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### Economy and health

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# CHAPTER 1

## 1. INTRODUCTION

### 1.1. MOTIVATION AND RESEARCH QUESTIONS

Good health is one of the many attributes of a desirable life. In economic terms, consumers pursue good health and other objectives, while subject to budget and time constraints. The interaction between objectives pursued and constraints observed is traditionally described by quantities demanded at a given price of goods. In the healthcare market, the quantity of healthcare demanded is largely determined by the health status of the consumer while the price consumers face is usually partially covered by insurance thus giving space for complex interactions.

This thesis focuses on two aspects of these interactions. First, since the demand for healthcare is determined by the health status of individuals, it is important to understand the determinants of health. The common determinants of health have been widely studied in medical sciences, epidemiology and health economics; however, a less investigated, but rapidly expanding line of research suggests a relationship between the economic circumstances at birth and health. The literature has documented both, negative and positive effects of adverse economic conditions around the time of birth on infant health (e.g., Dehejia and Lleras-Muney, 2004), childhood health (e.g., Angelini and Mierau, 2014) and a range of late-life mortality and morbidity outcomes (see, for instance, Doblhammer *et al.*, 2013; van den Berg *et al.*, 2006, 2009, 2011, 2013; Lindeboom *et al.*, 2010). Even the Netherlands Scientific Council for Government Policy in its latest policy brief on health prevention calls for emphasis on the early-life period as interventions early in life have the greatest potential for health gains (Broeders *et al.*, 2018). However, the sometimes contradicting findings from the literature on the effects of early-life circumstances warrant further research into the mechanisms behind these relationships, which is carried out in

this thesis.

Second, health insurance, which covers the cost of healthcare, creates incentives for moral hazard and selection. It is well established in the economic literature that moral hazard and adverse selection create inefficiencies in health insurance markets and, these effects must be taken into account in the optimal design of insurance policies. However, addressing the inefficiencies caused by either moral hazard or adverse selection often exacerbates the problems caused by the other factor. For example, individual mandate for health insurance reduces adverse selection, but having insurance, in turn, decreases the effective price of health care to the consumers, thus creating incentives for moral hazard. This trade-off is an important concern for health care policy; therefore, it is crucial to disentangle these two effects and establish their relative magnitudes (Chiappori and Salanie, 2000, Chiappori, 2000, Finkelstein and Poterba, 2004). In this thesis I address one such trade-off created by a policy tool that is introduced to reduce moral hazard in the Netherlands – a voluntary deductible for basic health insurance.

The rest of this chapter is set up as follows. The following two sections describe each of the two lines of research in detail and explain the research questions addressed in this thesis. Next, section 1.2. summarizes the main findings of each chapter and discusses their policy implications.

### 1.1.1. EARLY-LIFE ECONOMIC CIRCUMSTANCES AND HEALTH

In medical sciences, it is well-established that deprivation during gestation is an important early origin of adult cardiac and metabolic disorders due to fetal programming that permanently shapes the body's structure, function, and metabolism and contributes to adult disease (Barker, 1995). This has led to the formulation of the developmental origins and fetal programming hypotheses, which state that certain diseases at older ages can be caused by deprivation in utero or around birth (see overviews in Kuh and Shlomo, 2004; Kuh and Hardy, 2002).

The above-mentioned research finds that various indicators of prenatal and early life conditions are associated with health and mortality later in life. However, the indicators of individual early life conditions often suffer from possible endogeneity, since individual socioeconomic circumstances and late life health can be caused by similar, yet unobserved characteristics. Therefore, the economic literature contributes to this research by using

clearly exogenous indicators of conditions at birth, such as unexpected periods of hunger and war, or for less extreme cases - the state of the business cycle or level of unemployment, to capture the effect of early life circumstances on later life health (see, for instance, van den Berg *et al.*, 2006, 2009, 2011, 2013, Angelini and Mierau, 2014, Cutler *et al.*, 2016, and the overviews in Almond and Currie, 2011 and van den Berg and Lindeboom, 2014). This thesis also uses the unemployment level as an approximation of the economic conditions in the given year. To ensure variation in the unemployment data, we use provincial unemployment level as our main explanatory variable.

The natural starting point for this thesis is the immediate health effects of economic conditions at birth, that is, infant health. The existing research on the link between the state of the economy at birth and infant health provides conflicting results. Some studies demonstrate that children's health improves during economic downturns (Dehejia and Lleras-Muney, 2004; Aparicio and González, 2014, Angelini and Mierau, 2014) while others find no effect (van den Berg and Modin, 2013) or show that economic downturns lead to an increase in the likelihood of babies being less healthy (Kaplan *et al.*, 2017; Margerison-Zilko *et al.*, 2011; Bhalotra, 2010; Bozzoli and Quintana-Domque, 2014).

I consider several mechanisms by which an economic downturn might affect babies' health. First, a decrease in income due to an economic downturn can lead to changes in health-related consumption by pregnant women, including changes in the quality and quantity of nutrition, but also changes in unhealthy consumption such as smoking or alcohol. Second, economic downturns might affect the decision to become pregnant differently for different population groups, thus affecting the socioeconomic cohort composition of the babies born in a given year (Dehejia and Lleras-Muney, 2004; Aparicio and González, 2014, Angelini and Mierau, 2014). Additionally, it is well established in the medical and epidemiological literature that male fetuses and infants are more sensitive to harsh conditions than female fetuses (e.g. Bruckner *et al.*, 2009); however, the economic literature on business cycle fluctuations and infant health, to the best of my knowledge, has not accounted for such gender differences. Subsequently, the first research question considered in this thesis is as follows:

*What is the effect of provincial unemployment on infant health and how does this effect differ between genders?* (Chapter 2)

After establishing the effects in childhood, I turn to adult health outcomes. Despite the extensive literature documenting the relationship between early-life conditions and late-life outcomes, this literature focuses predominantly on general or cause-specific mortality as outcome measures (van den Berg *et al.*, 2006, 2015, 2016). Since mortality is an end-state phenomenon, its analysis necessarily relies on cohorts that were born quite long ago. The increasing availability of biomarker data from large cohort studies provides an opportunity to study health effects other than mortality. Taking into account that cardiovascular diseases (CVD) are still the leading cause of death in Europe and around the world (Nichols *et al.*, 2014), I can use biomarker data to construct a measure of the 10-year risk of fatal cardiovascular event. Accordingly, the next research question I address is as follows:

*What is the effect of provincial unemployment at birth on adult CVD risk and how does this effect differ between genders?* (Chapter 3)

The literature exploring the mechanisms behind these effects suggests that malnutrition, changes in cohort composition and health behaviors of the parents could be potential explanations of the effects (e.g. Dehejia and Lleras-Muney, 2004; van den Berg *et al.*, 2006, 2009, 2011). In addition, some recent findings suggest that stress caused by economic problems might have direct health effects on pregnant women and fetuses (Alessie *et al.*, 2018, Olafsson, 2016, Bruckner *et al.*, 2014). Maternal stress can cause fetal distress which, in turn, is an indication for cesarean delivery (Bruckner *et al.*, 2014). Moreover, male fetuses are known to be more sensitive to maternal stress (Catalano *et al.*, 2005 and 2010). Consequently, my next research question is the following:

*Does stress caused by economic downturns affect the pregnant women severely enough to increase the probability of cesarean deliveries for male babies?* (Chapter 4)

### 1.1.2. MORAL HAZARD AND SELECTION IN HEALTH INSURANCE

The last chapter of this thesis focuses on the consumer incentives created by the fact that in healthcare markets insurance companies instead of patients themselves bear the risk of medical expenses. It is well-known that health insurance may lead to moral hazard behavior – individuals use more healthcare when facing lower out-of-pocket health care costs. To counteract moral hazard, policy makers and health insurers often use various cost sharing options, such as co-payments and deductibles. In Switzerland, US, and the

Netherlands, a voluntary deductible is offered to the consumer on top of a mandatory deductible in return for a premium rebate (Winssen *et al.*, 2015; Zweifel and Manning, 2000). A voluntary deductible likely leads to some selection, as healthy individuals choose a higher deductible and less healthy individuals opt for no deductible which ultimately leads to a transfer of costs from the healthy individuals to the unhealthy (Nyman, 1999). As a result, requests in the Dutch press have been made to abandon the voluntary deductible since it undermines the solidarity principle of health insurance and drives up the health insurance costs for those people who use a lot of care (NPO, 2017). Given this debate, the final research question of this thesis is the following:

*Does the voluntary deductible in the Netherlands reduce moral hazard in healthcare utilization or act as a selection tool for low-risk individuals?* (Chapter 5)

## **1.2. SUMMARY AND POLICY RECOMMENDATIONS**

Chapter two of this thesis studies the gender-specific impact of macroeconomic conditions around birth on infant health. First, using population data from Statistics Netherlands that are available for the period between 1959 and 1994, I investigate the effect of provincial unemployment levels on birth rates. Next, I focus on whether the decreasing fertility changes the cohort composition of mothers. For this purpose, I use a sample of over 50,000 respondents born between 1950 and 1994 from Lifelines – a large scale cohort study among people currently living in the three northern provinces of the Netherlands. Finally, to answer the main research question of this chapter, using the Lifelines data, I investigate how provincial unemployment affects the birthweight of babies.

My results show that high provincial unemployment rates decrease fertility and change the cohort composition of mothers with low socio-economic status mothers being less likely to become pregnant during high unemployment periods. Even though the cohort composition improves, high provincial unemployment rates still lead to a lower birthweight in boys. The negative impact of high unemployment on birthweight is particularly strong for boys born to older mothers and for babies born to smoking mothers.

These results have direct policy implications. Since infant health has been shown to have long-term impact on a host of outcomes later in life, such as accumulation of human capital, labor market outcomes, marital status and welfare dependency, my results clearly

point to the population groups that deserve particular attention during economic hardship. Supporting older or low socio-economic status mothers during pregnancy could have long-term impact on health and socio-economic status of their children. This is supported by the latest policy brief on health prevention by the Netherlands Scientific Council for Government Policy which recommends focusing on early-life interventions as they might have the greatest potential for health gains (Broeders *et al.*, 2018). Moreover, as opposed to findings from US or Spain (Dehejia and Lleras-Muney, 2004; Aparicio and González, 2014), the effects in the Netherlands are not large enough to cause clinically low birthweight, possibly, owing to the protective effects of the Dutch unemployment benefits.

Chapter 3 of this thesis investigates the impact of economic conditions at birth on adult health by studying the effect of regional unemployment rates at the time of birth on gender-specific cardiovascular disease (CVD) risk in adulthood. I operationalize CVD risk by constructing the Systematic COronary Risk Evaluation (SCORE) index (Conroy *et al.*, 2003) using biomarker data from Lifelines, which provides us with 75,566 respondents aged between 18 and 65. In addition I investigate whether the results can be explained by cyclical changes in cohort composition.

I find that women exposed to unfavorable business-cycle conditions at birth are at an increased risk for fatal CVD events in adult life. I interpret this as evidence that unfavorable conditions in the household at birth cause an elevated CVD risk in prime and late adulthood among women. For men, CVD risk, on average, is unaffected by early-life exposure to recessions. However, this does not necessarily mean that causal effects of adverse economic conditions at the individual level are absent. Instead, the business cycle might not be capturing fluctuations in economic conditions well, due to improving social safety nets over the 20<sup>th</sup> century.

The policy implications of these results are threefold. First, since policy interventions aimed at preventing late-life CVD rely on predictors of CVD such as the CVD risk SCORE that we examine, the collection of the relevant biomarker data can be targeted at individuals born under adverse conditions. Second, the recent policy focus on adult lifestyle as measure for preventing CVD might be insufficient, since the results of this chapter show that some causes of CVD may occur already before birth. For preventing CVD in future generations, it is important to consider the effects of early life conditions on health

later in life. Third, if being born in an economic downturn has a negative effect on later life health and risk of mortality, then the total lifetime earnings for the affected individuals are reduced. This underlines the long-term benefits of policies that help young children and pregnant women during economic hardship and can be seen as a justification for macroeconomic stabilization policies.

In chapter 4, I investigate one of the potential mechanisms behind the health effects of economic conditions, that is, maternal stress. This chapter examines whether stress caused by economic downturns affects the pregnant women severely enough to increase the probability of Cesarean Deliveries (CD) for male babies. As in the previous two chapters, for this analysis I also use data from Lifelines cohort study. I select a subsample of individuals from Lifelines study who are born in the Netherlands between 1970 and 1993. In addition, I select a subsample of individuals who are born in the weekends and Dutch public holidays to more precisely estimate the effect of unemployment level on unplanned CDs, since only the unplanned CDs can be caused by fetal distress in reaction to maternal stress and planned CDs are not routinely scheduled during weekends and holidays.

The results show that the probability of CD for male babies increases when unemployment levels rise. This result suggests that maternal stress might be one of the mechanisms how early life economic conditions affect health. The maternal response to increased unemployment levels may elicit clinical signs of distress in male fetuses upon which medical staff may intervene. In addition, the results do not seem to be driven by differential selection into fertility.

The policy implications of this result are the following. I have shown that economic downturns cause stress for pregnant women that is strong enough to cause health effects in their babies. While macroeconomic stabilization policies would address the root cause for stress, it is worthwhile to consider investing in programs that help pregnant mothers to manage and reduce stress during economic hardship. This could also, to some extent, help to counteract the negative health effects later in the child's life that were discussed in Chapters 2 and 3. Moreover, since CD is a costly medical procedure, an increase in the male CD rates represents not only a health effect but also a direct cost of economic downturns. In that sense, such a stress management program could even create savings within the

healthcare sector. Taken together with the results of Chapters 2 and 3, these results show that both, men and women, are affected by the economic conditions at birth, although, possibly, at different points in their lives and in different ways.

Chapter 5 investigates whether the voluntary deductible in the Dutch health insurance system reduces moral hazard or acts as a cost reduction tool for low-risk individuals using the LISS panel data (Longitudinal Internet Studies for the Social sciences). The panel is based on a true probability sample of Dutch households drawn from the population register by Statistics Netherlands and consists of approximately 4500 households. In the Dutch institutional setting, insurance companies are not allowed to risk-rate the insurance premiums which means that existence of asymmetric information is inevitable. Nevertheless, since van Winssen *et al.* (2015) find that the uptake of the voluntary deductible is much lower than would be profitable for the consumers, it is an open question whether the consumers, in fact, use their private information. To answer this, I test, first, if individuals with voluntary deductible use less healthcare, and, second, whether there are any individual characteristics that are correlated with both insurance coverage and healthcare utilization of an individual. As proposed by Finkelstein and McGarry (2006), the existence of such characteristics can be treated as evidence of asymmetric information. Next, I estimate the moral hazard effect of the voluntary deductible. The economic theory predicts that individuals who choose a voluntary deductible and experience a negative health shock, consume less health care than they would without the voluntary deductible. Hence, empirically I test for the moral hazard as the effect of having a voluntary deductible on healthcare utilization, conditional on individual's health status and preferences. We use four types of healthcare utilization – visits to a specialist, visits to the general practitioner (GP), visits to mental care providers and days spent in hospital. In my models I account for the fact that both, the choice of the deductible and healthcare utilization could be correlated to some unobserved individual characteristics, by treating the voluntary deductible as endogenous. Moreover, due to the distribution of my outcome variables, I explicitly model both, the probability of having any visit or hospital day and the actual number of visits / days.

I find that asymmetric information is important for the uptake of voluntary deductible and healthcare utilization in the Netherlands. I present evidence of adverse

selection with regard to the utilization of care for physical health, but advantageous selection for mental health care. Moreover, I show that voluntary deductible reduces moral hazard in the Netherlands, especially in the decision to have any doctor's visits (extensive margin) as compared to the number of visits (intensive margin). Overall, my results show that different types of healthcare utilization exhibit different levels of moral hazard.

From a policy perspective, these results contribute to the discussion on the optimal insurance design. Clearly, even though a voluntary deductible creates incentives for adverse (or in the case of mental health care – advantageous) selection, it is an effective tool to reduce moral hazard in health care utilization in the Netherlands.