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Mennyit ér monetáris értékekkel kifejezve Covid-19 vakcinával beoltottnak lenni Magyarországon? A Covid-19 elleni oltottság monetáris értékének szubjektív jólét módszerrel történő meghatározása.

How much does Covid-19 vaccination worth in monetary value? The well-being valuation approach of being vaccinated against Covid-19 in Hungary.

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Introduction:

In this thesis, at first, I would like to examine how does the satisfaction with life of the individuals changes if the income and vaccination status changes. After running a regression, I will calculate the monetary value of getting a Covid19 vaccine in Hungary, using the wellbeing valuation method, and a monetary value equation. After calculating the monetary value of getting vaccinated in the country, I will also check the regions of Hungary, in terms of vaccination rates, average satisfaction with life, and monetary value of vaccination.

In my opinion, dealing with this issue is important in 2022, because the Covid19 pandemic changed our life drastically in the past two years. Healthcare professionals and policy makers implemented several measures to tackle the pandemic, and the losses it causes. Providing vaccinations against it might meant the biggest breakthrough in this process. With the help of vaccinations, herd-immunity can be achieved, and the further spread of the virus might be stopped. Vaccinations against Covid19 therefore can be and are considered important. The information about the price of a vaccine is available, but so far, we had limited knowledge on how much is it worth, to be vaccinated against the virus for the individuals. It is for this reason, that in this thesis I will calculate the monetary value of getting vaccinated against Covid19 in Hungary.

To make the calculation, in recent economic literature, authors implemented several methods, with which it is possible to calculate monetary values to non-market goods, by the examination of individuals preferences, willingness to pay, or life-satisfaction. In this thesis I intend to introduce three of these methods, the revealed preference approach, the contingent valuation approach and the well-being valuation method. With the help of the last, wellbeing valuation method, I will perform a regression on a large cross-sectional database consisting of 2000 cases, using the help of the Satisfaction with life scale, income and vaccination status variables. Having done the regression, I intend to calculate the monetary value of getting a Covid19 vaccination in Hungary using the regression coefficients, and an equation, both in the country and in each region. The method which I used will be introduced further in the following paragraphs.

Background:

The outbreak of Covid19 pandemic changed our life various ways and resulted the spread of many health promoting policies and guidelines. Keeping a social distance, quarantine, hand disinfection, obligatory mask wearing and providing vaccines against the virus were the most common measures, governments introduced to tackle the pandemic situation. The World Health Organisation declared the severe acute respiratory syndrome coronavirus 2 outbreak a pandemic on 11 March 2020 and developing vaccines against it became a major undertaking in fighting the disease. By December 2020, many candidate vaccines against the virus have been shown to be effective and safe at generating immune response. (Loomba, de Figueiredo, J. Piatek, de Graaf, & J. Larson, 2021) In the same month, the first vaccine was given in to an individual in Hungary, resulting the start of the vaccination campaign.

In the recent economics literature, several methods were developed, with which it became possible, to calculate monetary value to non-market goods. Although these methods can be considered widely known and acknowledged, there are researchers, that view the process, in which monetary values are assigned to health conditions unethical and controversial. In their point of view, evaluating based on the individual's willingness to pay contradicts with the health care system's central aim, to provide health care to all citizen regardless their ability to pay. (van den Berg & Powdthavee, 2011) Despite this argument, the method with which non-market health care related goods are valued, still considered important, when it comes to decision-making. As some researchers point out, measuring the costs of health interventions like vaccines can be done using the established methods but measuring the benefits of them present a great challenge. The costs of an illness, or the benefits after recovering from it, are of diverse nature. As Ada Ferrer-i-Carbonell and Bernard M.S. van Praag mentioned in their study, when talking about benefits, the costs of an illness or a treatment are also important. There are economic costs, like medical care, informal care and income losses, and intangible cost, the monetary countervalue of the loss of health per se. (Ferrer-i-Carbonell & M.S. van Praag, 2002) To calculate the intangible cost of a health condition, health intervention, or any non-market goods, different measures were created in many recent health policy writings. In the next chapter, will introduce three of the most widely used method to value non-market goods, the revealed preference approach, the contingent valuation approach and finally the wellbeing valuation method. I will also draw attention to additional differences between them, together with the arguments of why to use one over another.

Methods to calculate monetary value of non-market goods:

Revealed preference approach:

One of the most used approaches is the revealed preference approach. This approach uses people's revealed preferences and behaviours in the market to derive values for different health conditions. For example, analyzing health risks people are willing to take in exchange for higher wages is a revealed preference approach. The method is used in economic literature to draw statistical inferences on values from choices individuals make within markets. This method is often used in studies discussing travel costs, hedonics and defensive behaviors and damage costs. Examination of damage cost is also important in case of the health care, researchers use this approach to value the health effects of pollution, in which case the damage it causes is illness. Researchers differentiate two types of this method, the revealed preference approach and the stated preference method. The difference between them is the data they use for the estimation. Moreover, taking a conceptual perspective, the method of stated preference provide estimates of Hicksian surplus, while revealed preference estimates the Marshallian surplus. (Boyle, 2003) The limitation of this approach is that representative data can be difficult to collect, and the method does not allow generalization across different cases of health conditions. (van den Berg & Powdthavee, 2011) It is for this reason, that in this study I used a different method.

Contingent valuation method:

In health economics, this valuation elicits the monetary valuation of health programs and health states of individuals. The questions of the method are framed to ask individuals the willingness to pay to obtain positive changes in health status, or to ask how much they would need to be paid to compensate for the decrease in their health status. These questions can be targeted to the general population to value health insurance premiums or individuals with a disease. (Bayoumi, 2012) The Contingent valuation method is hypothetical, direct, based on a survey and used to elicit monetary valuations of effects of health technologies and conditions. This method can be viewed as the alternative of the pervious approach, because it allows generalization across different cases of health conditions, by asking individuals to state their willingness to purchase medicines, treatments on a price, directly. (van den Berg & Powdthavee, 2011) This method, similarly, to the previous one, also has some biases. These biases can occur in the way in which participants of the study are selected, the questions are

posed, the missing responses are interpreted or the way respondents value losses. (Bayoumi, 2012) Powdthavee and van der Berg highlighted in their study, that there is a great difference between willingness to pay and willingness to accept a value, when it comes to contingent valuation method. The ratio of the two indicators can vary from 2.5 to 2.9 (Brown, 2005), resulting skepticism on the validity of contingent valuation method responses. (van den Berg & Powdthavee, 2011) The method also have cognitive biases, like the endowment effect, focusing effect and the loss aversion. (Kahneman & Tversky, 1979). Other than health care, this approach is widely used in environmental economics, to value estimates of environmental goods. (Carson & Hanemann, 2005)

Wellbeing valuation method:

Last but not least, I would like to introduce the wellbeing valuation approach. The wellbeing valuation approach is a new method to determine the monetary value of health conditions. This new area of Happiness Economics is based on the people's Subjective Wellbeing (SWB), rather than their preferences (Water, et al., 2018). In the studies made with this approach, subjective wellbeing (SWB) and the Satisfaction with life Scale (SWLS) have increasingly been used as a proxy for welfare. (Fujiwara, A General Method for Valuing Non-Market Goods Using Wellbeing Data: Three-Stage Wellbeing Valuation, 2013) In order to calculate the monetary value, researchers need to conduct a study on a randomly selected representative sample, where the respondents were asked to rate experiences like well-being, moment-to moment happiness and life-satisfaction. Then using a linear regression where the well-being, life-satisfaction variable depends on the income and health-status of the respondents, it is possible to determine the implied price of health conditions, the additional amount of money, income needed to be given to the individual to compensate for the well-being losses caused by suffering from a health-condition. With the help of this approach, the different health losses can be studied empirically. When income is also included in the regression, controlled with other personal characteristics, providing a positive and statistically significant coefficient, it is possible to estimate the trade-offs between the income and health conditions, by estimating the change in income needed to offset a given health loss. (van den Berg & Powdthavee, 2011)

The reason why I have chosen the well-being valuation method in this thesis, is because it has a growing acceptance in the economic literature, and it can be used to calculate monetary values for many occurrences in life with no obvious market value. Valuing goods with wellbeing approach moreover does not rely on people stated or revealed preference, and provides

important evidence, suggesting that the preferences of the people are not always consistent, well informed, therefore relying in preferences can be difficult. (Fujiwara, A General Method for Valuing Non-Market Goods Using Wellbeing Data: Three-Stage Wellbeing Valuation, 2013) Researchers used this method to calculate the monetary value of crime (Moore & Shepherd, 2006), culture and sport (Fujiwara, Kudrna, & Dolan, 2014), trust in government (Suriyanrattakorn & Chia-Lin, 2021), chronic diseases (Ferrer-i-Carbonell & M.S. van Praag, 2002) and health behaviours (Shi, Joyce, Orpana, & Bancej, 2019). Later in the conclusions, I will compare my results of the monetary value of a Covid19 vaccination with the results of Shi and Water et al, who studied the value of physical activity and smoke-free life.

Methods:

Data collection:

I used the data of a large-scale cross-sectional survey, but I did not participate in the data collection. The large-scale cross-sectional survey was carried out between May 25th – June 08th 2021. Panel data of a professional survey company was used for online self-completed data collection, until the broad representativeness regarding age, gender, educational level, geographical region and place of living of the Hungarian general population was reached. The number of cases in the database is 2000. Inclusion criteria for the study were being aged ≥ 18 years and providing informed consent. Permission for conducting the study was granted by the Research Ethics Committee of Corvinus University Budapest. The reference number is KRH/109/2021). The database included data of the individual's subjective wellbeing, life satisfaction score, household income, education, vaccination status, residence and employment, all of which were included in the well-being regression model.

Well-being valuation approach and calculation of monetary value:

To calculate the monetary value of getting vaccinated against Covid19, I used the well-being valuation approach. This approach according to Yipu Shi, is used to value the impact of health behaviours on subjective well-being. In this paper, I am going to consider receiving a Covid19 vaccine as health behaviour and will use the cited calculation. According to the authors, this approach assumes that individual life-satisfaction is a linear function of the natural logarithm of household income, health related behaviours and other individual characteristics, therefore

the effects of these variables on life-satisfaction can be estimated using an ordinary least squares regression model, based on the following equation:

$$LS_i = \alpha + \beta_1 M_i + \beta_2 H_i + \beta_3 X_i + \varepsilon_i.$$

In the equation, the β coefficient represents the proportional association of the healthy behaviours, logarithm of the household income and other variables with life-satisfaction and ε is the measure of error. In order to calculate the life-satisfaction regression, the natural logarithm of the household income is needed, a scale variable.

Transformation of income variable:

In my database, as I will share it more detailed in the following page, household income was a categorical variable. It is for this reason, that I needed to take the midpoints of each category and transform the categorial variable into a scale. The variable “household income” in the database consisted of 20 levels between 50.000 Ft and 3.000.000 Ft or more. Taking the midpoints in each category was quite an easy job, except for the last, open-ended category, which was between 3.000.000 and more. Following the guideline of Celeste and Bastos, midpoints can be calculated even in open ended categories. The authors used the method of Parker & Fenwick, based on Pareto’s law on income distribution: “The logarithm of the percentage of units with an income in excess of some value is a negatively sloped linear function of the logarithm of that value” (Celeste & Bastos, 2013). Based on the law, the mean income for the top-coded category is $X(v/v-1)$ and the median income is $10^{(0.301/v)*X}$. X is the lower value of the open-ended category and the value of “ v ” can be calculated in the following way: $v=c-d/b-a$. “ a ” is the logarithm of the lower-limit of the interval preceding the open-ended category, “ b ” is the logarithm of lower-limit in the open-ended category, the value of “ c ” is the logarithm of the sum of the frequencies in the open-ended category and in the category preceding it, and “ d ” is the logarithm of the frequencies in the open-ended category (Celeste & Bastos, 2013). Using the method, I calculated the value (household income is 3.000.000 or more) and got 4.097.025,9 as midpoint for the open-ended category, and was able to transform the categorical variable into a scale.

Having calculated the regression with the new log income variable, I got the two regression coefficients necessary to calculate the monetary value. If the estimated coefficients for β_1 (income) and β_2 (vaccination) is positive, it is possible to calculate the equivalence between income and health behaviours by estimating the amount of increase in income required to counterbalance the absence of vaccination in order to keep life-satisfaction constant. According to Yipu Shi, the monetary value of any health behaviour can be calculated using the following equation:

$$\text{Monetary value} = M0 - e^{[\ln(M0) - (\beta_2/\beta_1)]}$$

In the equation, $M0$ is the average annual household income, β_1 is the effect of income in life-satisfaction, and β_2 is the effect of health behaviour on life-satisfaction, the coefficients are taken from the regression. (Shi, Joyce, Orpana, & Bancej, 2019)

Hypothesis and research question:

My first hypothesis, which I would like to test using the previously mentioned methods, is that those people, who received a Covid19 vaccination, have higher well-being scores, than those who did not received any vaccine. To test this hypothesis, I am going to make a regression, where the dependent variable is the SWLS score of the respondents, the independent variables are the vaccination status, logarithm of the income, sex and age of the respondents, and the control variables are the education level, residency, employment level of the individuals. I would also like to get the answer to my research question: How much does Covid-19 vaccination worth in monetary value?

Having mentioned the first hypothesis and research question, while I was checking the sample, I became interested in whether Hungarian regions differ in any way, in case of SWLS score or vaccination, because I remembered from my previous studies, that in the case of many index, geographical differences can be observed. I made a second hypothesis, saying that in the western part of Hungary, SWLS scores will be higher than in other regions in Hungary, because the standard of living, vaccination rates and incomes are higher there. In order to test this hypothesis and calculated the regression and the monetary value of a Covid19 vaccination in

each Hungarian region and prepared two coloured maps. To calculate the regression, monetary value, and later illustrate the variables on maps, I used IBM SPSS software, Microsoft Excel and QGIS software.

Results:

Characteristics of the sample:

The demographic characteristics of respondents can be observed from Table 1.

I. Table 1

Demographic characteristics of respondents		
	Vaccinated	Non-vaccinated
Variables	Mean (SD) or N (%)	Mean (SD) or N (%)
Number of participants	1347, 67,4%	653, 32,7%
Age (years)	51,55 years	43,8 years
Sex		
Female	793 (58,7%)	451 (69,06%)
Male	554 (41,3%)	202 (30,94%)
Education		
Primary	18,78%	27,87%
Secondary	39,13%	21,13%
Tertiary	42,09%	50,99%
Residence		
Capital	23,76%	16,54%
village	22,12%	28,48%
city	54,12%	54,98%
Employment		
Employed full-time	44,25%	49,62%
Employed part time	5,20%	8,88%
Retired	31,55%	13,02%
Disability pensioner	3,64%	2,91%
Unemployed	3,19%	7,50%
Student	2,67%	3,06%
Other	9,51%	15,00%
Infected by COVID-19: respondent	15,00%	25,73%

Not infected by COVID-19: respondent	85,00%	74,24%
Infected by COVID-19: household member(s)	14,63%	22,97%
Not infected by COVID-19: household member(s)	85,37%	77,03%
Infected by COVID 19: close family member	38,23%	40,43%
Not infected by COVID 19: close family member	61,77%	59,57%
Living in household with 65+ year old	22,42%	7,81%
Not living in household with 65! Year old	77,58%	92,19%
Median income of respondents	475 000 Ft	425 000 Ft
Average SWLS score of respondents	21,43	19,43

58,7% of vaccinated respondents, 1 244 people were female, and 41,3%, 756 people male. The median age of vaccinated respondents was 51,55 years, while amongst unvaccinated respondents, it was 43,8 years. The biggest share of vaccinated respondents was living in cities and received tertiary education. The rate of people living in cities and receiving tertiary education was similar in the two groups. The number of people employed full-time was higher amongst unvaccinated respondents, than vaccinated ones. 85% of people who got at least one vaccine have not been infected by Covid-19 by the time the study was conducted. 22,42% of vaccinated people reported that were living in the same household with an elderly people. This percentage in case of unvaccinated people is only 7,81%. The median income of vaccinated respondents (475 000 Ft) was higher than the income of unvaccinated ones (425 000 Ft) and had a higher score on satisfaction with life scale (SWLS). Based on the SWLS score, we can say that vaccinated people are rather satisfied, than unvaccinated respondents.

Regression and calculation of monetary value:

I was interested in knowing how SWLS scores changes if income changes and if a person is vaccinated. My dependent variable was the SWLS score of respondents. The Satisfaction with Life Scale (SWLS) is a 7-point Likert style response rate, where the rate of scores is between 5 and 35. It is designed to measure the global cognitive judgements of satisfaction with life. It measures the life satisfaction component of the well-being. If the sum of the scores of respondents is between 5-9, it indicates that the respondent is very dissatisfied, while the score of 31-35 indicates that the respondent is very satisfied with its life. The average SWLS score of the database was 21,43 in case of vaccinated respondents, close to the neutral point of the scale. In the regression, I used vaccination status as a dummy variable. The value was 0 if the respondent was not vaccinated, and 1 if he/she received at least one vaccine. I also put age, sex

and the logarithm of the income as independent variables, based on the method of the previously mentioned literatures. Having seen the results, I also put control variables into the regression, to check the strength of the relationship. I used the dummy variables of education, residence, employment and got the following table:

I. Table 2

Coefficients					
	B	Std. Error	Standardized Coefficients	t	Sig.
(Constant)	-16,025	3,396		-4,719	0,00
Covid19 vaccination	1,249	0,387	0,079	3,229	0,001
Natural log midincome	2,894	0,269	0,281	10,77	0,00
Male respondent	-0,656	0,366	-0,043	-1,79	0,074
Primary education	-0,875	0,511	-0,049	-1,712	0,087
Secondary education	-0,836	0,412	-0,056	-2,032	0,042
Capital residence	-0,331	0,449	-0,018	-0,783	0,461
Village residence	-0,363	0,419	-0,021	-0,866	0,386
Full time employment	0,593	0,533	-0,04	1,112	0,266
Part time employment	-0,705	0,825	-0,023	-0,854	0,393
Retired	1,756	0,563	0,105	3,118	0,002
Unemployed	-1,407	0,925	-0,04	-1,521	0,128
Student	0,812	1,251	0,016	0,516	0,516

Receiving Covid19 vaccination, log_income and retired variables had positive and significant effect on SWLS scores. Those individuals, who received at least one vaccine, reached on average 1,249 more points on SWLS score, than those people, who did not receive any vaccination. This means, that receiving a Covid19 vaccine results 1,249 change in SWLS score, and 2,894 change in income. The constant is -16,025, meaning that those people, who did not receive any vaccination, female, received tertiary education living in cities earned 16 point fewer on average on SWLS scores than others. Having received these results, I accept my first hypothesis, those people, who received a Covid19 vaccination, have higher well-being scores, than those who did not received any vaccine.

Differences in the sample:

To determine the monetary value, I used the model described in the study of Shi, with the regression coefficients (β_1 (income) and β_2 (vaccination)) and the average annual household income. In case of the regression shown in Table number 2, the average annual household

income (M0) was 345.668,2 Ft, β_1 was 1,249 and β_2 was 2,894. Based on the monetary value equation of Shi:

$$\text{Monetary value} = M0 - e^{[\ln(M0) - (\beta_2/\beta_1)]},$$

monetary value in my case was equal to

$$\text{Monetary value} = 345.668,2 - e^{[\ln(345.668,2) - (2,894/1,249)]}$$

which is 311.597 Ft.

Table 3 shows the regression coefficients, the p value and the monetary value of getting a Covid19 vaccine calculated with the above-mentioned equation. In the first regression, the SWLS score was the dependent variable and the logarithm of the income, vaccination status, age and sex of the respondents were the independent variables. In the second regression made in the same sample, I put other control variables. The reason why I ran two regressions in case of the full sample, male respondents only and female respondents only, was because I wanted to show how much does the monetary value of getting a Covid19 vaccine changes, when other control variables are included into the regression. These control variables were not changing the effect of the original explanatory variables, they rather strengthened it. By running two regressions, I was able to check the robustness of the analysis.

I. Table 3

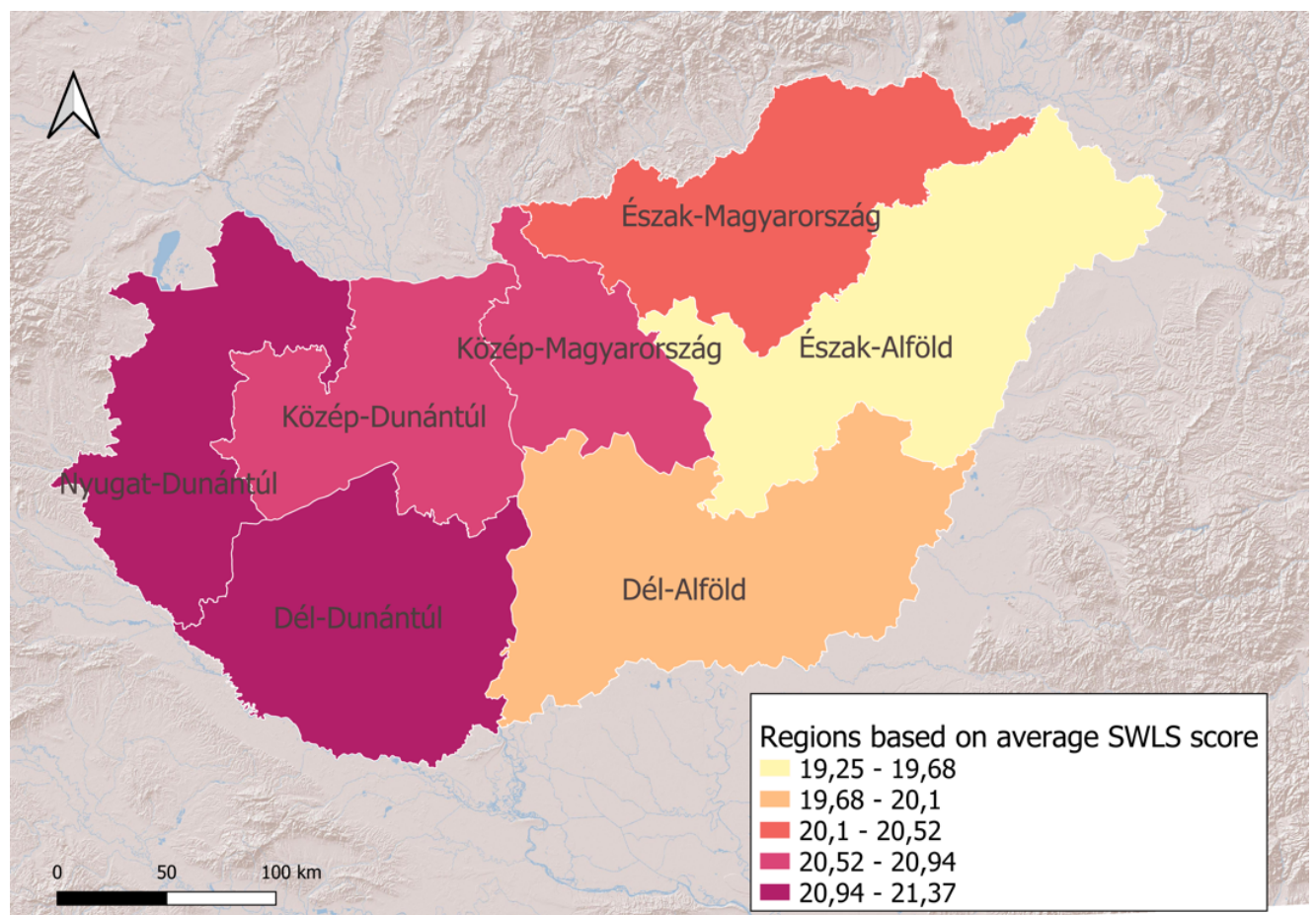
		B1 (vaccine)	P value	B2 (income)	P value	Monetary value
Full database	Vaccine + log income + age + sex regression	1,645	0,00	3,151	0,00	294 762 Ft
	Multiple variables regression	1,249	0,01	2,894	0,00	311 597 Ft
Male respondents only	Vaccine + log income +age regression	0,997	0,11	3,707	0,00	374 352 Ft
	Multiple variables regression	0,759	0,234	3,363	0,00	352 529 Ft
Female respondents only	Vaccine + log income + age regression	1,992	0,00	2,789	0,00	241 847 Ft
	Multiple variables regression	1,538	0,02	2,598	0	261 333 Ft

It is clear from the table, that the monetary value of getting a Covid19 vaccine differs between sexes. When only the dependent and independent variables were included into the regression made on the original database (SWLS score, vaccination status, logarithm of the income and sex), the value of getting a Covid19 vaccine was 294.762 Ft. It means, that it takes 294.762 Ft additional income to bring someone who is not vaccinated to the same level of well-being as vaccinated respondents. When other control variables were included into the regression, the value was 311 597 Ft. The change in the monetary value indicates, that when other control variables are included into the regression, the strength of the relationship is strong. The difference is even greater between sexes: if the individual is male, it takes 352 529 Ft to take the wellbeing of an unvaccinated people to the same level as vaccinated ones, based on the regression made in the database which only included men. This number in case of women is only 261 333 Ft.

Regional differences:

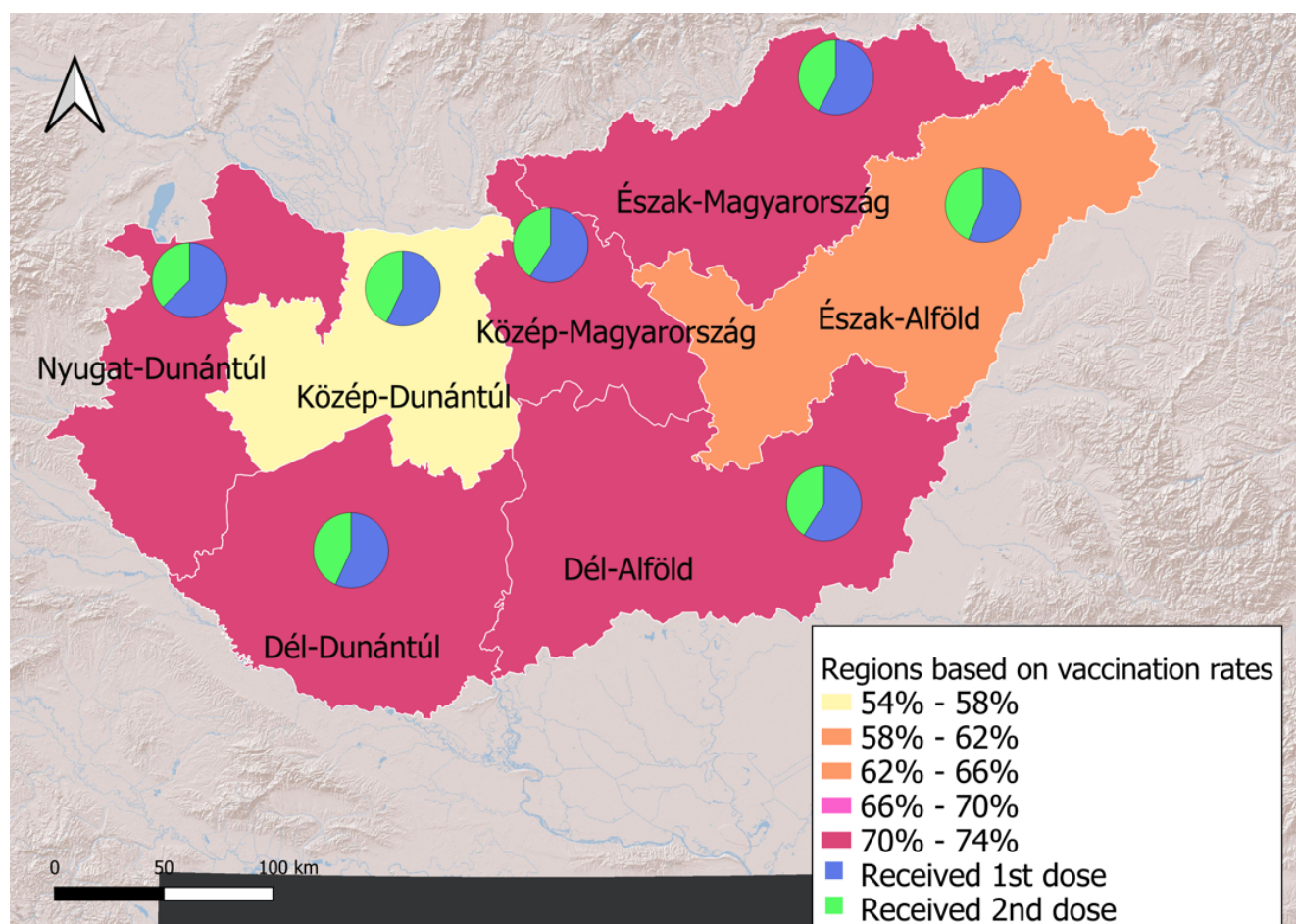
I made two maps using the QGIS program, to test my second hypothesis. In order to illustrate the data in the QGIS program, I exported the SPSS file into Excel, calculated the data for each region, and then uploaded the file to QGIS, The second hypothesis stated, that in the western part of Hungary, SWLS scores will be higher than in other regions in Hungary, because the standard of living, vaccination rates and incomes are higher there. In order to test it, I calculated the average SWLS score in each region, and the vaccination rate, then illustrated the regions coloured by these variables using QGIS software, illustrating the occupational differences between the regions. Table 4 shows the regions based on SWLS scores, and table 5 shows the vaccination rates

I. Table 4



The map of Table 4 shows, that those respondents, who live in the western regions of Hungary, had a higher average SWLS score, than those, who lived in other regions. The easter the respondent lived, the smaller the average of the SWLS scores was. The SWLS score was highest in Nyugat-Dunántúl and Dél-Dunántúl, and the lowest in Észak-Alföld.

I. Table 5



In case of the vaccination rates, Közép-Magyarország region have the highest percentage of vaccinated individuals. 73,47% respondents living there reported that they received at least one vaccine, followed by Dél-Dunántúl and Nyugat-Dunántúl regions, with 72% and 67% percent.

The maps are showing, that in the western part of Hungary, both the SWLS scores and vaccination rates are higher. Table 4 shows clearly the east-west geographic differences of Hungary. Based on the maps, I accepted my second hypothesis, in the western regions of Hungary, SWLS scores and vaccination rates are higher.

Having seen the maps, I checked the monetary value of getting a Covid19 vaccine in each region, because if a difference between SWLS scores and vaccination rates can be found between regions, then the monetary value of vaccinations will be different as well. I divided the database into 7 groups based on the region of the respondents. I ran the regression and calculated the monetary value in every region. Table 6 shows the differences of the monetary values between regions.

I. Table 6

Region	Monetary value with "normal" regression	Monetary value with multiple variables regression
Dél-Alföld	-297 985 Ft	-301 526 Ft
Dél-Dunántúl	79 020 Ft	10 556 Ft
Észak-Alföld	272 195 Ft	270 697 Ft
Észak-Magyarország	287 945 Ft	289 866 Ft
Közép-Dunántúl	195 273 Ft	210 837 Ft
Közép-Magyarország	317 440 Ft	262 618 Ft
Nyugat-Dunántúl	289 754 Ft	272 383 Ft

The regression analysis and the monetary value calculation showed that there is a huge difference between regions, when it comes to the monetary value of vaccinations. The value of receiving a Covid19 vaccine is the highest in Észak-Magyarország region, it takes 289.866 Ft to take an individual living there unvaccinated to the same level of SWLS score, as the score of the vaccinated people. Észak-Magyarország was amongst the leading regions, in case of vaccination rates, and in the middle, when SWLS scores were considered. Similarly, to the regressions described before, the monetary value of receiving a Covid19 vaccine were different in case of dependent and explanatory variables only, and in case of involving other control variables into the regression. Interestingly, Dél-Alföld received a negative monetary value for receiving Covid19 vaccine, meaning that the people living there should be even get paid, to compensate for the losses in satisfaction in life due to getting vaccinated. Getting a result like this is controversial, because it was clear from the maps, that Dél-Alföld had a high average SWLS score, and a high vaccination rate. The reason behind this negative monetary value in my opinion is the low number of cases included into the regression.

Conclusions:

Using the well-being valuation approach, I performed a regression, where SWLS score of the respondents were the dependent variable and the vaccination status, the logarithm of the income, the sex and the age of respondents were my independent variables. Other personal

characteristics, like the respondent's education level, employment, residence were the control variables. Using the equation of Shi, and the regression coefficients, I calculated the monetary value of getting vaccinated against Covid19 in Hungary. Based on my calculation, 311 597 Ft is required to counterbalance the absence of vaccination in order to keep life-satisfaction constant. The amount is different, when I calculate the regression separately between sexes. It takes 352 529 Ft for men and 261 333 Ft for women, to take the wellbeing of an unvaccinated people to the same level as the level of vaccinated individuals. In my opinion, the reason why there is such a big difference between the monetary value of getting vaccinated for females and males, is the gender differences in income. Based on the database, the median income for males was higher, than the median income for females, which can cause the different monetary value between the groups. Having said that, the average satisfaction with life points also showed dissimilarity between females and males.

The monetary value of vaccination against Covid19 were different between regions: having seen the maps illustrating vaccination rates and average SWLS scores, the monetary value of getting a Covid19 vaccine is the highest in Észak-Magyarország, and the lowest is Dél-Alföld. The reason why people living in certain regions are more satisfied with their life, is in my opinion quite complex. Közép-Magyarország, Közép-Dunántúl and Nyugat-Dunántúl are amongst the regions, where GDP/capita was the highest in 2020. Perhaps the reason why the average SWLS score were the highest in these regions, is because the GDP/capita is also high there. Another possible reason, why the west regions are scoring higher average SWLS score, than eastern regions, might be the migration within the country. The eastern regions of Hungary are affected more by younger generations migrating away, than any other region in Hungary, due to the lack of working possibilities. The population of the eastern regions are getting older, resulting a reduction in average satisfaction with life score and in income.

According to the calculations, 311 597 Ft change in income is required in Hungary to offset the loss of not getting vaccinated. To compare, the price of a Pfizer/Biontech vaccine is \$19,50/dose (around 6776,5 Ft), the price of Moderna is between \$25-\$37 per dose (8 700-13 000 Ft/dose), according to Biospace webpage. With the help of this example, we can say, that if an individual did not receive a vaccine against Covid19 for a price of ≈ 6800 Ft, 311 597 Ft income is needed to be given to them to compensate for the loss in satisfaction in life.

A study conducted in 2020 in determined the monetary value of one QALY in Hungary using wellbeing measures. According to the study, in case of well-being valuation method, € 70 731

was the shadow price for a QALY in Hungary. (Thema, Rencz, Péntek, & Brodszky, 2020) This means, that individuals value one year lived in perfect health to approximately 26 million Forint, while getting a Covid19 vaccination worth 311 597 Ft.

To decide whether these values are high or low, I am going to show a comparison between my findings and other studies conducted with the same method. The monetary value of active physical activity was \$1092/week $\approx$ \$ 56 783/year in the study of Shi. Taking the current currencies of 2022, around 19 733 007,8 Ft is required to take the wellbeing of someone not doing active physical activity to the same level as active people. (Shi, Joyce, Orpana, & Bancej, 2019). Comparing this 19 million to the 311 597 Ft, the monetary value of a Covid19 vaccine is not that high. The authors also examined the monetary value of smoke-free life, and found that \$1019/week, around 18 413 859 Ft/ year is required to counterbalance the smokers in order to keep life-satisfaction constant. (Shi, Joyce, Orpana, & Bancej, 2019) Comparing this to the monetary value of Covid19 vaccination in Hungary (311 597 Ft), I can see that Canadian people are valuing a smoke-free life higher than Hungarians the Covid19 vaccination. Having made the comparisons, it is important to acknowledge, that the studies of Shi were conducted on Canada's population and household income, while I did my calculation based on Hungarian data.

A different study in Germany made a similar calculation, the authors calculated the monetary value of doing sports and volunteering. One hour of sport per month were valued at €18,73 $\approx$ 7033,5 Ft, while one hour of volunteering had the monetary value of €20,99 $\approx$ 7882, 2 Ft. (Thormann, Gehrman, & Wicker, 2022) The value of sports and volunteering were similar to how people living in Dél-Dunántúl value Covid19 vaccination, where it takes 10 556 Ft Ft to take an individual living there unvaccinated to the same level of SWLS score, as the score of the vaccinated people.

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