Neuroeconomics of health care financing options: willingness to pay and save

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KEY MESSAGES

1. Voluntary health care insurance plans and savings schemes are potential means of reforming the health care financing structure.
2. Willingness-to-pay and willingness-to-save are notions which may be explored by behavioural theories.
3. Willingness-to-pay may be higher in low-risk insurance plans and lower in high-risk plans.
4. Willingness-to-save may not necessarily be lower in longer saving plans but may be lower in high-amount saving plans.
5. Neuroeconomics revealed that the Prospect eory may explain the skewing in willingness-to-pay, whereas the Hyperbolic Discounting eory may explain factors determining willingness-to-save partially.

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Introduction

In Hong Kong, the health care financing structure consists of a publicly funded service (for in-patient care, complex, and referred cases) and a privately funded service (for family medicine and a smaller proportion of hospital care). is financing structure may not be sustainable in the future if the provision of funding is purely from public funds, owing to the ageing population and the rising cost of new diagnostic methods, treatment and drugs. Health care insurance plans and savings schemes have been explored by the Government in terms of willingness-to-pay in health care insurance plans and willingness-to-save in savings schemes by means of behavioural theories.[1-3] e Prospect eory states that willingness-to-pay may not be linear across di erent options of risk and probability. Some options of gain may be preferred over others even if they are mathematically the same. e Hyperbolic Discounting eory states that the notion of deferred gain may be considered with less importance compared with an immediate gain. erefore, in two options with the same statistical risk, the one with a closer time-point of gain may be chosen over the other. ese theories can be translated into the setting of health care financing.

We used neuroeconomics (scans of the brain during thoughtful processes to register areas of activation) to explore willingness-to-pay in insurance plans and willingness-to-save in savings schemes and whether the two behavioural theories could explain these economic phenomena. Activation of brain areas in a distributed network of the frontal cortex may correspond to the perceived 'risk centres' or 'emotional centres' of the brain.[4,5] By eliciting activations in a neuroeconomic study the validity of behavioural theories can be verified.

Methods

is study was conducted from May 2009 to August 2010. e first part was a field survey using an online health care financing questionnaire. e second and third parts were neuroeconomic studies of four health care insurance plans and four health care savings schemes. Scanning using magnetic resonance imaging (MRI) enabled visualisation of brain functions and identification of 'risk centres' or 'emotional centres', which may help understand whether the behavioural theories were at work. e first, second, and third parts of the study recruited 208, 21, and 21 participants, respectively.

Referring to the four insurance plans, package 1 covered rare but important illnesses (1/500 chance, with a treatment cost of HK$5000/year); package 2 covered treatable common illnesses (1/60 chance, with a treatment cost of HK$6000/year); package 3 was a disaster plan (1/600 chance, with a treatment cost of HK$120 000/year); and package 4 covered categorical chronic illnesses (1/50 chance, with a treatment cost of HK$150 000/year).

Referring to the four savings schemes, package 5 involved expected dependency and early saving.

e participant starts saving from the age of 25 to 65 years, and thereafter a dependency period of 10 years is assumed. e participant needs to save HK$5.29 million over 40 years. Package 6 involved less dependency and early saving. e participant starts saving from the age of 25 to 75 years, and thereafter a dependency period of only 5 years is assumed. e participant needs to save HK$3.37 million over 45 years. Package 7 involved expected dependency and late saving. e participant starts saving from the age of 45 to 65 years, and thereafter a dependency period of 10 years is assumed. e participant needs to save HK$1.99 million over 20 years. Package 8 involved less dependency and late saving. e participant starts saving from the age of 45 to 70 years, and thereafter a dependency period of 5 years is assumed. e participant saves HK$1.27 million over 25 years.

Results

For packages 1, 2, and 3, the anticipated amounts of money that people might pay were HK$10, HK$100, and HK$200, respectively. Yet the field survey found that people were willing to pay HK$43.4, HK$145.4, and HK$295, respectively (Fig). For package 4, the anticipated amount of money that people might pay was HK$3000, but participants were only willing to pay HK$2580. In the neuroeconomic study comparing the signalling of areas during thought processes for a low-value plan with that of a high-value plan, an area of activation in the lateral frontal region confirmed the same distributed network of 'risk centre' or 'emotional centre', which the Prospect eory predicted (Table 1).

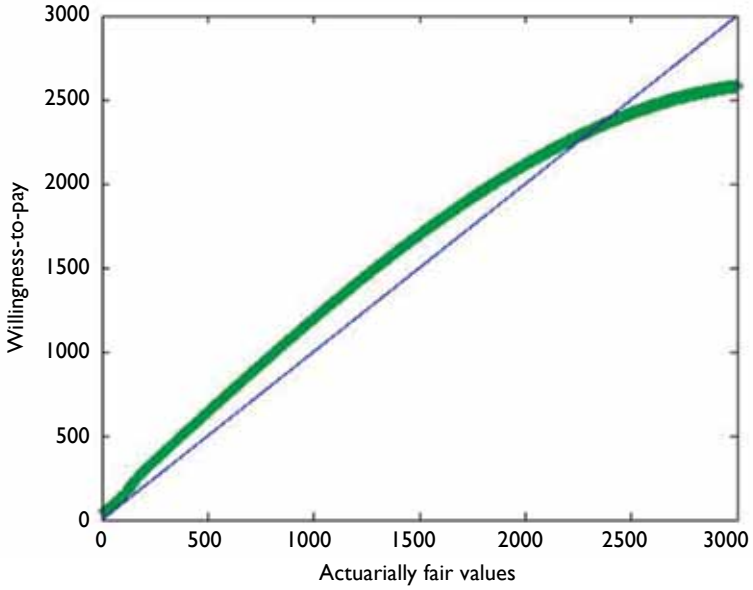
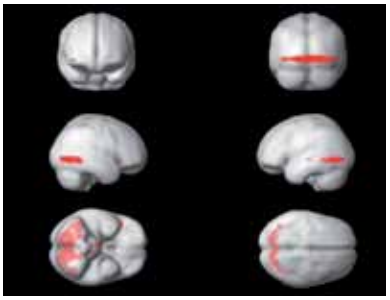


FIG. Plot of willingness-to-pay versus anticipated values

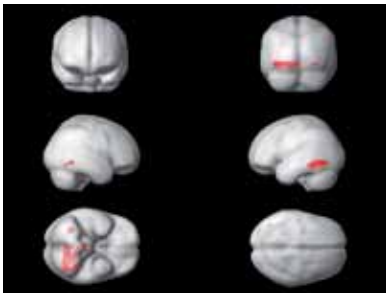
TABLE 1. Areas of activation (right inferior frontal region) in analysis of simulation of package 1 (low actuarially fair value) versus package 4 (high actuarially fair value)



Brain region	Brodmann's area	Coordinates			Z score (2-sample *t*-test)
		x	y	z	
Right frontal lobe	47	50	17	-4	3.62*
Left occipital lobe	19	-25	-88	8	4.51
Right occipital lobe	18	27	-90	10	4.68

* P<0.05 corrected, all other regions are P<0.001 uncorrected

TABLE 2. Areas of activation (left posterior temporal region and left pre-frontal region) in analysis of simulation of package 6 (low actuarially fair value) versus package 7 (high actuarially fair value)



Brain region	Brodmann's area	Coordinates			Z score (2-sample *t*-test)
		x	y	z	
Right occipital lobe	17	45	-66	-3	4.17
Left occipital lobe	18	-32	-93	-8	4.01
Left posterior temporal region	21	-63	-53	4	3.25*
Left prefrontal region	45	-56	27	1	3.02*

* P<0.05 corrected, all other regions are P<0.001 uncorrected

For packages 5 and 7, the premiums that people were expected to save were HK$1564 and HK$3132, respectively. However, the field survey found that people were only willing to save for premiums of HK$1243 and HK$2344, respectively. For packages 6 and 8, people were expected to save with premiums of HK$695 and HK$1251. Yet the participants were willing to save with HK$836 and HK$1493, respectively. In the neuroeconomic study comparing the signalling of areas during thought processes for a low-saving-amount scheme with that of a high-saving-amount scheme, an area of activation in the frontal region also pointed towards the same distributed network of 'risk centre' or 'emotional centre' (Table 2). However, when we compared the signalling during thought processes for paradigm of short-saving durations versus long-saving durations, no significant activation was found. is suggested that the Hyperbolic Discounting eory does not explain our phenomena in its entirety, at least not with our neuroeconomic analysis.

Discussion

e synthesis of di erent insurance packages can produce a skewing e ect for willingness-to-pay. is is called adverse selection, in which only people at risk are willing to insure. Providing insurance plans may 'activate' their risk or emotional centres, an e ect which might potentially o set this phenomenon can be potentially achieved. From a more realistic point of view, packages such as those for chronic illness might also require subsidy.

As regards to saving schemes, there were some opposing forces between the monetary value and the duration of the saving scheme. e longer-duration plans were not necessarily undervalued, and participants may still be inclined to take out such schemes. However, the lack of risk or emotional centres activation when comparing the longer- with the shorter-duration schemes did not support the hyperbolic discounting e ect in its entirety. Instead, the same e ect when comparing the monetary values of the saving amounts indicated that the saving value per se can trigger the emotional centre.

e results of this project are referenced from a behavioural economist's point of view, and should always be interpreted together with actuarial studies of health care projects.

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