

DEMOGRAPHIC DEVELOPMENT IN THE SOCIO-ECONOMIC CONTEXT

Michaela Tichá¹

Abstract

The aim of this paper is to investigate consequences between demographic structure, population development and income per capita through cross-sectional analysis. The countries of the world were divided into 4 quartiles according to GDP per capita. The results show that namely in the first two (or sometimes three) quartiles increasing in income causes an increase in life expectancy (including healthy life expectancy), mean age of population and higher number of dependents per population in productive age. In the fourth quartile of the richest countries is not significant. The curve of relationship has inverted J-shape. Relationship between GDP per capita and fertility: with increasing income, the fertility rapid falls in the first two quartiles of the least developed countries. In the richest countries, there is fertility below replacement level and there is no correlation between income and fertility. Relationship between fertility and educational level is similar: in the first three quartile of the countries with lower educational level, fertility decreases with increasing levels of education, in the fourth quartile it is not so significant.

Keywords

Demographic Change, Demographic Transition, Economic Growth, Income Per Capita, Fertility

I. Introduction

The relationship between economic development and demographic changes including population growth is the focus of many economic analysts and demographers. The discussion on this topic was started by the pessimistic economist Malthus, who assumed that disproportionate population growth is a hindrance to the further development of society due to the lack of food resources (see e.g. Kelley, 2001; Weil and Wilde, 2010).

The aim of this paper is to investigate consequences between demographic structure, population development and income per capita through cross-sectional analysis.

Population growth was also an important factor in later models of economic growth. Firstly, Solow showed that population growth and rate of savings as exogenous variables determine the steady-state level of income per capita. While growth in savings shifts to a steady state and countries become rich, population growth without sufficient physical capital accumulation causes a decline in economic level (income per capita). The Solow model was later extended by Mankiw, Romer and Weil (1992) who included accumulation of human capital as well as physical capital. They added a proxy for human capital accumulations as an additional explanatory variable in cross-country regressions. According to Mankiw, Romer and Weil (1992), differences in savings, education, and population growth should explain most of cross-country differences in income per capita. Consequences between economic development, population growth, and demographic changes and their short- and long-run impacts were investigated also by Robert Barro (e.g. Barro and Becker, 1989), who emphasized namely the role of education (Barro, 2001).

Most analysts of relationship between population changes and economic development focus on the impact of population growth and human capital on economic growth because they find out

¹ PRIGO University, V. Nezvala 801/1, 73601 Havířov, Czech Republic E-mail: michaela.ticha@prigo.cz.

causes of different economic level of the countries. But it is clear, that causality is also in the opposite direction. At least according to empirical studies, it is evident that long-term economic growth and related economic conditions influence population behavior and demographic changes. According to Galor and Weil (2000) or Doepke (2004), economic growth has a negative effect on fertility.

Economic point of view on family behavior is known namely by Gerry Becker who applied economic analysis to such areas as discrimination, marriage, family relations, and education (Becker, 1960; Becker, 1993). Main thoughts of Becker deal with returns to education and the cost of child-rearing, and women's economic activities becoming less compatible with raising children, which shaped understanding of the demographic transition (Becker, 1981). Similarly, Schultz (1973) declared that growth of family income increases the opportunity costs of children raising. Parents with higher income do not want to sacrifice their lost wages, job opportunities and social network and status, and therefore their demand for children is decreasing.

Becker formulated his approach to understanding fertility as rational choice and other similar topics namely during the 1960s till the early 1990s, which was the period of the population explosion in the developing countries, and on the other hand, the period of gradual decline in fertility and large changes in demographic structure of the Western and Northern Europe towards demographic aging. Demographers and economists formulated economic-demographic paradox which described relationship between an economically advanced society with a rising standard of living and declining fertility: the higher society welfare and richer standard of living, the lower number of children per woman (total fertility rate). Already in the mid-60s, the developing nations put forward the slogan that *Development is the best contraceptive* (Lee, 2015).

But invention of the contraceptive pill was not the only factor of demographic changes during second half of the 20th century. Improving living conditions, increases in educational level of women and other social and economic development in Europe had been accompanied by considerable declines in fertility (e.g. Myrskylä, Kohler, and Billari 2009). These changes in population development are typical for the last stages of demographic transition (e.g. Sobotka 2008). The speed and timing of the changes during the second half of the 20th century were not the same in all parts of Europe. In contrast to the Western and Northern Europe, demographic changes in Eastern Europe were delayed due to communist regimes which prevented changes in population behavior. Slower growth of economic performance, worse standards of living, related to enclosure to external influences, and namely lower educational level of women, in comparison with Western countries, caused rigid population behavior. But after the fall of communist regimes in 1989, the changes were very rapid. While population changes in Western countries occurred during the 1960s and 1970s, post-communist countries have undergone a change in demographic structure and population behavior within 10 years of the 1990s.

II. Data and Methodology

Whereas many economic analyzes deal with the effects of demographic change on economic growth, this paper focuses mainly on the influence of the economic level on demographic change through cross-sectional analyses. In addition to standard research methods of deduction, analysis or synthesis, there is used correlation analysis which examines the existence of the relationship between two variables and the tightness of this relationship.

The used data are from database of UNDP (United Nations Development Programme), every indicator is related to 2018. Economic level is expressed by *GDP per capita (in constant process 2011, PPP)* and this indicator is perceived as the result of long-term economic development.

Demographic structure is described by age structure, specifically, *mean age* and *old-age dependency ratio* (ratio of the population ages 65 and older to the population ages 15–64, expressed as the number of dependents per 100 people of working age (ages 15–64)). Age structure of population relates to *life expectancy at birth* (number of years a newborn infant could expect to live and healthy life expectancy at birth) and *healthy life expectancy at birth* (average number of years that a person can expect to live in full health by taking into account years lived in less than full health because of disease and injury).

Educational level is expressed by two indicators: *mean years of schooling* and *expected years of schooling*. The first one means average number of years of education received by people ages 25 and older, converted from educational attainment levels using official durations of each level; the second one means number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child’s life. Measuring educational level is a bit debatable, for example Mankiw, Romer and Weil (1992) measure educational level as percentage of the working-age population that is in secondary school. But this way is difficult in the case of many countries with incompatible education system.

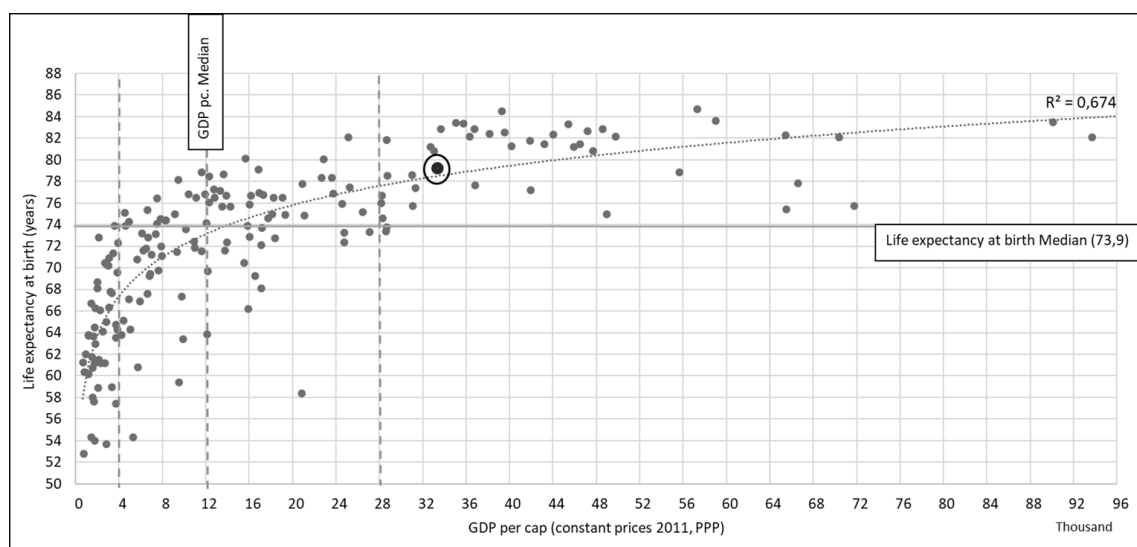
Population development is expressed by *total fertility rate* (number of children who would be born to a woman if she were to live to the end of her child-bearing years and bear children at each age in accordance with prevailing age-specific fertility rates), and *adult mortality rate* (probability that a 15-year-old will die before reaching age 60, expressed per 1,000 people).

III. Results

Relationship between GDP per capita and demographic structure

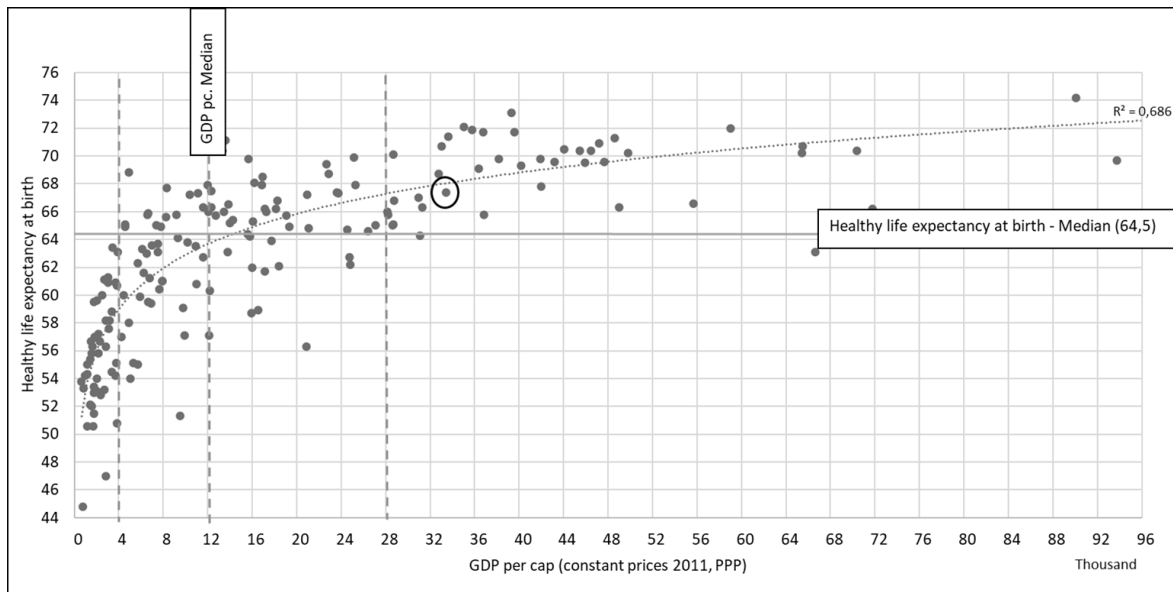
Based on GDP per capita, the countries are divided into 4 quartiles. In the first two quartiles, there is a strong positive relationship between GDP/pc and life expectancy, similar to a healthy life expectancy. With one or two exceptions, all the fourth quartile countries (with the highest level of GDP) have life expectancy under median level (73,9 years), resp. healthy life expectancy (64,5); see Figure 1 and 2.

Figure 1 GDP p.c. and Life expectancy (2018)



Source: UNDP (2020), own processing (Czechia is in the circle)

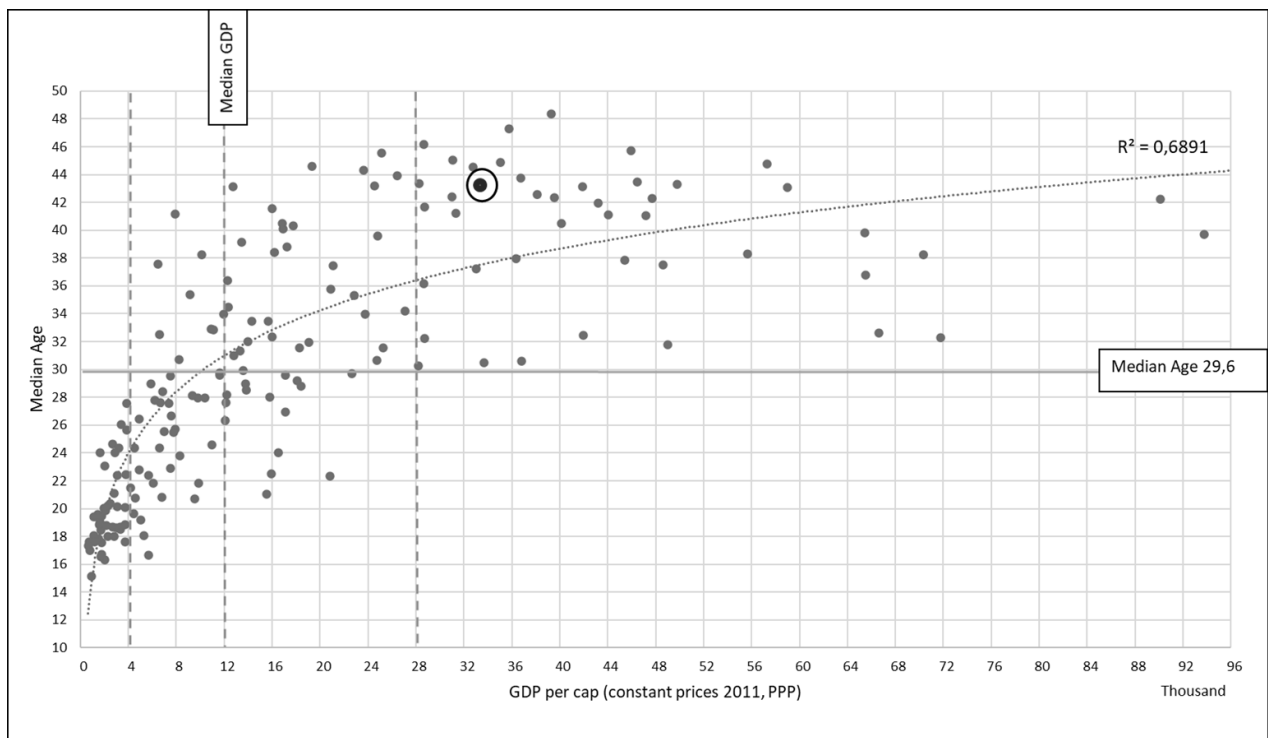
Figure 2 GDP p.c. and Healthy life expectancy at birth (2018)



Source: UNDP (2020), own processing (Czechia is in the circle)

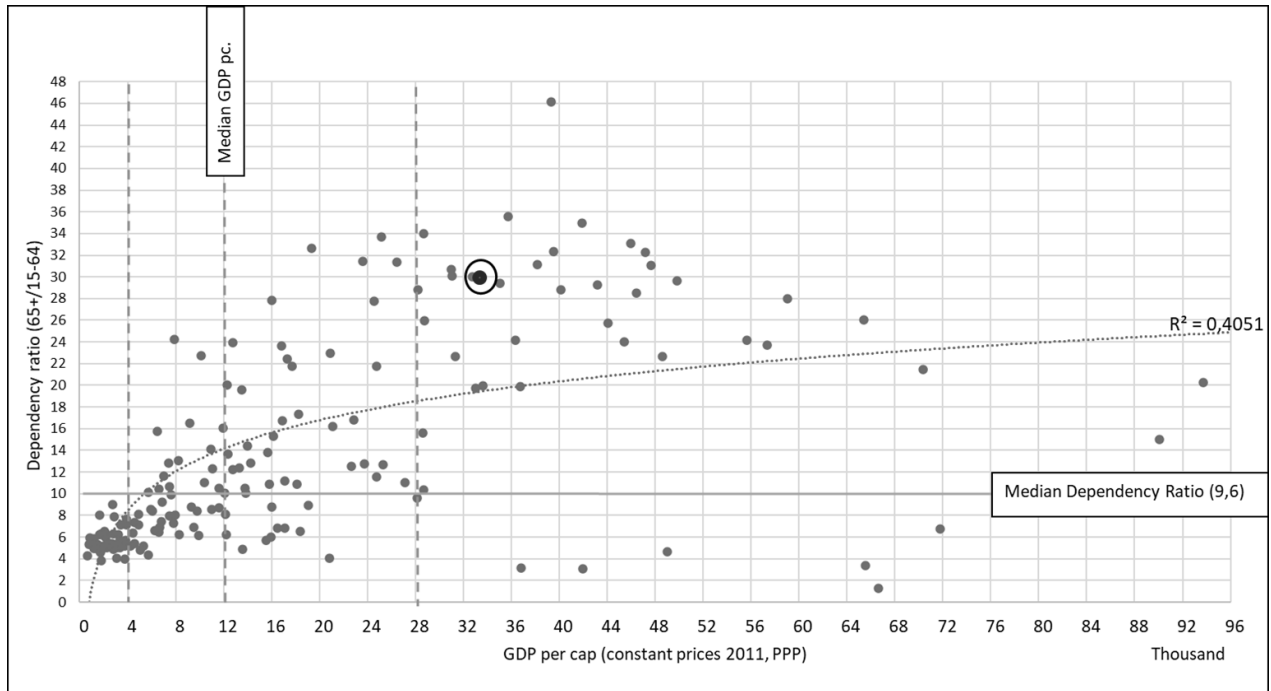
The age structure changes with increasing GDP level, namely in the case of countries below median level of GDP per capita, there is rapid growth of median age with increasing GDP. Every country in the fourth quartile GDP has median age under median level, e.g. in the Czechia, there is median age circa 43 years which is result of demographic aging. In the fourth quartile of GDP, there is very high old-age dependency ration, most of the counties have more than 20 people ages 65+ per 100 people of working age (Czechia: 30/100). (See Figure 3 and 4).

Figure 3 GDP p.c. and Median Age (2018)



Source: UNDP (2020), own processing (Czechia is in the circle)

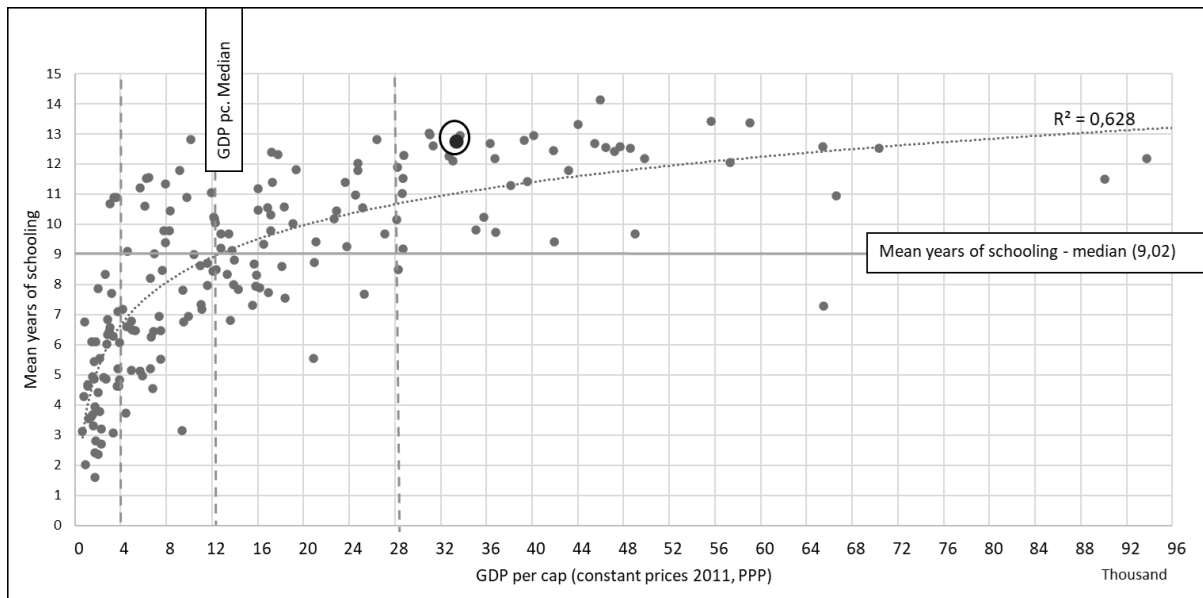
Figure 4 GDP p.c. and Old-age Dependency Ratio (2018)



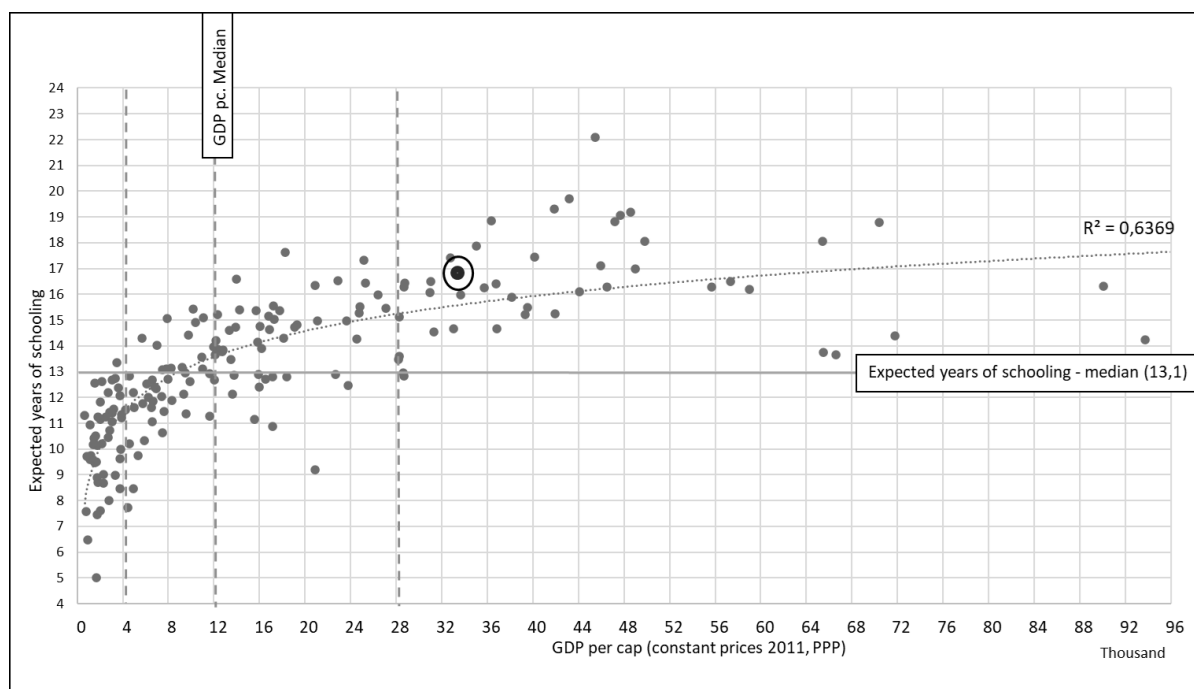
Source: UNDP (2020), Old-age dependency ratio: Ratio of the population ages 65 and older to the population ages 15–64, expressed as the number of dependents per 100 people of working age (ages 15–64).

Relationship between educational level and GDP is also strong and positive correlated, namely in the first three quartiles (see Figure 5 and 6). The curve has J-shape because in the countries with GDP/pc below median level, we can observe very rapid growth of educational level with growth of GDP/pc.

Figure 5 GDP p.c. and Educational Level (2018)



Source: UNDP (2020), own processing (Czechia is in the circle); Mean years of schooling: Average number of years of education received by people ages 25 and older, converted from educational attainment levels using official durations of each level.

Figure 6 GDP p.c. and Educational Level (2018)

Source: UNDP (2020), own processing (Czechia is in the circle);

Expected years of schooling: Number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child's life.

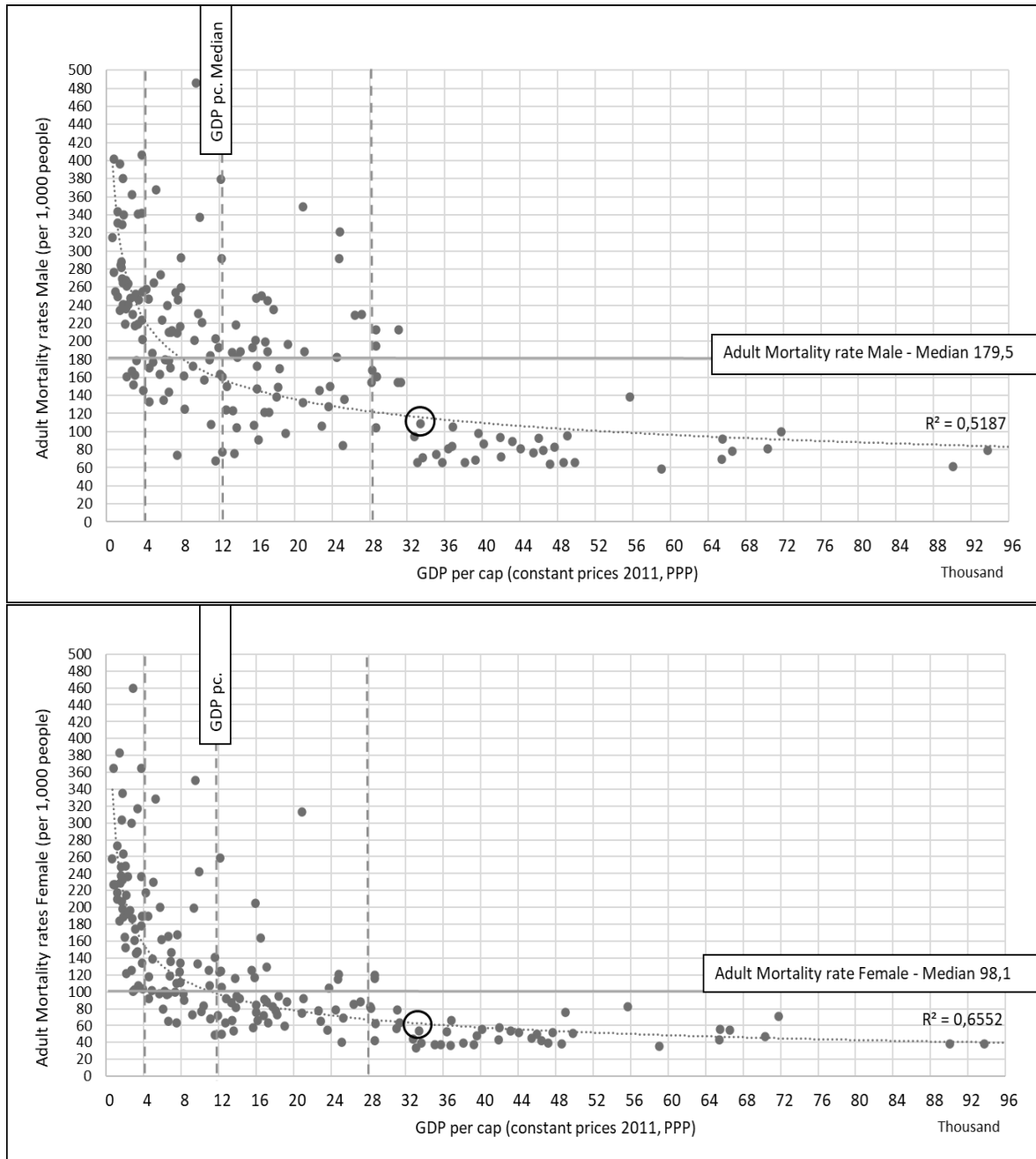
Relationship between GDP per capita and population development

Population development is characterized primarily by rate of mortality and fertility. Figure 7 describes relationship between adult mortality rate and GDP/pc, which is negative correlated, as expected. Due to higher life expectancy of women, they have lower adult mortality rate. It means that for example in Czechia, 53 women ages 15 years and older probably die before reaching age 60, expressed per 1,000 people. Compare to men: it is 109 men per 1,000 p. It is interesting that also in the developing countries with very low economic development, there are lower female total mortality rate than male despite poor maternity care and high fertility and maternal mortality. Even in the least developed countries, women live on average 4 years longer than men.

Figure 8 expresses demographic-economic paradox because higher GDP per capita relates to lower fertility rate. This negative relationship is strong namely in the first two quartiles. After reaching a high standard of living (GDP per capita in the fourth quartile), fertility is no longer strongly correlated with income. With a few exceptions, all countries of the richest quartile have total fertility rate below median level (2,27 children per woman), even below replacement fertility rate (2,1); average total fertility rate for countries of the fourth quartile is 1,7. Only four countries with the highest GDP/pc have fertility under 2,1 level: they are oil powers (Kuwait, Saudi Arabia, and Oman) and, maybe surprisingly, Israel. The group of oil exporters is characterized by different social status of women and their unequal access to education and the labor market.

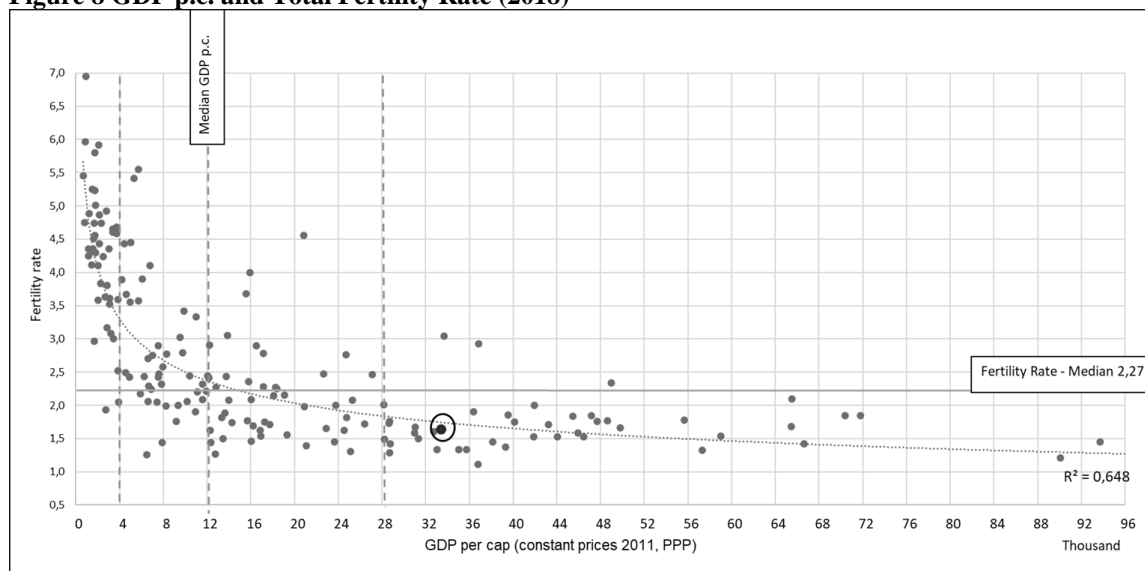
Situation in the Figure 9 is similar, but the curve expressing relationship between fertility and Human Development Index (HDI) is not in typical J-shape. It is because HDI includes not only income per capita but also other components as educational level and life expectancy at birth.

Figure 7 GDP p.c. and Adult Mortality Rates – Male and Female (2018)



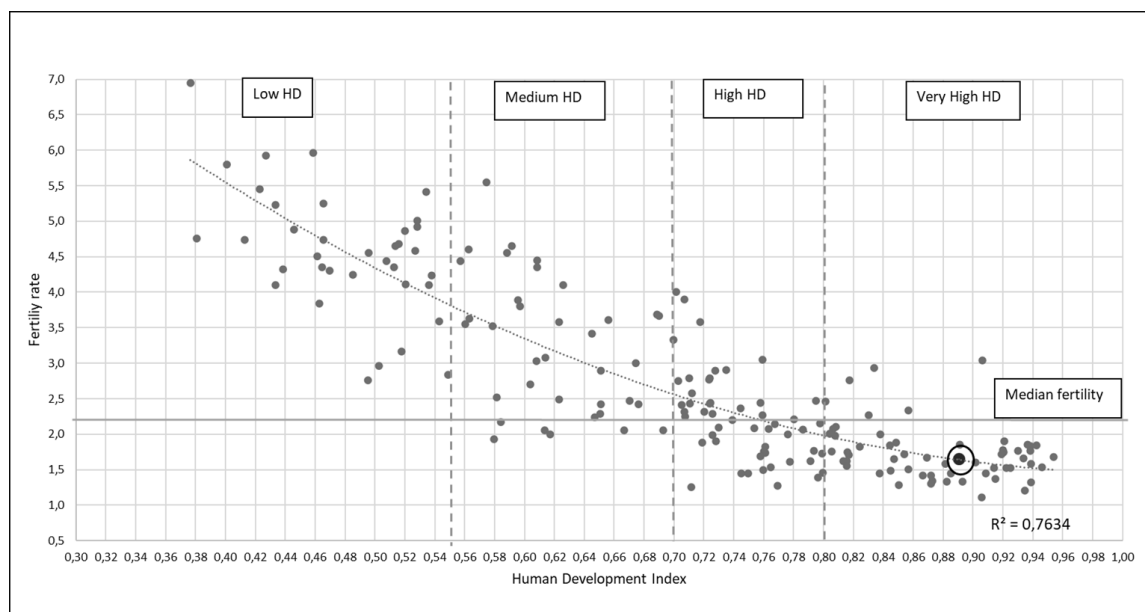
Source: UNDP (2020), own processing (Czechia is in the circle); Adult mortality rate: Probability that a 15-year-old will die before reaching age 60, expressed per 1,000 people.

Figure 8 GDP p.c. and Total Fertility Rate (2018)



Source: UNDP (2020), own processing (Czechia is in the circle)

Figure 9 Human Development Index and Total Fertility Rate (2018)



Source: UNDP (2020), own processing (Czechia is in the circle)

Relationship between fertility and educational level

Figure 10 describes correlation between educational level, expressed by *mean years of schooling* and *expected years of schooling*, and total fertility rate. Mean years of schooling expresses educational level of the whole population ages 15 years and older, i.e. including older group of population. In contrast, indicator expected years of schooling expresses situation in the young population, so that there is higher number of years for each country. In the first three quartiles of educational levels, we can observe strong negative correlation: fertility decreases rapidly with increasing levels of education. Only the fourth quartile (Figure 11) of the countries with the highest expected years of schooling is different, there is not any correlation between these variables. It is similar as in the case of relationship between fertility and GDP per capita.

Figure 10 Female Educational Level and Total Fertility Rate (2018)

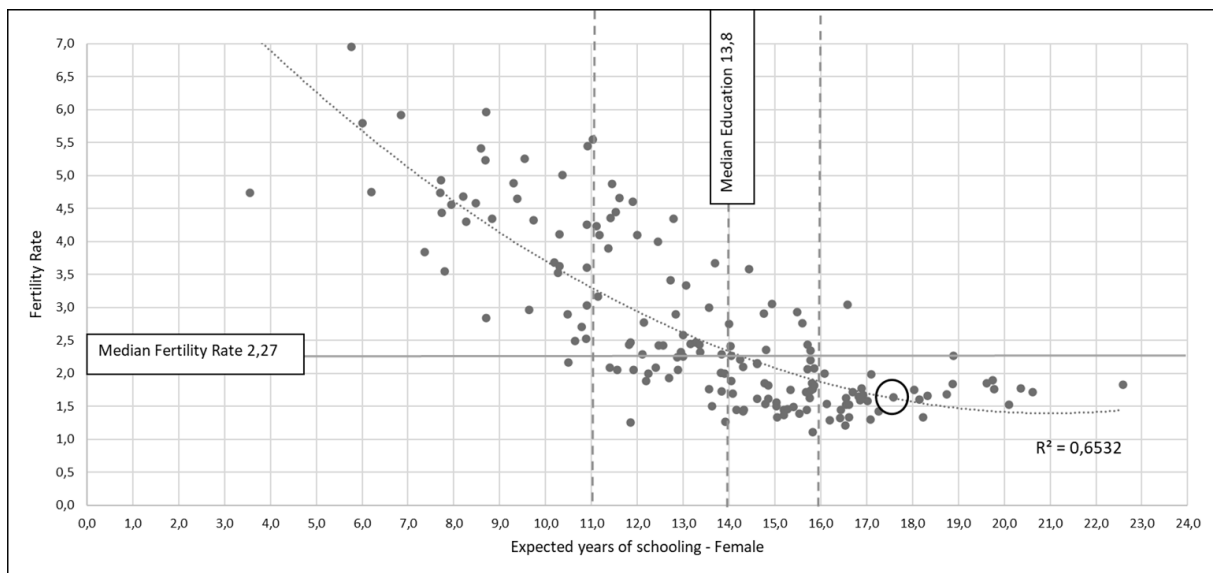
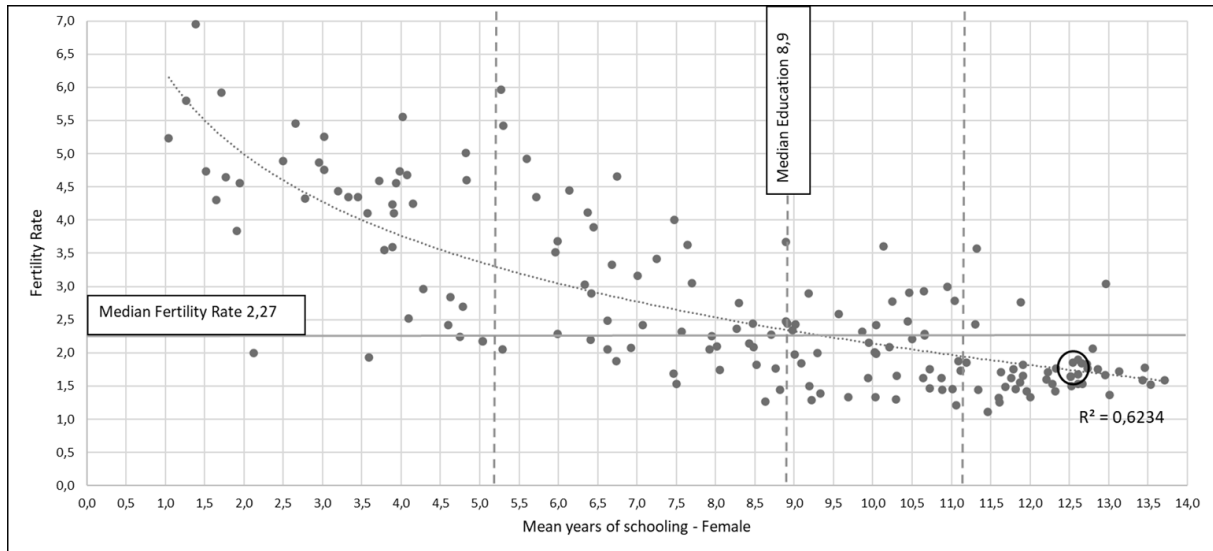
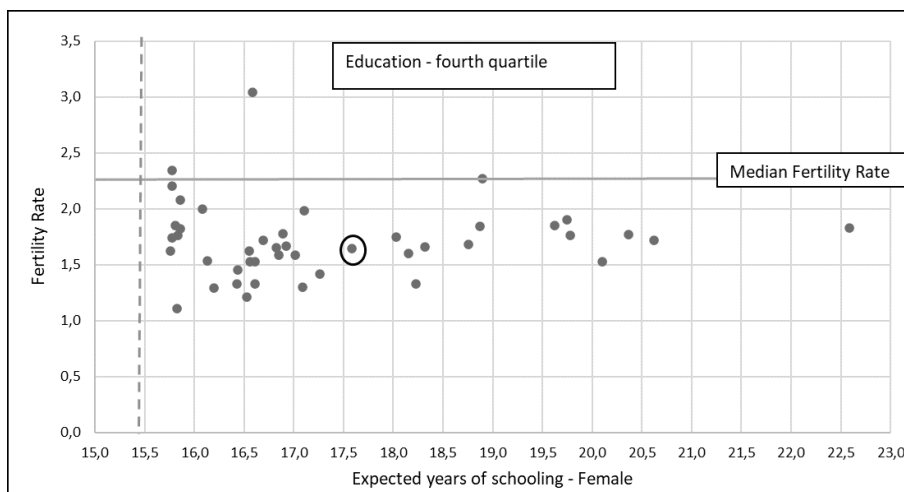


Figure 11 Female Educational Level and Total Fertility Rate – fourth quartile (the highest educational level)



Source: UNDP (2020), own processing (Czechia is in the circle)

IV. Conclusion

The discussion on the topic of the consequences between economic development and demographic change was started by Malthus, who was rather pessimistic. He did not assume future large progress of technologies as well as human capital. This imperfection was later corrected by authors of modern economic growth models. Most of them investigate the impact of population and human capital on economic growth. The goal of this paper is more different: to investigate consequences between demographic structure, population development and income per capita through cross-sectional analysis with emphasis on the impact of economic development on demographic change. For analysis, the countries of the world were divided into 4 quartiles according to GDP per capita. The results of correlation analyses show that namely in the first two (or sometimes three) quartiles increasing in income causes an increase in life expectancy (including healthy life expectancy), mean age of population and higher number of dependents per population in productive age. In the fourth quartile of the richest countries is the situation a bit different, correlation is not so strong. The curve of relationship has inverted J-shape. The same result is for relationship between GDP per capita and mortality, just the correlation is negative, as expected. Regarding relationship between GDP per capita and fertility, the results correspond to the stages of demographic transition. With increasing income, the fertility rapidly falls in the first two quartiles of the least developed countries. Then the decrease in fertility is not so fast, and in the richest countries, there is fertility below replacement level and correlation between income and fertility is not significant. The same conclusion applies to the relationship between fertility and educational level. The curve has J-shape because in the first three quartile of the countries with lower educational level, fertility decreases with increasing levels of education, whereas in the fourth quartile it is not so significant.

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