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THE DETERMINANTS OF HAPPINESS AND SATISFACTION IN BRAZIL THROUGH THE LENSES OF THE APC APPROACH

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Textos para Discussão

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2014

SUMÁRIO

ABSTRACT

This paper is the fourth of a series of five papers that discuss factors associated with well-being in Brazil using the World Values Survey (WVS). The main objectives are to analyze happiness and satisfaction using an Age, Period and Cohort approach, by applying the HAPC/CCREM model. This methodology enables the study of age, period, and cohort effects separately in order to disentangle the contributions of each one of them. For happiness, it was found that age and period effects were significant, while cohort effects were non-significant. For age effects, the relationship found consisted of an inverted U, with a maximum level of happiness around 48 years of age. Period effects showed a general increasing tendency of happiness levels with time. Results are different for satisfaction. Age effects were also significant, however, satisfaction increased with age. Period effects were non-significant for satisfaction and cohort effects were decreasing and significant.

Key-words: happiness, satisfaction with life, Brazil, APC, WVS.

RESUMO

Este trabalho faz parte de uma série de cinco artigos que analisa os determinantes da felicidade no Brasil usando World Values Survey (WVS) como base de dados, e complementa a discussão dos três primeiros. O objetivo principal do artigo é de analisar a felicidade e satisfação com a vida utilizando a abordagem Idade, Período e Coorte, aplicando o modelo HAPC/CCREM. Essa metodologia permite analisar em separado os efeitos de idade, período e coorte. Na análise para felicidade, os efeitos de idade e período foram significativos, enquanto que os efeitos de coorte foram não significativos. Os efeitos de idade apresentou uma relação de U-invertido com a felicidade, com máximo em aproximadamente 48 anos de idade. Os efeitos de período mostraram uma tendência de aumento da felicidade com o tempo. Os resultados foram diferentes para satisfação com a vida. Os efeitos de idade também foram significativos, mas com tendência de crescimento com a idade. Os efeitos de período foram não significativos e os efeitos de coorte apresentaram uma tendência significativa de diminuição.

Palavras-chave: felicidades, satisfação com a vida, Brasil, IPC, WVS.

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1. INTRODUCTION

This paper is the fourth of a series of five papers that discuss the determinants of well-being in Brazil using as database the World Values Survey (WVS), as measured by the already mentioned concepts of happiness and life satisfaction. This study draws from the findings of the first three papers of the series entitled: "An introduction to the determinants of happiness in Brazil", "The influence of attitudes and beliefs on the determinants of happiness in Brazil" and "An overview of the determinants of happiness in Brazil in 2006". Below, we briefly summarize the main findings of each paper.

The first paper of the series introduced the field of inquire and some of its main literature. A discussion about the differences between happiness and satisfaction, as well as their measurements is also presented in the first paper of the series. It also explored the main determinants of happiness and satisfaction with life in Brazil. The second paper of the series discussed other factors that affect well-being in Brazil, and complemented the first presentation, providing an extended overview of its determinants. These papers used the three available waves of the WVS for Brazil, related to the years of 1991, 1997 and 2006. Similar studies also discussed the determinants of happiness and/or satisfaction in other geographic areas or using different approaches (For instance: Blanchflower and Oswald, 2004; Corbi and Menezes-Filho, 2006; Frey, 2008; Kahneman et al, 2006; Layard, 2005; Slutzer and Frey, 2006; Yang, 2008).

The third paper of the series discussed in more depth the determinants of happiness in Brazil in 2006, the most recent wave, as some variables were not present in all three databases. Besides including the explanatory variables of the first two papers, it incorporated contextual variables, such as town size, macroregion or state of residence, occupation type, sense of belonging, tolerance, number of children, and opinions about equality, government and personal fate, as well as information on general level of trust, personal savings, and specific actions. .

This fourth paper utilizes the same database from the first two papers and is based on the findings of the three of them. However, the main objective and methodological approach are different. While the first two papers discussed the main determinants of happiness and satisfaction, this paper develops the exercise of placing happiness and satisfaction in a life course perspective, using the three waves of the WVS to build synthetic cohorts. This method, known as the Age-Period-Cohort (APC) approach, will then allow the visualization of the dynamics of happiness and satisfaction in Brazil.

In the APC approach, age, period, and cohort effects are analyzed separately in order to disentangle the contribution of each of them. The method is briefly described below. For a more detailed discussion of the approach see Mason and Smith (1985), Yang (2008, 2011), Yang et al (2004), Yang and Land (2008) and Yang et al (2008).

When changes that take place in a society belong to a specific age group (or groups), the result is an *age effect*, aging-related developmental changes that occur in life. In this case, one would observe that certain age groups, regardless of their cohort or period, share the same characteristics or face the same phenomenon. Puberty is a classic example of an age effect. Another example of this could be the probability of older people being more satisfied with life when compared to youngsters.

When changes occur in all age groups at the same time, this configures a *period effect*, which "reflects changes in social, historical and epidemiological conditions that are unique to a time period that affect all living conditions regardless of age or life stage" (Yang, 2011, p. 18). The economic crisis of 1929 in the United States and the terrorist attacks of 2011 are examples of period effects that are likely to affect society in which they occur as a whole. In the case of Brazil, a period effect would make the whole population happy or unhappy without distinction of age.

Finally, *cohort effects* refer to individuals who share specific experiences, such as being born in the same year or entering a university in the same period. According to Ryder (1965), birth cohorts represent the effect of formative experience, shaped not only by life conditions from the moment of birth but also because of a continuous and shared exposure to historical and social factors that might affect living conditions throughout life, thus making the specific group unique. For instance, individuals of specific cohorts might trust others less than other cohorts.

The APC approach can be applied by different methods. Ideally, one would prefer to work with databases that follow the same individual over time. In the absence of longitudinal data to investigate long-term changes, recently developed statistical tools transform cross-sectional data as the WVS, into well-grounded synthetic cohorts that mimic the true birth cohorts (Yang, 2008). This method is called Hierarchical Age-Period-Cohort (HAPC) and Cross-Classified Random Effects Model (CCREM), and it overcomes many of the limitations that previously plagued the APC approach.

Similarly to Yang (2008), who used this same approach to discuss happiness in the US, we were able to disentangle the multiple effects of age, cohort, and period on happiness and satisfaction trends in Brazil using the three existing waves of the WVS for Brazil. To pursue this objective, this paper is divided into 5 sections, including this introduction. In section 2, we start by discussing how we constructed the synthetic cohorts, followed by descriptive statistics of the main trends in well-being and in the explanatory variables. Section 3 presents the methodology for the HAPC/CCREM as well as the models' specification, followed by the results of the econometric models in section 4The last section concludes the paper.

2. DESCRIPTIVE STATISTICS FOR TRENDS OF SYNTHETIC COHORTS

In the absence of longitudinal data that could tell us the story of happiness and life satisfaction for specific individuals in Brazil, we transformed cross-sectional data from the three existing waves of the WVS into synthetic cohorts.

The procedure is as follows: the individuals were classified in their respective age groups at the time of the interview in the year of 1991: 18-24, 25-29, 30-39, 40-49, 50 and over. Because the next wave of data was in 1997, six years after the first wave, the same synthetic cohort was built for individuals six years older in 1997, and following the same procedure, 15 years older in 2006. Notice that although we do not have the same individuals in the three waves, we can assume that these groups represent similar groups of individuals in the population in the three waves as the database is

approximately nationally representative. The use of synthetic birth cohorts built with nationally representative samples effectively replaces the absence of longitudinal data for studies similar to this one (Yang, 2011) because the representativeness of the main independent variables, such as race/ethnicity and gender is carried on from one survey to the next. For a more extensive discussion about synthetic cohorts see Preston et al (2001) and Yang (2011).

Notice that the four younger age groups truly mimic their respective birth cohorts; however, this is not true for the oldest age groups. Because of data limitations in the 1991 WVS, these last age groups were classified as 50 years and over, without an age limit. Therefore, in 1997 and 2006, these oldest age groups were classified, respectively, as 56 and over and 65 and over.

Below, we present the descriptive statistics for happiness and satisfaction stratified by sex. For this part of the paper, the variables happiness and life satisfaction were measured as in the previous papers, which presented these indicators in greater detail. Happiness is a self-measured variable: "In general, you consider yourself a person who is: a) very happy; b) quite happy; c) not very happy; or d) not at all happy.", Given that very few people considered themselves "Not at all happy," we initially grouped the last two categories, and the variable happiness had three categories in the previous papers: 1 – Not Happy; 2 – Quite Happy; and 3 – Very Happy. Life satisfaction was captured by the answer to the following question: "In general, are you satisfied or unsatisfied with your life?" The answers ranged from 1 - Totally unsatisfied, to 10 - totally satisfied. These indicators were grouped in order to be the dependent variables in the econometric models, as detailed in the methodological section.

Table 1 shows the mean values for happiness and satisfaction by cohort in 1991, 1997 and 2006. Notice that the mean value for happiness, increased for most cohorts for men and women. For instance, for men aged 18-24 in 1991, the mean value for happiness increased from 1.83 in 1991 to 2.02 in 1997, when the group aged 24-30, and then to 2.25 in 2006, when they aged 33-39. Similar trends are observed for all cohorts. For satisfaction, the values increased for younger cohorts, and decreased for the oldest ones.

Moreover, for a given year, cohorts differed. In 1991 older cohorts of both sexes had higher levels of well-being than younger ones. At the end of the period the values for happiness and satisfaction did not differ much.

TABLE 1
Mean value for happiness and satisfaction for each synthetic cohort by year

Cohort	Year		
	1991	1997	2006
Happiness			
Age in 1991	Men		
18-24	1.83	2.02	2.25
25-29	1.88	2.06	2.20
30-39	1.84	2.02	2.22
40-49	2.02	1.99	2.13
50 and over	2.10	2.06	2.16
Age in 1991	Women		
18-24	1.93	2.13	2.24
25-29	1.99	2.12	2.19
30-39	2.01	2.08	2.19
40-49	2.04	2.08	2.29
50 and over	2.07	2.06	2.26
Satisfaction			
Age in 1991	Men		
18-24	7.03	7.06	7.60
25-29	7.03	6.90	7.65
30-39	6.81	6.98	7.99
40-49	7.48	6.66	7.42
50 and over	7.94	7.31	7.32
Age in 1991	Women		
18-24	7.35	7.47	7.99
25-29	7.26	7.38	7.63
30-39	7.45	7.24	7.76
40-49	7.28	7.75	7.75
50 and over	8.10	7.83	7.81

Source: WVS, 1991, 1997 and 2006.

Now that we showed the trends of happiness and satisfaction for cohorts and periods, let's move to the trends for selected explanatory variables that were found to be the most pronounced determinants of happiness in Brazil, based on the results of the econometric models in the previous papers. It must be emphasized that we analyzed associations between these determinants and well-being levels, by doing so, we make the assumption that some causality exists, possibly circular causality. For instance, married individuals might be happier, and happier individuals may have a greater propensity to get married.

For this paper, we selected seven of them to be further analyzed using the APC approach, they are: health, marital status, employment status, family, finance, self-determination and religiosity. The

details of these variables are described below, as some were modified in order to be included in the HAPC/CCREM models.

In order to investigate health status, the WVS respondents are faced with the following question: "In general, how is your health?" The categories of answers were: a) very good; b) good; c) fair; d) poor; e) very poor. Due to small sample sizes, the categories were grouped in the previous papers in three categories: 1 - Poor and fair, 2 - Good and 3 - Very good. For this fourth paper, in order to facilitate the models' interpretation, the variables was further grouped into two categories: 0 – Very poor, poor and fair, 1 - Good and very good.

In the WVS the variable for marital status was classified as follows: married, living together, divorced, separated, widowed and single/never married. Given the small numbers of divorced and separated, these categories were grouped in the previous papers. Moreover, as the main differences concerning well-being were found between married individuals and others, we utilize a dummy variable for marital status in this paper, indicating if the individual was married or not (1 – Yes, 0 – No).

The WVS for Brazil had the following categories for employment status: full-time workers, part-time workers, self-employed, retired, housewives, students and unemployed. The main differences in well-being level were observed between this last group and the others. Therefore, similarly as above, we created a dummy indicating if the individual was unemployed or not (1 – Yes, 0 – No).

Concerning the family, the WVS has the following question: "How important is family for your life?" The options of response were: 1 – Very important, 2 – Important, 3 – With some importance; 4 - Not important at all. Very few people selected one of the last two categories. Hence, as the previous papers, the variable was defined as a two category one: 0 – Not important or important; 1 – Very important.

The WVS has the following question associated with self-determination: "How much freedom of choice and control do you have over your life?" Answers ranged from "1 - Not at all" to "10 - A great deal". The first four categories were not numerous and we grouped them and obtained a seven categories variable from "1-A little" to "7 – A great deal", which was applied in the previous papers and also to this one.

For finance, the question in the WVS was: "How is your satisfaction with the financial situation of the household?" The possible answers vary from "1 – Totally dissatisfied" to "10 – Totally satisfied". This was the variable used in the previous papers, and also here.

In the WVS database there are some variables related to religion and religiosity. One of the variables is similar to the one already discussed for the importance of family: "How important is religion for your life?: 1 – Very important, 2 – Important, 3 – Somewhat important; 4 - Not important at all." Very few people selected one of the two last categories. Hence, we grouped the last three and obtained a two-category variable: 0 – Not important or important; 1 – Very important.

A second question asks how the individual classifies himself: "1 - A convinced atheist; 2 - Not a religious person; or 3 - A religious person." This first category was not numerous and we grouped the first two and obtained a two category variable: 0 - Not a religious person; 1 - A religious person.

A third question asks how important God is in the individual's life. Answers ranged from "1- Not at all" to "10 - Very important".. Most people answered "Very important", hence we grouped the first nine categories and obtained a two category variable: 0 – Not very important; 1 - Very important.

Given that these three last variables are highly correlated, we created a unique variable for religiosity summing them. Therefore, the answers for the religiosity variable have four categories, ranging from 1 – Less religious to 4 – More religious.

The next tables analyze the trends for these variables for each synthetic cohort and sex. Although we cannot infer causality, by analyzing overall trends in happiness and satisfaction together with overall trends in the variables of interest, we are able to suggest some hypothesis that could explain the trends in well-being.

Table 2 presents the results for self-rated health. It was expected that individuals tend to decrease their level of self-rated health as they age. Indeed, notice that for a given year, older cohorts do have smaller values for health than younger ones in all three years. However, when we compare each cohort separately, the perspective is rather different. For men, the results are stable for all cohorts, even though they are aging. For instance, individuals who were 18-24 years old in 1991 presented a similar value for health 15 years later in 2006 when they had 33-39. For this cohort, the results are not surprising as individuals were still quite young. Contrarily, for the cohort that was 40 to 49 in 1991 and 55 to 64 in 2006, a decrease in values for health was expected, but not observed. It is possible that this trend might had been compensated by a general increase in health values as a period effect.

Women, differently than men, self-rated health levels decline for cohorts aged 25-29, 30-39 and 40-49 in 1991, as they grow old. For the other two cohort, the values remain rather stable. Comparing the values of men and women in similar cohorts in 1991, one can see that values were higher for females, but the gender gap gets smaller in 2006.

Table 1 showed that most cohorts increased their happiness and satisfaction levels with the successive periods. As discussed in previous papers, health and well-being indicators are positively correlated. However, health level variations might not be responsible for the general increase in well-being levels because their trends do not follow the same fashion. These results suggest that part of the increasing trends of well-being in a cohort analysis could be due to the stability in health levels, while other determinants varied and influenced happiness/satisfaction positively.

TABLE 2
Mean value for self-rated health by synthetic cohort and year

Cohort	Year		
	1991	1997	2006
Age in 1991	Men		
18-24	0.78	0.80	0.75
25-29	0.74	0.72	0.74
30-39	0.62	0.63	0.63
40-49	0.52	0.55	0.45
50 and over	0.46	0.38	0.48
Age in 1991	Women		
18-24	0.89	0.83	0.89
25-29	0.83	0.81	0.76
30-39	0.80	0.70	0.72
40-49	0.74	0.66	0.61
50 and over	0.52	0.54	0.53

Source: WVS, 1991, 1997 and 2006.

As extensively observed in the previous papers, married individuals tend to be happier. At least part of the increase in well-being level for the younger cohorts observed in table 1 might be related to the increase in the proportion of married individuals among them, as described in table 3. As expected, notice that for the youngest cohorts, the proportion of married individuals increased as they aged, especially for women. For the oldest cohorts, although the proportion of married individuals decreased – possibly due to widowhood and divorce, happiness increased, indicating that despite being non-married in greater proportion, other factors positively influenced their level of happiness. However, notice that satisfaction with life decreased for the oldest cohorts, suggesting that this decrease could be partially because of trends in marital status.

TABLE 3
Mean value for marital status by synthetic cohort and year

Cohort	Year		
	1991	1997	2006
Age in 1991	Men		
18-24	0.35	0.43	0.54
25-29	0.44	0.65	0.49
30-39	0.59	0.61	0.48
40-49	0.64	0.60	0.47
50 and over	0.49	0.58	0.28
Age in 1991	Women		
18-24	0.12	0.39	0.52
25-29	0.37	0.51	0.45
30-39	0.58	0.61	0.69
40-49	0.75	0.73	0.76
50 and over	0.79	0.75	0.63

Source: WVS, 1991, 1997 and 2006.

Also as extensively discussed in the previous papers, the unemployed tend to be more frequent among the most miserable. Table 4 shows the proportion of unemployed for each synthetic cohort and sex. While values for men increased over time, they were roughly stable for each cohort of females. That is, these trends do not contribute for the observed variations in happiness; actually they show the opposite trend. The increase in unemployment rates for the oldest cohort for men might partially explain the variations in satisfaction.

TABLE 4
Mean value for employment status by synthetic cohort and year

Cohort	Year		
	1991	1997	2006
Age in 1991	Men		
18-24	0.18	0.16	0.19
25-29	0.10	0.10	0.19
30-39	0.05	0.09	0.10
40-49	0.02	0.04	0.08
50 and over	0.00	0.00	0.05
Age in 1991	Women		
18-24	0.20	0.24	0.20
25-29	0.16	0.14	0.15
30-39	0.11	0.10	0.07
40-49	0.09	0.05	0.09
50 and over	0.03	0.04	0.00

Source: WVS, 1991, 1997 and 2006.

Previously, we observed that individuals that give more importance to family tend to be happier and more satisfied. Notice in table 5 that the proportion of men that thought family was very important remained fairly stable for younger cohorts and decreased for the older cohorts. For women, the number decreased for most cohorts. These variations do not resemble those for happiness, although might explain part of the decreased in satisfaction for oldest cohorts.

TABLE 5
Mean value for importance of the family for each synthetic cohort by year

Cohort	Year		
	1991	1997	2006
Age in 1991	Men		
18-24	0.88	0.95	0.87
25-29	0.94	0.98	0.94
30-39	0.93	0.95	0.89
40-49	0.88	0.88	0.80
50 and over	0.94	0.92	0.78
Age in 1991	Women		
18-24	0.90	0.93	0.84
25-29	0.89	0.93	0.85
30-39	0.91	0.91	0.86
40-49	0.87	0.89	0.76
50 and over	0.88	0.95	0.81

Source: WVS, 1991, 1997 and 2006.

Table 6 shows the results for self-determination. Previously, we observed that persons that considered they had control and freedom over their own lives tended to be happier and more satisfied with life. For men, the youngest cohort and those with age between 30-49 years in 1991 thought their control over their life had increased over time. The cohorts with age between 25 and 29 and the oldest cohort had approximately the same values self-determination. For women, trends were quite similar, although for the oldest cohorts the values of self-determination increased over time. Most of these tendencies might be contributing for the variations in well-being.

TABLE 6
Mean value for self-determination by synthetic cohort and year

Cohort	Year		
	1991	1997	2006
Age in 1991	Men		
18-24	7.59	7.52	7.90
25-29	7.68	7.63	7.68
30-39	7.26	7.55	7.90
40-49	7.14	7.92	7.85
50 and over	7.69	8.25	7.75
Age in 1991	Women		
18-24	6.56	7.30	7.52
25-29	7.11	6.78	7.44
30-39	6.91	6.95	7.92
40-49	7.13	6.59	7.55
50 and over	7.49	7.47	7.89

Source: WVS, 1991, 1997 and 2006.

Table 7 indicates that the financial situation of respondents was approximately the same for most cohorts over time, especially for women. For men, two cohorts showed stability, the first and the third, while for all other cohorts, the overall value increased. These tendencies support some of the variations on well-being levels, as financial situation is correlated with happiness and satisfaction, as observed in previous papers. Notice that for a given year the values tend to increase with age for men, but not for women.

TABLE 7
Mean value for financial situation by synthetic cohort and year

Cohort	Year		
	1991	1997	2006
Age in 1991	Men		
18-24	5.59	5.95	5.64
25-29	5.58	5.26	6.76
30-39	5.59	5.54	5.75
40-49	5.17	6.11	6.20
50 and over	6.23	6.70	6.70
Age in 1991	Women		
18-24	5.49	5.06	5.69
25-29	5.53	4.84	5.49
30-39	4.87	4.78	5.11
40-49	5.24	5.25	5.55
50 and over	5.60	5.75	5.72

Source: WVS, 1991, 1997 and 2006.

The results of the previous paper indicated that individuals who are more religious also tend to be happier. Table 8 shows the results for religiosity.. It can be noticed that for both sexes, younger cohorts increased their mean values of religiosity, while older ones decreased. These trends are similar to some of the observed tendencies for well-being.

TABLE 8
Mean value for the religious variable by synthetic cohort and year

Cohort	Year		
	1991	1997	2006
Age in 1991	Men		
18-24	1.96	2.24	2.33
25-29	1.98	2.25	2.21
30-39	2.17	2.26	2.19
40-49	2.25	2.34	2.00
50 and over	2.41	2.50	2.13
Age in 1991	Women		
18-24	2.17	2.38	2.38
25-29	2.21	2.51	2.61
30-39	2.39	2.58	2.44
40-49	2.49	2.50	2.50
50 and over	2.71	2.65	2.38

Source: WVS, 1991, 1997 and 2006.

Tables 2 to 8 presented the trends by cohorts and sex for each explanatory variable selected as a main determinant of well-being. Next, Table 9 will summarize these findings, and includes the trends of the two well-being indicators, happiness and satisfaction, as well as the other seven variables. First, notice the expected correlations between the well-being indicators (happiness and satisfaction) and each of the explanatory variables, as discussed in the previous papers. It is expected that well-being levels increase as health, marital status, family, self-determination (freedom/autonomy), financial situation and religiosity increase, and decrease as unemployment increase.

As Table 9 shows, for men aged 18-24 in 1991, and consequently 33-39 in 2006, happiness and satisfaction levels increased in the period. Notice that three variables showed similar tendencies: marital status, freedom and religiosity. That is, young adults tend to increase their levels when growing older and this might positively influence well-being levels. Four others variables presented slightly stable values: health, employment status, financial situation and importance given to family. That is, apparently these variations do not contribute for the increase in well-being levels, but also do not suppress them. Hence, the overall tendencies of the determinants of well-being for this cohort might be contributing to an increasing in levels of happiness and satisfaction. For women, the results are similar.

For men and women who were 25 to 29 years old in 1991, and who in 2006 were between 40 and 44 years old, well-being levels also increased over time. For men, marital status and financial situation showed positive trends, possibly impacting well-being levels. On the other hand, unemployment increased, probably decreasing happiness/satisfaction, but the overall effect of this variable might be small compared to the others. Other four variables showed approximately the same values in the period. For women, two variables showed increasing tendencies, marital status and religiosity, while health levels decreased. Although these last trends might tend to decrease well-being, the overall effect of the first two might be more decisive to determine well-being.

Next cohorts were between 30-39 years old in 1991 and 45-54 in 2006, i.e., they were adults in the beginning of the period and were middle age in the end. For both men and women, well-being levels increased. Only the increasing trend for self-determination, which might be related to the presence of older children in the household, instead of younger ones, might be related to the variations on well-being for both sexes. For men, there were trends in opposition to the increasing in well-being, such as the decrease in the proportion of married individuals and the increase in unemployment. For women, the proportion of married females increased and of unemployed decreased, trends that might promote an increase in well-being levels, as observed for freedom/autonomy. On the other hand, health levels decreased, possibly having a negative impact in happiness and satisfaction.

For the age groups 40-49 in 1991 and 55-64 in 2006, happiness increased for men and women, but satisfaction increased only for women. For men, financial situation and freedom improved in the period, however, all other variables showed a tendency of possibly decreasing well-being. For women, only freedom increased, while health deteriorated and the importance of family decreased, possibly with negative impacts on well-being.

The cohorts discussed so far truly mimic birth cohorts. However, as emphasized before, this is not true for the oldest cohorts, and results should be interpreted with greater caution. While happiness levels were reasonable stable for men, they increased for women, while satisfaction decreased for both sexes. That is, overall levels of well-being mostly decreased. Some trends seem to have impacted negatively the well-being of both sexes, such as the trends in marital status, importance given to family and religiosity. The only exception for this general decreasing trend of well-being was financial situation, which ameliorated for both sexes over time. Moreover, unemployment increased for men, possibly decreasing their well-being. For women, unemployment decreased and freedom increased, trends that might have contributed for an increase in well-being.

TABLE 9
– Summary of the overall trends in selected variables for each synthetic cohort by year

Cohort	Variable								
	Happ.	Satisf.	Health	Marital	Unemplo.	Family	Freed.	Finan.	Religi.
Expected correlation with well-being			+	+	-	+	+	+	+
Age in 1991	Men								
18-24	+	+	*	+	*	*	+	*	+
25-29	+	+	*	+	+	*	*	+	*
30-39	+	+	*	-	+	*	+	*	*
40-49	+	*	-	-	+	-	+	+	-
50 and over	*	-	*	-	+	-	*	+	-
Age in 1991	Women								
18-24	+	+	*	+	*	*	+	*	+
25-29	+	+	-	+	*	*	*	*	+
30-39	+	+	-	+	-	*	+	*	*
40-49	+	+	-	*	*	-	+	*	*
50 and over	+	_	*	-	-	-	+	*	-

Notes: + = positive, * approximately stable and - negative

This section presented the descriptive results of trends for the indicators of well-being and for the main determinants of happiness and satisfaction for synthetic cohorts, giving an overview of the tendencies and making some hypothesis of causality. These same trends are further analyzed with the Hierarchical APC (HAPC) and Cross-Classified Random Effects model (CCREM). Next section describes this methodology.

3. METHODOLOGY

The previous section presented the trends in descriptive statistics for happiness, satisfaction and selected explanatory variables. The econometric models utilized in the previous section of the paper were the ordered logistic regression and the linear regression. These are well known methods, so further explanation is not necessary. the methodology applied in this section of this paper is less well known and less commonly applied, what justify the inclusion of this methodological section.it is important to notice, whatsoever, that due to data availability, we used only three different WVS waves to discuss the determinants of happiness and satisfaction in Brazil with the HAPC/CCREM methodology. It should be emphasized that the use of more periods is advised in order to apply this methodology (yang, 2011).

Data

The dependent variable in the HAPC/CCREM model is a dichotomous one. Therefore, both well-being indicators, which are initially expressed in ordered categories in the WVS databases as

described in the previous section, were dichotomized in order to be used as dependent variables in the models.

In order transform Happiness into a dependent variable in the HAPC/CCREM model, we created the dummy 1 – Very happy, 0 – Not or quite happy. We also transformed Life Satisfaction into a dummy by aggregating the categories 1 to 7 and 8 to 10, obtaining: 1 – Very satisfied, 0 – Not very satisfied.

These two variables are the dependent variables in the models. The explanatory variables remain those related to the APC approach - age, period and cohort - and those discussed in the previous section. Age is included as a continuous variable, and in a quadratic form to allow for non-linear effects Moreover, two other dummies are included in the models as a control: one for sex (1- Male, 0 –Female) and another for race/ethnicity (1- White, 0 – Non-white).

The model

In section 2, we presented some descriptive statistics that showed some general trends concerning well-being and the determinants of well-being according Age, Period and Cohort. However, these three parameters have confounding aspects if used together in the same regression. (Yang et al, 2004). That happens because by knowing one person's age and the year of the interview, it is possible to learn their year of birth (or cohort). Because of the linear dependency among age, period, and cohort (period = age + cohort), models using the APC approach might present problems of identification (Glenn, 2003), which may make the assessment of the age, period, and/or cohort effects troublesome (Yang, 2011).

How can one proceed to disentangle the effects of age, period and cohort, then? Recent analytical advances provide some leverage on these limitations while using the APC approach (Yang et al., 2008), as the HAPC/CCREM, the method we used in this paper.

The CCREM is a mix of fixed and random effects models, which characterizes contextual effects of historical time and cohort membership and can accommodate covariates (Yang, 2011; Yang et al, 2008). The model's first level in our analysis is represented by the following equation:

$$Y_{ijk} = \alpha_{jk} + \beta_{1jk} Age + \beta_{2jk} Age^2 + \beta_{3jk} Male + \beta_{4jk} Ethinic + \beta_{5jk} Health + \beta_{6jk} Marital$$
$$+ \beta_{7jk} Unemployed + \beta_{8jk} Family + \beta_{9jk} Freedom + \beta_{10jk} Finance + \beta_{11jk} \mathrm{Re}ligion + e_{ijk},$$

where *i* represents individuals, *j* represents periods and *k* cohorts, Y is the dependent variable, which is a dummy for happiness or satisfaction (one at a time), βs are the estimated coefficients, the explanatory variables are named above, and e_{ijk} is the random error.

The equation for the second level of the model is the following:

$$\alpha_{jk} = \pi_0 + \tau_{0j} + c_{0k},$$

where π_0 is the expected mean at the zero values of all level-1 variables averaged over all periods and cohorts, τ_{0j} is the overall *period effect* in terms of residual random coefficients of period *j* averaged over all birth cohorts, and c_{0k} is the overall *cohort effect* in terms of residual random coefficients of cohort *k* averaged over all time periods.

We applied this methodology using the SAS 9.3 statistical package and the GLIMMIX command.

4. RESULTS OF THE ECONOMETRIC MODELS

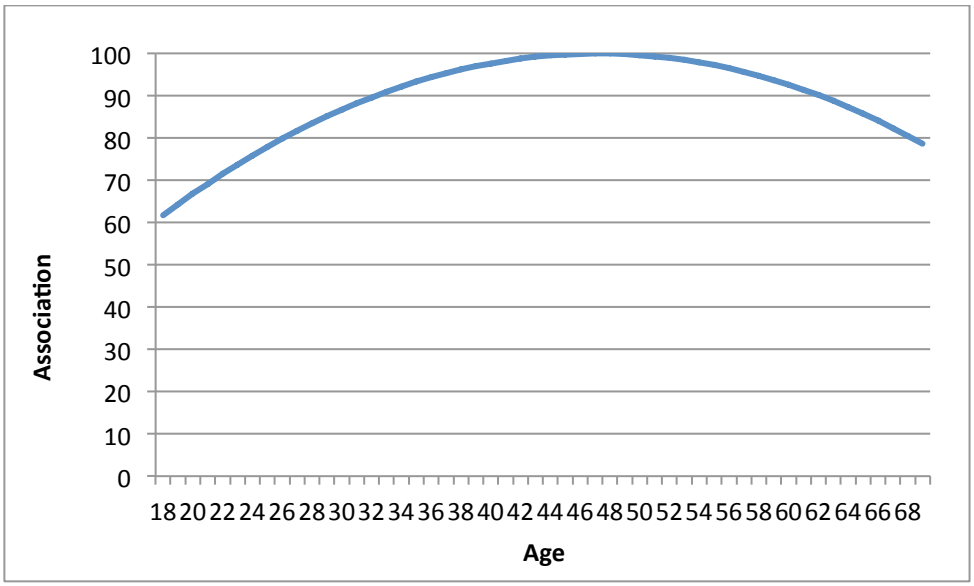
This section presents the results obtained with the methodology described above by using two tables. Table 10 describes the results for happiness and Table 11 brings the results for satisfaction. Both tables present five different econometric models, which differ in the set of explanatory variable. The first model only incorporates the variables of the APC approach with the covariates: age, age squared, period and cohort. Model 2 also includes the selected variables discussed in the first paper of the series: sex, ethnic group, health, marital status and employment status. Model 3 through 5 includes the variables importance given to: family, finance, autonomy/freedom and religion. Due to estimation problems, we could not run a model that contained all variables.

We begin the discussion with the age variables. In the first paper of the series, the econometric models for happiness showed non-significant coefficients when the variables health and marital status were included as explanatory variable. This same result was observed in the second paper of the series. That is, young individuals were happier because they had better health, and unhappier because they were less likely to be married, however, after controlling for these two aspects, age was not significant as a determinant of happiness. Notice that these results were obtained controlling for period, as dummies for years were included in the econometric models. However, the models discussed in the previous paper did not incorporate the variable for cohorts, so the effects of age, period and cohort could not be disentangled, as in this forth paper of the series.

Model 1 shows a positive and significant coefficient for age and a negative and significant one for age squared. The association of age with happiness is better described with the use of a graph, as figure 1 shows. After controlling for cohorts and periods, the age effects net of period and cohort effects, we find that individuals with age close to 48 years old were the happiest.

Notice, however, that the coefficients for age squared were negative and non-significant in models 2 to 5, and the coefficients for age were positive and significant only in models 2 and 3. That is, part of the observed age effect is explained by the other variables in the models.

FIGURE 1
Associations of happiness with age in model 1

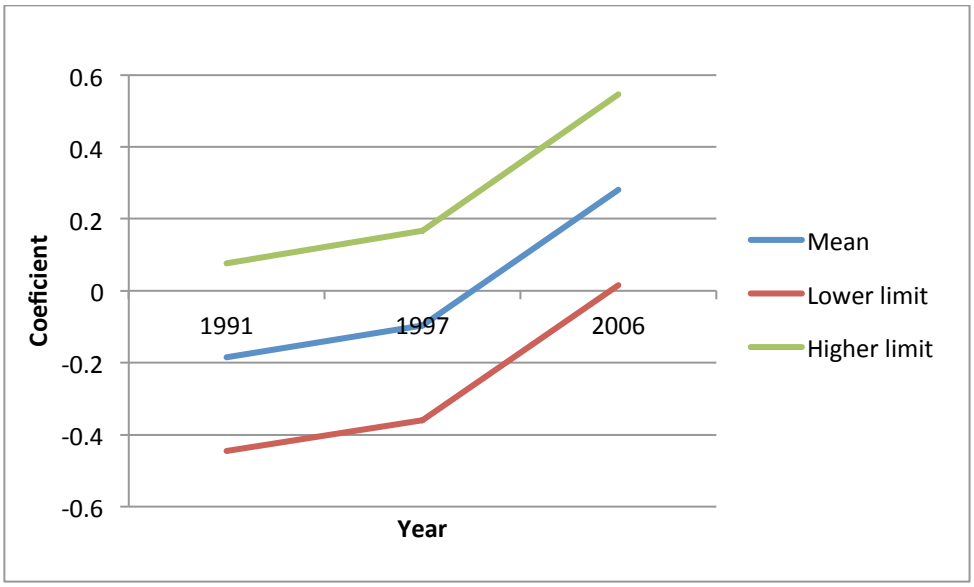


Source: WVS, 1991, 1997, and 2006.

Now, we continue the discussion with the other variables of the APC approach. The next one is period, which was included in the second level of the model. In the first two papers of the series, the coefficients for the dummies representing the year of 1997 and 2006 were positive and significant, with greater magnitude for the last year. This indicates that overall happiness levels in these years were higher than in 1991, the year of reference, and that there was an increasing tendency for happiness over time. That is, the econometric models showed that happiness in Brazil increased in the period, even after controlling for the other variables in the models.

All the models in table 10 showed similar results, with negative and non-significant coefficients for 1991 and 1997, and positive and significant for 2006, indicating the robustness of the results. These results, the period effect net of age and cohort effects, are better described with a graph, as can be seen in Figure 2. This graph shows the values for the coefficients and for the 90% confidence interval observed in model 1. Notice that, although the coefficient for 2006 is the only one which is significant, the general trend is the same as observed in the previous paper, that of general increasing happiness levels.

FIGURE 2
Period effect for happiness in model 1



Source: WVS, 1991, 1997, and 2006.

For cohorts, notice that all models in table 10 showed non-significant coefficients, indicating that the different cohorts did not show significant differences in happiness levels. Therefore, concerning the APC variables, age showed an inverted U association with happiness, and the period effect was significant and increasing as the cohort effects were non-significant.

Besides the APC variables, model 2 included other variables, such as a dummy for sex and another dummy for race/ethnicity. First, notice that the differences between Whites and Non-whites were non-significant for all models. Differences between sexes were non-significant in models 2 and 5, but the coefficients were negative and significant in models 3 and 4, indicating that after controlling for financial situation or for self-determination, men were unhappier. These results are possibly partially explained by the greater level of both of these variables for men when compared with women. Indeed, tables 6 and 7 show that men had higher values for both variables.

Models 2 to 5 include the variables for health, marital status and employment status. Basically, the conclusions do not differ from the previous papers: individuals with better health, married and employed were happier. Notice, however, that in model 3, when financial situation is controlled for, the coefficient for employment status becomes non-significant, although negative, indicating that part of the lower happiness of unemployed individuals might be due to the financial constrains they might be subjected.

Models 3 to 5 incorporate the variable for importance of family. Notice, as was observed in the previous papers, that the coefficients were all positive and significant. The same was observed for finance, self-determination and religion.

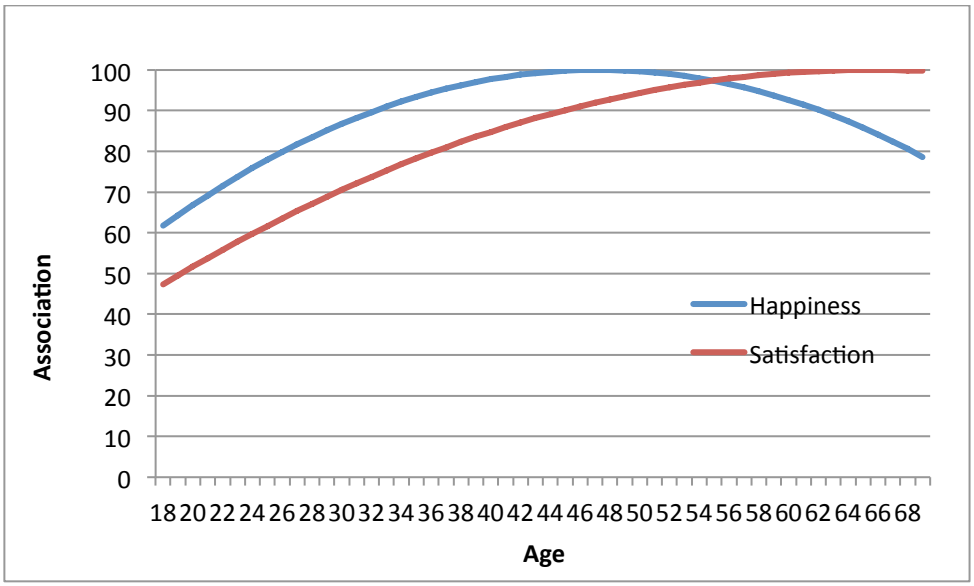
TABLE 10
Results of the CCREM econometric models for happiness

	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed Effects					
Intercept	-1.867**	-2.787**	-3.881**	-4.062**	-3.818**
Age	0.035**	0.036*	0.037**	0.030	0.026
Age squared	-0.00037*	-0.00031	-0.00032	-0.00024	-0.00021
Male		-0.120	-0.141*	-0.141*	-0.026
White		-0.113	-0.119	-0.121	-0.112
Health		0.647**	0.586**	0.607**	0.648**
Marital status		0.452**	0.402**	0.472**	0.397**
Employment status		-0.271*	-0.199	-0.272*	-0.298*
Family			0.671**	0.673**	0.536**
Finance			0.103**		
Self-determination				0.114**	
Religion					0.324**
Random Effects - Intercepts					
Period					
1991	-0.185	-0.158	-0.165	-0.148	-0.163
1997	-0.096	-0.097	-0.101	-0.104	-0.130
2006	0.281*	0.255*	0.266*	0.252*	0.293*
Cohort					
18 – 24	0.013	0.033	0.001	0.025	0.012
25 – 29	-0.001	-0.010	0.000	-0.007	-0.004
30 – 39	-0.021	-0.041	-0.001	-0.035	-0.016
40 – 49	-0.003	-0.006	0.000	0.003	0.002
50 and over	0.011	0.023	0.000	0.013	0.006

Source: WVS, 1991, 1997, and 2006.
Note: **p < 0.05, * p < 0.1

Table 11 presents the results for the modeling of Age, Period and Cohort of life satisfaction.. First, in model 1, notice that the coefficients for age and age square were both significant, positive and negative respectively. The analysis presented in the two first papers of the series showed a positive association between satisfaction and age when health levels were included in the model, and a non-significant relationship otherwise. Figure 3 shows the findings for the effect of age on happiness and satisfaction. Notice that although the results resemble each other in the tables, the magnitude of the coefficients indicate a rather different perspective. For happiness, the greatest effects were observed for the age group around 48 followed by a decline, while satisfaction seems to increase with age. This same tendency for increasing satisfaction with age is observed in the other models, which also includes covariates.

FIGURE 3
Age effects on happiness and satisfaction in model 1

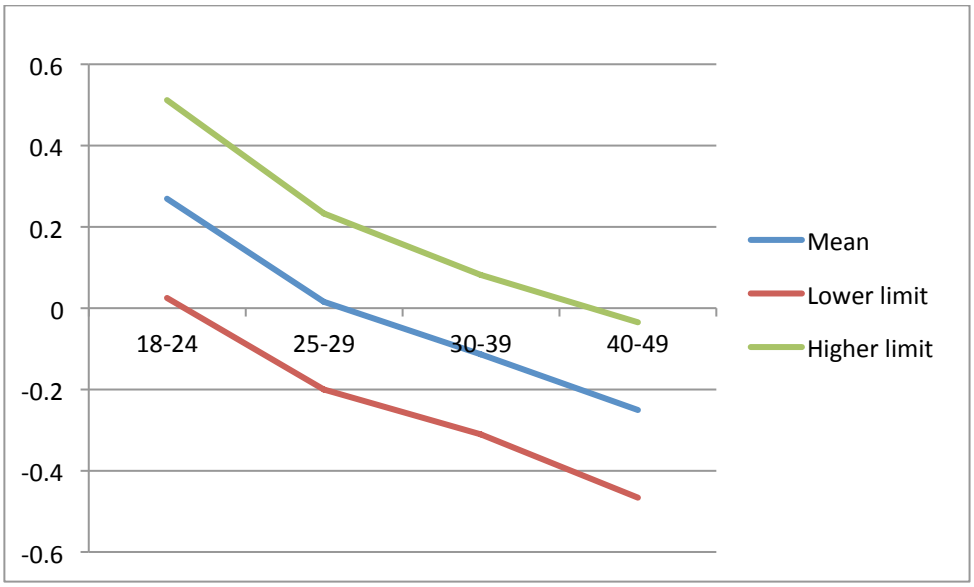


Source: WVS, 1991, 1997, and 2006.

For period, previous analysis did not indicate an overall tendency of increasing well-being over time. Past studies shows a mostly negative coefficient for the year 1997 and a non-significant or positive for 2006, being 1991 the year of reference. In the APC approach, all models showed non-significant coefficients for period, which means that general satisfaction levels did not differ significantly between periods. This indicates no net period effect, differently than the observed for happiness.

Also differently than the observed for happiness, which showed no significant cohort effects, life satisfaction exhibit significant coefficients for cohorts. Given that the database for 1991 shows some limitations for age declaration for the oldest cohort, as already explained, the coefficients for this cohort are not going to be analyzed. Figure 4 shows the overall tendency for the coefficients of model 1 with a 90% confidence interval. After controlling of age and period, the younger cohorts tend to be more satisfied with life.

FIGURE 4
Net cohort efffects for satisfaction in model 1



Source: WVS, 1991, 1997, and 2006.

Regarding the covariates in the models, most of the results for satisfaction did not differ from those for happiness. In sum, healthier individuals, those married, employed, those who believed the family was very important, with a better financial situation, with greater self-determination and those more religious were more satisfied with life.

The results for sex and race/ethnicity for satisfaction differed from those of happiness. Male showed a tendency to be more satisfied with life, at least when religiosity was included in the model. Probably, as it is shown in table 9, this is due to the fact that men are less religious than women.

Whites were less satisfied with life in all models, as also observed in previous papers. Which features are associate with this finding? Are non-white intrinsically more satisfied with life? Do they have lower expectations with life and therefore lower benchmarks for comparisons? Notice that groups of different race/ethnicity differ in many aspects. For instance, it is expected that whites enjoy better health and financial situation than non-whites. Without controlling for these aspects, are the results robust?

TABLE 11
Results of the CCREM econometric models for life satisfaction

	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed Effects					
Intercept	-1.189	-1.589*	-2.784	-3.038**	-2.022*
Age	0.054**	0.045**	0.046**	0.031	0.033*
Age squared	-0.00041**	-0.00027	-0.00033	-0.00017	-0.00016
Male		0.073	-0.009	0.007	0.149**
White		-0.178**	-0.209**	-0.194**	-0.167**
Health		0.474**	0.374**	0.405**	0.478**
Marital status		0.395**	0.349**	0.504**	0.367**
Employment status		-0.242**	-0.120	-0.240*	-0.260**
Family			0.263**	0.248**	0.111
Finance			0.216**		
Self-determination				0.225**	
Religion					0.252**
Random Effects - Intercepts					
Period					
1991	-0.010	-0.005	-0.011	0.010	-0.010
1997	-0.050	-0.065	-0.059	-0.073	-0.087
2006	0.060	0.070	0.070	0.062	0.096
Cohort					
18 – 24	0.269*	0.250*	0.194	0.211	0.222
25 – 29	0.016	0.007	-0.020	-0.015	-0.005
30 – 39	-0.114	-0.110	-0.056	-0.116	-0.108
40 – 49	-0.251*	-0.256*	-0.215*	-0.196	-0.214*
50 and over	0.081	0.109	0.097	0.115	0.105

Source: WVS, 1991, 1997, and 2006.
Note: **p < 0.05, * p < 0.1

5. CONCLUSIONS

This paper is the fourth of a series that discusses the determinants of happiness and life satisfaction in Brazil using the World Value Survey databases. The first three papers are entitled: "An introduction to the determinants of happiness in Brazil", "The influence of attitudes and beliefs on the determinants of happiness in Brazil" and "An overview of the determinants of happiness in Brazil in 2006".

The three first papers discussed the determinants of well-being using Ordered Logistic and OLS models, while this forth paper intended to analyze happiness and satisfaction using the Hierarchical Age-Period-Cohort (HAPC) and Cross-Classified Random Effects Model (CCREM). This methodology enables the study of age, period, and cohort effects, which are analyzed separately in order to disentangle the contributions of each of them.

For happiness, it was noticed that age and period effects were significant, while the cohort effects were non-significant. For age, the relationship found was an inverted U with a maximum level of happiness around 48 years of age. That is, young and old individuals were unhappier than middle aged persons, after controlling for period and cohort effects. Notice that this conclusion is different than the observed in the previous paper when cohort's effects were not controlled for, as age mostly showed non-significant coefficients. Period effects showed a general increasing tendency of happiness levels with time.

Results differed for life satisfaction according to age, period and cohorts effects. Age effects were also significant. However, satisfaction increased with age and was not an inverted U relationship. Period effects were significant and increasing for happiness and they were non-significant for satisfaction. Cohort effects were non-significant for happiness, and decreasing and significant for satisfaction.

Which factors might explain these trends? Although no causality can be inferred using the dataset and methodological configuration, the covariates in the econometric models showed a similar trend for happiness and satisfaction, as observed in previous papers. Healthier individuals, those married, unemployed, and individuals who believed the family was very important, who had better financial situation, who had greater freedom/autonomy and who were more religious were happier and more satisfied with life.

Table 12 shows a summary of the age, period and cohort effects for happiness and satisfaction, as described in models 1 through 5. The table also presents the variations in age, period and cohort for the explanatory variables, as tables 2 through8 also brought.

Age effects for happiness were found to be an inverted U in model 1 and were non-significant in models 4 and 5 (that contained the covariates of self-determination and religiosity). Therefore, part of the age effects were explained by other variables in the model. For satisfaction, the age effect was positive in model 1, non-significant for model 4, and significant only at 10% in model 5. That is, the same covariates explained part of the age effects also for satisfaction. Period and cohort effects did not differ much between models, suggesting that they were approximately independent of the explanatory variables.

TABLE 12
Summary of trends for selected explanatory variables

Variable	Happ.	Satisf.	Health	Marital	Unemp.	Family	Freed.	Finan.	Religi.
Age effect/variation	I- U/*	+/+	-	I- U	-	*	*	U	NC
Period effect/variation	+/+	*/*	+	-	+	*	+	NC	+ young - old
Cohort effect/variation	*/*	-/-	*	+ young - old	*	* young - old	+	+	+ young - old

Notes: I- U = Inverted U, + = positive, * = non-significant or small, – = negative and NC = Not clear

This third paper of the series enabled the study of age, period, and cohort effects, with a discussion that complemented the three previous papers. The next and last paper of the series, paper 4, will conclude the presentation of these three papers. More specifically, it will discuss the main differences between the most blissful and most miserable individuals in Brazil using the most recent WVS database, the one of 2006. Then it will also describe selected determinants of well-being among socio-economic subgroups in the population.

This series has as its main objectives to discuss the determinants of happiness in Brazil using the World Values Survey (WVS) as a database, introducing and giving an overview of the field in order to be a basis for further studies on the topic.

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