Econ 613 - Applied Econometrics - 2022 Spring
Reading 2

Summary for *Paying on the Margin for Medical Care*

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Different regions have different health care insurance policies, and the increasingly large medical expenditure makes it important to reduce the spending on medical care. To solve this problem, the authors analyze the social welfare from a new policy, the "top-up" design. In this paper, the authors use a simple graphical framework to present and estimate the social welfare of different insurance policy. They show that such top-up policy is more efficient than "full coverage" or "no top-up" policy because it makes people stay on the margin of therapy cost. Moreover, with the datasets for cancer patients and radiation facility location, they estimate the demand function for lumpectomy, a radiation therapy for breast cancer, by using the distance between the nearest radiation facility to the patients' address. With this demand function, the authors illustrates that using the efficient top-up insurance will increase the social welfare compared to the other two policies.

The authors focus on the breast cancer patients who have two therapy choices: lumpectomy and mastectomy. These two treatments have similar survival rate for the breast cancer patients, but lumpectomy is much more expensive than mastectomy. To estimate the demand curve of lumpectomy, the authors use two data sources. First, they use the patient-level data from California Cancer Registry (CCR), in which the cancer patients' cancer diagnosis are recorded. Second, they use the private firm IMV to get the location of radiation treatment for cancer. To join these two datasets together, the authors use Google Maps to compute the distance to the nearest radiation therapy facility.

Before the empirical analysis part, the authors describes the theoretical background of this paper. The main idea of this paper is to calculate the demand curve for lumpectomy (L). The authors estimate the relative demand of lumpectomy to mastectomy (M) via $v_i = v_{i,L} - v_{i,M}$, where $v_{i,\cdot}$ is the willingness of patient i to pay for some therapy (L or M). Moreover, the target for the analysis is the cumulative distribution function of $F(v_i)$ across patients. Under this framework, the author analyze the efficiency of "top-up," "full coverage," and "no top-up" policies. First, the "top-up" policy covers these two therapies with the price of M. Thus, patients need to pay for the additional costs if they choose L. Second, for "full coverage" policy, the treatment costs for both of these two therapies are fully covered, and patients may choose L or M with a zero cost. Third, "no top-up" policy only covers the cheaper choice, M. In this case, patients need to pay for the full price of treatment if they choose L. By analyzing the demand curve of L, the "no top-up" and "full coverage" policies are not efficient because they generate social welfare loss.

Based on the theoretical framework, the authors estimate the demand function of lumpectomy relative to mastectomy with the distance to the nearest radiation therapy facility. They design the empirical analysis with the following three steps. First, they present the summary statistics to show the basic facts. By plotting the probability of selecting lumpectomy or mastectomy by the distance, the author find that the patients who live faraway from radiation facility are less likely to choose lumpectomy. This relationship is also not sensitive when controlling for other covariants such as demographic characteristics and neighborhood characteristics.

Second, the authors quantitatively investigate the relationship between treatment choices and distance with logit regression. They run altogether six regressions with homogeneous logit or heterogeneous logit regression model with different control variables. These regression coefficients show the robust negative correlation between traveling distance and the probability of choosing lumpectomy as the breast cancer treatment. If the distance increase 1 unit (10 minutes for traveling to the nearest radiation facility), the probability of choosing lumpectomy will decrease 0.7-1.1 percentage.

Third, based on the previous estimated demand function, the authors estimate the social welfare for choosing lumpectomy with different insurance policies. As defined in the previous section, the utility from lumpectomy is estimated as $u_i \equiv \alpha_i + \beta_i(\theta_i d_i + p)$, where α_i and β_i are preference parameters. With this equation, the authors derive the willingness for patient i to pay for the lumpectomy as

$$v_i \equiv \frac{\alpha_i}{\beta_i} - \theta_i d_i$$

In this function, d_i is known for every patient, θ_i is estimated as \$1,150. The joint distribution of α_i and β_i could be estimated. Thus, the authors could calculate the distribution function of v_i, $F(v_i)$. Given the incremental price of lumpectomy, p, which is estimated as \$10,000,[1] the consumer surplus is $(1 - F(p))E(v_i | v_i > p)$, and the total incremental cost can be calculated as $(1 - F(p))c$. Comparing to "no top up" or "full coverage" policies, the social welfare is increased by \$700-\$2,500 with "top-up" design.

At the end of the this paper, the authors analyze the ex ante efficiency of top-up policy. Similar to the previous sections, they estimate patients' willingness to pay for the incremental price of lumpectomy. In addition, they assume that patients maximize their expected-utilities, and the utility function is CARA, $w(x) = -\exp(-rx)$. If $v_i > 0$, the utility is

$$\pi_i = \frac{1}{r} \log[\rho \times \exp(r \times \min(v_i, p)) + 1 - \rho]$$

where ρ is the annual probability of breast cancer, r is the parameter for risk aversion, and p is the incremental price for lumpectomy. In this case, insurance pays for the full price of mastectomy. The authors assume that $\rho = 0.48\%$, and the value of r is estimated from other papers. By setting the U.S. policy (full coverage) as the benchmark, the author estimate the ex ante utility and show that top-up policy is better than no top-up and full coverage policy. Moreover, if they estimate utility of the ex post efficient top-up policy, the results are highly dependent on the risk aversion parameter, r. These results indicate that ex post efficient top-up policy is not good enough for policymaker. However, ex ante risks cover more information.

In conclusion, the authors make two main contributions in this paper. First, they use a novel graphical framework to show that top-up policy is more efficient comparing to no top-up and full coverage policy. Second, in this paper, they compute the demand curve of lumpectomy. By using the distance to the nearest radiation therapy facility, the authors show the demand system for lumpectomy and estimate the social welfare with the estimated demand curves. There are two limitations in this paper. On the one hand, this model is not applicable when there are multiple choices where people have more than three therapies for a certain cancer. On the other hand, it might be better if the authors use some other variables, such as family income, to estimate the demand curve for robustness check.

[1] In this paper, the approximate cost for lumpectomy is \$50,000 and cost for mastectomy is \$40,000.