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“The Circular Relationship Between Income and Fertility”

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ABSTRACT

Il controllo del tasso di crescita della popolazione è stato l’obiettivo di molte policies, specialmente negli ultimi decenni, pur avendo probabilmente interessato l’uomo sin da quando ha iniziato ad aggregarsi in comunità: la sovrappopolazione minaccia malattie e un eccessivo consumo di risorse, mentre un numero esiguo inficia le opportunità di crescita della comunità. Tuttavia, ben poco è certo tuttora sulla relazione causale che intercorre tra fertilità e reddito; gli studi empirici hanno trovato evidenze talvolta contrastanti riguardo al segno di questa relazione e alla magnitudine nella risposta di una variabile a cambiamenti nell’altra. In questa tesi, letteratura precedente viene ripresa con l’obiettivo di presentare le idee emerse finora, alcuni dei principali studi empirici e dei problemi incontrati nell’analisi di questa relazione elusiva e reciproca. Infine, viene condotta un’analisi empirica sui comuni italiani, utilizzando un modello a effetti fissi per comune: i risultati aggiungono evidenza a sfavore di una presunta linearità della relazione. Inoltre, si osserva diversa significatività dei coefficienti della regressione per le diverse aree del Paese: questi effetti differenziali delle variazioni nel reddito sulla fertilità osservati fra Nord e Centro/Sud apportano ulteriore evidenza delle profonde differenze fra le due macro-aree del Paese.

INTRODUCTION

The demographics of fertility have always been a high-interest field of analysis for social researchers, as it is one of the main indicators of population growth and the target of policies in many countries. Population growth explosion can slow down economic development and reduce progress in life standards in developing countries (reasons for which the famous Two-Child-Policy and One-Child-Policy in China were first applied in the ‘70s), while fertility rates below the replacement level, combined with population ageing, make elders care and social security subsidies more difficult to finance, a well-known problem to Europe and other developed countries with below replacement level fertility. Nevertheless, policies’ effectiveness is difficult to predict, since little is known with certainty about the causality between income and fertility.

The informativeness of population trends for policy making is also given by their use in economic analysis to calculate optimal consumption levels (especially of non-renewable resources), since future population must be predicted in order to discount future consumption and calculate intergenerational resource allocations.
Tracking fertility rates and being able to predict population swings is also fundamental for more efficient planning and resource allocation within a region. If a country experiences unusually high sustained fertility rates, it may need to build additional schools or expand access to affordable child care (such as happened in the US during post-World War II baby boom era).

A focal point in economists’ discussion on fertility has been income, studied both in its effects on fertility and in the way in which it can be influenced by fertility choices. Initially, studies focused on quantum, i.e. the number of children and amount invested in them, while in the last decades researchers started to consider the tempo, i.e. the timing of childbearing, as well. In the first two chapters, literature will be revised separately according to the analyzed causality direction, in the attempt to outline the reciprocal relationship between fertility and income: in the first chapter, studies regarding the effects of income on fertility will be presented, in the second chapter vice-versa. Although correctly observing this two-way causal relationship is challenging, because of endogeneity problems, still it is convincing that cleverly designed studies contain highly valuable information and results.

In the first chapter, literature discussing both the response to changes in the cost of children and the response to changes in income will be reviewed, since the net price of a child and the opportunity cost of a mother’s time are correlated to income and it is likely that in empirical observations the income-fertility relationship results obfuscated by such factors. Because endogeneity and omitted variables are an issue in examining this relationship, discussion will not be restricted too tightly on the bare measure of income, as the intention is to give an idea of its predictive limitations, of the role played by other factors in determining fertility and of the entanglement with endogenous factors influencing both: in particular, attention will also be paid to socioeconomic factors related to income such as occupation, education and wealth. At the same time, considering the different contributions of other variables can be useful in understanding some of the identification difficulties that researchers experience in the observation of this elusive relationship.

While in this discussion it is made larger use of developed-countries literature, researches conducted in developing-countries have been considered as well, in the attempt to present patterns that could hold across different environments. Similarly, females, rather than males, are protagonists in the analysis, since a major part of literature has focused on them, but the discussion is extended to the male counterpart as well.

In the end, an empirical analysis will be conducted, meant to test the effects of income on fertility. Data from Italian municipalities will be used to estimate a region by time municipality fixed effects model. Evidence is found against the possibility of a linear
relationship between the two variables; moreover, a differential effect is found in fertility responses to variations in income between Northern and Central/Southern Italy: this adds to estimates regarding economic, social and infrastructural differences between these macro-areas.

1. THE EFFECTS OF INCOME ON FERTILITY

Several studies have shown that economic development is associated with a decrease in total fertility rates (TFR). Two of the most important qualitative theories describing this correlation are demographic transition theory and second demographic transition (SDT). While the first predicts that TFR, after a sharp increase in the beginning of transition, which occurs when a certain level of minimum development is reached, will settle at fertility rate of 2.1 (the replacement level) at the end of transition, SDT allows TFR to reach values lower than 2.1 and to be strongly influenced by the spread of postmodernist values, social changes and social learning and feedback reinforcement (see Van de Kaa 2002: from the “king-child with parents” to a “king-couple with child”). Van de Kaa links recent demographic trends to the emergence of higher-order needs and post-materialist values, e.g. individual autonomy, self-actualization, expressive work. Nonetheless, surveys about the desired family size do not show significant changes in family preferences. The latter statement converges with findings by Lacalle-Calderon, Perez-Trujillo and Neira (2017) and Myrskylä, Kohler and Billari (2009) that TFR increases again after that a certain level of economic development is reached, drawing an inverse J-shape. Policies making it easier to combine work and family life may have an important role in this. Strulik and Sikandar (2002), contrastingly, find that there exists a certain income threshold above which the correlation between income and fertility is significantly negative, so that the fertility-income relationship assumes an inverted U shape. They also find evidence for a low-income, high-fertility trap, and for a decrease in time of the income level from which fertility rates start to decline in a developing country.

Another theory is Malthus’s (1798), which is the first, basic description of the relation between population growth and income. His starting point is the assumption of a fixed factor of production: when population size is small, the standard of living will be high, and population will grow, and simultaneously living standards will go down and population will be reduced. Posters have added to this cycle two other momentums: Post Malthusian regime and Modern Growth regime. In the former, technology makes its first apparition in society, making income per capita grow, with the Malthusian relationship between population growth
and income per capita staying the same; while in the latter, technological progress keeps income per capita steadily growing, but the relationship between the level of output and the growth rate of population turns negative: the highest rates of population growth are found in the poorest countries, and many rich countries have population growth rates near zero, as it has seemed to be the case in the last decades.

Moving from the previous theories, Galor and Weil (2000) speculate that the reversal of income-population growth relationship is determined by a substitution from quantity of children to quality (term with neutral value, used to indicate expenditure in each), supposing that technology brings the need of investment in human capital: technological progress raises the return of human capital.

Indeed, human capital investment made necessary by the extension of schooling further contributed to higher costs associated with having children, as more time spent in education prolonged the period in which children were dependent on the economic support of their parents.

The influence of quantity-quality choices in growing countries can be explained considering another aspect of economic development: infant mortality. When child mortality risks are high, the chances of survival until adulthood and thus the incentive to invest in any single offspring are low. If the goal of the parents is spreading their heritage or assuring themselves support in their old age, their preferred strategy may be to invest in the quantity of children, thereby increasing the probability that a sufficient number of their offspring will survive childhood. This strategy is likely to become less attractive when the chances that a child will reach adulthood approach certainty: then, parents will prefer investing more in quality (Ozcan 2002, 2003).

The higher fertility rates in developing countries might as well be determined by preference for quantity, which reflects the need for children to engage in farming and other economic pursuits. To discuss the former statement with the words Becker (1960), one of the first economists analyzing the difference between quantity and quality choices in parenting and comparing children’s functions to the properties of an economic good, in an agrarian economy fertility rates might be higher because not only are children a “consumption good”, but also a “production good”, working in their teenage years already. It is possible that the role of children as a production good ended after industrialization and the institution of norms prohibiting infant labor, and then with the introduction of education until the age of consent.

Now parent’s returns from children are rather delayed to old ages, which means, that they are heavily discounted. At the same time though, children are still valued as a warranty against old age, but, considering the different lifestyle and shift in technology, now one child can be
sufficient to satisfy parents’ need of security in their retirement, with the payout mainly driven by human capital investment in their kids. The fact that the provision for parents is determined by investment in human capital, which is made a reliable investment by the low mortality rate, is another motivation for which parents might be willing to concentrate their energies on fewer children.

It must also be considered that a higher income per capita may increase quality and not quantity of children, even if parents do not make any deliberate choice for investment: given that children are not mere production goods and that resources are naturally shared in a family, a higher-income family will proportionally allocate more resources in each child (for example, they would eat better quality food and enjoy the same consumption level and assets that their parents do).

Of course, investments in children do are in great part voluntary. In modern societies unwillingness to diminish the quality of successive children is common, and that might be also driven by ethical considerations; moreover, behavioral, altruistic preferences might drive investments to permit the pursuit of better standards of living through social mobility and career advancement.

As it was previously mentioned, parents face a trade-off between quantity and quality (Becker 1973, 1976). In his household production model, an increase in income and a decline in price increase the demand for children, but, at the same time, it is necessary to distinguish between the quantity and quality of children demanded. Lee and Mason (2010) show that as income increases, lower fertility is associated with an increased expenditure in children’s human capital. According to Becker, quality elasticity is higher than quantity elasticity. This means that a decrease in income may result in higher fertility, if substantial investments in quality are substituted for quantity.

However, in the very high-income families, where family size tends to be larger than in the middle-income families, it seems evident that parents can satisfy their quality requirements without having tight restrictions on the quantity of children.

Many studies show that fertility is decreasing in income. Willis (1974) offers an explanation for the time trend of fertility decrease, associated with an increase in female income: since child production is intensive in mother’s time and since gender inequality has decreased, resulting in higher wages for women, the cost of children has risen and fertility rates have fallen.

In fact, it is widely accepted that taking care of a child is a time-investing activity. Using two microeconomic concepts, income and substitution effects, we can show that the effect of higher income on fertility is mixed: on one side, it permits greater consumption, motivating a
higher fertility, as children, with an economical abstraction, can be compared to a consumption good; while at the same time, due to the substitution effect between work and leisure, higher remuneration would determine a higher opportunity cost for women to have children and a decreased demand of children.

In line with several studies, in this paper substitution effect is assumed to dominate income effect. Hence, higher wage employees are predicted to have fewer children by economic models, because their opportunity cost of time is higher: with increasing wages, the shadow price of children rises. But what if there are instruments to relax time constraints, and hence decrease opportunity costs? If there exists a market for childcare, since higher income individuals can afford nannies and better childcare facilities and outsource child rearing, the previous prediction should not be necessarily verified. A possible explanation of the observed fertility-income gradient could be the fear of moral hazard, which is costly to monitor. At the same time, it could be true that the higher opportunity cost of time would mean less consumption and enjoyment of children, with the result that the rich could not be interested in having many children since the time for enjoyment is still constrained.

Along with a different line of analysis, the fact that fertility decreases with income could be explained by children being inferior goods. This possibility has been implicitly mentioned, while talking about the need of children as work providers in less developed, agricultural societies. Robinson (1997), who defines children utility as given by three functions, of consumption goods, labor-services providers and insurance against old age, predicts that children, since they are cheaper than other assets, will be produced in a higher number in poorer countries, where people cannot afford purchasing market substitutes for those purposes. Although, this hypothesis will not be discussed further, since many other studies find that income is positively correlated to fertility (e.g. Lindo 2010).

This correlation may depend also on whether it is the female’s or the male’s income to be observed. Since, at least until some decades ago, mothers would spend more time than fathers on childcare, father’s time could be ignored as an input in child production and, while mother’s income would affect fertility through the cost of having a child (substitution effect), fathers’ income would affect fertility mainly through the income effect instead. The gendered division of labor in the family, with family formation being more likely to reduce the time spent by women on paid labor than by men, predicts that income effect will prevail for men, whereas opportunity costs will outweigh income effects for women. For this reason, also the effects of education on fertility are assumed to be negative for women, and positive for men (given that a higher education level is associated with higher wages). At the same time, however, father’s income may actually affect fertility via cost effect, even in such gender-
unequal environments, since a higher spouse’s income might generate a substitution effect because of an higher tenure of household, which might increase females’ time value (e.g. looking after their husband’s businesses) or give her other attractive consumption possibilities. Moreover, nowadays parents’ division of household and childcare duties are more equal, thus cost effect is likely to have become more relevant also for fathers. In addition, many studies found evidence of assortative matching of spouses, so that a high-income husband is sorted up with a high-income wife.

The previously mentioned prediction that higher-income individuals are more likely to have fewer children because of their higher opportunity costs is related to the literature that demonstrates that postponement of the birth of the first child provides substantial earnings returns for higher educated women or those in professional occupations. This makes sense because generally highly educated people are found in career tracks where age and experience are important determinants of wages, hence they need to avoid human capital depreciation and the damage for future career development, which would result from a temporary break from labor market, when they are not established yet. Besides, with seniority job flexibility is more available for highly professional workers: once they reach a level of experience in the office, productivity is not tied so closely with “face time”.

Cigno and Ermisch (1989) found that the higher the accumulation of human capital or the higher the returns to education, the later the transition to motherhood. Martin (2000) examines the growing trend of delaying fertility beyond the age of 30 and finds that the women underlying this aggregate trend are more educated women. Gustafsson (2001), examining the optimal age for motherhood, demonstrated that women’s career planning was the main explanation for postponement and fertility decrease. Other models predict that postponement is more likely when chances of an increase in parents’ income after a certain point in their career are higher. At the same time, Chen and Morgan (1991) also find that the likelihood that childless women age 30 and over will experience a first birth has increased over time.

It must be noticed that postponement is clearly interrelated with TFR, since the age at first birth influences the final total number of children, since fertility is constrained to a determined time period in a woman’s life cycle. Though, women postponing childbearing seem to recuperate later, reaching levels comparable to women having children at earlier stages.

Not only career may affect fertility tempo choice: Galloway and Hart (2015) found that also a change in the price of children affects postponement. The introduction of a child benefit policy and a tax-reducing reform only in the northern municipality of the same county in Norway, enabled them to conduct a quasi-experimental analysis, with the comparison of the northern (treatment group) to the southern (control group) county, since these kinds of
policies quasi-configure a natural experiment, given that the risk of influencing women’s’ behavior through elicitation of social norms and beliefs due to the behavioral influence of policy labelling is unlikely. They found that lowering the direct cost of a child had shifted childbearing to lower ages.

Economic uncertainty and unemployment have been considered as variables that influence TFR. Lindo (2010) finds that the negative shock due to displacement (Lindo considered also the effect of displacement due to business closure separately, since it is with more certainty an exogenous variation, and found similar results) accelerates the timing of children, but reduces fertility in the long period. Other recent researches studying the effect of economic recessions on fertility have found similar patterns: high unemployment and bad, unstable economic conditions reduce fertility and induce postponement (Örsal and Goldstein 2010), since rational actors will delay long-term decisions in times of uncertainty. Adserà (2004) finds that economic uncertainty determines highly educated women’s decision to delay motherhood until they are not well established at work; however, according to Neels, Theunynck and Wood (2013), postponement is later compensated during times of economic prosperity. Previous studies instead, moving especially from Becker’s microeconomic analysis, suggested that the relationship between fertility and economic conditions is counter-cyclical: postponement would be delayed in good times, because the opportunity cost of having children is higher.

Facilities giving the opportunity to outsource childcare and better combine work and family are also shown to be a determinant factor in fertility choices, because they are able to decrease opportunity costs of having a kid. Evidence is found by Rondinelli, Aassve and Billari (2006) for Italy that for births of order two or three the effect of women’s income depends on the availability of external care. Since higher-income parents are more likely to take advantage of these facilities, these kinds of facilities may stimulate fertility to grow with income and education level, given that the latter is correlated with wages. Indeed, income effect is predicted to dominate when access to childcare, gender equality, and good economic conditions (linked to education) are present.

Education is also likely to induce postponement: both because highly educated parents will wait until they have reached a certain point in their career path, which is a function of experience, and both because individuals who are still enrolled in education are at a lower risk of having a child, which is likely due to the presence of a socially accepted sequencing norm of first finishing education, combined with a self-perception of an age of pre-adulthood, echoed by the scarce resources and economic dependence of students.
Individuals with a high self-actualization drive may self-select into longer education and training path, or education may vice-versa determine different values and family formation preferences. In addition, in less-developed countries knowledge of contraceptives techniques is linked with education.

However, while there does is some agreement on the fact that education induces postponement (even after controlling for family environment, parental characteristics and genetics), results linking education to fertility are mixed. Because opportunity costs are considered to be higher among the more educated, education is assumed to have a negative effect on fertility. On the other hand, the income effect associated with higher wages may well outweigh substitution effects and increase fertility, leading to education having a positive effect on fertility. Educated women might present higher fertility also because, due to assortative matching, they are also likely have a partner with higher education and therefore a higher wage, plus they have stronger bargaining power within the couple, leading to a more equal division of domestic labor, and enjoy better possibilities to outsource housework.

Although higher educated women have their first child later than their lower educated counterparts, Kravdal and Rindfuss (2008) have highlighted that the higher educated are also more likely to recuperate at a later age. They have also observed that the postponement - recuperation at later ages mechanism holds true for higher educated males as well.

If we figure a model with fertility, education and work supply as endogenous variables, parents might anticipate children choices adjusting the amount they work or investments in human capital. Both fertility and education/work choices might be driven by unobservable third factors, such as individual characteristics, e.g. impatience: high discounters are more likely to have both lower income and more unplanned children.

The line of reasoning applied for education works similarly for occupation. Reverse causality studies show earlier fertility among women in educational fields related to the more ‘feminine’ fields of caring (e.g., teaching, healthcare), although there are no clear causal relationships. The mechanism is that women either self-select themselves into educational paths that lead to jobs where they are more able to combine motherhood and employment or that the difficulty of combing career and children varies by chosen career type. Adserà (2004) finds that employment in public sector boosts fertility, because it is associated with job stability and more generous family policies.

A similar self-selection mechanism could bring parents who want large families to allocate less time to developing market-based skills in anticipation of having many children, gaining therefore lower wages and earned income.
In this discussion, it is important to notice that different sources of income are likely to have different effects on fertility: the nature of a rise in income is relevant to predict fertility choices. Schultz (2005) found that with an increase in earned income, the opportunity cost of children rises, lowering fertility, while with an increase of rents or land ownership fertility rises. Consistently with this consideration, Schultz found that education, raising earned income and opportunity costs, is linked to a decrease in fertility: he found that an increase in the mother’s schooling attainment by one year, while it was associated with a rise in household consumption per adult, holding the household consumption effect of the woman's schooling constant, each additional year of schooling had an additional effect of reducing fertility by 0.12.

McDonald’s gender theory (2000) describes trends in fertility as a result of the interaction between micro-level factors, such as employment and education, and macro-level factors, such as political, welfare and family institutions, and predicts that extremely low fertility rates are likely when women’s roles have changed, but institutions and partnerships have not yet followed: once women have achieved gender equality in opportunities in education and labor, if institutions do not adapt, they will face demanding family-work conflicts and then they will tend to restrict the number of children. Therefore, family policies that support parents in reconciling work and family can be a crucial element in this process: once institutions have adapted, the increased female employment and earning opportunities might drive completed fertility up again. More educated women, who seem to achieve gender equality in family faster, might be among the firsts to increase their fertility. McDonalad’s gender theory is supported by empirical evidence at aggregated level: in Northern and Western European countries, which were the forerunners in implementing family policies to reduce family-work unbalances, fertility rates have started to recover, while in Central and Southern European, fertility rates are still lagging behind.

There are other studies that suggest income alone may not be the most important factor in determining fertility: environmental forces might drive fertility. Apart from genetic and biologic factors, social norms, values and culture play an important role. Kleven, Landais and Søgaard (2018) demonstrated that the best predictor of fertility outcomes for a woman was her mother’s work-family balance. Thus, intergenerational factors and the formation of female identity during childhood might be decisive in determining future fertility choices.
2. THE EFFECTS OF FERTILITY ON INCOME

Costs of children are made up both by the expenses required to rise the child, and the time-labor cost of providing child-care. There are three main ways in which income can decrease due to time-labor cost of children: through the reduction of participation to labor force and employment, number of hours worked and hourly wage. In this section, the focus will be on time-labor cost and on how fertility may affect occupational income. Other sources of income will not be considered in detail, since the objective is to describe the effect of fertility on labor supply choices. In this section focus will be on the female counterpart, as many studies have shown that having a child negatively impacts mothers’ earnings, also in the long run (Waldfogel 1997), with estimates from different studies ranging from 5% to 10% on average, while in most studies it is shown to positively impact fathers’ occupational income (Budig and Jean 2014), hence this effect is called “fatherhood bonus”.

Many early studies treated fertility as an exogenous determinant of labor supply behavior, but, more plausibly, it is endogenous in household decisions: as it was anticipated in the previous chapter, people may self-select both in education and occupation, according to their expectations on future fertility. People willing to settle down and form a family sooner might opt out from long career paths and choose to invest less in education and chose less-demanding and less-paying jobs: hence, the effects of fertility might be retroactive, through expectations.

Anyhow, researches show that a great part of the income drop comes only after the event of birth, and that it impacts women much more than men. In fact, nowadays 80% of gender gap in incomes can be explained by child penalties (Kleven, Landais and Søgaard 2018): differently from 40 years ago, now occupational income for males and females starts diverging only after the birth of the first child. This means that, while women used not to invest in their career at work, because there were social constraints or they anticipated the effects of having a baby, nowadays women are able and willing to invest in their career, but, as soon as they have a baby, their earnings fall, not only in the short run. The increase of the percentage of gender gap explained by penalties is also due to the fact that increasing gender equality has led to higher wages for women. It is important to notice that the term child penalty is used because it is costume in the literature, but it should not necessarily be interpreted with negative value: it can be seen as something that needs to be changed if, for example, it is due to an unequal division of childcaring between men and women and constricting cultural beliefs that hurt women’s possibilities; but it should not be left
unconsidered that it can also be a woman’s choice and willingness to decrease her labor supply after childbirth.

The role of the so-called child penalty is also demonstrated by the significant mothers vs non-mothers gap. This gap could subsist because they may be discriminated -mothers were found less likely to be hired (Correll, Benard and Paik 2007), perceived as less competent (Cuddy, Fiske and Glick 2004), less committed and more irrational-, or they may be less productive at work, have lost human capital and job experience, because they temporally stayed out of the labor force (Hill 1979), have less energies for work because of the effort spent in childrearing, have transited to mother-friendly jobs and flexible occupations (often in the public sector, that often offers lower wages). The gap may also result from negative selection, with unobservable individual characteristics driving both higher fertility and lower earnings. The tendency of mothers to work part-time when the child is pre-school aged may affect their current hourly wages, compared to non-mothers, as employees usually do not grant raises in part-time jobs: Waldfogel (1997) found an hourly wage penalty of mothers employed part-time of over 4% if they had one child, and over 10% if they had two or more children, even after controlling for job status, unobserved heterogeneity between individuals and human capital, although these explained quite a big portion of the penalty, of about 50%; see also Anderson, Binder and Krause (2003). Jacobsen, Pearce and Rosenbloom (1999), using twin births to overcome the endogeneity issue given by the simultaneity in decisions on fertility and labor supply behavior, found evidence that in the short run the birth of a child causes a decrease in labor supply and that, even after supply offer of mothers was back to the pre-birth event, earnings would not completely recover.

Going back to the motherhood penalty and fatherhood premium phenomena, many empirical findings seem to be consistent with predictions of household specialization theory (Becker 1965). According to this theory, spouses divide labor consistently with the traditional view of the male as the breadwinner and the female as the nurturer. Thanks to this division, the couple would enjoy specialization gains. Note that as men and women’s abilities converge, as it tends to happen with higher gender equality (for example, women pursuing the same careers as men), specialization gains start to decrease, and marriage and fertility rates start to fall: hence this model represents an alternative to Van De Kaa’s stress on idealization change and postmodernist values for explaining last century’s changes in fertility and couple behavior. Becker’s household specialization theory implies stable relationships and a gendered division of household labor, so that it can be relatively outdated, but it still can give valid theoretical insights to certain patterns. For example, the motherhood penalty is larger for married mothers than unmarried mothers (Budig and England 2001), while the fatherhood premium is larger.
for married than unmarried fathers, even though these effects differ across social statuses, ethnicity and family structure (Glauber 2008, Killewald 2013). Household specialization theory is also supported by evidence that, increasing the number of children, father’s childcare time declines, while mother’s childcare time increases. Moreover, the fatherhood premium for married men is smaller when their wives are employed full-time, year-round (Killewald 2013). Nevertheless, Killewald’s finding has no clear interpretation in favor of household specialization theory: it is not clear whether fathers are positively discriminated, or if fathers work more because they identify with the role of “provider” in the family (specialization model) - and they are indeed found to have heightened productivity-related traits - or if they simply increase their effort to offset the increased need of resources, especially when their spouse has lower earning power. Another finding in Killewald’s empirical setup contrasting the specialization theory is that the changes in parents’ wages were found to be positively correlated.

Interestingly, the fatherhood premium seems to be present only for men at the top and, similarly, for women at the top there seems not to be any motherhood penalty at all (Budig and Jean 2014). The fatherhood bonus at the top could be determined by a selection effect, i.e. man who have certain individual characteristics are both more likely to earn more and to become fathers. Trying to understand the causes of fatherhood premium, Budig and Jean (2014), after controlling for positive selection, increased effort and specialization, still find that there is a significative fatherhood premium. They conclude that fathers might be positively discriminated (Correll, Benard and Paik 2007), as fatherhood might be a signal for greater reliability, maturity and commitment. Regarding the absence of motherhood penalty at the top 10%, it must be reminded that higher paying jobs are linked with higher opportunity costs, autonomy and flexibility, and childcare outsourcing opportunities, hence they present greater incentives and capabilities to accommodate work-family conflicts. The work effort hypothesis (according to which energies are drained from work because they are used in childrearing) would predict top earners, who typically have more demanding jobs, to suffer higher motherhood penalties; nevertheless this empirical finding cannot be interpreted as a proof against this theory, since better childcare outsourcing opportunities can significantly reduce mothers’ fatigue. Moreover, work effort theory would predict mothers who go back to work when their children are pre-school aged to suffer the greatest child penalty, while Anderson, Binder and Krause (2003) find no clear evidence for that, with child age at time of return to work having differential effects according to the job position and educational level of their mother. Consistently with Budig and Jean’s findings, they find that college graduates did not experience any motherhood penalty at all. According to the findings of Ameudo-
Dorantes and Kimmel (2005) instead, not only college-educated mothers do not suffer any penalty, but they also enjoy a wage boost. They explain this with the correlation of education, postponement of childbearing and good jobs: it is possible that when mothers seek job matches that best accommodate work/family responsibilities, they are also end up inadvertently identifying jobs with other positive benefits. Additionally, the availability of family-friendly policies might serve as a signal of job quality in a broader sense, and employers who provide more generous family-friendly policies might also be likely to be the most motivated to attract and retain female employees: consequently, family-friendly policies might also signal a less discriminatory workplace.

The timing of childbearing plays an important role in determining the extent to which the birth of a child shapes women's career. Miller (2010) demonstrated that a year of delayed motherhood increased women’s earnings by 9%, their work experience by 6% and average wage rates by 3%, with postponement being more beneficial for college-educated and highly professional employees with on-going human capital accumulation. As we discussed in the previous chapter, workers expecting an ascending career path may postpone childbearing not to interrupt their climb and older, higher-income first-time mothers may be more likely to outsource childcare and return more quickly to fulltime employment. At the same time though, since richer mothers have more resources they can depend upon, they could be the ones that have the greater possibility to choose to take a break from work, therefore incurring in larger penalties. Drolet (2002) finds that women delaying motherhood do not incur into any penalty at all, with no statistically significant difference in wages between late mothers and non-mothers. She also finds that the benefits of delaying motherhood are greater for younger generations than for older generations. The decrease of gender wage gap may have contributed to heighten these benefits, but simultaneously trends in delaying childbirth may also help to explain why the gender wage gap has narrowed in recent years.

Policy makers may be interested in influencing timing of childbearing, since postponement may result in a decrease in total fertility and late-born children are shown to have lower health on average.

Social beliefs and cultural norms have been demonstrated to significatively influence child penalties: Steinhauer (2018) compared German and French mothers’ beliefs and incomes, ceteris paribus, using the peculiar setting of Switzerland, with no economic nor political differences, but with cultural differences, and finds out that German women incurred in much larger child penalties. Given the similarity of the two groups, the difference is likely due to culture. He supports his hypothesis of cultural differences and higher acceptance of working mothers in the French-speaking region using the International Social Survey Program (2002)
and European Values Survey (2008): German-speaking women were found more likely than French-speaking women to agree with sentences stating that mothers should stay at home or not work full time when they have a child under school age and that a pre-school child is likely to suffer if his or her mother works, and less likely to agree that a working mother can establish just as warm and secure a relationship with her children as a mother who does not work.

At the macro-level, given the importance of fertility in determining future human capital and economic growth, a further possible consequence is given by differentials in fertility levels between higher and lower income households, which is particularly relevant in developing countries: if large fertility differentials are accompanied with great inequality, this may cause the inequality to increase further, and the vast majority of population will have worse standards of living and health, with lower average growth rate of human capital, finally slowing down economic growth (De la Croix and Doepke 2003). Their empirical findings suggest that the differential-fertility channel is important for accounting for the cross-sectional relationship between inequality and growth, and that it is not overall population growth by itself that matters, but the distribution of fertility within the population. Policies that aim to assure an equal access to education could be a more convenient tool to address this issue, compared to income redistribution, which would rather threaten to increase fertility differential.

Scaling up from the macro to the household level, Schultz (2005), using the twin natural experiment to take advantage of exogenous fertility change, found that, while having one more child was significantly related to diminished consumption per adult, confirming that fertility is associated with lower consumption and greater poverty, with a random variation in fertility due to twins, this association was not observed, suggesting that consumption is not lower if the increase in fertility occurs randomly, as it might be the case in less developed countries where fertility planning has not been adopted yet evenly in the population. This finding add to the concern raised by fertility differentials thesis, suggesting that, for unplanned births in less-developed countries, parents do not place additional investment on children, but rather find a way to redistribute the already dedicated resources among an increased number of children.
3. EMPIRICAL ANALYSIS

In this section, panel data (also called “longitudinal data”) are used to estimate region by time municipality fixed effects, in the attempt to observe the effects of changes in income on fertility. In panel data the same observation is observed over time, like in time series, and there are observations for different entities, like in cross-sectional data. Panel data and fixed effects models offer a solution to unobservable omitted variables bias in all cases in which such unobservable factors are constant over time: this is done by taking differences, given the assumption that time invariant variables have constant effects as well. To give an intuition of the way in which the model washes away time invariant heterogeneity, let us define for the simple case of two time periods the error terms \( \varepsilon_{i1} = \beta v_i + u_{i1} \), \( \varepsilon_{i2} = \beta v_i + u_{i2} \), with \( v_i \) capturing all unobserved time-invariant factors that affect the dependent variable \( y_{it} \) (in fact, \( t \), which represents the time period, is not written in the subscript: only \( i \) is present, which identifies the subject) and that are called unobserved fixed effect or unobserved heterogeneity, and with \( u_{it} \) capturing unobserved factors that change over time and affect \( y_{it} \). Hence, we can write the relationship between \( y_{it} \) and the independent variable \( x_{it} \) in the two periods as \( y_{i1} = a + \alpha x_{i1} + \beta v_i + u_{i1} \), \( y_{i2} = a + \alpha x_{i2} + \beta v_i + u_{i2} \). Subtracting the latter equation from the former, it results that \( (y_{i2} - y_{i1}) = \alpha (x_{i2} - x_{i1}) + (u_{i2} - u_{i1}) \), which makes it immediately noticeable that the unobserved error component \( v \) has been taken away by differentiation.

The panel data that were used in this analysis are cross-sectional observations on almost all the 8000 Italian municipalities at 9 time periods, from 2009 to 2017, yearly observed; the sources of demographic data and income data are ISTAT (Italian National Institute of Statistics) and MEF (Ministry of Economics and Finance), respectively. The panel is unbalanced (due to municipalities creation or suppression), which means that there are missing data for at least one entity in at least one time period. Because of different treatment of transformed or merged municipalities between the two sources of ISTAT and MEF, less than 3% of the available observations were dropped, since they did not correspond in the two datasets. This is not problematic for the analysis, since it does not lead to self-selection problems, but it rather prevents from considering municipalities with particular economic conditions. In small villages, for privacy reasons, the dataset used for income does not present values for observations that are found at the very end of the spectrum (extreme richness or poverty), when there are very few (\( n \leq 3 \)) observations assuming those values. Nonetheless, not
being able to count them in the analysis does not lead to a significant measurement error, since these very extreme values are only residual.

As it has been previously anticipated, these data were used to build a region by time municipality fixed effects model with STATA’s command `xtreg`, that uses the approach of demeaning variables: within-subject means for all explanatory and dependent variables are calculated and subtracted from observed values, so that within a subject all demeaned variables have a mean of 0. This way, cross-subjects heterogeneity is gotten rid of, the effects of those variables are not estimated and they are controlled for, even if they have not been measured, as long as they are time-invariant. Controlling for unobserved variables that are constant across entities but vary over time (their effects change with time) can be done by including time fixed effects; while the control for unobserved variables that are constant over time but differ across entities, which was previously discussed, can be done by including entity fixed effects. While year fixed effects control for time varying factors that are common to all regions and region fixed effects control for time invariant factors specific to each region, interaction dummies of region and time, which were included in the model, control for time varying factors that may have differential impacts on regions. Municipality fixed effects control for time invariant unobservable factors across municipalities. Therefore, the model can be affected by omitted variable bias, in case that in the considered time period there was a shock at municipality level: municipality dummies do not pick up unobserved time-varying factors, but only those that are time invariant, while region by time dummies only pick up time-varying unobserved factors at the regional level.

An assumption needed for consistency in fixed effects models is that the error term is uncorrelated with all observations of the explicative variable for the entities over time: if this assumption is violated, the omitted variables bias is not resolved. Note that this does not require the observations and errors to be uncorrelated within an entity: autocorrelation is allowed in this case. In order to satisfy this assumption, clustered standard errors, which are heteroskedasticity and autocorrelation consistent (HAC), were used.

Since unobserved variables are likely to be correlated with the independent variables (for example, think of education), fixed effects model was preferred to random effects model, since the latter, despite being more efficient when unobserved factors are uncorrelated to the independent variables, is inconsistent when they do are correlated, such as in this case.
Both income variables were lagged one period, to account for the time period between conception and birth. Since data on mothers’ age at childbearing at the municipality level were lacking and it was not possible to calculate the age-specific fertility rates, which are necessary to calculate fertility rate, the bare rate of births per number of women in fertile age (16-49) in any given municipality was used as dependent variable.

In order to construct the explicative variable of income, data collected for IRPEF (personal income tax), were used. From 2012, total income considered for IRPEF calculations did not comprehend rent and cadastral income for unleased properties anymore, as they are now considered in IMU (municipal real estate tax). This could lead to a measurement error, because these sources of income have quite a different nature and potentially differential effect on fertility, as we previously discussed using Schultz’s insights: while occupational income is linked to a negative effect on fertility in some contexts, rent and land income are positively correlated to fertility. Nevertheless, land or second houses ownership is not frequent in population (remember also that data were missing in some municipalities for extremely rich people, who are more likely to possess second houses), hence used data may still be able to describe some patterns.

Another limit of this analysis is that income does not change very much over time, so that the regression with fixed effects model might not turn out to be explicative: since only within subject variation is left by fixed effects estimations, if it changes little over time, standard errors will be large and estimates will be imprecise. Similarly, municipalities are little realities, and they might be influenced more by factors determined at the macro-level of the region or area to which they belong, which are differentiated away in the regression. Hence, there might be very little left to explain for a municipality fixed effects model, which is meant to describe responses in fertility to changes in income at the very specific level of municipality.

3.1. RESULTS

The Y variable (births100000fw) reads as the number of births per 100.000 women in fertile age (16-49), while the explicative income variables are expressed in thousands. To decide for the specification, the simple plot of the regression of births100000fw on income was drawn. Anyhow, the units of municipalities appear like a cloud in this plot, since correlation between the two variables is completely obfuscated by omitted variables. Hence,
the first assumption was of a linear form, but eventually both income and square income were included, as the coefficient for the quadratic form was significative at 95% confidence level.

<table>
<thead>
<tr>
<th>Coefficient Clustered standard error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income 94,258 48,745</td>
<td>0,053</td>
</tr>
<tr>
<td>Square_income -1,770 0,823</td>
<td>0,032</td>
</tr>
<tr>
<td>Region by time fixed effects YES YES YES</td>
<td>YES</td>
</tr>
<tr>
<td>Municipality fixed effects YES YES YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

The asterisks *, **, and *** denote significance at the 90%, 95% and 99% level, respectively.

While with a linear model the coefficient estimate of the linear term Income was not significant, adding a quadratic income term improved the regression, with the quadratic term being significative at 95% confidence level. The significance of the quadratic term is not necessarily weakened by the small significance of the linear term. Thus, no evidence was found supporting a linear relationship, plus while the coefficient of the linear term is positive, the coefficient of the quadratic term is negative: the significance of Square_Income suggests that fertility increases with income until a certain threshold, and eventually starts to fall, with the turning point of the relationship comprehended in the range of income data, which could suggest an inverse U relationship, as it was found in the transitional setting of Holger and Sikandar (2002), although the significance of this term is not sufficient to verify the adequateness of the specification, whose fit still remains small, if the very small R is considered.

Secondly, the model was estimated separately for Northern, Central and Southern Italy, to seek whether there was a differential effect.
Northern Italy

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Clustered standard error</th>
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</thead>
<tbody>
<tr>
<td>Income</td>
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<td>-0,625</td>
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<td>YES</td>
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<tr>
<td>Municipality fixed effects</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
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</table>

The asterisks *, **, and *** denote significance at the 90%, 95% and 99% level, respectively.

Central Italy

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Clustered standard error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
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<td><strong>0,004</strong></td>
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<td>YES</td>
</tr>
<tr>
<td>Municipality fixed effects</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

The asterisks *, **, and *** denote significance at the 90%, 95% and 99% level, respectively.

Southern Italy

<table>
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<th></th>
<th>Coefficient</th>
<th>Clustered standard error</th>
<th>p-value</th>
</tr>
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<tbody>
<tr>
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<tr>
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<td>YES</td>
</tr>
<tr>
<td>Municipality fixed effects</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

The asterisks *, **, and *** denote significance at the 90%, 95% and 99% level, respectively.

Evidence was found for a differential effect between Northern and Central/Southern Italy, with the coefficients of explicative variables not being significative at all in Northern municipalities, and very significative, at 99% level, in Central and Southern Italy instead.
Significance of coefficients for the South is only slightly higher than for the Centre. From now on Central and Southern region will be unitarily referred to as Southern Italy, as to oppose them to Northern Italy, given the different findings.

The differential effect at macro-area level can be explained by differences in fertility behavior given by cultural, economic, social and infrastructural differences, rooted in the history of the country. The quadratic specification might result an inadequate description of the relationship in the North. Trying to find an adequate fit for Northern Italy, the quadratic term was deleted, but neither a linear nor a log specification improved the significance of coefficients, compared to the initial specification. A possible solution is offered by Caltabiano, Castiglioni and Rosina (2009): they found that while cohort fertility in the South has not stopped declining, the North seems to have started recover, and this seems to be especially for higher educated women (their choice are less constrained, since they can afford more childcare facilities, which are distributed quite evenly in Northern Italy municipalities, plus they typically enjoy higher gender equality in household labor division). The fact that Northern Italy can be placed among the recovering countries could cast the doubt that the adequate functional form for fertility behavior in Northern Italy might be J-shaped, as found in other contexts by Lacalle-Calderon, Perez-Trujillo and Neira (2017) and Myrskylä, Kohler and Billari (2009).

Anyhow, fertility rates started to decline first in the North, and only much later in the South, suggesting that the two areas might have different trajectories, or at least different timings.

Regarding other differences between these two macro areas, relevant features are that Southern Italy has lower female employment, more traditional and religious values, less industrialized and developed economic structure, and different pace of life.

Hence, these findings add to the literature assessing differences between Northern and Southern Italy.

On the other hand, the municipality fixed effect regression might not be significative if Northern municipalities fertility levels are determined by variations in income and trends only at the regional level, rather than following their own path.

A problem that remains with the fixed-effects approach are unobserved individual differentials related to selective migration to Northern Italy, which is likely to be undertaken by individuals with similar characteristics. Another limit, since the model requires exogeneity, is reverse causality, which leads to endogeneity. The use of lagged explicative variables does impede the consideration of effects of fertility on income, but this does not
solve the issue generated from reverse causality, because it introduces the assumption that unobserved variables are serially uncorrelated. Anyhow, mothers represent a very small percentage of the sample, so that the reverse effect should be ignorable.

In order to increase the precision of the regression, a method that could be used is instrumental variables regression. Nevertheless, this method is not simple to implement when the likelihood of endogeneity is pervasive, because it is not easy to design an adequate instrumental variable.

CONCLUSION

A lot has been written on the relationship between income and fertility, both theoretical and empirical dissertations, but there is still little confidence on its form. Theoretical dissertations give important insights, presenting valid explanations, but it is extremely challenging to abstract patterns from the real world, and empirical studies have had a hard time trying to observe patterns, since they are often obfuscated by apparently ultimately unsolvable biases from omitted variables, selection problems and endogeneity. For example, individuals may recognize and account for fertility effects when making childbearing decisions, which makes fertility endogenous rather than exogenous, while cross-sectional studies might suffer the risk of selective migration, and so on.

Trying to get close to the “gold standard” of randomized control trials, researchers have taken advantage of natural experiments such as twin births, policy introductions, fertility shocks etc., and these kinds of observations did indeed contribute to shed light on the relationship. Nonetheless, these observations are possible in very peculiar settings, and the external validity of these studies may result weakened.

Other studies have applied fixed effects models to panel data or used instrumental variables regressions. However, these methods present limits, too: in the former, endogeneity threatens the validity of results, while in the second it is not simple to design an adequate instrumental variable.

In the end, there still is no certainty about the shape of this relationship, whose ambiguity is increased by its reciprocal character, that leads to serious issues in estimating the magnitude of the effects of one variable on the other and vice-versa.

Low fertility is still an issue in Italy: the fertility decline in the country and in the rest of Southern Europe started later than in North European countries, in the 1990s, and fertility
rates have been extremely low in the last decades, of about 1.3, not showing clear recovery signs yet. It is likely that the recovery attested in Northern Europe is due to policy intervention. In this thesis, optimal family policies to target fertility levels have not been evaluated, since the primary goal was to understand the possible ways in which the variables are correlated and explore causal effects of income on fertility, since subsidies are one of the most used policy means to influence fertility. From the discussion of previous literature, it becomes evident that not only directly distorting the price of a child can be an effective measure to induce changes in fertility: from Northern Europe recovery, we have understood that policies aimed to help parents overcome work-family conflicts, such as childcare facilities, are of great importance, and they might also be able to decrease postponement; in addition, the fact that these countries show the highest gender equality, especially in household duties division, might not be a case, as women willing to pursue a career and to have a child can share its cost more equally with their partner, hence suffering lower opportunity-costs. One thing that we can get away with confidently is that income and direct cost variations by themselves are not a sufficient measure to target fertility levels, since multiple other factors interact with them in determining fertility, such as the presence of facilities, which is able to relax time constraints, reduce indirect costs and increase fertility, as it has been discussed above. The fact that fertility is not so low because of preferences (such as Van de Kaa would suggest), but rather because of constraints, is supported by the discrepancy between desired fertility, which is on average around the replacement level, across all income and educational levels, and actual fertility, which in Italy is still at the lowest-low rate of around 1.3.

The conducted empirical analysis supports the evidence that income does not influence fertility linearly: it seems to have positive effects when income is little, then from a certain point its effects seem to decrease or even turn to a negative relationship, although no specification form can be proposed with certainty from the analysis that was conducted. Moreover, evidence was found for a differential impact of variations in income on fertility between Northern and Southern Italy. This adds further material to literature assessing economic, social and infrastructural differences between the two areas of the country. Anyhow, from this empirical analysis it is not possible to conclude anything certain about the functional form of the relationship between income and fertility: further research is needed to understand the elusive relationship between income and fertility, and in particular its functional form, about which not much literature has been written. Increasing attention should be spent in finding new ways and ideas to overcome endogeneity, selection and omitted variable problems.


ISTAT, demo.istat.it/index.html


