptive statistics of all the variables used in this study.

4 | RESULTS

Table 1 shows the frequency of medical services utilization by sex. We observed that, on average, people visit a general practitioner more often than a specialist physician and that women make greater use of both services. Additionally, the use of these services has increased significantly over the years. We also observe a high concentration

TABLE 1 Frequency of visits to a general practitioner and specialist by gender and year

	General practitioner				Specialist			
	Men %		Women %		Men %		Women %	
Visits	2009	2015	2009	2015	2009	2015	2009	2015
0	89.52	86.01	83.33	78.56	93.91	91.43	89.29	86.14
1	6.87	10.25	10.15	14.63	3.91	5.78	6.56	9.06
2	1.51	1.67	2.48	2.96	0.94	1.2	1.69	2.04
3	1.29	1.16	2.38	2.14	0.65	0.87	1.35	1.46
4	0.32	0.33	0.61	0.63	0.12	0.19	0.37	0.38
5	0.14	0.14	0.34	0.34	0.08	0.11	0.19	0.2
6	0.14	0.14	0.27	0.28	0.19	0.15	0.22	0.27
7	0.04	0.05	0.06	0.06	0.03	0.03	0.06	0.06
8	0.04	0.04	0.07	0.05	0.02	0.06	0.07	0.09
9	0.03	0.04	0.06	0.06	0.02	0.01	0.03	0.04
10	0.03	0.08	0.1	0.15	0.02	0.06	0.07	0.14
Over 10	0.07	0.09	0.15	0.14	0.11	0.11	0.1	0.12

Source: 2009 and 2015 CASEN Survey.

of zeros in both variables: 89.52% and 86.01% of men in 2009 and 2015, respectively, did not visit a general practitioner compared with 83.33% and 78.56% of women, respectively. In 2015, 91.43% of men did not visit a specialist compared with 86.14% of women.

We divided the discussion of the econometric results into three parts. First, we present the model selection for nested and non-nested models. Second, we use cross-validation to evaluate the robustness of these results and evaluate the models' prediction power by using a root mean square error criterion. Third, we discuss the implications for the determinant factors in the use of medical services given the chosen model. In the estimation process, we did not use expansion factors (weighted estimation) because the outcome for the selection criteria AIC and BIC do not change using these factors. Using these weights does not alter the coefficients, but it slightly reduces the standard errors and *p*-values. In this sense, our results are "conservatives", as they accept null hypotheses that could be rejected if using sample weights.

4.1 | Model selection

We started by assessing the Poisson model, which requires proving the equal dispersion property. One means to perform this test is the use of a NB model (NB2 as we stated in the methodological section). The statistical significance of the α parameter in the NB is used to test the overdispersion hypothesis. The test suggests that the response variable is more disperse and not appropriately described by the Poisson model (Tables 2 and 3). The specification of the zero-inflated model can be obtained by mixing a distribution concentrated on zero and a Poisson (ZIP) or NB model (ZINB). The estimation for GPV and SV was made with both the ZIP and ZINB. Once again, we can conclude that the ZINB specification is superior, by using the α coefficient (Tables 2 and 3 second row of tests). Finally, the BIC and AIC criteria suggest that the NB is preferred to the ZINB (Tables 4 and 5).

The logit model was used for the first stage in the hurdle model, and the second stage was estimated with a truncated Poisson model and a truncated NB. The latent class model was also implemented with the Poisson and NB specification. The results using the two-stage hurdle model are consistent under the assumption that the period under analysis contains only one sickness episode. This is more likely to be true when analysing specialist physician

TABLE 2 Likelihood ratio test for GPV

	2009		2015	
Test	**Men**	**Women**	**Men**	**Women**
Likelihood ratio, $\alpha = 0$ for NB	χ^2 = 1.3e+04	χ^2 = 2.3e+04	χ^2 = 1.7e+04	χ^2 = 2.8e+04
	p-value = 0.01	*p*-value = 0.01	*p*-value = 0.01	*p*-value = 0.01
Likelihood ratio, $\alpha = 0$ for ZINB	χ^2 = 3570.6	χ^2 = 6574.90	χ^2 = 6259.46	χ^2 = 1.1e+04
	p-value = 0.01	*p*-value = 0.01	*p*-value = 0.01	*p*-value = 0.01

Source: NB, ZINB (STATA 15) estimation models

TABLE 3 Likelihood ratio test SV

	2009		2015	
Test	**Men**	**Women**	**Men**	**Women**
Likelihood ratio, $\alpha = 0$ for NB	χ^2 = 1.3e+04	χ^2 = 2.0e+04	χ^2 = 2.6e+04	χ^2 = 2.8e+04
	p-value = 0.01	*p*-value = 0.01	*p*-value = 0.01	*p*-value = 0.01
Likelihood ratio, $\alpha = 0$ for ZINB	χ^2 = 4104.15	χ^2 = 5665.98	χ^2 = 6645.13	χ^2 = 9148.32
	p-value = 0.01	*p*-value = 0.01	*p*-value = 0.01	*p*-value = 0.01

Source: NB, ZINB (STATA 15) estimation models

visits. Notoriously, the best model (best goodness of fit) in 2009 for both genders is the hurdle NB model for GP, and for 2015, the best model for both genders is the latent class model using NB distribution (Tables 4 and 5). By contrast, the best model for SV is the latent classes for all years and genders. There is one pattern in these results: in all comparisons between the Poisson and NB models, the latter presents notoriously better goodness of fit. Although we have not been able to estimate the selection model using the NB distribution, we hypothesise that the same pattern would follow in this comparison.

In conclusion, the model with the best goodness of fit is the latent class model for all genders for SV and GP in 2015. In 2009, the results are heterogeneous because for GPV the hurdle model has a better fit for both genders. Therefore, the selection of the best model varies according to the year of the data and the type of health service, suggesting that researchers should test different specifications, as we observe that the results are case-specific.

Similarly, Deb, Trivedi,[36] and Winkelmann[60] found that the latent class specification is superior to the two-part model (Hurdle). Nevertheless, Jiménez-Martín, Labeaga, Martínez-Granado,[4] using data from 12 European countries, found heterogeneous results: The best model was the latent class for GPV whereas the hurdle model was superior for SV.

4.2 | Cross-validation

Table 6 presents the comparison of the three models used for cross validation: hurdle negative binomial, latent class negative binomial, and sample selection Poisson. The sample selection model was always worst in terms of goodness of fit (log-L and AIC); therefore, we do not include comparisons with these two criteria in Table 6. Table 6 shows the number of times that AIC is lower in the LC (columns 2 to 5), log-likelihood differences between LC and Hurdle (columns 6 to 9), a positive value implies that the LC is better. Finally, we included which model has the lowest average RMSE for each case (columns 10 to 13).

According to the table, the hurdle model is better than the LC model for GPV in 2009 for males and females, and the LC has better goodness of fit in the remaining specifications. Results are similar using the hold-out sample and in

TABLE 4 AIC-BIC information criteria for GPV

	2009				2015			
	Men		Women		Men		Women	
Model	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC
Poisson	72,228	72,541	120,693	121,009	104,967	105,285	169,454	169,777
NB	58,931	59,254	97,502	97,827	88,454	88,781	141,641	141,973
ZIP	62,502	62,825	104,077	104,402	94,713	95,041	152,729	153,061
ZINB	58,933	59,265	97,504	97,838	88,456	88,793	141,643	141,984
Hurdle Poisson	64,844	65,646	107,221	108,028	100,623	101,437	160,984	161,808
Hurdle BN	**58,281**	**58,917**	**96,336**	**96,976**	87,456	88,101	139,847	140,501
SSP	63,778	64,423	105,867	106,516	98,348	99,003	156,642	157,305
Latent class Poisson	59,764	60,400	99,009	99,649	88,813	89,458	142,579	143,233
Latent class BN	58,315	58,969	96,443	97,101	**87,219**	87,883	**139,732**	**140,405**

Source: Estimation results.

TABLE 5 AIC- BIC information criteria for SV

	2009				2015			
	Men		Women		Men		Women	
Model	AIC	BIC	AIC	BIC	AIC	BIC	AIC	BIC
Poisson	45,772	46,086	79,608	79,924	79,784	80,102	129,805	130,128
NB	32,890	33,212	59,342	59,667	59,697	60,025	101,839	101,507
ZIP	36,994	37,317	65,008	65,333	66,342	66,670	110,656	110,987
ZINB	32,892	33,224	59,344	59,678	59,699	60,036	101,509	101,850
Hurdle Poisson	37,245	38,046	66,145	66,952	66,647	67,461	113,348	114,173
Hurdle NB	32,233	32,869	58,503	59,144	58,177	58,822	99,745	100,399
SSP	34,942	35,587	63,547	64,196	63,807	64,462	109,794	110,458
Latent class Poisson	33,972	34,608	60,603	61,243	60,307	60,952	102,280	102,934
Latent class NB	**32,173**	**32,827**	**58,436**	**59,094**	**57,975**	**58,640**	**99,539**	**100,212**

Source: Estimation results.

almost all cases the LC model is better. In terms of prediction, LC models have the lowest RMSE for males and females in 2015, but only for males and SV in 2009. For the remaining cases, the sample selection Poisson model is better.

4.3 | Determinant factors in the use of medical services

In this section, we provide an overview of the main results regarding the determinant of health services demand (further details in appendix B). We consider only the hurdle negative binomial model, sample-selection Poisson model, and latent class model because these models presented the best goodness of fit and/or the best prediction power. In appendix A, we report marginal effects for all models (Tables A2–A9) and provide more details regarding the magnitudes and changes across the years.

The variables self-reported health status, living in a rural area and inactive people have the same sign and are statistically significant across all the models and years. Reporting *good* or *very good* health status reduces the medical

TABLE 6 Cross-Validation results

	Times AIC LC NB < AIC hurdle NB				Log-L(LC) – Log-L(Hurdle)				RMSE			
	GPV		SV		GPV		SV		GPV		SV	
	Training sample	Hold-out sample	Training sample	Hold-out sample	Training sample	Hold-out sample	Training sample	Hold-out sample	Training sample	Hold-out sample	Training sample	Hold-out sample
Males 2009	0	25	30	9	−19.33	49.36	−22.85	44.41	SSP	SSP	LC	LC
Males 2015	30	22	23	23	334.72	141.45	91.87	41.25	LC	LC	LC	LC
Females 2009	0	28	24	23	−38.05	40.05	21.62	74.8	SSP	SSP	SSP	SSP
Females 2015	29	27	27	23	94.54	41.01	92.85	40.86	LC	LC	LC	LC

services demand, whereas living in rural areas compared to living in urban areas reduces the utilization of medical services Damrongplasit, Wangdi.[61] The variable inactive people has a positive and significant effect on the utilization of medical services for both women and men. Its marginal effects are higher on men's utilization than the marginal effects on women's utilization.

Other variables changed the magnitude of their marginal effects, signs, and statistical significance between 2009 and 2015 and across models. These variables are the region where the person lives, level of education (secondary or elementary education), physical limitations and income. In the first case, although there are some differences in signs and magnitude in some regions, it is possible to conclude that living in extremes regions in comparison to living in the capital (Santiago) decreases SV, which is not surprising given the deficit of medical specialists in these areas.

The models show a negative influence of secondary or elementary education level on SV, whereas we observed a change in sign of the effect on GPV for 2015. Furthermore, older people use medical services more often than younger people, and in most cases, physical limitation has a positive and statistically significant effect on GPV and SV. Being *married or cohabitating*, it is always positive but not always statistically significant across models and years. We cannot derive a general conclusion regarding income because this variable presents different sign in different regressions and it is not statistically significant in some models or years. Finally, belonging to the public health system has a positive effect on GPV but a negative effect on SV in both years for women and men.

5 | DISCUSSION

In this paper, we compared several models that estimate the use of healthcare services in Chile in order to obtain the best econometric specification to analyse the determinants of the utilization of medical services. The study focuses on General Practitioner Visits (GPV) and Specialist Physician (SV). In addition we differentiate the analysis according to gender given the remarkable difference between men and women in health needs. The models under comparison are Poisson, Negative Binomial, Poisson zero-inflated, Negative Binomial zero-inflated, hurdle, sample-selection Poisson, and Latent Class (Poisson and NB); and the selection criteria were the AIC and BIC information criteria.

Previous studies using data from developed countries, such as Germany and Canada, reported that the best means to model the use of medical services was to consider the participation decision and then the intensity of use separately, that is, the hurdle model.[33,34] Nevertheless, this literature did not include either the latent class model or the sample selection Poisson model. For instance, Deb, Trivedi[36] reported that the LC model was superior to the hurdle model. But authors that included the LC model in their estimations found no conclusive results.[4]

Based on Chilean data, our results show that the models with the best goodness of fit change depending on the medical services and the year of the data. In particular, the latent class is the model with the best goodness of fit in both GPV and SV (women and men) but only when the estimation is carried out using the 2015 data. Estimates with 2009 data indicate that the hurdle model has the best goodness of fit in GPV's case (women and men), while the latent class fit the data better in the case of SV. Regarding the predictive power, there is not a unique best model again. The sample selection Poisson predicts better females and males in 2009 GPV and only females in SV for 2009, in all other cases, the LC model is the best.

These results are in line with the study of Jiménez-Martín, Labeaga, Martínez-Granado[4] using data for 12 European countries. We found that not always the LC model was superior to the hurdle model. Noteworthy is that these authors found heterogeneity across health systems in different countries, whereas we additionally found heterogeneity within the same health system but in different years. Understanding and identifying the factors driving these differences is beyond the objective of this paper.

Furthermore, some variables show changes in signs between models while others change the level of significance from 1 year to another. Additionally, our results differ in some way from other studies performed mainly in developed countries, such as the United States.[35,36] We attribute these facts to two main reasons: (1) the particularities of the health system; and (2) the underlying assumptions associated with each model. The Chilean health system has

changed between 2009 and 2015, mainly explained by the AUGE health reform that has been implemented since 2005. In particular, between the years considered in this paper, 24 new diseases were incorporated into universal coverage. As the health system expands its coverage, it is expected that the factors that determine the use of medical services will also vary, as is the case, for example, of the physical limitation variable, which in the case of GPV was statistically significant in the year 2009 but in the year 2015, it is not.

Furthermore, each estimated model uses different underlying assumptions regarding health care utilization. For instance, while the Latent Class model estimates the utilization of medical services dividing the population into groups, low-frequency, and high-frequency users, the hurdle model separates the decision process between whether or not to visit the doctor and conditional on this, it explains the frequency of use. Thus, the factors driving the utilization of a high-frequency person (under the Latent Class model) are not necessarily the same factors that drive the first decision to contact the doctor (first stage of the Hurdle Model).

Identifying the model with the best goodness of fit allows us to find the set of main factors that drive the utilization of these two medical services. In our applications, health Status self-perception is one of the most important determinants in the use of medical services, in terms of marginal effects, regardless of the model used, gender, or year. As expected, persons who consider having a good health status reduces their utilization of medical services. Beyond the characteristics of individuals that undoubtedly play a fundamental role in determining the use of medical services, the results show the relevance of the Chilean geography (measured by regions and area) and the structure of the Chilean's health system in the probability to reduce or increase the utilization of medical services.

Our results show the relevance of model selection in terms of interpretation and implications for public policies. Thus, two important points should be considered before any choice, and any recommendation is made: the first is to know what is being prioritised, the best fit or the prediction power; and second, is to know the nature of each econometric specification, since the models are not directly comparable. While the LC divides the sample into groups according to their frequency of use, the hurdle models separately first the decision of using or not using any medical services, and then how many times they are used (frequency). The sample selection model considers these two decisions simultaneously.

Our findings are subject to the proper limitations of secondary data and self-reported variables. The use of self-reported data could lead to information or misclassification bias. The literature has recognized three types of information bias: self-reporting, measurement error, and confirmation bias.[64–66] One of the most important issues regarding self-reporting bias is related to the recall period. The answer to the self-reported question will depend on the ability of the individuals to recall past events. Besides, recall bias has been related to several factors, including the length of the recall period, characteristics of the disease under investigation, patient/sample characteristics, and study design.[64] On the other hand, the measurement error varies across different socioeconomic groups, with evidence showing that individuals who are not working tend to report their health status incorrectly.[65]

The use of administrative data would be an excellent option to assess the existence of these limitations. However, they are not always available. Short et al.[67] evaluated, using the well known Health Risk Assessment database from the United Sates, the concordance of self-reported values of health care utilization and administrative claims values and found that self-report and administrative data showed greater concordance for shorter recall periods (monthly vs. yearly). For instance, they found that the percent of agreement ranged from 30% to 99%. Furthermore, younger people, males, those with higher education, and healthier individuals more accurately reported their healthcare utilization.

Finally, our models may present misspecification bias since we are not controlling for characteristics of the health system. According to our results, belonging to the public or private health system has different effects on SV and GPV. Although the interest of this article is not to analyse the implications that belonging to different health system may have on the use of medical services, we hypothesise that the differences in the visits to a physician could be related to the waiting times associated with the care of specialist doctors in the public health systems. The fact that the general practitioner acts as a gatekeeper to specialist attention may produce significant delays. It also could be that this differences reflect a potential migration of individuals from the public to the private health system explained

by an increase in educational and income levels in Chile.[62] This issue is a matter of policy relevance given the evidence of disparities in health care coverage between FONASA and ISAPRE.[63] Another factor that might contribute to the difference is that patients who are more likely to need specialist medical care prefer the private sector as it generally provides a more expeditious emergency care system, as well as better infrastructure. In this line, Aravena and Inostroza[68] in a study carried out in Chile with data from the Survey on the Chilean Health System, found that the main factor considered for the evaluation of public and private health care systems was the response capacity of the emergency system. Indeed, it would be a good empirical exercise to analyse the effect of this variable in other dependent variables, such as emergency care or dentist visits.

6 | CONCLUSION

According to different criteria, the latent class model presented the best goodness of fit but not necessarily the best predictive power. Although our results cannot be generalized to other countries with different health systems, we demonstrate a methodological path that other researchers could follow to create and identify more generalisable patterns.

Our results are consistent with the structure of the Chilean Health System, in which the general practitioner acts as a *gatekeeper* to specialist attention in the public sector, and beneficiaries of the private sector have direct access to specialists. The results show that individuals' behaviour changes depending on the medical service being considered, suggesting that behaviour may differ for other healthcare services not analysed here (emergency services, hospitalisation, and use of dental medical services).

Beyond the limitations of this study, our findings show that selection of the econometric model may have implications for the estimated influence that variables such as age, income, or affiliation to the public versus private sector have on the use of medical services; naturally, different policy implications would emerge according to the selection of the econometric specification. In light of these results, the exercise of comparing alternative models is highly recommended from both the econometric perspective and from a pure policy perspective.

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CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

ETHICS STATEMENT

Not applicable (No human subjects were involved in this econometric analysis).

AUTHOR CONTRIBUTIONS

All authors are responsible for the content of this manuscript, the interpretation of the data and approval of the final draft.

DATA AVAILABILITY STATEMENT

Authors are willing to share data file used in this study upon request.

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APPENDIX A

TABLE A1 Descriptive statistics

		Women				Men			
		2009		2015		2009		2015	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
GPV	General practitioner visits, last 3 months	0.329	1.099	0.381	1.152	0.189	0.812	0.231	0.880
SV	Specialist physician visits, last 3 months	0.215	0.962	0.264	1.011	0.125	0.879	0.162	0.848
Log-income	Log of family income per adult equivalent.	11.649	0.888	12.281	0.800	11.706	0.876	12.361	0.813
Age 18–34	1 if between 18 and 34 years of age	0.349	0.477	0.342	0.474	0.365	0.481	0.368	0.482
Age 35–44	1 if between 35 and 44 years of age	0.203	0.402	0.178	0.382	0.199	0.400	0.174	0.379
Age 45–54	1 if between 45 and 54 years of age.	0.196	0.397	0.200	0.400	0.196	0.397	0.192	0.394
Age 55–64	1 if between 55 and 64 years of age	0.142	0.350	0.164	0.370	0.138	0.345	0.158	0.365
Age 65–74	1 if between 65 and 74 years of age	0.110	0.312	0.116	0.321	0.101	0.302	0.108	0.311
Health status	1 if self-reported health is good or very good	0.590	0.492	0.815	0.388	0.675	0.468	0.856	0.351
Physical limitation	1 if physical limitation exists	0.095	0.293	0.044	0.206	0.090	0.286	0.041	0.198
no_limit	1 if no physical limitation	0.905	0.293	0.908	0.289	0.910	0.286	0.920	0.271
Educ -elementary	1 if completed only elementary level	0.409	0.492	0.278	0.448	0.410	0.492	0.274	0.446
Educ –secondary	1 if completed up to secondary level	0.435	0.496	0.713	0.452	0.443	0.497	0.716	0.451
Educ –College	1 if completed college.	0.155	0.362	0.369	0.483	0.147	0.354	0.377	0.485
Independent	1 if independent worker	0.073	0.261	0.086	0.281	0.166	0.372	0.157	0.364
Unemployed	1 if unemployed	0.052	0.221	0.042	0.202	0.065	0.247	0.052	0.222

TABLE A1 (Continued)

		Women				Men			
		2009		2015		2009		2015	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Retired	1 if retired	0.082	0.274	0.091	0.288	0.070	0.255	0.074	0.262
Student	1 if studying	0.051	0.221	0.071	0.258	0.050	0.219	0.073	0.260
Housework	1 if dedicated to housework	0.304	0.460	0.255	0.436	0.005	0.072	0.005	0.070
Employed	If working	0.289	0.453	0.374	0.484	0.547	0.498	0.576	0.494
Inactive	1 if inactive	0.149	0.356	0.079	0.270	0.096	0.295	0.063	0.243
Ethnic group	1 if part of an ethnic group.	0.098	0.297	0.110	0.312	0.099	0.299	0.102	0.303
Rural	1 if lives in rural area	0.343	0.475	0.206	0.405	0.375	0.484	0.231	0.421
Urban	1 if lives in urban area	0.657	0.475	0.794	0.405	0.625	0.484	0.769	0.421
reg-1	1 if belongs to the first region	0.017	0.129	0.030	0.169	0.017	0.128	0.030	0.172
reg-2	1 if belongs to the second region	0.028	0.165	0.024	0.155	0.029	0.167	0.025	0.156
reg-3	1 if belongs to the third region	0.022	0.146	0.050	0.217	0.022	0.145	0.051	0.220
reg-4	1 if belongs to the fourth region	0.045	0.206	0.047	0.211	0.043	0.204	0.045	0.207
reg-5	1 if belongs to the fifth region	0.112	0.315	0.105	0.307	0.110	0.313	0.105	0.306
reg-6	1 if belongs to the sixth region	0.090	0.287	0.085	0.278	0.094	0.292	0.088	0.284
reg-7	1 if belongs to the seventh region	0.090	0.286	0.065	0.247	0.091	0.288	0.066	0.248
reg-8	1 if belongs to the eighth region	0.169	0.374	0.138	0.345	0.169	0.374	0.136	0.342
reg-9	1 if belongs to the ninth region	0.083	0.277	0.082	0.274	0.084	0.278	0.080	0.271
reg-10	1 if belongs to the 10th region	0.072	0.259	0.071	0.256	0.074	0.263	0.074	0.261
reg-11	1 if belongs to the 11th region	0.013	0.115	0.012	0.110	0.014	0.117	0.012	0.110
reg-12	1 if belongs to the 12th region	0.009	0.093	0.019	0.138	0.009	0.096	0.021	0.144
reg-13	1 if belongs to the metropolitan region	0.207	0.405	0.224	0.417	0.201	0.401	0.219	0.413
reg-14	1 if belongs to the 14th region	0.033	0.180	0.039	0.193	0.032	0.176	0.038	0.191
reg-15	1 if belongs to the 15th region	0.010	0.099	0.010	0.098	0.010	0.098	0.010	0.101
Married-cohab.	1 if married or cohabitating. 0 otherwise.	0.577	0.494	0.526	0.499	0.594	0.491	0.573	0.495

(Continues)

TABLE A1 (Continued)

		Women				Men			
		2009		2015		2009		2015	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Ms_other	1 if widowed. Separated. Single. Divorced or annulled. 0 otherwise.	0.423	0.494	0.474	0.499	0.406	0.491	0.427	0.495
Pub. System	1 if belongs to the public health system	0.895	0.306	0.839	0.368	0.857	0.351	0.775	0.417

Source: 2009 and 2015 CASEN Survey.

TABLE A2 Latent class negative binomial marginal effects

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
Class 1								
Log of family income per adult equivalent	0.010***	0.008***	0.009***	0.013***	0.026***	0.033***	0.032***	0.056***
1 if between 35 and 44 years of age.	0.028***	0.053***	0.006***	−0.002	0.034***	0.077***	0.005	0.033***
1 if between 45 and 54 years of age.	0.048***	0.100***	0.014***	0.021***	0.079***	0.162***	0.031***	0.052***
1 if between 55 and 64 years of age.	0.113***	0.144***	0.029***	0.032***	0.152***	0.233***	0.056***	0.065***
1 if between 65 and 74 years of age.	0.180***	0.192***	0.039***	0.036***	0.201***	0.291***	0.086***	0.086***
1 if self-reported health is good or very good.	−0.155***	−0.253***	−0.071***	−0.099***	−0.132***	−0.185***	−0.128***	−0.159***
1 if physical limitation exists.	0.042***	0.060***	0.027***	0.046***	0.021***	0.037***	0.029***	0.042***
1 if completed only elementary level.	−0.033***	−0.044***	−0.022***	−0.042***	−0.013	0.021	−0.036***	−0.053***

TABLE A2 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if completed up to secondary level.	−0.023***	−0.041***	−0.014***	−0.024***	−0.007	0.015	−0.030***	−0.029***
1 if independent worker.	−0.004	0.009	−0.005***	−0.006	−0.011***	−0.004	−0.009***	−0.001
1 if unemployed.	0.005	−0.003	0.004	0.001	0.004	0.018	0.000	0.012
1 if retired.	0.006	−0.003	0.007**	0.004	0.034***	0.021**	0.029***	0.022***
1 if studying.	−0.006	−0.055***	0.010**	−0.007	0.019	−0.002	0.037***	0.010
1 if dedicated to housework.	0.029	−0.012**	−0.010	−0.010***	0.012	−0.017***	0.001	−0.008**
1 if inactive.	0.014***	0.023***	0.021***	0.016***	0.033***	0.022***	0.041***	0.039***
1 if part of an ethnic group.	0.007	0.012*	0.004	−0.003	0.005	0.011	0.005	−0.001
1 if lives in rural area.	−0.014***	−0.023***	−0.007***	−0.013***	−0.026***	−0.039***	−0.011***	−0.029***
1 if belongs to the first region	−0.011	0.029*	−0.017***	−0.029***	−0.047***	−0.042***	−0.028***	−0.045***
1 if belongs to the second region	−0.005	−0.002	−0.004	−0.005	−0.020**	−0.016	−0.017***	−0.037***
1 if belongs to the third region	−0.017***	−0.004	−0.013***	−0.023***	−0.037***	−0.050***	−0.011***	−0.017***
1 if belongs to the fourth region	−0.017***	−0.042***	−0.009***	−0.016***	0.022***	0.044***	−0.011**	−0.019***
1 if belongs to the fifth region	0.013***	0.031***	0.002	−0.001	0.009	0.010	0.002	0.015***
1 if belongs to the sixth region	0.021***	0.045***	−0.004*	−0.009**	0.002	0.018**	0.000	0.005
1 if belongs to the seventh region	−0.003	−0.017**	−0.013***	−0.030***	−0.002	−0.004	−0.012***	−0.011*
1 if belongs to the eighth region	0.011***	0.026***	−0.003	−0.006*	0.031***	0.054***	−0.007**	−0.009**

(Continues)

TABLE A2 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the ninth region	0.019***	0.050***	−0.011***	−0.023***	0.050***	0.094***	−0.010***	−0.008
1 if belongs to the 10th region	0.022***	0.057***	−0.004	−0.009**	0.042***	0.072***	0.012***	0.014**
1 if belongs to the 11th region	0.032***	0.084***	−0.002	−0.032***	−0.053***	−0.099***	−0.030***	−0.056***
1 if belongs to the 12th region	−0.014	0.033	0.006	−0.003	0.000	−0.018	−0.022***	−0.048***
1 if belongs to the 14th region	0.007	0.004	−0.004	−0.009	0.057***	0.056***	−0.012**	−0.007
1 if belongs to the 15th region	0.024***	0.071***	−0.014**	−0.032***	0.007	0.036	0.019**	−0.001
1 if married or cohabitating. 0 otherwise.	0.014***	0.021***	0.006***	0.008***	0.017***	0.012***	0.014***	0.004
1 if belongs to the public health system	0.002	0.018***	−0.010***	−0.023***	0.005	0.014**	−0.016***	−0.032***
Class 2								
Log of family income per adult equivalent	0.140***	0.060	0.030	0.011	0.023*	−0.006	0.078*	0.065**
1 if between 35 and 44 years of age	0.322***	0.004	0.031	0.077	0.047	0.101***	0.145*	−0.138**
1 if between 45 and 54 years of age	0.319***	0.002	0.083	0.067	0.169***	0.198***	−0.008	−0.038
1 if between 55 and 64 years of age	0.728***	0.061	0.089	0.036	0.183***	0.192***	0.145*	−0.026

TABLE A2 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if between 65 and 74 years of age	0.803***	−0.318*	0.366***	−0.055	0.300***	0.285***	0.150	−0.040
1 if self-reported health is good or very good	−1.343***	−1.180***	−0.537***	−0.580***	−0.738***	−0.737***	−0.963***	−0.923***
1 if physical limitation exists	0.606***	0.621***	0.397***	0.256***	0.093*	0.203***	0.083	0.147
1 if completed only elementary level	−0.092	0.314*	−0.246***	−0.274***	0.011	−0.067	0.107	0.069
1 if completed up to secondary level	−0.265*	0.079	−0.165***	−0.231***	−0.001	−0.091	0.338	0.165
1 if independent worker	−0.282***	−0.202	−0.069	0.058	−0.014	−0.030	−0.030	−0.161**
1 if unemployed	0.262	0.100	0.107	−0.115	−0.053	0.046	−0.027	−0.167*
1 if retired	−0.541***	−0.209	−0.079	−0.100	0.053	−0.090*	0.049	0.118
1 if studying	−0.250	−0.413**	−0.062	−0.128	−0.039	−0.147***	0.009	−0.176**
1 if dedicated to housework	0.655	−0.224*	−0.270	−0.107**	0.091	−0.089***	−0.094	−0.103*
1 if inactive	0.835***	0.352**	0.171*	0.261***	0.187***	0.174***	0.561***	0.325***
1 if part of an ethnic group	−0.165	−0.247	0.176**	−0.043	0.023	−0.061	0.027	−0.077
1 if lives in rural area	−0.380***	−0.304***	−0.099**	−0.211***	−0.127***	−0.234***	−0.043	−0.177***
1 if belongs to the first region	0.138	−0.208	−0.132	−0.166	−0.028	0.010	0.294*	−0.229**
1 if belongs to the second region	1.271***	0.256	−0.250***	0.001	0.069	0.104	−0.278**	−0.263**
1 if belongs to the third region	0.218	−0.239	0.147	−0.135	−0.079*	−0.176***	−0.228**	−0.259***

(Continues)

TABLE A2 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the fourth region	−0.494***	−0.122	−0.023	−0.238***	−0.043	0.099	−0.088	−0.185*
1 if belongs to the fifth region	0.225	0.092	−0.046	−0.029	−0.051	0.008	−0.010	0.020
1 if belongs to the sixth region	0.379***	−0.182	−0.176***	−0.161**	−0.079**	−0.087*	−0.188**	−0.122
1 if belongs to the seventh region	−0.006	−0.223	−0.108	−0.221***	−0.015	0.044	0.017	−0.041
1 if belongs to the eighth region	0.266	0.087	−0.161***	−0.016	0.018	0.034	−0.234***	−0.232***
1 if belongs to the ninth region	0.228	−0.193	−0.202***	−0.230***	0.024	0.137**	−0.128	−0.101
1 if belongs to the 10th region	0.693***	−0.183	−0.151**	−0.136*	0.039	0.102**	−0.036	−0.193**
1 if belongs to the 11th region	0.610	1.191***	−0.253*	−0.234*	0.055	0.421***	0.028	−0.107
1 if belongs to the 12th region	0.792	−0.075	−0.056	0.243	0.293***	0.411***	−0.085	−0.022
1 if belongs to the 14th region	0.031	0.403	0.015	−0.168	0.062	0.125*	−0.207*	−0.256**
1 if belongs to the 15th region	1.197*	−0.108	−0.119	−0.331**	−0.011	−0.393***	−0.359*	−0.451**
1 if married or cohabitating. 0 otherwise.	0.119	0.188*	0.095**	0.194***	0.052***	0.054**	0.126**	0.088**
1 if belongs to the public health system	−0.001	−0.132	0.001	−0.012	0.026	0.024	−0.210***	−0.143**
Log likelihood	−29086.5	−48150.3	−16015.4	−29146.9	−43538.6	−69795.1	−28916.7	−49698.7
Pi 1	0.969	0.943	0.930	0.888	0.781	0.749	0.915	0.882
Pi 2	0.031	0.057	0.070	0.112	0.219	0.251	0.085	0.118
Wald chi2(66)	2815.47	2961.51	2024.73	1703.07	3634.75	4036.17	2975.94	2954.67
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Estimation result. Marginal effects are reported with the significance level of their corresponding parameter.

TABLE A3 Poisson model marginal effects

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
Log of family income per adult equivalent	0.0138***	0.00906***	0.0105***	0.0166***	0.0255***	0.0222***	0.0419***	0.0710***
1 if between 35 and 44 years of age	0.0356***	0.0409***	0.00780**	0.00589	0.0299***	0.0774***	0.0114**	0.0109*
1 if between 45 and 54 years of age	0.0538***	0.0819***	0.0176***	0.0225***	0.0895***	0.159***	0.0273***	0.0361***
1 if between 55 and 64 years of age	0.126***	0.117***	0.0265***	0.0301***	0.146***	0.193***	0.0578***	0.0399***
1 if between 65 and 74 years of age	0.177***	0.123***	0.0479***	0.0216***	0.194***	0.256***	0.0855***	0.0551***
1 if self-reported health is good or very good	−0.201***	−0.325***	−0.114***	−0.165***	−0.266***	−0.339***	−0.226***	−0.275***
1 if physical limitation exists	0.0611***	0.0970***	0.0503***	0.0785***	0.0253***	0.0702***	0.0295***	0.0423***
1 if completed only elementary level	−0.0366***	−0.0310***	−0.0425***	−0.0748***	−0.0137	0.00407	−0.0668***	−0.0762***
1 if completed up to secondary level	−0.0309***	−0.0356***	−0.0273***	−0.0469***	−0.00907	0.000789	−0.0387***	−0.0316**
1 if independent worker	−0.00777**	0.00583	−0.0069***	0.000239	−0.0133***	−0.0120	−0.0143***	−0.0115*
1 if unemployed	0.0190**	0.00205	0.00644	−0.00469	−0.00507	0.0324**	−0.00340	−0.0115
1 if retired	0.000706	−0.00957	0.00483	0.00211	0.0418***	0.00272	0.0392***	0.0376***
1 if studying	−0.0171*	−0.0775***	0.00527	−0.0188***	−0.00120	−0.0468***	0.0270***	−0.0177**
1 if dedicated to housework	0.0585**	−0.0234***	−0.0312***	−0.0240***	0.0258	−0.0377***	−0.00665	−0.0151***
1 if inactive	0.0388***	0.0432***	0.0434***	0.0466***	0.0851***	0.0593***	0.0809***	0.0808***

(Continues)

TABLE A3 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if part of an ethnic group	0.00454	0.00577	0.0206***	−0.0101*	0.0113*	−0.00146	0.00534	−0.00576
1 if lives in rural area	−0.0286***	−0.0459***	−0.0149***	−0.0383***	−0.0506***	−0.0931***	−0.0167***	−0.0501***
1 if belongs to the first region	−0.0108	0.0162	−0.0321***	−0.0457***	−0.0318***	−0.0127	−0.0111*	−0.0711***
1 if belongs to the second region	0.00814	0.00241	−0.0168***	−0.0157**	−0.00615	0.00998	−0.0371***	−0.0709***
1 if belongs to the third region	−0.0123	−0.00961	−0.00601	−0.0411***	−0.0507***	−0.0834***	−0.0292***	−0.0472***
1 if belongs to the fourth region	−0.0325***	−0.0486***	−0.0116***	−0.0458***	0.00821	0.0622***	−0.0223***	−0.0389***
1 if belongs to the fifth region	0.0220***	0.0428***	−0.00309	−0.00788*	−0.00312	0.0150*	0.00103	0.0178***
1 if belongs to the sixth region	0.0330***	0.0482***	−0.0156***	−0.0228***	−0.0155**	−0.00616	−0.0162***	−0.0129**
1 if belongs to the seventh region	−0.00445	−0.0233***	−0.0248***	−0.0587***	−0.00765	0.0140	−0.0175***	−0.0113*
1 if belongs to the eighth region	0.0188***	0.0359***	−0.0116***	−0.00787**	0.0267***	0.0499***	−0.0265***	−0.0339***
1 if belongs to the ninth region	0.0276***	0.0465***	−0.0292***	−0.0534***	0.0466***	0.115***	−0.0216***	−0.0205***

TABLE A3 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the 10th region	0.0348***	0.0511***	−0.0169***	−0.0280***	0.0412***	0.0887***	0.00897*	−0.00818
1 if belongs to the 11th region	0.0611***	0.165***	−0.0161***	−0.0532***	−0.0157	0.0371*	−0.0285***	−0.0805***
1 if belongs to the 12th region	−0.000253	0.0406*	−0.00326	0.0174	0.0599***	0.0853***	−0.0347***	−0.0675***
1 if belongs to the 14th region	0.0122	0.0267**	−0.00604*	−0.0284***	0.0461***	0.0846***	−0.0275***	−0.0348***
1 if belongs to the 15th region	0.0366**	0.0732***	−0.0270***	−0.0643***	−0.00217	−0.0702***	−0.00393	−0.0582***
1 if married or cohabitating. 0 otherwise	0.0142***	0.0304***	0.0125***	0.0261***	0.0276***	0.0255***	0.0234***	0.0134***
1 if belongs to the public health system	0.00750*	0.0123*	−0.008***	−0.0257***	0.00698	0.0179***	−0.0329***	−0.0561***
Log likelihood	−36079.8	−60312.6	−22852.2	−39770.2	−52449.6	−84693.2	−39857.9	−64868.6
LR chi2(33)	10,637.3	12,640	8020.4	8348.8	8775.7	10,489.6	8676.4	10,231.12
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Estimation result. Marginal effects are reported with the significance level of their corresponding parameter.

TABLE A4 Negative Binomial model marginal effects

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
Log of family income per adult equivalent	0.0150***	0.0121***	0.0123***	0.0152***	0.0264***	0.0260***	0.0422***	0.0645***
1 if between 35 and 44 years of age	0.0345***	0.0419***	0.00718*	0.00741	0.0326***	0.0777***	0.0194***	0.0148*
1 if between 45 and 54 years of age	0.0532***	0.0864***	0.0191***	0.0277***	0.0951***	0.160***	0.0280***	0.0440***
1 if between 55 and 64 years of age	0.127***	0.131***	0.0363***	0.0347***	0.150***	0.203***	0.0680***	0.0576***
1 if between 65 and 74 years of age	0.200***	0.162***	0.0614***	0.0296**	0.216***	0.269***	0.0997***	0.0727***
1 if self-reported health is good or very good	−0.205***	−0.325***	−0.110***	−0.164***	−0.279***	−0.344***	−0.221***	−0.265***
1 if physical limitation exists	0.0704***	0.108***	0.0564***	0.0788***	0.0368***	0.0809***	0.0451***	0.0629***
1 if completed only elementary level	−0.0398***	−0.0315***	−0.0398***	−0.0792***	−0.0179	0.00264	−0.0651***	−0.089***
1 if completed up to secondary level	−0.0327***	−0.0397***	−0.0264***	−0.0534***	−0.0127	−0.00562	−0.0343*	−0.0514*
1 if independent worker	−0.0139***	−0.000307	−0.00908***	0.000409	−0.0135*	−0.0124	−0.0120**	−0.0176*
1 if unemployed	0.00974	−0.00166	0.0121	−0.0134	−0.00756	0.0251	−0.000601	−0.00607
1 if retired	−0.00253	−0.0147	0.00481	−0.00108	0.0430***	0.00110	0.0429***	0.0410***
1 if studying	−0.0153	−0.0760***	0.00699	−0.0234**	0.00339	−0.0436***	0.0343***	−0.0159
1 if dedicated to housework	0.0450	−0.0262***	−0.0289**	−0.0212***	0.0280	−0.0378***	−0.00196	−0.0176**
1 if inactive	0.0355***	0.0398***	0.0366***	0.0465***	0.0683***	0.0587***	0.0913***	0.0865***

TABLE A4 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if part of an ethnic group	0.00238	−0.00256	0.0173***	−0.00619	0.00843	−0.00497	0.00710	−0.0105
1 if lives in rural area	−0.0255***	−0.0409***	−0.0126***	−0.0352***	−0.0493***	−0.0903***	−0.0136***	−0.05***
1 if belongs to the first region	−0.00456	0.0158	−0.0277***	−0.0513***	−0.0432***	−0.0284	−0.0107	−0.072***
1 if belongs to the second region	0.0245*	0.0182	−0.0211***	−0.00590	−0.00752	0.00574	−0.0427***	−0.073***
1 if belongs to the third region	−0.0154	−0.0167	−0.00259	−0.0373***	−0.0497***	−0.0866***	−0.0303***	−0.05***
1 if belongs to the fourth region	−0.0312***	−0.0484***	−0.00968*	−0.0423***	0.00726	0.0573***	−0.0170*	−0.041***
1 if belongs to the fifth region	0.0230***	0.0386***	−0.000887	−0.00409	−0.00536	0.00817	0.00156	0.0155
1 if belongs to the sixth region	0.0316***	0.0341**	−0.0163***	−0.0292***	−0.0163*	−0.00790	−0.0141*	−0.0119
1 if belongs to the seventh region	−0.00220	−0.0289**	−0.0214***	−0.0574***	−0.00544	0.00847	−0.0122	−0.0146
1 if belongs to the eighth region	0.0203***	0.0336***	−0.0138***	−0.00869	0.0281***	0.0521***	−0.0274***	−0.04***
1 if belongs to the ninth region	0.0274**	0.0430***	−0.0257***	−0.0499***	0.0427***	0.107***	−0.0195**	−0.0160
1 if belongs to the 10th region	0.0417***	0.0519***	−0.0149***	−0.0241***	0.0408***	0.0802***	0.00763	−0.0112

(Continues)

TABLE A4 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the 11th region	0.0485**	0.158***	−0.0200***	−0.0595***	−0.0240	0.0381	−0.0333**	−0.074***
1 if belongs to the 12th region	0.00727	0.0240	0.00188	0.0201	0.0607***	0.0893***	−0.0341***	−0.059***
1 if belongs to the 14th region	0.00783	0.0254	−0.00324	−0.0276***	0.0541***	0.0773***	−0.0315***	−0.04***
1 if belongs to the 15th region	0.0603*	0.0800*	−0.0235***	−0.0698***	−0.00133	−0.0693**	−0.0122	−0.056***
1 if married or cohabitating. 0 otherwise	0.0184***	0.0372***	0.0147***	0.0301***	0.0278***	0.0259***	0.0261***	0.0166***
1 if belongs to the public health system	0.00150	0.00901	−0.0102**	−0.0272***	0.00662	0.0162*	−0.0335***	−0.059***
Log likelihood	−29430.7	−48716.1	−16410	−29636.1	−44191.9	−70785.4	−29813.6	−50718.6
LR chi2(33)	4451.5	4982.2	2707.7	2872.8	3879.14	4370.1	2878.5	3575.1
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Estimation result. Marginal effects are reported with the significance level of their corresponding parameter.

TABLE A5 Zero inflated Poisson model marginal effects

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
Log of family income per adult equivalent	0.0102***	0.007**	0.0058***	0.0072***	0.0179***	0.0091**	0.0193***	0.0348***
1 if between 35 and 44 years of age	0.0355***	0.0323***	0.00549	0.0103*	0.0302***	0.0697***	0.0130**	−0.0068
1 if between 45 and 54 years of age	0.0482***	0.0482***	0.0122***	0.0083*	0.0833***	0.127***	0.0151**	0.0082
1 if between 55 and 64 years of age	0.0968***	0.0545***	0.0082**	0.008	0.113***	0.128***	0.0308***	0.0059
1 if between 65 and 74 years of age	0.107***	0.0384***	0.0195***	−0.00125	0.137***	0.166***	0.0344***	0.0089
1 if self-reported health is good or very good	−0.185***	−0.282***	−0.0983***	−0.122***	−0.210***	−0.250***	−0.132***	−0.176***
1 if physical limitation exists	0.0380***	0.060***	0.0250***	0.0335***	0.0247***	0.0570***	0.0141**	0.0190**
1 if completed only elementary level	−0.0269***	−0.0127	−0.0233***	−0.0417***	−0.0159	−0.0106	−0.029***	−0.0114
1 if completed up to secondary level	−0.0260***	−0.0229***	−0.0171***	−0.0327***	−0.0114	−0.0126	0.0006	0.0123
1 if independent worker	−0.0057	−0.001	−0.00470*	0.0110*	−0.0072	−0.0136	−0.0082*	−0.0176**
1 if unemployed	0.0165*	0.0008	0.00168	−0.0065	−0.0120	0.0248*	−0.0140*	−0.0268**
1 if retired	−0.0039	−0.0022	0.00324	0.002	0.0245***	−0.0133	0.0155**	0.0201**
1 if studying	−0.0203**	−0.0865***	0.00610	−0.02**	−0.0107	−0.0581***	0.0020	−0.0314***
1 if dedicated to housework	0.0520*	−0.0186***	−0.0323***	−0.0221***	0.0258	−0.0339***	−0.0159	−0.0165***
1 if inactive	0.0398***	0.0408***	0.0338***	0.0320***	0.0732***	0.0493***	0.0463***	0.0568***
1 if part of an ethnic group	0.0048	0.0041	0.0142***	−0.01	0.0148**	−0.007	0.0021	−0.0132*
1 if lives in rural area	−0.0261***	−0.0446***	−0.0143***	−0.0360***	−0.043***	−0.0838***	−0.011***	−0.0433***

(Continues)

TABLE A5 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the first region	0.008	0.0029	−0.0254***	−0.0214*	−0.0276**	0.0025	0.0382***	−0.0618***
1 if belongs to the second region	0.0194*	0.002	−0.0148***	−0.0181**	0.0003	0.0118	−0.030***	−0.0510***
1 if belongs to the third region	−0.0079	−0.0185	0.0182**	−0.0232**	−0.047***	−0.0822***	−0.027***	−0.0454***
1 if belongs to the fourth region	−0.0285***	−0.0337***	−0.0059	−0.0407***	−0.0062	0.0408***	−0.0107	−0.0260***
1 if belongs to the fifth region	0.0252***	0.0387***	−0.0069**	−0.0084*	−0.0093	0.0118	−0.0027	0.0023
1 if belongs to the sixth region	0.0297***	0.0315***	−0.0179***	−0.0200***	−0.021***	−0.0205*	−0.022***	−0.0244***
1 if belongs to the seventh region	0.002	−0.0181*	−0.0201***	−0.0487***	−0.0069	0.0156	−0.0092	−0.0047
1 if belongs to the eighth region	0.0243***	0.0356***	−0.0105***	−0.0075*	0.0152**	0.0339***	−0.027***	−0.0371***
1 if belongs to the ninth region	0.0183**	0.0191*	−0.0286***	−0.0468***	0.0194**	0.0727***	−0.018***	−0.0198**
1 if belongs to the 10th region	0.0351***	0.0175*	−0.0193***	−0.0311***	0.0246***	0.0586***	−0.0036	−0.0245***
1 if belongs to the 11th region	0.0555***	0.112***	−0.0207***	−0.0360***	0.0065	0.140***	0.0124	−0.0465**
1 if belongs to the 12th region	0.0312	0.0217	−0.0045	0.0262*	0.0746***	0.121***	−0.0157*	−0.0284*
1 if belongs to the 14th region	0.0134	0.0453***	−0.00510	−0.0269***	0.0211*	0.0541***	−0.028***	−0.0402***

TABLE A5 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the 15th region	0.0535**	0.0725**	−0.0182**	−0.0612***	−0.0133	−0.0873***	−0.0123	−0.0670***
1 if married or cohabitating. 0 otherwise.	0.0098***	0.0204***	0.01***	0.0223***	0.0195***	0.0210***	0.0119***	0.0094**
1 if belongs to the public health system	0.00201	−0.0044	−0.0043	−0.0066	0.0023	0.0071	−0.028***	−0.0382***
Log likelihood	−31216	−18462.1	−52003.1	−32469	−47321.7	−76329.6	−33136.2	−55292.7
LR chi2(33)	4090.4	2364.7	4325.5	2258.5	3700.8	4102.7	1957.3	2640.8
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Estimation result. Marginal effects are reported with the significance level of their corresponding parameter.

TABLE A6 Zero inflated negative binomial model marginal effects

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
Log of family income per adult equivalent	0.0150***	0.0121***	0.0123***	0.0152***	0.0264***	0.0260***	0.0422***	0.0645***
1 if between 35 and 44 years of age	0.0345***	0.0419***	0.00718*	0.00741	0.0326***	0.0777***	0.0194***	0.0148*
1 if between 45 and 54 years of age	0.0532***	0.0864***	0.0191***	0.0277***	0.0951***	0.160***	0.0280***	0.0440***
1 if between 55 and 64 years of age	0.127***	0.131***	0.0363***	0.0347***	0.150***	0.203***	0.0680***	0.0576***
1 if between 65 and 74 years of age	0.200***	0.162***	0.0614***	0.0296**	0.216***	0.269***	0.0997***	0.0727***
1 if self-reported health is good or very good	−0.205***	−0.325***	−0.110***	−0.164***	−0.279***	−0.344***	−0.221***	−0.265***
1 if physical limitation exists	0.0704***	0.108***	0.0564***	0.0788***	0.0368***	0.0809***	0.0451***	0.0629***
1 if completed only elementary level	−0.0397***	−0.0315***	−0.0398***	−0.0792***	−0.0179	0.00264	−0.0651***	−0.0894***
1 if completed up to secondary level	−0.0327***	−0.0397***	−0.0264***	−0.0534***	−0.0127	−0.00561	−0.0343*	−0.0514*
1 if independent worker	−0.0139***	−0.000307	−0.009***	0.0004	−0.0135*	−0.0124	−0.0120**	−0.0176*
1 if unemployed	0.00974	−0.00166	0.0121	−0.0134	−0.0076	0.0251	−0.0006	−0.0061
1 if retired	−0.00253	−0.0147	0.00481	−0.00108	0.0430***	0.00110	0.0430***	0.0410***
1 if studying	−0.0153	−0.0760***	0.00699	−0.0234**	0.003	−0.0436***	0.0343***	−0.0159
1 if dedicated to housework	0.0450	−0.0262***	−0.0289**	−0.0212***	0.0280	−0.0378***	−0.002	−0.0176**
1 if inactive	0.0355***	0.0398***	0.0366***	0.0465***	0.0683***	0.0587***	0.0913***	0.0865***

TABLE A6 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if part of an ethnic group	0.00238	−0.00256	0.0173***	−0.00619	0.00843	−0.005	0.00710	−0.0105
1 if lives in rural area	−0.0255***	−0.0409***	−0.0126***	−0.0352***	−0.0493***	−0.0903***	−0.0136***	−0.0497***
1 if belongs to the first region	−0.00456	0.0158	−0.0277***	−0.0513***	−0.0432***	−0.0284	−0.0107	−0.0724***
1 if belongs to the second region	0.0245*	0.0182	−0.0211***	−0.00590	−0.0075	0.00574	−0.0427***	−0.0729***
1 if belongs to the third region	−0.0154	−0.0167	−0.00259	−0.0373***	−0.0497***	−0.0866***	−0.0303***	−0.0489***
1 if belongs to the fourth region	−0.0312***	−0.0484***	−0.00968*	−0.0423***	0.00726	0.0573***	−0.0170*	−0.0415***
1 if belongs to the fifth region	0.0230***	0.0386***	−0.000887	−0.00409	−0.0054	0.00817	0.00156	0.0155
1 if belongs to the sixth region	0.0316***	0.0341**	−0.0163***	−0.0292***	−0.0163*	−0.00790	−0.0141*	−0.0119
1 if belongs to the seventh region	−0.00221	−0.0289**	−0.0214***	−0.0574***	−0.005	0.0085	−0.0122	−0.0146
1 if belongs to the eighth region	0.0203***	0.0336***	−0.0138***	−0.00869	0.0281***	0.0521***	−0.0274***	−0.0398***
1 if belongs to the ninth region	0.0274**	0.0430***	−0.0257***	−0.0499***	0.0427***	0.107***	−0.0195**	−0.0160
1 if belongs to the 10th region	0.0417***	0.0519***	−0.0149***	−0.0241***	0.0408***	0.0802***	0.00763	−0.0112

(Continues)

TABLE A6 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the 11th region	0.0485**	0.158***	−0.0200***	−0.0595***	−0.0240	0.0381	−0.0333**	−0.0736***
1 if belongs to the 12th region	0.00727	0.0240	0.00188	0.0201	0.0607***	0.0893***	−0.0341***	−0.0593***
1 if belongs to the 14th region	0.00783	0.0254	−0.00324	−0.0276***	0.0541***	0.0773***	−0.0315***	−0.0402***
1 if belongs to the 15th region	0.0603*	0.0800*	−0.0235***	−0.0698***	−0.00133	−0.0693**	−0.0122	−0.0560***
1 if married or cohabitating. 0 otherwise	0.0184***	0.0372***	0.0147***	0.0301***	0.0278***	0.0259***	0.0261***	0.0166***
1 if belongs to the public health system	0.00150	0.00901	−0.0102**	−0.0272***	0.00662	0.0162*	−0.0335***	−0.0590***
Log likelihood	−29430.7	−48716.1	−16410	−29636.1	−44191.9	−70785.4	−29813.6	−50718.6
LR chi2(33)	4451.5	4982.2	2707.7	2872.8	3879.1	4370.1	2878.5	3575.1
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Estimation result. Marginal effects are reported with the significance level of their corresponding parameter.

TABLE A7 Hurdle negative binomial model marginal effects

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
First step								
Log of family income per adult equivalent	0.131***	0.0559***	0.266***	0.170***	0.177***	0.139***	0.499***	0.441***
1 if between 35 and 44 years of age	0.277***	0.231***	0.174**	0.0142	0.200***	0.265***	0.124**	0.194***
1 if between 45 and 54 years of age	0.447***	0.441***	0.406***	0.267***	0.483***	0.509***	0.353***	0.337***
1 if between 55 and 64 years of age	0.832***	0.633***	0.729***	0.352***	0.749***	0.683***	0.620***	0.403***
1 if between 65 and 74 years of age	1.145***	0.802***	0.892***	0.398***	0.935***	0.814***	0.835***	0.502***
1 if self-reported health is good or very good	−1.191***	−1.085***	−1.376***	−1.108***	−0.861***	−0.758***	−1.086***	−0.887***
1 if physical limitation exists	0.438***	0.331***	0.660***	0.549***	0.174***	0.191***	0.373***	0.309***
1 if completed only elementary level	−0.406***	−0.226***	−0.900***	−0.733***	−0.135	0.0995	−0.782***	−0.690***
1 if completed up to secondary level	−0.288***	−0.220***	−0.550***	−0.432***	−0.0836	0.0656	−0.490***	−0.388***
1 if independent worker	−0.0965**	0.0454	−0.141**	−0.0688	−0.0988**	−0.0176	−0.153***	−0.020
1 if unemployed	0.0122	−0.00410	0.152	−0.0477	0.00453	0.0754	0.0729	0.0702
1 if retired	0.0683	−0.0471	0.163*	−0.00716	0.276***	0.0814*	0.401***	0.207***
1 if studying	−0.111	−0.361***	0.206	−0.178*	0.0946	−0.0743	0.448***	0.041
1 if dedicated to housework	0.264	−0.0770**	−0.575	−0.150***	0.0916	−0.105***	0.0418	−0.069*
1 if inactive	0.125*	0.104**	0.456***	0.242***	0.230***	0.105***	0.552***	0.314***

(Continues)

TABLE A7 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if part of an ethnic group	0.0246	−0.00299	0.167*	−0.0365	0.0150	0.0151	0.0626	−0.016
1 if lives in rural area	−0.163***	−0.107***	−0.215***	−0.219***	−0.263***	−0.241***	−0.176***	−0.271***
1 if belongs to the first region	−0.163	0.118	−0.904***	−0.650***	−0.395***	−0.208***	−0.490***	−0.470***
1 if belongs to the second region	−0.00458	0.0411	−0.200	−0.0280	−0.152*	−0.0532	−0.404***	−0.457***
1 if belongs to the third region	−0.212*	−0.0174	−0.458**	−0.414***	−0.325***	−0.300***	−0.231***	−0.192***
1 if belongs to the fourth region	−0.272***	−0.255***	−0.261*	−0.330***	0.122*	0.166***	−0.197**	−0.224***
1 if belongs to the fifth region	0.116*	0.123***	0.0499	−0.0117	0.0184	0.00993	0.0585	0.138***
1 if belongs to the sixth region	0.176***	0.152***	−0.185*	−0.212***	−0.0333	0.0376	−0.00259	0.042
1 if belongs to the seventh region	−0.108	−0.146***	−0.557***	−0.616***	−0.0543	−0.0308	−0.201**	−0.075
1 if belongs to the eighth region	0.0616	0.0769*	−0.164**	−0.0889*	0.188***	0.176***	−0.182***	−0.121***
1 if belongs to the ninth region	0.219***	0.251***	−0.451***	−0.466***	0.297***	0.314***	−0.146*	−0.04
1 if belongs to the 10th region	0.224***	0.320***	−0.109	−0.113	0.243***	0.259***	0.152**	0.09*
1 if belongs to the 11th region	0.185	0.397***	−0.235	−0.748***	−0.345**	−0.339***	−0.691***	−0.669***
1 if belongs to the 12th region	−0.229	0.113	0.0787	0.0145	0.0829	0.0185	−0.479***	−0.574***
1 if belongs to the 14th region	0.0372	−0.00656	−0.0749	−0.170*	0.318***	0.214***	−0.226**	−0.130*
1 if belongs to the 15th region	0.216	0.220*	−0.609**	−0.783***	0.0486	−0.0119	0.107	−0.089
1 if married or cohabitating. 0 otherwise	0.172***	0.149***	0.222***	0.178***	0.158***	0.0678***	0.263***	0.073***
1 if belongs to the public health system	0.0203	0.0846*	−0.228***	−0.296***	0.0266	0.0615*	−0.236***	−0.26***
Second step								
Log of family income per adult equivalent	0.0448	0.00346	−0.0357	−0.0126	−0.0252	−0.0994***	−0.103**	−0.0110

TABLE A7 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if between 35 and 44 years of age	0.0998	−0.0908	−0.0219	0.0861	−0.0345	−0.0200	0.0326	−0.307***
1 if between 45 and 54 years of age	0.0486	−0.100	−0.126	−0.0762	0.0466	0.0246	−0.213*	−0.277***
1 if between 55 and 64 years of age	0.231*	−0.149*	−0.366**	−0.114	0.0116	−0.0636	−0.176*	−0.317***
1 if between 65 and 74 years of age	0.203	−0.355***	−0.0306	−0.328**	0.0677	0.00624	−0.217*	−0.334***
1 if self-reported health is good or very good	−0.738***	−0.631***	−0.776***	−0.463***	−0.816***	−0.627***	−0.764***	−0.606***
1 if physical limitation exists	0.302***	0.305***	0.409***	0.167*	0.0773	0.196**	−0.0389	−0.0220
1 if completed only elementary level	0.00134	0.124	−0.194	−0.125	0.125	−0.189	−0.241	0.149
1 if completed up to secondary level	−0.0808	0.0636	−0.156	−0.111	0.0797	−0.180	0.127	0.204
1 if independent worker	−0.0517	−0.0758	−0.109	0.126	0.0240	−0.0584	−0.0122	−0.164*
1 if unemployed	0.320*	0.0299	0.218	−0.0606	−0.154	0.0752	−0.120	−0.236*
1 if retired	−0.163	−0.0706	−0.209	0.0180	0.0172	−0.128*	−0.0782	0.00659
1 if studying	−0.200	−0.190	−0.328	−0.131	−0.254*	−0.277***	−0.416**	−0.320***
1 if dedicated to housework	0.419	−0.115*	−1.727	−0.156*	0.222	−0.0970*	−0.140	−0.0250
1 if inactive	0.443***	0.209***	0.390**	0.310***	0.442***	0.234***	0.278**	0.257***
1 if part of an ethnic group	0.00326	0.0364	0.352*	−0.102	0.121	−0.0700	0.0135	−0.0401
1 if lives in rural area	−0.285***	−0.236***	−0.343***	−0.351***	−0.227***	−0.342***	−0.000750	−0.0766
1 if belongs to the first region	0.109	−0.0626	−0.128	0.0210	0.338*	0.239*	0.787***	−0.124

(Continues)

TABLE A7 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the second region	0.431**	0.0527	−0.997***	−0.208	0.352*	0.242*	−0.191	−0.147
1 if belongs to the third region	0.156	−0.0866	0.654*	−0.231	−0.0655	−0.148	−0.304*	−0.351***
1 if belongs to the fourth region	−0.308	−0.0398	−0.00184	−0.464**	−0.193	0.142	−0.132	−0.102
1 if belongs to the fifth region	0.205*	0.168*	−0.206	−0.103	−0.119	0.0686	−0.0881	−0.0801
1 if belongs to the sixth region	0.293**	0.135	−0.488**	−0.105	−0.220*	−0.152*	−0.428***	−0.257***
1 if belongs to the seventh region	0.148	0.0442	−0.136	−0.160	0.0487	0.139*	0.0778	−0.0228
1 if belongs to the eighth region	0.290***	0.198**	−0.316**	0.0142	−0.0260	0.0486	−0.297**	−0.222***
1 if belongs to the ninth region	0.127	−0.0485	−0.989***	−0.365**	−0.0285	0.187**	−0.240*	−0.179*
1 if belongs to the 10th region	0.313**	−0.131	−0.634***	−0.381**	0.0124	0.117	−0.108	−0.346***
1 if belongs to the 11th region	0.588**	0.496**	−0.534	0.00995	0.441*	0.858***	0.564	0.228
1 if belongs to the 12th region	0.606*	0.125	−0.00855	0.279	0.638***	0.571***	0.105	0.237
1 if belongs to the 14th region	0.115	0.281*	−0.0229	−0.290	0.00507	0.145	−0.221	−0.247*
1 if belongs to the 15th region	0.449	0.267	−0.177	−0.378	−0.144	−0.783***	−0.439	−0.755***
1 if married or cohabitating. 0 otherwise.	0.00537	0.0345	0.112	0.193***	0.0399	0.0497	0.0236	−0.00153
1 if belongs to the public health system	0.0576	−0.0283	0.0264	0.0660	0.0838	0.0173	−0.218***	−0.114*
Log likelihood	−29071.7	−48099	−16047.6	−29182.8	−43659.1	−69854.3	−29019.3	−49803.5
Wald chi2(33)	4658.1	5307.5	3001	3219.1	4082.7	4800.1	4055.5	4487
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Estimation result. Marginal effects are reported with the significance level of their corresponding parameter.

TABLE A8 Sample-selection Poisson model marginal effects.

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
First model								
Log of family income per adult equivalent	0.0504***	−0.001	0.107***	0.0621***	0.0494***	0.0143	0.172***	0.158***
1 if between 35 and 44 years of age	0.101*	−0.0295	0.0496	−0.00168	0.0539	0.0673**	0.0969*	−0.015
1 if between 45 and 54 years of age	0.137***	−0.0407	0.152*	0.0684	0.165***	0.161***	0.106*	0.0500
1 if between 55 and 64 years of age	0.324***	−0.0705	0.248***	0.0904*	0.240***	0.174***	0.224***	0.0569
1 if between 65 and 74 years of age	0.407***	−0.150***	0.381***	0.0420	0.294***	0.241***	0.305***	0.0694
1 if self-reported health is good or very good	−0.585***	−0.230***	−0.740***	−0.571***	−0.522***	−0.444***	−0.710***	−0.527***
1 if physical limitation exists	0.239***	0.117***	0.371***	0.255***	0.0905*	0.118***	0.162**	0.115**
1 if completed only elementary level	−0.114**	0.0368	−0.362***	−0.315***	−0.0174	0.0321	−0.404***	−0.226**
1 if completed up to secondary level	−0.104**	0.0162	−0.232***	−0.201***	−0.0102	0.0222	−0.186*	−0.0826
1 if independent worker	−0.0258	−0.0144	−0.117*	0.0308	−0.0247	−0.0242	−0.0834*	−0.057
1 if unemployed	0.114	0.0171	0.104	−0.0298	−0.0250	0.0525	−0.0457	−0.048
1 if retired	−0.0134	−0.00996	0.00013	0.0156	0.0913**	−0.00937	0.161**	0.087*
1 if studying	−0.0670	−0.0791	0.0250	−0.115	−0.00388	−0.102**	0.0846	−0.112*
1 if dedicated to housework	0.178	−0.0334	−0.536	−0.0900*	0.133	−0.0631**	0.0131	−0.037
1 if inactive	0.179***	0.0960***	0.348***	0.185***	0.202***	0.117***	0.309***	0.214***

(Continues)

TABLE A8 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if part of an ethnic group	0.0353	0.0202	0.0955	−0.0285	0.0491	−0.00622	0.00729	−0.01
1 if lives in rural area	−0.144***	−0.0992***	−0.180***	−0.185***	−0.154***	−0.182***	−0.0869*	−0.134***
1 if belongs to the first region	0.0264	−0.0180	−0.449*	−0.252	0.0267	0.0507	0.0278	−0.218***
1 if belongs to the second region	0.0757	−0.00138	−0.288**	−0.0935	0.00970	0.0505	−0.211*	−0.166*
1 if belongs to the third region	−0.0717	−0.0311	−0.0272	−0.203*	−0.131*	−0.121**	−0.148*	−0.172***
1 if belongs to the fourth region	−0.156*	−0.0192	−0.152	−0.293***	−0.0109	0.101**	−0.0931	−0.121*
1 if belongs to the fifth region	0.0984*	0.0744**	−0.0102	−0.0492	−0.0146	0.0475	−0.0197	0.027
1 if belongs to the sixth region	0.161***	0.0658*	−0.165*	−0.129**	−0.0503	−0.00277	−0.0940	−0.0795*
1 if belongs to the seventh region	0.0243	0.0200	−0.232**	−0.326***	0.0230	0.0556	−0.0638	−0.024
1 if belongs to the eighth region	0.114**	0.0844***	−0.121*	−0.0571	0.0489	0.0915***	−0.165***	−0.127***
1 if belongs to the ninth region	0.0965*	−0.00979	−0.411***	−0.285***	0.0769*	0.182***	−0.115*	−0.044
1 if belongs to the 10th region	0.159**	−0.0390	−0.199*	−0.189***	0.113**	0.137***	0.02	−0.067
1 if belongs to the 11th region	0.307***	0.199**	−0.194	−0.321*	0.0589	0.212**	−0.082	−0.244*
1 if belongs to the 12th region	0.147	0.0553	0.0634	0.0914	0.236***	0.225***	−0.174	−0.161*
1 if belongs to the 14th region	0.0300	0.108*	−0.138	−0.161*	0.112*	0.126***	−0.189*	−0.143**

TABLE A8 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the 15th region	0.217*	0.123	−0.263	−0.399**	−0.0279	−0.173*	−0.0366	−0.237*
1 if married or cohabitating. 0 otherwise	0.0522	0.0108	0.158***	0.111***	0.0657**	0.0438**	0.109***	0.0347
1 if belongs to the public health system	0.0404	−0.0163	−0.142**	−0.0867*	0.0357	0.0321	−0.162***	−0.140***
Second model								
Log of family income per adult equivalent	0.0686***	0.0314***	0.125***	0.0839***	0.0853***	0.0766***	0.237***	0.223***
1 if between 35 and 44 years of age	0.131***	0.119***	0.0816**	0.0130	0.0751***	0.147***	0.0700**	0.100***
1 if between 45 and 54 years of age	0.211***	0.235***	0.205***	0.145***	0.202***	0.301***	0.171***	0.176***
1 if between 55 and 64 years of age	0.441***	0.349***	0.366***	0.195***	0.353***	0.403***	0.309***	0.214***
1 if between 65 and 74 years of age	0.608***	0.454***	0.438***	0.218***	0.467***	0.484***	0.430***	0.253***
1 if self-reported health is good or very good	−0.613***	−0.599***	−0.609***	−0.553***	−0.503***	−0.455***	−0.564***	−0.491***
1 if physical limitation exists	0.249***	0.199***	0.335***	0.308***	0.108***	0.109***	0.203***	0.173***
1 if completed only elementary level	−0.213***	−0.125***	−0.417***	−0.394***	−0.0711	0.0575	−0.431***	−0.386***
1 if completed up to secondary level	−0.155***	−0.121***	−0.259***	−0.246***	−0.0441	0.0305	−0.281***	−0.230***
1 if independent worker	−0.0349	0.0227	−0.0754**	−0.0293	−0.0452**	−0.0101	−0.083***	−0.0112

(Continues)

TABLE A8 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if unemployed	0.0111	−0.00391	0.0940*	−0.0154	0.00167	0.0397	0.0258	0.0263
1 if retired	0.0336	−0.0287	0.0626	−0.0249	0.190***	0.0482*	0.211***	0.128***
1 if studying	−0.0539	−0.178***	0.0738	−0.0767*	0.0520*	−0.028	0.217***	0.0419
1 if dedicated to housework	0.144	−0.0435**	−0.287*	−0.069***	0.0513	−0.056***	0.0121	−0.0369*
1 if inactive	0.0707**	0.0574**	0.225***	0.127***	0.0992***	0.0717***	0.273***	0.171***
1 if part of an ethnic group	0.0161	−0.00406	0.0458	−0.00638	0.00590	−0.0006	0.0262	−0.009
1 if lives in rural area	−0.087***	−0.059***	−0.109***	−0.099***	−0.137***	−0.137***	−0.078***	−0.138***
1 if belongs to the first region	−0.0686	0.0608	−0.436***	−0.358***	−0.189***	−0.116***	−0.249***	−0.267***
1 if belongs to the second region	−0.00354	0.0273	−0.0617	−0.0151	−0.0874**	−0.0171	−0.205***	−0.221***
1 if belongs to the third region	−0.118*	−0.0185	−0.181**	−0.179***	−0.176***	−0.163***	−0.124***	−0.113***
1 if belongs to the fourth region	−0.144***	−0.137***	−0.120*	−0.186***	0.0442	0.0951***	−0.086*	−0.131***
1 if belongs to the fifth region	0.0474	0.0676***	0.0253	−0.0175	−0.00594	0.0113	0.0272	0.0593**
1 if belongs to the sixth region	0.0980***	0.0793***	−0.0888**	−0.124***	−0.0293	0.0192	−0.008	0.011
1 if belongs to the seventh region	−0.0542*	−0.084***	−0.253***	−0.314***	−0.0298	−0.0211	−0.127***	−0.045
1 if belongs to the eighth region	0.0316	0.0422*	−0.0572*	−0.0636**	0.0763***	0.0969***	−0.113***	−0.08***
1 if belongs to the ninth region	0.119***	0.138***	−0.187***	−0.238***	0.133***	0.182***	−0.082**	−0.012

TABLE A8 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the 10th region	0.121***	0.179***	−0.0253	−0.0919**	0.116***	0.147***	0.0678*	0.0321
1 if belongs to the 11th region	0.0879	0.213***	−0.129	−0.432***	−0.206***	−0.155***	−0.338***	−0.375***
1 if belongs to the 12th region	−0.0910	0.0567	0.0512	0.0414	0.0335	0.0111	−0.245***	−0.300***
1 if belongs to the 14th region	0.0166	−0.00134	0.00193	−0.0996**	0.147***	0.111***	−0.140***	−0.081**
1 if belongs to the 15th region	0.0943	0.124*	−0.282**	−0.451***	0.0158	−0.00565	0.0724	−0.057
1 if married or cohabitating. 0 otherwise	0.0917***	0.0864***	0.123***	0.0923***	0.0771***	0.0420***	0.129***	0.04***
1 if belongs to the public health system	0.00834	0.0433*	−0.101***	−0.143***	0.00351	0.0374**	−0.132***	−0.145***
Log likelihood	−31819	−52863.3	−17401.2	−31703.3	−49104.1	−78250.8	−31833.3	−54827
Rho	0.982***	-0.063	0.988***	0.985***	0.987***	0.985***	0.984***	0.985***
Wald chi2(33)	1033.4	242.70	950.84	604.22	1144.61	1563.9	1024.9	1223.3
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: In Rho, stars imply the rejection of the null hypothesis of independence between equations.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Estimation result. Marginal effects are reported with the statistical significance level of their corresponding parameter.

TABLE A9 Latent class Poisson model marginal effects

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
Class 1								
Log of family income per adult equivalent	0.0064***	0.00568***	0.00557***	0.00887***	0.0207***	0.0254***	0.0261***	0.0433***
1 if between 35 and 44 years of age	0.0183***	0.0317***	0.00489**	0.00325	0.0251***	0.0548***	0.00334	0.0192***
1 if between 45 and 54 years of age	0.0307***	0.0590***	0.0104***	0.0169***	0.0638***	0.115***	0.0175***	0.0340***
1 if between 55 and 64 years of age	0.0639***	0.0926***	0.0215***	0.0203***	0.113***	0.164***	0.0380***	0.0422***
1 if between 65 and 74 years of age	0.108***	0.120***	0.0316***	0.0242***	0.147***	0.205***	0.0546***	0.0578***
1 if self-reported health is good or very good	−0.0724***	−0.123***	−0.0415***	−0.0662***	−0.124***	−0.174***	−0.09***	−0.122***
1 if physical limitation exists.	0.0225***	0.0362***	0.0222***	0.0384***	0.0193***	0.0398***	0.015***	0.0254***
1 if completed only elementary level	−0.0169***	−0.0192***	−0.0190***	−0.0345***	−0.0103	0.0001	−0.03***	−0.046***
1 if completed up to secondary level.	−0.0136***	−0.0189***	−0.0124***	−0.0194***	−0.00699	−0.0039	−0.024***	−0.029***
1 if independent worker	−0.00330*	0.00283	−0.00210*	−0.00612**	−0.0085**	−0.0022	−0.007***	−0.0008
1 if unemployed	−0.000676	0.00295	0.00565*	−0.00391	−0.00185	0.0183*	0.0011	0.0063
1 if retired	0.00372	−0.00569	0.000952	−0.000595	0.0334***	0.0158**	0.0235***	0.0217***
1 if studying	−0.00786	−0.0320***	0.00332	−0.00397	0.00625	−0.0099	0.0227***	0.0107*

TABLE A9 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if dedicated to housework	0.0192	−0.00763*	−0.00857*	−0.0080***	0.00512	−0.015***	−0.0038	−0.008**
1 if inactive	0.00659*	0.0100**	0.0106***	0.0182***	0.0313***	0.0275***	0.0349***	0.0290***
1 if part of an ethnic group	−0.000615	−0.00102	0.00580**	−0.00437	0.00317	−0.0001	0.0049	−0.00413
1 if lives in rural area	−0.0069***	−0.009***	−0.0042***	−0.0117***	−0.025***	−0.043***	−0.01***	−0.024***
1 if belongs to the first region	−0.0117**	0.00837	−0.0126***	−0.0219***	−0.038***	−0.033***	−0.022***	−0.039***
1 if belongs to the second region	0.000604	0.00121	−0.00374*	−0.000013	−0.00779	−0.0084	−0.018***	−0.039***
1 if belongs to the third region	−0.00677	−0.00116	−0.00521**	−0.0165***	−0.032***	−0.05***	−0.014***	−0.017***
1 if belongs to the fourth region	−0.0106***	−0.0218***	−0.00446**	−0.0132***	0.0148*	0.0307***	−0.013***	−0.023***
1 if belongs to the fifth region	0.00439	0.00741	−0.00106	−0.00202	0.00338	0.0039	0.0034	0.0133***
1 if belongs to the sixth region	0.00664*	0.00989*	−0.0048***	−0.00710**	−0.00236	0.0033	−0.003	0.0036
1 if belongs to the seventh region	−0.0083***	−0.0158***	−0.0102***	−0.0231***	−0.00477	−0.0037	−0.01***	−0.0114**
1 if belongs to the eighth region	−0.00148	0.00151	−0.0042***	−0.00309	0.0235***	0.0354***	−0.01***	−0.012***
1 if belongs to the ninth region	0.0102**	0.0221***	−0.0079***	−0.019***	0.0388***	0.0733***	−0.01***	−0.013***

(Continues)

TABLE A9 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the 10th region	0.00839**	0.0359***	−0.00323*	−0.00394	0.0279***	0.0583***	0.0102**	0.0059
1 if belongs to the 11th region	0.00555	0.0570***	−0.00503*	−0.0233***	−0.04***	−0.067***	−0.027***	−0.047***
1 if belongs to the 12th region	−0.0137**	0.00773	0.000374	0.0106	0.00903	−0.0028	−0.021***	−0.042***
1 if belongs to the 14th region	0.00125	−0.00558	−0.000164	−0.00875**	0.0420***	0.0466***	−0.009**	−0.01
1 if belongs to the 15th region	0.00479	0.00608	−0.0111***	−0.0234***	0.00532	−0.004	0.0032	−0.01
1 if married or cohabitating. 0 otherwise.	0.00647***	0.0127***	0.00309***	0.00955***	0.0138***	0.0123***	0.0125***	0.0062**
1 if belongs to the public health system	0.00272	0.0106**	−0.00254*	−0.0164***	0.00296	0.0122**	−0.012***	−0.021***
Class 2								
Log of family income per adult equivalent	0.124***	0.0466	0.136*	0.0965*	0.131**	−0.057	0.351***	0.290***
1 if between 35 and 44 years of age	0.286***	0.0964	0.148	0.470***	0.115	0.231*	−0.333*	−0.376***
1 if between 45 and 54 years of age	0.346***	0.213**	0.397**	0.215	0.517***	0.517***	−0.632***	−0.183
1 if between 55 and 64 years of age	0.789***	0.307***	0.256	0.123	0.567***	0.651***	−0.203	−0.280**

TABLE A9 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if between 65 and 74 years of age	1.013***	0.0604	0.902***	−0.0661	0.958***	1.025***	−0.210	−0.091
1 if self-reported health is good or very good	−1.626***	−1.715***	−2.208***	−1.669***	−2.345***	−1.988***	−2.186***	−2.042***
1 if physical limitation exists	0.481***	0.473***	1.242***	0.993***	0.269	0.654***	−0.146	−0.0270
1 if completed only elementary level	−0.270***	0.0758	−1.759***	−0.974***	0.227	−0.613	−0.798*	−0.256
1 if completed up to secondary level	−0.288***	−0.0454	−1.256***	−0.726***	0.213	−0.672	0.0566	−0.0815
1 if independent worker	−0.116*	−0.0550	0.114	0.0623	−0.00426	0.0012	0.0661	−0.204
1 if unemployed	0.185	0.0920	0.223	−0.245	−0.335*	0.210	−0.333	−0.422*
1 if retired	−0.155*	−0.0872	−0.0658	−0.181	0.653***	0.0411	0.224	0.577***
1 if studying	−0.253*	−0.589***	−0.621***	−0.251	−0.504***	−0.409**	−0.692**	−0.091
1 if dedicated to housework	1.006*	−0.143*	−1.039	−0.432***	0.0184	−0.154	−0.508	−0.135
1 if inactive	0.554***	0.301***	1.034***	0.855***	0.806***	0.577***	0.821***	0.518***
1 if part of an ethnic group	−0.0778	−0.0319	0.878***	−0.259*	−0.0239	−0.338***	0.335	−0.253*
1 if lives in rural area	−0.285***	−0.342***	−0.286**	−0.656***	−0.481***	−0.748***	−0.181	−0.432***
1 if belongs to the first region	−0.0265	−0.153	−0.756**	−0.109	−0.408*	−0.213	0.947**	−0.665***

(Continues)

TABLE A9 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the second region	0.478**	0.142	−0.625***	0.0123	0.853**	0.257	−0.800**	−0.828***
1 if belongs to the third region	0.0994	−0.116	2.113***	−0.280	−0.367*	−0.793***	−1.074***	−0.635***
1 if belongs to the fourth region	−0.391***	−0.109	0.113	−0.674***	−0.178	−0.0157	−0.652**	−0.612***
1 if belongs to the fifth region	0.246**	0.227**	−0.425***	−0.205*	−0.317**	−0.176	0.167	−0.0452
1 if belongs to the sixth region	0.225**	0.105	−0.764***	−0.374**	−0.523***	−0.583***	−0.912***	−0.227
1 if belongs to the seventh region	−0.0570	−0.197*	−0.700***	−0.737***	−0.356**	−0.189	−0.253	−0.210
1 if belongs to the eighth region	0.177**	0.0785	−0.566***	−0.0811	0.0821	−0.182	−0.890***	−0.579***
1 if belongs to the ninth region	0.283**	0.0746	−0.944***	−0.840***	0.163	0.216	−0.607**	−0.611***
1 if belongs to the 10th region	0.378***	0.0464	−0.692***	−0.444***	−0.125	0.209	−0.325	−0.499***
1 if belongs to the 11th region	0.339*	1.251***	−0.868***	−0.337	−0.112	0.575*	0.00894	−0.306
1 if belongs to the 12th region	0.332	0.120	−0.194	2.588***	0.759**	0.485*	−0.719**	−0.384
1 if belongs to the 14th region	0.203	0.343*	0.519	−0.510**	−0.0622	0.172	−0.320	−0.543**

TABLE A9 (Continued)

	2009				2015			
	GPV		SV		GPV		SV	
	Men	Women	Men	Women	Men	Women	Men	Women
	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.	Marg. Eff.
1 if belongs to the 15th region	0.282	−0.00374	−0.900***	−0.969***	−0.268	−1.282***	−0.842*	−1.173***
1 if married or cohabitating. 0 otherwise.	0.0892*	0.131**	0.132	0.546***	0.0700	0.135*	0.311**	0.153*
1 if belongs to the public health system	0.0137	−0.0959	0.367***	−0.0916	−0.0653	0.0680	−0.354**	−0.256**
Log likelihood	−29813	−49436	−16917	−30232	−44337.4	−71220.6	−30084.5	−51071.1
Pi 1	0.939	0.915	0.980	0.965	0.962	0.943	0.979	0.96
Pi 2	0.061	0.085	0.020	0.035	0.039	0.057	0.021	0.04
Wald chi2(66)	3459.7	3598.4	3555.6	3410.1	4691.1	5843.0	4813.3	5525.6
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Pi 1 and Pi 2 are the probabilities of belonging to each class.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Source: Estimation result. Marginal effects are reported with the statistical significance level of their corresponding parameter.

APPENDIX B

In this appendix, we discuss in further detail the results.

In a latent class model, *self-reported health status* has the highest marginal effect compared with other factors in the high-frequency users' estimation, but its magnitude decreases between 2009 and 2015. The marginal effect for GPV decreases from −1.343 to −0.738 in the case of men and from −1.18 to −0.737 in the case of women. By contrast, in the low-frequency users, the marginal effects of this variable increase their magnitudes from 2009 to 2015 in both medical services (except for GPV for women). In both stages of the hurdle model, *self-reported health status* has the highest marginal effect; however, in the first stage, its magnitude decreases between 2009 and 2015, but in the second stage, its effect does not change significantly through the years. In the selection Poisson model, again, self-reported health status presents the highest marginal effects in both stages.

The variable *physical limitation* determines positively the decision of GPV and SV in almost all estimations. In the first stage of the hurdle model, it shows a higher marginal effect than in the second stage; besides, in the second stage, the effect is no longer statistically significant in the year 2015 (except for women in GPV). In the selection Poisson model, *physical limitation* is statistically significant in both stages and the magnitude of the marginal effect for men and women for SV and GPV decreases from 2009 to 2015. *Physical limitation* is also statistically significant for the utilization of medical services in the latent class model, with a higher marginal effect in the high-frequency users than in the low-frequency users, but again, in the former group, *physical limitation* decreases its magnitude from 2009 to 2015, and in the case of SV in 2015, it is no longer statistically significant.

In the hurdle model, the variable *inactive people*, shows higher marginal effects in the second stage (frequency of medical services utilization) than in the first stage (decision to use medical services). The opposite occurs in the selection Poisson model, where the marginal effects are higher in the first stage. This variable also has a higher marginal effect on the high-frequency users' utilization of both medical services than in the low-frequency group.

Age groups are statistically significant in general and have a positive effect for low-frequency users in the latent class model, with an increasing marginal effect through age groups. That is older people use medical services more often than younger people; for high-frequency users, age groups are statistically significant but only for men in GPV in 2009 (also with increasing marginal effects through groups) and in GPV for men and women in 2015. In the hurdle model *age groups* are statistically significant only in the participation decisions but not in the frequency of utilization. By contrast, *age groups* are statistically significant in the selection Poisson model in the second stage (frequency) but not in the first stage (participation decision).

The marginal effect of *living in rural areas* are higher in the hurdle model than in the selection Poisson model and the latent class model. *Region* is in many cases a statistically significant determinant of medical services utilization. Regions have been enumerated in order from the north (region 1) to south (region 12) except for region 13 (the capital of the country located between regions 5 and 6), region 15 (in the north), and region 14 (in the middle of the country). To analyse their effects, we group regions into three zones: North (Reg 1 to 4 and Reg 15), Central (Reg 5 to 7) and South (Reg 8 to 14). In general, living in the northern regions (North) implies a negative effect on both SV and GPV across models. The Central regions and Southern regions show a lower utilization of SV but higher utilization of GPV. These results reflect the structure of the Chilean health system: for individuals using public medical services, a GPV is the first obligatory step before being referred to a specialist and in most regions, and especially in the extreme north and south, there is an insufficient number of specialists.

The variable *public health system* is not always statistically significant. In the latent class model, is a determining factor for low-frequency users (except for men's GPV in both years), whereas for high-frequency users is only significant in the case of SV for men and women in 2015. In the hurdle model, it is significant in all cases in the participation decision (except for men's GPV), but in the second stage (frequency), it is only significant in the case of SV in 2015 for men and women.

Having secondary or elementary education compared with a college-level education reduces GPV and SV for men and women in all three models except for the estimations of GPV in 2015 and the second stage of the hurdle model. In all the cases where these variables are statistically significant, elementary education has higher marginal effects than secondary education. Finally, *being married* or cohabitating has a positive effect in all models except for the second stage of the hurdle model and Income is a positive determinant of utilization except for the second stage in the hurdle model and for high-frequency users in the latent class model.