THE WILLINGNESS TO SPEND ON HEALTHCARE: EVIDENCE FROM SINGAPORE

Lydia L. Gan[*] and James R. Frederick[*]

Abstract: For the past few decades, the household healthcare expenditures have experienced a phenomenal growth in Singapore. This paper seeks to identify the underlying socio-economic factors that contribute towards this phenomenon by employing time series data to examine the household willingness to spend on healthcare from 1970 to 2006. The results from our log-linear regression show that the willingness to spend on healthcare is positively related to the proportion of Singapore's population who are elderly, the literacy rate, the ratio of price of other goods and services to the price of healthcare, and the establishment of Singapore's mandatory health savings plan, Medisave. In terms of their effects on the growth of Singapore's willingness to spend on healthcare, the most important factors are the ageing of the population and the increase in the literacy rate.

JEL Classifications: I11, D12, R22

Keywords: healthcare demand, price of healthcare, ageing, Medisave, Singapore

INTRODUCTION

The phenomenal economic growth of Singapore over the previous four decades has resulted in a steady rise in general healthcare prices. The life expectancy at birth for Singaporeans was 78 for men and 82 for women in the year 2005 (WHO, 2007). The elderly (those over 65 years old) constituted 7% of the population in 2007 and they are expected to triple to 21% in 2030. The increased affluence, higher life expectancy and the ageing of the population have further raised household expenditures on healthcare over time. Over the time span of this study, Singapore's real per-capita spending on healthcare increased by 659% from S$718.3 million in 1970 to S$5,453.6 million in year 2006 (in year 2000 constant dollars, Department of Statistics, 2009). In 2005, healthcare expenditures constituted 4% of GDP expenditures in Singapore (WHO, 2007), and this figure is expected to grow to 7% by year 2030. This trend is likely to continue with almost every hospital in Singapore raising its charges due to technological upgrades and the rising demand for healthcare service. Numerous studies have focused on supply-side healthcare factors, such as the effect of the number of healthcare professionals on healthcare costs. The ageing population of the island nation, along with its greater demand for healthcare,

[*] Department of Economics, Finance and Decision Sciences, School of Business, The University of North Carolina at Pembroke, P. O. Box 1510, Pembroke, NC 28372-1510, USA, E-mail: lydia.gan@uncp.edu, james.frederick@uncp.edu

has motivated us to investigate the demand-side socio-economic factors that will help to explain such a trend in Singapore. Income, education, and the age distribution of the population have been shown to have effects on the amount of healthcare demanded in other countries, but no studies have sought to estimate the demand for healthcare in Singapore.

LITERATURE REVIEW

One of the major variables used in the empirical healthcare research is the price charged for various types of healthcare services. Wedig (1988) and Rosett and Huang (1973), studied the price elasticity of demand for healthcare in the United States and found it to be as low as -0.35. The latter finding is supported by several other authors who studied developing nations (Sauerborn et al., 1994 using Burkina Faso; Gertler et al., 1987 using Peru; Akin et al., 1986 using the Philippines; and Heller, 1982 using Malaysia). In contrast, there were at least three country studies (De Bethune et al. on Zaire, 1989; Yoder on Swaziland, 1989; and Chernichovsky and Meesook on Indonesia, 1986) which found the demands for medical care to be elastic in developing countries.

Standard microeconomic theory shows that typical households face budget constraints. The prices of substitutes for, and complements of, healthcare may very well affect the demand for healthcare. For instance, Cheong (2004) found that Singaporean households may choose to increase expenditures on their children rather than spending more on their personal healthcare. Changes in the prices of complements of healthcare services such as pharmaceutical products can also influence the demand for healthcare. A study in China found that food and healthcare were complements, with a negative cross-price elasticity of medical care with respect to food prices (Mocan et al., 2004).

The ability of households to pay for healthcare services depends partly on the level of household income (Hayward et al., 2000). While the studies find that healthcare is a normal good, the estimates of the income elasticity of the demand for healthcare have shown considerable variation. This is probably due to the various measurements used for income (Benzeval et al., 2001), the types of medical care included in the study, and the differences between cross-sectional studies and longitudinal studies within a country and international studies. Nevertheless, several studies have found a significant effect of income on the utilization of medical care facilities (Gerdtham, 1997; Windmeijer and Silva, 1996; Van Doorslaer et al., 1993). Some studies in particular showed that healthcare is a normal good with a low income elasticity (Mocan et al., 2004; Di Matteo and Di Matteo, 1998; Hitiris and Posnett, 1992; and Rosett and Huang, 1973) whereas other studies showed that healthcare is a luxury good with income elasticity greater than 1 (Parkin et al.,1987; Newhouse, 1977).

If education leads to efficient investments in health, Grossman (1972) proposed that a more educated individual will demand a greater stock of health. Many studies since then have supported this finding (Grossman, 2003; Grossman and Kaestner, 1997). However, more recent research carried out in advanced economies such as Sweden, Denmark, Europe and the U.S. (Fuchs, 2004, Spasojevic, 2003; Arendt, 2002; Lleras-Muney, 2002) failed to show that a higher level of education leads to better health.

Ichoku and Leibbrandt (2003) extended this concept to the household level and found a positive relationship between household education and the number of physician visits. Similarly,

Elo and Preston (1992) observed a negative relationship between education and mortality rates. In a similar vein, a UNESCO study (2005) found that literacy is also an important determinant affecting individual's health. That study defined literacy as the ability to read with understanding and to write simple short statements related to their everyday life. Fuchs (2004) argued that the association between education and health may not be due to the benefits of education per se, but that education may be a proxy for other variables, such as intelligence, sense of self efficacy, or the willingness to delay gratification. Moreover, there have even been cases found in which there was simply no significant relationship between education and health (Ellis and Mwabu, 1991; Gertler and van der Gagg, 1990).

Cultural-demographic factors, including attitudes toward seeking healthcare, and physiological condition and age can influence an individual's demand for healthcare. Wedig (1988) found that persons with adverse lifestyle habits and the elderly demand more healthcare services. Smoking is an example of a common proxy adopted for lifestyle habits (Goddard et al., 1994). Kawachi et al. (1997) showed that the intensity of the exposure to environmental tobacco smoke increases the risk of cardiovascular disease, which can in turn raise the demand for healthcare services.

Furthermore, most studies have shown age to have a negative relationship with health status, which is consistent with Grossman's (1972) argument in which individuals demand more healthcare as their health stocks depreciate with age. Nevertheless, there is sharp disagreement in the healthcare literature as to the actual impact age has upon the demand for healthcare. Some researchers held that the growing elderly population has been the major reason for the recent increases in healthcare costs in the United States (Boccuti and Moon, 2003; Cutler and Meara, 1999, 1998). Others proposed that supply-side factors such as the availability of expensive new medical technology and labour shortages in healthcare were mainly responsible for the higher costs of providing healthcare (Reinhardt, 2003; Strunk and Ginsburg, 2002).

Some recent studies have shown that Americans in their 50s and 60s today have healthier lifestyles than their preceding generations had. Their healthcare costs are still expected to increase with age, but these people have postponed the age at which their demand for healthcare increases. This has led some analysts to believe that the effects of the aging population will be felt later than had been expected.

The way in which healthcare is financed also affects the demand for healthcare. While there was always some private health insurance before and after the creation of Medisave in 1984, Medisave marked a fundamental change in the way healthcare is funded in Singapore. Asher (1995) states that Singapore's philosophy of personal responsibility has resulted in a system in which people save for their own retirement instead of having the state take care of them. The concept of "self-insurance" was proposed by Goodman and Musgrave (1992) to replace wasteful third-party insurance in the U.S. through Medical Savings Accounts in which patients (1) now have self-interest to spend more prudently on health care, and (2) can transfer savings from insurance premiums back to their Medical Savings Accounts (Pauly and Goodman, 1995). While Massaro and Wong (1996) assert that Singapore's Medisave system keeps the country's health care expenditure low, Hsiao (1995) argued that the Medisave system does not curb the rising costs in medical technology and qualified physicians, and Barr (2001) argued that strict government control, rationing of health care services and prices and a young population base play key roles instead.

In summary, there is good reason to believe that the amount of healthcare demanded by the citizens of a country depends on the price of healthcare, the prices of substitutes and complements of health care, income, the education level of its citizens, social factors (such as life styles, marital status and government support of healthcare), and the age distribution of its citizens.

DATA COLLECTION

While the more recent estimations of healthcare demand models generally employ cross-sectional (Dawson et al., 2006; Benzeval et al., 2001) or panel data (Mangalore, 2006; Arber, 2004), in our paper, we chose to use annual time series data from 1970 to 2006 to estimate the demand for healthcare in Singapore. All data in this study except for the Medisave variable were found in various editions of the Singapore Department of Statistic's Yearbook of Statistics from 1970 to 2007. Descriptive statistics are provided in Table 1.

Table 1
Description of the Variables

Variable	mean	median	std. dev.	ADF	p
HHE	0.7842	0.7982	0.2834	-0.176	0.049
HPI	58.75	52.23	34.62	-0.104	0.958
POI	81.06	83.08	18.18	-0.139	0.233
GDP	20,829	16,794	13,534	-0.110	0.671
LIT	86.41	87.00	6.69	-0.115	0.419
ADR	8.27	8.22	1.60	-0.438	0.658
MED	0.611		0.494		

Note: ADF is the coefficient ($\rho - 1$) from an augmented Dickey-Fuller test with a constant and trend. Finding that this coefficient is significantly less than zero implies that the time series is stationary. The ADF tests were performed using the natural logarithms of the variables since the natural logarithms were used in the regression. The last column gives the p values for this test.

We use the total household healthcare expenditure (HHE) as the dependent variable, following approach of Manning et al. (1987), and of Rosett and Huang (1973), instead of other common measures in the literature such as hospital admissions and physician visits. HHE gives a more comprehensive view of the overall demand for healthcare than hospital admissions alone or physician visits alone. Manning, et al. (1987), also note that the more comprehensive view is appropriate when examining the effects of insurance on healthcare prices. The data for HHE are the private consumption expenditures on health per capita at 2000 market prices and expressed in thousands of Singapore dollars. The necessary adjustments were made to account for base years before 2000.

Based on reviews of the existing literature, the independent variables included in our model are: (1) a health price index; (2) an index for prices of other goods and services; (3) the gross domestic product per capita; (4) literacy rates; and (5) the aged dependency ratio.

Price Indices

The inclusion of the price of healthcare services is important in modelling the demand for healthcare. Our proxy for the price of healthcare services is the health price index (HPI), which takes into account the variation in the patients as well as the type of disease being treated over

the years (Feldstein, 1966). Based on previous empirical research (Chong et al., 2001; Tan and Chew, 1997), we derived the health price index by dividing the nominal healthcare expenditure data by the corresponding real healthcare expenditure for each year of the period under study. By construction, it is equal to 100 in the year 2000.

Our price index for other goods and services is an index of prices on goods and services which are substitutes for healthcare in a household's budget. We used transportation, communication, recreation, education, and food and beverages as the substitute goods. These expenditure categories account for a large part of the typical Singaporean household's budget. An index for the price of other goods and services (POI) was constructed by dividing the sum of nominal spending by the real spending on these categories of goods and services. It also has a value of 100 for the year 2000. This index for the price of other goods and services is highly correlated with our healthcare price index ($r = 0.901$).

Socio-demographics Variables

The real GDP per capita is used as a proxy for individual household income in our demand model. These data were obtained by dividing the real GDP figures, with 2000 as the base year, by Singapore's midyear population.

The literacy rate is used as a proxy for the educational level of the population. We use the literacy rate as a measure of the extent to which individuals are able to read and write at a level adequate for understanding and communicating about their health to medical professionals. Our data are the literacy rate expressed as a percentage of the population aged 15 years or older. Over the period of 37 years under our study, the literacy level of the population in Singapore has been increasing steadily from 72.2 per cent in 1970 to 95.4 per cent in 2006.

The data in this sample reflect another social trend in Singapore: there is strong evidence of an ageing population in Singapore. Singapore's Department of Statistics defines the aged-dependency ratio (ADR) as the number of aged Singaporeans (aged 65 years and older) per working-aged Singaporean (aged 15 to 64). Wong et al. (2005) showed that there is a positive correlation between the proportion of aged and the aged dependency ratio. Expressed as a percentage, the aged-dependency ratio was estimated as 11.9 in year 2008 (Department of Statistics, 2009), and it will be expected to be 29 in the year 2030 — this means only 3.5 economically active persons (aged 15-64) will be supporting the average elderly person in the year 2030. We use the aged dependency ratio as a proxy to determine the effect of the ageing population on the demand for healthcare.

Finally, we capture the effect of the creation of Singapore's Medical Savings Account program (MediSave), which became effective in April 1984. This program allows Singaporean employees to contribute from 6.5% to 9%, depending on their age, of their income to a medical savings account for their use. We use a dummy variable which has the value of 1 for years after 1984 and the value of 0 otherwise.

METHODOLOGY

Some healthcare demand models commonly seen in the literature include the latent-class and two-part models (Deb and Trivedi, 2002), two-stage ordinary least squares (OLS) probit models

(Arkes, 2001) and the multivariate nested logit model (Ichoku and Leibbrandt, 2003; Ellis and Mwabu, 1991). Nevertheless, these models only apply to cross-sectional or panel data. Based on Hunt-McCool et al. (1994), we apply the log-linear model to our time series data to analyse the dynamics of healthcare demand in Singapore over a span of 37 years.

The general model for our healthcare demand model is as follows:

$$\ln HHE = \beta_0 + \beta_1 \ln HPI + \beta_2 \ln POI + \beta_3 \ln GDP + \beta_4 \ln LIT + \beta_5 \ln ADR + \beta_6 MED + \mu$$

Where ln refers to the natural logarithm of the following variables:

HHE: Real household healthcare expenditure per capita

HPI: Health price index

POI: Index for price of other goods and services

GDP: Real gross domestic product per capita

LIT: Literacy rate of Singapore's residents aged 15 and above

ADR: Aged dependency ratio

MED: 0 if the time period is before and including 1984

        1 if the time period is after 1984

With the above log-linear (double-log) model, we can interpret the coefficients of the independent variables as the elasticity with respect to the household healthcare expenditure.

Hypotheses

The effect of the budget constraint. The literature cited above (especially, Mocan et al., 2004, Benzeval, et al., 2001, and Haywood, 2000) clearly suggests that the amount of desired spending on health care should be constrained by households' incomes. It should be positively related to per capita income (implying that $\beta_3 > 0$), negatively related to the price of healthcare ($\beta_1 < 0$), and positively related to the prices of substitutes in households' budgets ($\beta_2 > 0$). Accordingly, we pose the following set of hypotheses:

$$H_1: \beta_1 < 0 \text{ vs. } \beta_1 \geq 0$$
$$H_2: \beta_2 > 0 \text{ vs. } \beta_2 \leq 0$$
$$H_3: \beta_3 > 0 \text{ vs. } \beta_3 \leq 0$$

The effect of education. In light of the criticism from Fuchs (2004) and others, we test Grossman's (2003) finding that more educated consumers are more efficient users of healthcare and therefore spend more on healthcare. Using the literacy rate as a proxy for the level of education in the population, we pose the following hypothesis:

$$H_4: \beta_4 > 0 \text{ vs. } \beta_4 \leq 0$$

The effect of age. As discussed earlier, Reinhardt (2003) and others have argued that the ageing of the population is not an important factor in determining the demand for healthcare. On the other hand, in Grossman's (1972) model, desired spending on healthcare increases with age as the stock of health declines with age. Since the stock of health tends to decline faster

after age 65, we used the aged-dependency ratio as a proxy for the percentage of the population that is in this age range. We pose the following hypothesis:

$$H_5: \beta_5 > 0 \text{ vs. } \beta_5 \leq 0$$

The effect of healthcare financing. The dummy variable MED was added to test for the effects of Medisave on healthcare expenditure since its implementation in 1984. Prior to 1984, there was no national health program in Singapore, though private health insurance has always been available. Medisave mandates that Singaporeans contribute to medical savings accounts. Since households tend to consume more healthcare services with the reduction in their out-of-pocket healthcare expenditures under the Medisave scheme (Massaro and Wong, 1996; Boccuti and Moon, 2003), we offer the following hypothesis:

$$H_6: \beta_6 > 0 \text{ vs. } \beta_6 \leq 0$$

Estimation

As preliminary steps to our regression analysis, the Augmented Dickey-Fuller (ADF) test (see Table 1) and the Johansen's co-integration test are used to check for the presence of unit root and cointegration relationships among the variables. Although the ADF test confirms the presence of a unit root and non-stationarity among our variables, results from the cointegration test indicate the presence of two co-integrating vectors. The λ-max tests for the first and second eigenvalues have p values of 0.0177 and 0.0340, respectively. This implies that there is a long-run relationship among the variables in our demand model (Ericsson and Irons, 1994), and that the errors passed the ADF test.

To assess the robustness of the estimated relationship, we performed a Chow test using the midpoint of the sample (1987) as the breakpoint. No significant difference was detected (p = 0.231). A Doornik-Hansen test detected no reason to believe that the residuals were not normal ($\chi^2 = 1.638$, p = 0.441). There was evidence of multicollinearity among the regressors; only MED had a VIF less than 10, the others were greater than 40. Nonetheless, the only regressor which when omitted made a noteworthy change in the coefficients was ADR, the omission of which caused the sign of the coefficient on POI to become negative.

ANALYSIS AND RESULTS

The regression results for the household healthcare expenditure in Singapore are shown in Table 2. The estimated coefficients provide us with the elasticity of household healthcare expenditure with respect to each explanatory variable, which is the percentage change in the household healthcare expenditure as the result of a percentage change of a given independent variable.

The regression results from our log-linear demand model produce all the expected signs for the regressors as hypothesized in the previous section. However, not all the variables are significant at the 5 per cent level of significance. Hence, to verify that all the included regressors are necessary and relevant in explaining the household healthcare expenditure in Singapore, we conducted a Wald test and the result from this test provides support for the joint significance of all the explanatory variables in affecting the demand for healthcare in Singapore.

Table 2
Regression Results for Household Healthcare Expenditure

Independent variables	Estimated coefficients	Standard errors	T-statistics
Constant	-11.060	2.427	-4.557*
Health price index (HPI)	-0.296	0.047	-6.301*
Index for price of other goods and services (POI)	0.294	0.129	2.281*
Gross domestic product per capita (GDP)	0.057	0.098	0.582
Literacy rate (LIT)	1.650	0.737	2.240*
Aged dependency ratio (ADR)	1.283	0.260	4.928*
Medisave (MED) (dummy)	0.070	0.013	5.547*
Summary statistics:			
R-square = 0.992			
Sum of squared residuals = 0.032			
Durbin-Watson stat = 1.118			

* The t-statistics are significant at 5% level of significance.

The large but negative t-statistic associated with the health price index (HPI) implies that the price of healthcare is significant in explaining the change in healthcare expenditure. As the price of healthcare increases by 1 per cent, the healthcare expenditure of the household will fall by 0.30 per cent. Our log-linear model implies that the household demand for healthcare is irresponsive to the change in the price of healthcare and therefore inelastic with respect to the price. Our finding is generally consistent with several studies conducted in both developing nations and developed countries mentioned previously. The low price elasticity and a low estimated coefficient of between 0 and 1 for GDP per capita, our measure of income, suggest that healthcare is viewed as a form of necessity by the households in Singapore.

Once again, the t-statistic of the index for the price of other goods and services (POI) shows that it is highly significant. Similar to the result on HPI, an increase in the price of other goods and services by 1 per cent leads to a less than proportionate increase in the amount of healthcare expenditure by 0.29 per cent. The positive coefficient also implies that faced with budget constraints, households will need to make a choice that entails a trade-off between the consumption of healthcare and other substitute goods and services. The substitutes are other major competing household expenses such as transport and communication, recreation and education, and food and beverages. Our results are consistent with most of the previous findings.

We employ the literacy rate (LIT) as one of the socio-demographic factors in this model to capture the effects of a higher level of education on the demand for healthcare. The estimated coefficient for LIT is statistically significant and in general, a one per cent increase in LIT will lead to a more than proportionate increase in the amount of healthcare expenditure of about 1.65 per cent. Our results thus demonstrate a positive relationship between education and healthcare expenditures, which is consistent with several previous articles.

Next, we use the aged dependency ratio (ADR) to highlight the effects of a greying population on the demand for healthcare. Once again, the high t-statistic associated with the ADR indicates that it is significant in explaining the change in healthcare expenditures. Specifically, the latter will rise by 1.28 per cent as a result of a 1 per cent increase in ADR. This result emphasizes the

increasing importance of the elderly in influencing the household consumption for healthcare in Singapore. As far as age is concerned, our results are consistent with Grossman's (1972) general finding that exhibited a direct link between age and the demand for healthcare.

The dummy variable MED is used to test the importance of the Medisave scheme in influencing household healthcare expenditures. Medisave is a medical savings scheme linked to the retirement account introduced by the Singaporean government in 1984. The scheme helps individuals save a portion of their incomes for their future personal or immediate family's medical expenses (Ministry of Health, 2009). Our results indicate that MED has a very high t-statistic, suggesting that the introduction and changes to the Medisave policy in Singapore since 1984 have been effective in influencing healthcare expenditures in Singapore. The coefficient of 0.070 further indicates that it has a positive impact on household healthcare expenditures. This is indeed consistent with an earlier study that showed that, as compared to the general health insurance, the Medisave self-insurance scheme plays a stronger role in affecting household consumption of healthcare services (Goodman and Musgrave, 1992). With the extension of the Medisave to pay for the treatment of chronic diseases such as diabetes, hypertension, and stroke effective January 2007, we anticipate that there would be a further increase in the household consumption of healthcare goods and services.

The relationship between GDP per capita and the household healthcare expenditure is not significantly different than zero in our model. Based on these data, the 95% confidence interval for the income elasticity of demand for healthcare is from -0.143 to 0.257. However, we can say that it is less than unity ($p < 0.0001$). Thus, healthcare in Singapore has the characteristics of a necessity.

Finally, a high R^2 of 0.99 means that about 99 per cent of the variation in household healthcare expenditure can be explained by the explanatory variables used in this model.

CONCLUSIONS

This paper adds to the growing body of literature in the estimation of healthcare demand in Asia. The demand for healthcare in Singapore was found to be price inelastic. This is not surprising and is consistent with several previous studies of the demand for healthcare in other countries. It is noteworthy that prices of other goods had a positive effect on healthcare spending. This suggests that, taken together, the other goods (transportation, communication, recreation, education, and food and beverages) are a substitute for healthcare spending. We did not test the finding of Mocan, et al. (2004), that food is a complement of health care. We leave that as a direction for future research. On the other hand, the relationship between GDP per capita and the household healthcare expenditure is not significantly different than zero and it is between zero and one in our model. This finding implies that health care is a necessity, and is therefore not sensitive to income. Unlike neighbouring countries in the region such as the Philippines, Indonesia, and Thailand (Russo et al., 2003 for the Philippines; Russo et al., 1994 for Thailand; Russo et al., 1994 for Indonesia) that demonstrate income elasticities greater than one (implying that healthcare is a luxury good), Singapore shows a consumption pattern closely resembles that of advanced economies such as the United States and the United Kingdom.

The two most important factors in explaining the growth of Singapore's household healthcare spending are the literacy rate and the ageing of the population as measured by the aged-dependency ratio. Between 1970 and 2006, the literacy rate increased from 72.0% to 95.4%, and the regression shows that as the literacy rate increased, so did the spending on healthcare. It is apparent that purchasing healthcare services as an investment in health has a better rate of return for the well educated than for the poorly educated. As Singapore's population became better educated, it chose to make more investment in its health.

During the same period, the aged-dependency ratio increased from 5.8% to 11.8%, an increase of 104%. The aged-dependency ratio is found to have a positive effect on per capita healthcare spending, as well. The ADR reflects the aging of Singapore's population, and it is not surprising that this measure is associated with more healthcare spending. It is estimated that at least 25% of Singaporeans will be aged 60 or above by year 2030 (Ministry of Health, 1999). The elderly are more likely to have chronic diseases such as diabetes, heart disease, hypertension, and stroke, which are more expensive to treat. Per-capita real GDP and the price of healthcare experienced larger changes, but the elasticities show that the willingness to spend on healthcare is much more sensitive to changes in the aged-dependency ratio and the literacy rate than to changes in the price of health care or per-capita real GDP.

Since medical care is a time-intensive good, the time price of medical care, which includes travel time and waiting time, is important and should be included to give the full price of medical care. And since most families in Singapore are dual-income households, their opportunity costs of seeking medical care for themselves or taking their sick children to a physician are relatively high. However, due to data constraints, we did not include the time price in our model. This variable should be incorporated into future research.

Our estimates show that Medisave increased annual real per-capita healthcare spending by seven per cent. This suggests that the mandatory savings program did not simply replace voluntary private saving that would have occurred anyway in the absence of Medisave. Compared to the role of private health insurance, the Medisave program is more significant in affecting the consumption patterns of health care services (Cheong, 2004; Goodman and Musgrave, 1992) and is thus more effective in increasing the public's access to healthcare. In 1999, Medisave accounted for partial financing of hospital bills for 87% of total hospitalized patients (Chia, 2002). The Medisave approach to the financing of healthcare in Singapore is predominantly based on individual responsibility. Personal incomes and family savings accounted for more than half of healthcare financing in Singapore (Reisman, 2006). Chan et al. (2005) estimated that more than 70 per cent of the older adults in Singapore rely on private transfers to finance their healthcare expenses. Although the reliance on individual incomes for healthcare expenses is effective in curbing excessive demand for healthcare, one concern is whether these incomes are sufficient to sustain the healthcare expenditure for the elderly when they retire. Given a positive relationship between income and the amount of mandatory Medisave savings, retired elderly will face a stagnation of Medisave balances, which may be wiped out with a catastrophic illness. To mitigate this risk, Medisave account holders have the option of purchasing Medishield health insurance, which covers 80% of deductibles for approved hospital expenses. The security provided by Medisave does not necessarily guarantee that every person is able to meet his or her medical costs. The Singapore government has opted to establish an endowment fund known

as "Medifund" to waive the fees for those with such a deficiency. Other policies that could help to meet the needs of elderly Singaporeans who have depleted their Medisave funds include providing regular subsidies for the elderly, improving access to catastrophic-care insurance, and encouraging enterprises to hire retired workers to ensure the continuous flows of their incomes should be in place.

Limitations

Our time series data present a macroeconomic perspective on Singaporeans' willingness to spend on healthcare. They tell us how changes in the GDP or relative prices affect spending in the aggregate. A cross-sectional study of Singaporean households at a point in time would give another useful perspective. This would be especially valuable when investigating the income effects. In our study, we were hampered by the kinds of data that were available. For example, we were unable to define spending on healthcare, but had to rely on the official measure which includes contributions to Medisave and to health insurance plans. To assess a longer effect of education on spending, we used the literacy rate as a proxy for the level of education. Although Singapore publishes statistics about the number of people enrolled in various levels of education, the data did not go back as far as the literacy rate. Future research might be able to include these data and thereby capture the education effect better. Similarly, we only used a dummy variable to capture the effect of the existence of Medisave as an institution. Future research might be able to assess the importance of the amount of savings in Medisave accounts. An interesting related question, which we did not include in our model, is the extent to which Medisave has replaced private insurance.

Discussion

Healthcare spending by residents of Singapore is not the only source of demand for healthcare services in Singapore. In 2007, when the island nation spent S$7 billion on its healthcare, Singapore earned about S$1.5 billion (US$1 billion) from approximately 350,000 foreign patients who also sought medical care in Singapore. Singapore's goal is to triple the number of medical tourists who use its healthcare facilities by the year 2012 (Hospitals.sg, 2009). It is likely that this influx will raise healthcare prices in Singapore, and our regression shows that Singaporeans' spending on healthcare is sensitive to these prices. A 10% increase in healthcare prices would lead to a 3% reduction in Singaporeans' real healthcare spending. The extent to which healthcare prices rise will depend on the supply response, which we did not estimate. If there are unexploited economies of scale in healthcare services, it is even possible that healthcare prices would fall. This would be another interesting direction for further research.

As Singaporeans continue to age rapidly, more bold and innovative policy reforms as well as financing options of healthcare will be among the top priorities on the healthcare reform agenda. The supply-side options can include better use of technology, better information sharing on diagnosis, treatment options, and even outsourcing to neighbouring countries like Thailand and Malaysia. The demand for healthcare will drive the development of private health insurance, financing options that target the long term healthcare needs for the elderly, and more flexible government options such as extending the use of Medisave to cover elective hospitalisations and day surgeries outside Singapore, and the financing of stays at nursing homes, as currently considered by the Singaporean government.

References

Akin, J. S., Griffin, C. C., Guilkey, D. K. and Popkin, B. M. (1986), The Demand for Primary Health Care Services in the Bicol Region of the Philippines, Economic Development and Cultural Change, 34(4), pp. 755–782.

Arber, S. (2004), Gender, Marital Status, and Ageing: Linking Material, Health, and Social Resources, Journal of Aging Studies, 18(1), pp. 91–108.

Arendt, J. N. (2002), Education Effects on Health: A Panel Data Analysis using School Reform for Identification, Doctoral Dissertation, University of Copenhagen, Copenhagen, Denmark.

Arkes, J. (2001), Does Schooling Improve Adult Health? RAND Working Paper No. 3051.

Barr, M. D. (2001), Medical Savings Accounts in Singapore: A Critical Inquiry. Journal of Health Politics, Policy and Law 26(4): 709–726.

Benzeval, M., Judge, K. and Shouls, S. (2001), Understanding the Relationship between Income and Health: How Much Can be Gleaned from Cross-sectional Data? Social Policy and Administration, 35(4), pp. 376–396.

Boccuti, C. and Moon, M. (2003), Comparing Medicare and Insurers: Growth Rates in Spending over three Decades, Health Affairs, 22(2), pp. 230–237.

Chan, A. (2005), Aging in Southeast and East Asia: Issues and Policy Directions, Journal of Cross-Cultural Gerontology, 20(4), pp. 269–284.

Chernichovsky, D. and Meesook, O. (1986), Utilization of Health Services in Indonesia, Social Science and Medicine, 23(6), pp. 611-620.

Cheong, N. F. L. (2004), Medical Savings Accounts in Singapore: The Impact of Medisave and Income on Health Care Expenditure, on website http://www-econ.stanford.edu/academics/Honors_Theses/Theses_2004/Cheong.pdf, accessed on November 30, 2006.

Chia, N. C. (2002), Health for all, In: Tee, K. A., Lian, L. K., Tat, H. W., Rao, B., and Mng, C. M. (eds.), Singapore Economy in the 21st Century, McGraw-Hill, Singapore, pp. 164–87.

Chong, M. P., Tan, P. S. L. and Wong, P. S. (2001), Rising Cost of Medical Care in Singapore, Final Year Project, Nanyang Technological University.

Cutler, D. and Meara, E. (1998), The Medical Costs of the Young and the Old: A Forty Year Perspective'. In Wise, D. (eds.). Frontiers in Aging. Chicago: University of Chicago Press.

Cutler, D. and Meara, E. (1999), The Concentration of Medical Spending: An Update, National Bureau of National Research Working Paper No. 7279.

Dawson, D., Jacobs, R., Martin, S. and Smith, P. (2006), The Impact of Patient Choice and Waiting Time on the Demand of Health Care: Results from the London Patient Choice Project, Applied Economics, 38(12), pp. 1363–1370.

Deb, P. and Trivedi, K. P. (2002), The Structure of Demand for Health Care: Latent Class versus Two-part Models, Journal of Health Economics, 21(4), pp. 601–625.

De Bethune, X., Alfani, S. and Lahaye, J. P. (1989), The Influence of an Abrupt Price Increase on Health Service Utilization: Evidence from Zaire, Health Policy and Planning, 4(1), pp. 76–81.

Department of Statistics, Singapore, Yearbook of Statistics, 1970–2007.

Department of Statistics, Singapore (2009), 'Statistics: Key Annual Indicators, on website http://www.singstat.gov.sg/stats/keyind.html#popnarea, accessed on March 22, 2009.

Di Matteo, L. and Di Matteo, R. (1998), Evidence on the Determinants of Canadian Provincial Government Health Expenditures: 1965–1991, Journal of Health Economics, 17(2), pp. 211–228.

Ellis, R. and Mwabu, G. (1991), The Demand for Outpatient Medical Care in Rural Kenya, The Institute of Economic Working Papers Series No. 140.

Elo, I. T. and Preston, S. H. (1992), Effects of Early-life Conditions on Adult Mortality: A Review, Population Index, 58(2), pp. 186–212.

Ericsson, N. R. and Irons, J. S. (1994), 'Testing Exogeneity, Advanced Texts in Econometrics, New York: Oxford University Press.

Feldstein, J. P. (1966), Research on the Demand for Health Services, The Milbank Memorial Fund Quarterly, 44(3), pp. 128–165.

Fuchs, R. V. (2004), Reflections on the Socio-economic Correlates of Health, Journal of Health Economics, 23(4), pp. 653–661.

Gerdtham, U. G. (1997), Equity in Health Care Utilization: Further Tests based on Hurdle Models and Swedish Micro Data, Health Economics, 6(3), pp. 303–319.

Gertler, P., Locay, L. and Sanderson, W. (1987), Are User Fees Regressive? The Welfare Implications of Health Care Financing Proposals in Peru, Journal of Econometrics, 36(1-2), pp. 67–88.

Gertler, P. and van der Gaag, J. (1990), The Willingness to Pay for Medical Care: Evidence from Two Developing Countries, Baltimore: The Johns Hopkins University Press.

Goddard, J. A., Malek, M. and Tavakoli, M. (1994), An Economic Model of the Market for Hospital Treatment of Non-urgent Conditions, Health Economics, 4(1), pp. 41–56.

Goodman, J. C. and Musgrave, G. L. (1992), Controlling Health Care Costs with Medical Savings Accounts, National Center for Policy Analysis Study No. 168.

Grossman, M. (1972), "On the Concept of Health Capital and the Demand for Health", Journal of Political Economy, 80(2), pp. 223–255.

Grossman, M. (2003), Education and Nonmarket Outcomes, In: Hanushek, E., & Welch, F. (eds.), Handbook of the Economics of Education. North-Holland, Elsevier Science, Amsterdam.

Grossman, M. and Kaestner, R. (1997), Effects of Education on Health, In: Behrman, J. R., Stacey, N. (eds.), The Social Benefits of Education, University of Michigan Press, Ann Arbor, MI, pp. 69–123.

Hayward, M., Miles, P. T., Crimmins, M. E. and Yang, Y. (2000), The Significance of Socioeconomic Status in Explaining the Racial Gap in Chronic Health Condition, American Sociological Review, 65(6), pp. 910–930.

Heller, P. S. (1982), A Model of the Demand for Medical and Health Services in Peninsular Malaysia, Social Science and Medicine, 16(3), pp. 267–284.

Hitiris, T. and Posnett, J. (1992), The Determinants and Effects of Health Expenditure in Developed Countries, Journal of Health Economics, 11(2), pp. 173–181.

Hospitals, S. G. (2009), Singapore's Medical Tourism Figures Revealed by Health Minister, Available on website http://www.hospitals.sg/singapore-medical-tourism-figures, accessed on April 4, 2009.

Hunt-McCool, J., Kiker, B. F. and Ng, Y. C. (1994), Estimates of the Demand for Medical Care under Different Functional Forms, Journal of Applied Econometrics, 9(2), pp. 201–218.

Kawachi, I., Colditz, G. A., Speizer, F. E., Manson, J. E., Stampfer, M. J., Willet, W. C. and Hennekens, C. H. (1997), A Prospective Study of Passive Smoking and Coronary Heart Disease in Women, Circulation, 95, pp. 2374–2379.

Ichoku, E. and Leibbrandt, M. (2003), The Demand for Healthcare Services in Nigeria: A Multivariate Nested Logit Model, African Development Bank, 15(2-3), pp. 396–424.

Lleras-Muney, A. (2002), The Relationship between Education and Adult Mortality in the United States, National Bureau of Economic Research Working Paper No. 8986.

Mangalore, R. (2006), Income, Health and Health Care Utilization in the UK, Applied Economics, 38(6), pp. 605–617.

Manning, W. G., Newhouse, J. P., Duan, N., Keeler, E. B., Leibowitz, A. and Marquis, M. S. (1987), Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment, American Economic Review, 77(3), pp. 251–277.

Massaro, T. A. and Wong, Y. N. (1996), Medical Savings Accounts: The Singapore Experience, National Center for Policy Analysis Policy Report No. 203.

Ministry of Health, Singapore (1999), Inter-ministerial Committee on Health Care for the Elderly, Report of the Inter-Ministerial Committee on Health Care for the Elderly.

Ministry of Health, Singapore (2009), Introduction to Medisave, on website http://www.moh.gov.sg/mohcorp/hcfinancing.aspx?id=304, accessed on March 22, 2009.

Mocan, H. N., Tekin, E. and Zax, J. S. (2004), The Demand for Medical Care in Urban China, World Development, 32(2), pp. 289–304.

Newhouse, J. P. (1977), Medical Care Expenditure: A Cross-national Survey, Journal of Human Resources, 12(1), pp. 115–125.

Parkin, D., McGuire, A. and Yule, B. (1987), Annual Total Health Care Expenditures and National Income: Is Health a Luxury Good? Journal of Health Economics, 6(2), pp. 109–127.

Reinhardt, E. U. (2003), Does the Aging of the Population Really Drive the Demand of Health Care? Health Affairs, 22(6), pp. 27–39.

Reisman, David (2006), Payment for Health in Singapore, International Journal of Social Economics, 33(2), pp. 132–59.

Rosett, R. N., Huang, L. F. (1973), The Effect of Health Insurance on the Demand for Medical Care, Journal of Political Economy, 81(2), pp. 281–305.

Russo, G., Racelis, R., and Mason, A. (2003), Baseline Estimates of Health Care Expenditures of Older Persons: Philippines, 1994, East West Center, 28 November 2003.

Russo, G., Lekprichakul T., and Phananiramai, M. (1994), Household Expenditures for Health Care in Thailand: Estimates from the 1988 Socioeconomic Survey (SES), East West Center, Program on Population, August 1994.

Russo, G., Ogawa, N., Dr. Wandaningsih, and Sardjunani N. (1994), Household Expenditures for Health Care in Indonesia: Estimates from the 1987 Socioeconomic Survey (SUSENAS), Report prepared for the Asian Development Bank, East West Center, Program on Population, August 1994.

Sauerborn, R., Nougtara, A. and Latimer, E. (1994), The Elasticity of Demand for Health Care in Burkina Faso: Differences Across Age and Income Groups, Health Policy and Planning, 9(2), pp. 186–192.

Spasojevic, J. (2003), Effects of Education on Adult Health in Sweden: Results from a Natural Experiment, Doctoral Dissertation, City University of New York Graduate Center, New York.

Strunk, B.C. and Ginsburg, P. B. (2002), Aging Plays Limited Role in Health Care Cost Trends, Washington: Center for Studying Health System Change. Data Bulletin 23, pp. 1–2.

Tan, T. M. and Chew, S. B. (1997), Affordable Health Care: Issues and Prospects, Singapore: Prentice Hall.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2005), 'Education for all: Global monitoring report, on website http://portal.unesco.org/education/en/ev.php-URL_ID=43140&URL_DO=DO_TOPIC&URL_SECTION=201.html, accessed on March 26, 2007.

Van Doorslaer, E., Wagstaff, A. and Rutten, F. (eds) (1993), Equity in the Finance and Delivery of Health Care: An International Perspective, Oxford: Oxford University Press.

Wedig, G. J. (1988), Health Status and the Demand for Health: Results on Price Elasticties, Journal of Health Economics, 7(2), pp. 151–163.

World Health Organization (2007), World Health Statistics 2007, on website http://www.who.int/whosis/whostat2007.pdf, accessed on October 21, 2007.

Windmeijer, F. A. G. and Silva, S. (1996), Estimation of Count Data Models with Endogenous Regressors: An Application to Demand for Health Care, Technische Universitat Monchen, Discussion Paper No. 20.

Wong, Y.W., Balasooriya, U. and Tan, K. C. (2005), A Note on the Future Population of Singapore Residents, The Singapore Economic Review, 50(2), pp. 269–280.

Yoder, R. (1989), Are People Willing and Able to Pay for Health Services? Social Science and Medicine, 29(1), pp. 35–42.