The Origins of Romantic Love and Asceticism: How Economic Prosperity Changed Human Psychology in Medieval Europe

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Abstract

Recent works in behavioral economics have demonstrated that poverty has drastic effects on human psychology: when resources are scarce, individuals tend to be more materialistic and present-oriented, preferring immediate gratifications to higher but delayed rewards. In this paper, we study the effect of economic development on individual psychology during the Middle Ages in a panel of European countries. We show that the increasing prosperity enjoyed by Europeans transformed their psychology and shifted their motivations away from physiological and safety needs toward higher levels of needs like romantic love and self-transcendence through asceticism. To test this idea, we construct a unique database on these two behaviors – romantic love and asceticism – from relatively homogenous sources over the long-term: the biographies of the saints for asceticism, and the topics of narrative fictions for romantic love. We use the introduction of the heavy plow as an instrument for economic prosperity (in the form of population density) to identify the causal impact of economic growth on these behaviors. Our results show that higher population density caused a rise in love and asceticism, which provides first macroeconomic historical evidence that economic development has a causal effect on human psychology and personal development.

JEL Codes: O15, N33, Z11, Z12

Keywords: Psychology, Asceticism, Romantic Love, Economic Development, Medieval Europe

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1 Introduction

Individuals living in modern societies tend to display different behaviors than individuals living in pre-industrial societies, they are less impulsive and less violent (Eisner, 2003; Elias, 1982; Pinker, 2011), they wait longer before having children (Clark, 2008), they invest more time and resources in their own education and in the education of their children (A’Hearn, Baten, & Crayen, 2009; Clark, 2008; Stephens, 1990) and they are more optimistic about the future (Thomas, 1971; Wootton, 2015). Where do these modern preferences come from? Why do individuals living in early modern Europe started to display a range of future-oriented behaviors? Numerous hypotheses have been proposed from the influence of the Christian religion to the printing revolution and the invention of the modern state (Eisner, 2003; Elias, 1982; McCloskey, 2016; Pinker, 2011). In the paper, we put forward a psychological mechanism: rising standards of living may have triggered profound psychological changes in medieval populations, making individual shifting motivations away from materialistic goals (acquiring more wealth, addressing physiological and safety needs) toward higher levels of motivations like social belonging, altruism, or self-development.

In this paper, we explore the origins of modern human motivations, focusing on medieval Europe (600-1600). We show that economic development, as measured by population density, caused a move in human motivations from basic needs to higher levels of needs, namely romantic love and asceticism. Europe is a good test case for two reasons. First, it experienced important changes in the level of prosperity with a sharp decline in the 5th and 6th century followed by a steady period of growth from the 9th century on. From 800 to 1500, the population of the Western Europe grew from 22 million to 139 million (McEvedy, Jones, & others, 1978). Urbanization rate went from 2,83 to 10,65 (and urban population increasing twentyfold) (Bosker, Buringh, & van Zanden, 2013). Finally, GDP per capita grew from subsistence level (around $400) in 700 to $900 in 1500 and $1300 in 1800 with some area such as the Low Countries or Great Britain reaching $2500 (Broadberry, Campbell, Klein, Overton, & Van Leeuwen, 2015; Cascio & Malanima, 2009; Maddison, 2007; Morris, 2013; van Leeuwen, Izdebski, Liu, Yi, & Fölvari, 2012). Second, despite this massive economic change, European culture remained relatively homogeneous over time and space, with a common elite language (Latin) and a common religion (Christianity).

It is particularly difficult to quantify and to compare the evolution of human motivations over a long period time. For the least economically developed periods such as the early medieval period, documents reflecting people’s preferences in the form of discourses, books or art works are scant, and long homogeneous series of documents hard to build. In this paper, we use two materials for measuring human psychology: the biographies of the saints on the one hand, and the fictional narratives present in poems, plays and novels on
the other hand. They have the advantage of covering both long periods of time and a diversity of Europeans

countries.

The biographies of the saints inform us about the evolution of human motivations through the importance
given to various virtues in the process of canonization. During the Middle Age, sainthood was indeed mostly
decided by the people (Bartlett, 2013; Deloiz, 1983; Weinstein & Bell, 2010). It is not until the reform of
Urban VII in 1634 that the decision to make someone a saint became a prerogative of the Church hierarchy.
Before this date, sainthood was first and foremost the result of an uncontrolled and unsupervised process of
preferences aggregation.

In the same way, narrative fictions also reflect people’s psychology: while reading, people pay unequal
attention to the different aspect of a narration – power struggle, romantic stories, psychological information
– and in consequence writers tend to give more importance in the specific features that interest their readers
(Daniel Nettle, 2005; Pinker, 2003). For instance, the cultural evolution of individualism (Greenfield, 2013),
of women status (Twenge, 2015) or of the different conception of happiness (externally or internally caused)
(Oishi, 2015) show similar trends in books and in real life behaviours.

We focus on asceticism and romantic love mostly because, among the psychological traits described in the
behavioural literature, they are simply the easiest to measure in our materials. They also have the advantage
of being at the same time ubiquitous in our materials and highly variable from one period to another, and
from one country to another. This is because asceticism, in the form of sexual abstinence, fasting, or simple
clothing, is an important element in sainthood during the entire medieval period. Yet, its importance is
variable. Throughout the Middle-Age, people were indeed canonized for many different reasons: for being a
martyr, for performing miracles, for curing the sick, for founding an abbey, for remaining virgin (for women),
for renouncing to the world, for being an important scholar or for Christianizing a country (Weinstein &
Bell, 2010). Our prediction is thus that as the level of prosperity increases, the importance of asceticism in
the biographies of the saints will increase.

Romantic love is also both universal and highly variable. As a narrative topic, it has been shown to be
universally present in fictions the world over (Gottschall, 2008), from Romeo and Juliet in modern Europe,
to Erec and Enide in Medieval Europe and Daphnis and Chloé in the Roman Empire, but also to the story
of Layla and Majnum in the Muslim world, the Biography of Yingying in Tang China or the Recognition
of Shâkountalâ in medieval sanskrit drama. However, while being present everywhere, the importance of
love stories is also variable enough to be used to compare culture across time and space. For instance, love
stories are much less important in Greek archaic epics (i.e. the Iliad) than in the Greek novels of the early
Roman Empire (i.e. The Ephesian Tale), in Icelandic sagas than in medieval French literature. Of note is that love stories can be told in a range of different genre from drama (Romeo and Juliet, The story of the Western Wing) and novels (Daphnis and Chloé, Erec and Enid) to epistolary novels (La nouvelle Héloïse, the Heroïdes) and epics (Orlando Innamorato), suggesting that the expression of love is not constrained by literary conventions and that it can flourish in any literary genre. Here, our prediction is that as prosperity increases, people will favor the presence of love in fictional narratives.

Our results are based on the largest possible panel of European countries for which at least one narrative fiction or one saint biography could be found, as well as information on population density and information on soil composition (to construct our instrumental variable strategy). This results in a panel of 6 countries (England, France, Germany, Iceland, Ireland, and Italy) over 9 centuries (800-1600) for the analysis of romantic love, and a panel of 6 countries (Belgium, England, France, Germany, Spain, and Italy) over 8 centuries (600-1300) for the analysis of asceticism.

In line with the behavioral literature, we find that the importance of asceticism and romantic love in fictional narratives increased as a consequence of increasing economic prosperity. Our baseline estimation shows that a one standard deviation increase in population density leads to a .79 standard deviation increase in the incidence of 'love' in novels' abstracts, and to a .64 standard deviation increase in the proportion of saints described as ascetic. The estimates are robust to the inclusion of countries and centuries fixed effects.

To assess the causal impact of prosperity, we use the introduction of the heavy plough in European agriculture to instrument population density. Since the work of Marc Bloch (1940) and Lynn White (1962), it has been argued that the invention and widespread adoption of the heavy plow allowed for exploiting the fertile clay soils of Northern Europe. In a recent paper, Andersen et al. (2016) tested this idea in a difference-in-difference set-up by exploiting regional variation in the presence of fertile clay soils. Their estimation suggest that the heavy plow accounts for more than 40% of the increase in urbanization experienced in the High Middle Ages in Denmark in particular and almost 15% in Europe more generally. Following Andersen et al. (2016), our instrument exploits two sources of variation: time variation arising from the adoption of the heavy plow on the one hand, and cross-sectional variation arising from differences in regional suitability for adopting the heavy plow on the other hand. The IV results confirm the positive relationship between population density and the rise of love and asceticism in human motivations.

To the best of our knowledge, this is the first paper measuring the evolution of human psychology in a pre-industrial society and assessing the causal economic origin of this evolution. These findings contribute to several existing literatures. First, our findings converge with recent works in behavioral economics known
under the term “psychology of poverty” (Haushofer & Fehr, 2014) or “scarcity mindset” (Mani, Mullainathan, Shafir, & Zhao, 2013; Mullainathan & Shafir, 2013). These papers have indeed demonstrated that poverty has pervasive effect on individual behaviors: it makes individuals more present-oriented, more averse to losses, less exploratory, and more conformist. These pieces of work converge with a larger body of studies in experimental psychology, behavioral ecology, and evolutionary biology, known under the term ‘Life History Theory’ suggesting that, in particular, the level of resources have predictable effects on an organism’s life history (Figueroedo et al., 2006a; Pepper & Nettle, 2017). Specifically, when resources are scarce, organisms tend to ‘accelerate’ their life history: they grow faster, they reach the age of sexual maturity earlier, they reproduce earlier and they have more offspring. Such a capacity to modulate one’s life history is hypothesized to be an adaptation to the variability of the environment (Frankenhuis, Panchanathan, & Nettle, 2016).

Recently, the human behavioral literature has shown that in resource-poor environments, organisms tend to be more materialistic (focused on immediate gains), more defiant toward others (less likely to wait for someone to reciprocate) or more insecure in their long-term romantic relationships (Figueroedo et al., 2006a; Mell, Saffra, Algan, Baumard, & Chevallier, 2018; Pepper & Nettle, 2017). Natural experiments have recently put this theory to test. For instance, Horl and colleagues (2017) have used the differential exposure to hunger in occupied Germany to test the causality of the association between harshness and trust: they found that individuals exposed to low caloric rations in childhood have significantly lower levels of trust as adults, independently of their current socio-demographic status. Using the Great Smoky Mountains Study of Youth, Akee et al. (2015) examined how an exogenous positive change in household income affected children’s emotional and behavioral health and personality traits. Their results indicated that an increase in income increases consciousness in the long term. The principal contribution of our study is to provide a quantitative analysis of the evolution of human motivations and a rigorous testing of the causal impact of economic development on personal development in the very long-run.

This paper also contributes to the debate initially launched by Max Weber about the role of religion in furthering economic growth (Akçomak, Webbink, & Weel, 2016; Becker, Pfaff, & Rubin, 2016; Cantoni, 2015). Our paper suggests that the ascetic values emphasized in early modern Europe were the output rather than the cause of economic growth. In the light of our results, religion appears to be rather malleable and to reflect people’s values. Although the core beliefs of Christianity (monotheism, final judgment, divine nature of the Christ) did not change during the medieval period, the fundamental orientation of Christianity clearly shifts over time: it focuses on the rites and the services due to the gods when people wants short-term rewards (during the early Middle Age), and it focuses on individual reformation when people pursue long-
term rewards (during the central and late Middle-Age). In the European regions that were economically advanced during the Middle Age (Northern Italy, the Low Countries, Ile de France), prosperity made people more future-oriented which in turn made ascetic movements (Cathars, Franciscans, Dominicans, Beguines) more popular.

More generally, our investigation informs the debate about the interaction between psychology and economic development. Since Max Weber, it has been noticed that future-oriented preferences are associated with economic prosperity. In recent years, a number of work have put forward the idea that modern growth results from a change in individual preferences, with the emergence of “bourgeois virtues” or of a “culture of enlightenment” (Clark, 2008; McCloskey, 2006, 2010, 2016, Mokyr, 2009, 2016). In her work, Deirdre McCloskey imputes the ultimate source of the emergence of the bourgeois virtues to a set of key events in Europeans history (the four “R”: Reformation, Revolt, Revolution, and Reading). But the reason for this series of events remains elusive. Why did Europe experience such a lucky alignment of stars? What made reading, religious reformation and political revolution so appealing to Europeans? Why at this time and not before? Why there and not somewhere else before? Behavioral sciences could provide a missing link in the Bourgeois Virtues theory: it may explain why this particular set of values (’slow’ behaviors) became popular at this particular time (early modern period) and at this particular place (Europe) in history.

Finally, this paper furthers the understanding of endogenous growth theory. In endogenous growth models, growth is triggered by technological innovation, itself a function of some investment in the R&D sector or the by-product of the production process (Arrow 1962, Romer 1996, Kremer 1993). However, most often, in endogenous growth models, the mechanisms through which economic growth takes place are not specified with much precision. In these models, growth rate is an increasing function of the size of the population and of the rate of population growth, which is sometime in contradiction with the fact that growth was not higher in the most densely populated areas but rather in the most affluent ones. This paper put forward a plausible mechanism by which economic prosperity can be self-sustaining: economic growth indeed lead to more future-oriented preferences that increase productivity and creativity, leading to higher level of prosperity (see also Baumard, 2018). It complements recent econometrics demonstrating that early geographical advantages accumulate over the long range and can ultimately explain the divergent growth rate of modern nation (Diamond, 1998, Hibbs and Olsson 2004, Chanda and Putterman 2007, Easterly, Comin and Gong, 2007, Spolaore and Wacziarg, 2012; Abramson and Boix, 2015).

The remainder of our paper is organized as follows. Section 2 presents the background of the paper, the evolutionary basis of preference formation (section 2.1), the effect of economic prosperity on time discounting,
materialism and romantic attachment (section 2.2) and the actual evolution of individual preferences during the medieval period (section 2.3). Section 3 introduces our dataset. Section 4 present the OLS estimates of the relationship between economic development, asceticism and love, while Section 5 presents our instrumental variable strategy and its results. Section 6 presents some suggestive evidence about the channels of causality, and Section 7 concludes.

2 Background: The Effect of Economic Prosperity on Human Behaviors

2.1 Evolutionary Theory

This paper is based on Life History Theory, a branch of evolutionary biology that studies the way organisms allocate their resources to different activities (development, reproduction, body maintenance, etc.) across their lifespan (Roff, 1993; Stearns, 1992). The basic idea of Life History Theory is that organisms have a finite budget of resources and that they must optimize the use of this budget across their lifespan. To do so, organisms must make trade-offs between different activities (growth versus reproduction) and invest, at each instant of their life, into the activity with the largest marginal benefit in terms of reproductive success. For instance, if their risk of dying is high and their time horizon short, they should not invest in growing a large body or in developing a strong immune system, but they should rather start reproducing as soon as possible (Charnov, 1991; Promislow & Harvey, 1990). Life History Theory thus provides an explanation as to why species living in different environments with different level of resources may display drastically different physiological and behavioral traits (e.g. shorter or longer life spans, smaller or bigger bodies, lower or higher level of investment in offspring).

Life History Theory, first developed to account for the differences in life history across species (e.g. between species with shorter or longer life spans), has been extended to account for the difference in life history within the same species (Stearns & Koella, 1986). In humans, recent works have demonstrated that individuals tend to adopt different ‘life strategies’ depending of the environment they live (Ellis, Figueredo, Brumbach, & Schlomer, 2009; Figueredo et al., 2006; Frankenhaus, Panchanathan, & Nettle, 2016; Pepper & Nettle, 2017). In scarce environments, humans tend to grow faster, to reach the age of sexual maturity earlier, to reproduce earlier and to have more children. By contrast, in more favorable environment, humans display a different strategy, reaching maturity later, debuting sexuality later and having a smaller number of children. These opposite ‘life strategies’ are often referred as ‘Fast’ and ‘Slow’ (see Figure 1).

To conceptualize this phenomenon, biologists and psychologists often describe these strategies as different
points along a slow-to-fast continuum (Figueroa et al., 2006b; Griskevicius et al., 2013; D. Nettle, 2010) (See Figure 1). Faster strategies are associated with faster physiological development (e.g., earlier puberty onset, earlier senescence) and a psychological outlook oriented towards short-term results (e.g., earlier reproduction, higher impulsivity). Faster strategies are mediated by well-known markers of decreased somatic investment, such as higher rate of telomeres attrition (Bateson, Brilot, Gillespie, Monaghan, & Nettle, 2015). Importantly, as shown in Figure 1, these strategies are coordinated (Réale et al., 2010; Sih & Del Giudice, 2012): Individuals who develop in a harsh environment develop faster and reach puberty earlier, but they also have more sexual partners, more casual relationships and more children, creating a “Behavioral Constellation of Deprivation” (Pepper & Nettle, 2017). By contrast, individuals who develop in a safe environment develop slower and reach puberty later, but they also have fewer sexual partners, fewer casual relationships and fewer children.

Illustration of behaviors associated with fast and slow life-history strategies

### 2.2 Empirical Evidence

In recent years, a number of scholars in behavioral economics, experimental psychology and human behavioral ecology have demonstrated that poverty makes individuals more present-oriented, more averse to losses, less exploratory, and more conformist. In behavioral economics, they are often referred under the term “psychology of poverty” (Haushofer & Fehr, 2014) or “scarcity mindset” (Mani, Mullainathan, Shafir, & Zhao,
In this section, we focus on the other side of the coin, the “psychology of affluence” or the “abundance mindset”, i.e., evidence that affluence makes people more future-oriented. Specifically, we discuss the evidence regarding reward orientation and romantic relationships.

2.2.1 Self-Discipline and Self-Control

Does affluence have an effect on the preference for immediate rather than delayed reward? The empirical literature on time discounting provides a first answer. In a recent paper, Haushofer and Fehr (2014) reviewed the effect of poverty on time discounting, and showed that the level of resources has a strong effect on people’s preference regarding the future (Haushofer & Fehr, 2014). For example, the discount rates of poor U.S. households are substantially higher than those of rich households (Lawrance, 1991). Likewise, studies of Ethiopian farm households (Yesuf, Bluffstone, & others, 2008) and a South Indian sample (Pender, 1996) have found that poverty is significantly associated with higher (behaviorally measured) discount rates. This effect replicates across methods: pharmacological elevation of the stress hormone cortisol through hydrocortisone administration has been shown to increase time discounting (Cornelisse, Van Ast, Haushofer, Seinstra, & Joels, 2013), and inducing emotions has comparable effects (Iftcher & Zarghamee, 2011; Lerner, Li, & Weber, 2013).

Measuring impulsivity is another way to measure reward orientation. Carver et al. (2014) studied the impact of harshness during childhood on self-control in adults. They used validated psychometric scales assessing self-control, urgency, and perseverance. Their results show a consistent association between childhood harshness and lack of self-control. Similarly, Duckworth et al. (2013) demonstrated that negative life events in the past year (events such as getting fired or laid off from job, “major change in emotional closeness of family,” or divorce) were associated with diminished self-control in children and adolescents. In line with these results, poverty (i.e., inadequate housing, economic insufficiency, etc.) is associated with higher resting levels of salivary cortisol during the first four years of life which, in turn, is associated with worse performance on executive function tasks (Blair et al., 2011; Blair & Raver, 2012).

Materialism is another facet of the preference for immediate rewards because being materialistic amount to preferring immediate material goods to more effort and more work (which will eventually bring about a larger quantity of reward). Using longitudinal data on American 12th-graders between 1976 and 2007 (N = 355,296), Twenge and Kasser (2013) measured materialism (through questions measuring young people’s attitudes on “how important it is to have lots of money” or to have “a job which provides you with a chance to earn a good deal of money”). They showed that societal instability and disconnection (e.g., unemployment,
divorce) was associated with higher levels of materialism. This result is consistent with previous studies (Briers, Pandelaere, Dewitte, & Warlop, 2006; Cohen & Cohen, 1996; Kasser, Ryan, Zax, & Sameroff, 1995; Sheldon & Kasser, 2008). Carver et al. (2014) studied another kind of extrinsic goal, namely social success. Using a scale measuring hubristic pride, popular fame, and financial success, they showed that childhood adversity is associated with a greater tendency to set implausibly high goals (“I will be famous”, “I will run a Fortune 500 company”). Finally, sensation seeking is another behavioral construct that is related to intrinsic motivation. Carver et al. (2014) showed that childhood adversity is associated with higher level of sensation seeking. In the same line, people living in poverty are more likely to use illicit drugs and to drink excessive amounts of alcohol (Droomers, Schrijvers, Stronks, van de Mheen, & Mackenbach, 1999; Legleye, Janssen, Beck, Chau, & Khlat, 2011).

Finally, reward orientation can be studied through the individual’s intrinsic motivation, that is for the reward providing by working in itself. Using the World Values Survey, Haushofer (2013) showed a consistent association between intrinsic motivation and income, both across and within countries (Haushofer approximated intrinsic motivation with two questions: agreement with the statements “Working for a living is a necessity; I wouldn’t work if I didn’t have to” and “I do the best I can regardless of pay”. (Haushofer, 2013).

To summarize, the empirical literature demonstrate that, in line with theoretical biological models, affluence positively impact patience and intrinsic motivation, and negatively affect materialism and impulsivity.

2.2.2 Romantic Attachment

Pair-bonding is a human species-specific behavior (Kaplan, Hooper, & Gurven, 2009). Unlike most other mammals, humans display a long period of dependency and a late peak in productivity, which is rendered possible by a very high level of parental investment and the participation of both the mother and the father in providing resources to the children. In human behavioral ecology, romantic love is thus seen as a “commitment device” facilitating the establishment and the maintenance of long-term interactions between mother and fathers (Fletcher, Simpson, Campbell, & Overall, 2015). In line with this idea, romantic love has been described in all known human cultures (Jankowiak & Fischer, 1992) and has been shown to have a distinctive emotional, behavioral, hormonal, and neuropsychological signatures and is specifically involved in maintaining functional relationships between male and female (Fisher, Aron, & Brown, 2006; Fletcher et al., 2015).

Despite the universality of romantic attachment, evolutionary theory predicts that individual should vary in the amount of resources they invest in pair-bonding. When the environment is harsh and resources
are uncertain, individuals have an interest in diversifying their sexual and emotional investments, having multiple partners, sex without commitment and shorter committed relationships (Brumbach, Figueredo, & Ellis, 2009; Figueredo et al., 2006b; Figueredo, Vásquez, Brumbach, & Schneider, 2007). In line with this prediction, studies in behavioral sciences have demonstrated a robust association between prosperity (high resources, life expectancy, low child malnutrition) and a strong romantic attachment (Levine, Sato, Hashimoto, & Verma, 1995; Schmitt, 2008). In societies where resources are low and mortality high, parental investment in children tend to be lower and infidelity within spouses tend to be higher (Quinlan & Quinlan, 2007). Within the same country, people living in a harsh environment tend to be more insecure (Belsky, Steinberg, & Draper, 1991; Raby, Roisman, Simpson, Collins, & Steele, 2015; Simpson, Collins, & Salvatore, 2011).

Given the costs and benefits associated with long-term relationships, it should also be expected that people develop different attachment styles toward their partners in harsh vs. affluent environments. Using very large cross-cultural samples (the International Sexuality Description Project—a survey study of 17,804 people from 56 nations), Schmitt et al. demonstrated that a negative attitude towards attachment and a lower emotional investment are associated, across cultures, with higher levels of ecological stress: relatively few resources, low life expectancy, high child malnutrition, high fertility rate and high teen birth rates (Schmitt, 2008; Schmitt et al., 2009). More generally, empirical studies suggest that people growing up in harsh environments do not have the same pair-bonding motivation and mating style as people growing up in safer environments (Chisholm, Quinlivan, Petersen, & Coall, 2005; Del Giudice, 2009; Quinlan, 2003; Simpson et al., 2011).

To summarize, while romantic attachment is universal, empirical studies demonstrate that it varies with the level of resources and that a higher level of resources is associated with a higher level of romantic attachment.

2.3 The Case for Medieval Preferences

Historians have long noticed massive changes in people's mentalities regarding the religious and private domains during the Middle Age (Le Goff, 1964). During this period, religious life underwent important changes, shifting from a ritual religion focused on obtaining short-term rewards from the divinity toward a spiritual religion focused on reforming individuals and adopting future oriented behaviors (Baumard & Chevallier, 2015; Vauchez, 1993). In the same way, love and long-term commitment in marriage became increasingly important during the medieval and early modern period (Daumas, 2004; Duby, 1988; Reddy,
2012; Rougemont, 1939). In this section, we briefly reviewed the main steps of this dual evolution.

### 2.3.1 Asceticism

Although it started as a religion centered on moral behavior and self-discipline in the Roman Empire (Brown, 2008, 2013), Christianity rapidly evolved into a standard archaic ritual religion in which individuals exchange celebrations and sacrifices to the divinity for favor and good fortune. Historians have long noticed that after having wiped out the old pagan gods and goddesses, with their specific temples and domain of intervention, Christianity progressively endorsed all the roles played by these ancient deities, blessing the foods, the fields and the boats, protecting against bad luck and replacing the cult of the ancient gods by the cult of the saints (Bartlett, 2013).

A range of observations confirms that Christianity in the early medieval times was centered on getting short-term rewards rather than in adopting future oriented behaviors. For the lay people first, being a good Christian amounted essentially to obeying to the clergy, respecting the rites (the mass, in Sunday, the Christian calendar, etc.), and the taboos regarding sex (menstruation, pregnancy, intercourse). In his interactions with the clergy, Charlemagne for instance insisted in cleaning the sacred vases and having the correct books. Importantly, the books needed to be correct because the formula mattered and not because the laity needs to hear the right message. Indeed, the laity did not have any role in the church. Latin was the language of the religion, even in Germanic speaking countries where most of the population was unable to understand it. In the same way, the communal aspect of the mass, with the sharing of the bread, had evolved in a ritual where the bread was no bread anymore but a ritual token, the host and was not shared anymore but received like by kneeling down to the priest. Also, the host, instead of being a simple symbol of fraternity, had become endowed with magical powers. For instance, peasants believed that watching the priest blessing the host protected against danger and priests reported cases where peasants, believing that the host have supernatural power and increase fertility, would steal the host and put them in the ground (Vaucuez, 1993).

As for the priests, they were not regarded as preachers or moral models, as in later periods, but as “specialists of the sacred” who knew the rites and the efficacious formula. In line with these observations, early medieval priests behaved like any religious specialist of archaic religions. They blessed the food before a meal and a boat before a travel and they practiced rites against witchcraft and misfortune. Also, their life was no different from the one of the laity, and they were no more ascetics: they marry and create families, they develop money business in the cities, they hold political offices and when they are wealthy enough they
go hunting like any secular lord.

The same is true for monasteries. The original idea of Benedict of Nursia (480-543) was that the monk would join the abbey in order to expiate his sins and be under the spiritual direction of the abbot. But under the Carolingian clergy, such as Benoit of Aniane (751-821), individual reformation became marginal, and oration and prayers to God were much more important. At Cluny for instance, the most powerful order in the 10th century, the activity of the abbey consisted first and foremost in celebrating the power of God and interceding in favor of some particular individuals, again like in typical ritual religion. As Marc Bloch noted, the charitable, economic and cultural role of abbeys, that will later be central, remained marginal “in the eyes on the contemporaries” (Bloch, 1940). What mattered was the ritual power of the monks. Just like the priests, the monk were not seen as role models, but rather as an elite, who lived in a better, purer world, remote from daily life and closer to God.

Things start progressively changing from the 11th century on. In particular, asceticism and self-control became increasingly central in the definition of Christianity. Sexuality was probably the first battleground in this evolution. In the 11th century, people such as the Patarins in Milan started questioning the validity of sacraments done by married priests and soon, with the Gregorian reform, important new canon laws were pronounced against clerical marriage (Vauchez, 1993). Outside the Church, the preoccupation with sexual asceticism is visible in the growing popularity of dualistic heresies such as Catharism that adopt of very grim view of sexuality and encourage abstinence among the priests as well as the lay people (Lambert, 1977; Lansing, 1998; Vauchez, 1993).

More generally, the practice of denying oneself certain pleasures, such as permanently or temporarily abstaining (i.e. fasting) from food, meat or alcoholic beverages gained in popularity from the 11th century on. The Cistercians, the most successful order of the 11th century, consciously departed from the Clunisian rules by adopting more ascetic rules: one meal per day, no meat, no fish, no ornament in churches, non colored clothes, very few furniture, obligation to work effectively 4 to 6 hours a day, decision to settle in the ‘desert’ (e.g. forest, mountains), etc. (Vauchez, 1993). At the same time emerged in France, Italy and Germany new itinerant preachers such as Robert d’Arbrisel or Norbert of Xanten and heretic sects such as the Waldensians or the Humiliati, all defined by their high level asceticism. In these new movements, strict regulation of one’s bodily appetites was a pre-requisite of entry. A few generations later, at the end of the 12th century, the ascetic trends will became mainstream with the success of the mendicant orders founded by Francis of Assisi and Dominic of Osma. These new orders were based on voluntary poverty, also called “apostolic poverty” or “holy poverty”: the monks do not possess anything in private or in common, they wear
modest clothes and need to beg to get their food.

People’s view on poverty also evolved (Little, 1983). The idea that being poor amounts to imitating the Christ and its apostolic poverty, and that poverty is somehow “holy” became more and more popular. This reflects in people’s view of perfection. New kinds of saints, from much modest backgrounds, started emerging. These new saints, such as Francis of Assisi of course, but also such as Raymond the Palmer, a shoemaker, or Homobonus, a merchant, were canonized for their good deeds, their vow of poverty and abstinence, and their charitable actions to the poor, the destitute or the sick.

This evolution is also visible in the biographies of the royal saints such as Margaret of Scotland (died 1093) and Elisabeth of Hungary (died 1231). In her hagiography, typical of the early period, Margaret is celebrated for her behavior as a wife, a mother and a queen, for her good advices to her husband, the good education she gave to her sons and the money she gave to build an abbey and contribute to further the Christianization of the country. Two centuries later, Elisabeth is not celebrated for what she did as a queen but rather for her ascetic behavior, her work in a hospital or her refusal to eat food coming from domains where people were unjustly treated. The same could be said by comparing Louis IX of France (Saint Louis) to older saints rulers such as Charlemagne or Canute IV of Denmark who became saints essentially for the actions in favor of the Church. At all levels, Christian religion had moved from a ritualistic religion centered on celebrating the deities and asking immediate reward to a spiritual religion centered on reforming people and promoting self-control.

2.3.1 Romantic Love

It has long been noted that the economic growth of Western European countries was accompanied by an increasing emphasis on love (Duby, 1988; Reddy, 2012; Rougemont, 1939). This is visible with the flourishing of the ‘courtly literature’ exemplified by the work of Chretien de Troyes in France, Marie de France in England or Wolfram von Eschenbach in Germany. While the Celtic or German literatures of the early Middle Age were centered on war and honor, the literature of the central Middle Age gave a growing importance of love, and saw the re-emergence, after almost one millennium of absence, of narratives such as Tristan and Iseult in which love was the central element of the plot. This change is particularly perceptible in the evolution of specific narratives. For instance, the Arthurian legend in Wales and England was first and foremost about war and revenge in the early medieval times. Arthur was a powerful warrior, who defeated monsters and enemies. But from the 11th century on, Arthur became much less of a warrior and love rapidly became a central component of the Arthurian adventures (see in particular Reddy, 2012 p. 171). In the same way,
medieval authors rewrote the old Greek archaic epics, injecting love stories in the Iliad (Roman de Troie) or in the Thebaïd (Roman de Thebes).

Importantly, in this new medieval literature, love was explicitly conceived in opposition to short-term impulse such as sexual lust. As William Reddy (2012) wrote: “For the troubadours and trovaires, the idea of sexual desire as an appetite was utterly inadequate for describing all the things that lovers felt for each other.” On the contrary, the troubadours and trovaires in southern France, the trouvères in northern France and Belgium and the Minnesänger in the German-speaking courts insisted that love required self-control: “These authors implicitly accepted the Gregorian teaching that concupiscience was a bodily appetite responsible for sexual craving that could easily overwhelm the soul. But they quietly rejected the teaching that concupiscence was responsible for all forms of attraction bringing male and female partners together. Instead, they insisted, there was a form of true love, a sublime feeling that endowed those who gave themselves to it with a certain self-mastery.” (Reddy, 2012) These writers coined a new term “fin’amors” (refined love in Occitan) to distinguish the kind of long-term non-sexual emotion they celebrated in their works from more impulsive emotions such as concupiscence. They even made a parallel with the monastic life for lovers, just as monks and nuns, need to discipline their sexual appetites and their selfishness in order to be faithful to their lovers and respect them. Many stories like the one of Erec and Enide indeed celebrate this self-mastery through the adventures of the heroes whose love inspired them unequalled feats of knightly virtue.

2.4 Conclusion

To conclude, evolutionary theory, behavioral evidence and historical evidence concur to suggest that there should be an association between poverty and present oriented behavior in the first hand, and prosperity and future oriented behavior in the second hand. In the next section, we turn to the date regarding preferences in the biographies of the saints and the narrative fictions to test whether this association can be empirically assessed.

3 The Data

3.1 Data Sources

3.1.1 Biographies of Saints

Saints are especially convenient for studying the evolution of medieval preferences because they are distributed all over medieval Europe and during the whole period. However, they are most convenient as a source of information for the period 500-1500 CE. Before 500 CE, the main way to become a saint was to
be a martyr. It is only when Christianity became the dominant religion and when martyrdom therefore became much rarer that new ways to sainthood appeared (Bartlett, 2013; Delooz, 1983). After 1500 CE, the biographies of the saints become less informative. First, with the Reformation, most of the Northern Europeans countries stopped canonizing people. Second, with the 1634 reform, the pope and the Vatican Curie become the only body legitimate to decide sainthood. For this reason, we set the limit of our study to individuals who died after 500 and before 1499.

There is no definitive list of Christian saints (Bartlett, 2013). This is because up until the reform of 1634, sainthood was the result of popular decisions: were declared as saints those individuals that a local community regarded as saints. Scientific studies of saints have used various sources: Bibliotheca sanctorum Acta Sanctorum, through its scholarly checked version (Kroll & Bachrach, 2005; Stark, 2003), the Bibliotheca hagiographica latina (Herlihy, 1987) and Les vies de saints (Delooz, 1983; Weinstein & Bell, 2010). However, the creation of Wikipedia has considerably improved the situation. Compared to existing physical databases as well as other digital databases (Catholic.org, Catholicsaints.info), Wikipedia’s entries are created and maintained by a much larger number of contributors. Also, saint entries are longer, better sourced and more frequently up-dated than previous bases. Finally, they benefit from being included in a much larger database comprising all people living in the same century in the same country, which allow for crosschecking and cross-referencing entries. It is worth mentioning, however that despite all these changes, however, our descriptive statistics are very close to the ones already published in terms of number of saints, location of births and deaths and proportion of women (see Results section).

It is clear that the information available about the saints is partial, biased and limited. For instance, in the earlier medieval centuries, when society’s prejudices ran in favor of nobility, biographers had a strong temptation to elevate the social status of a saint. More generally, hagiographies were not written to document the live of a saint, but rather to inspire readers, to honor an individual or to make a case for canonization (Delooz, 1983; Weinstein & Bell, 2010). However, for our question, the biased nature of the saints’ lives is actually an advantage rather than a problem, as they tend to magnify the kinds of qualities and actions people liked in the saints. As such, hagiographies constitute an ideal material to quantify the importance of various values (chastity, magical power, social status, etc.) across time and space.

There is an apparent paradox in using ascetic heroes such as Francis of Assisi or Elisabeth of Hungary to document the evolution of the values of everyday people. It could be argued that saints, being heroes or exemplar, are necessarily atypical and unrepresentative. However, the perplexed reader should keep in mind that Martin Luther King, Nelson Mandela or Che Guevara have been cerebrated by millions of people who
would not have been ready to die for the civil rights, the end of the Apartheid or the success of communism. Thus, Martin Luther King, Nelson Mandela or Che Guevara are probably atypical in their choice of life, but the values that inspired them may actually be quite typical of their time and their society. In the same way, probably few thirteenth-century Italians would have been ready to give away the wealth of their father or to embrace a life of poverty in company of lepers, yet they may celebrate Francis of Assisi for being able to live up to the expectations of a perfect Christian life.

3.1.2 Fictionnal Narratives

We build a database of narrative fictions using Wikipedia. Wikipedia summaries have several advantages. First, narrative texts (epic poem, plays, etc.) can be very different from each other in terms of style or vocabulary, which makes comparison difficult. In this perspective, summaries offer a way to compare very different works: all love stories, whether in a tragedy or in a short story, whether originally written in English or not, are described with the same words by Wikipedia's contributors. Second, Wikipedia is by far the largest and the most documented database on narrative fictions. Wikipedia provides information about hundreds of narratives that are either extant, non translated in English, or non digitalized. Third, the constitution of a database of narrative could have been easily biased by the goal of the study. Since there is no exhaustive database of fictions (except for certain periods, and certain genres, such as Elizabethan Theater or Ancient Greek Literature), it is easy to allocate more energy and time gathering certain kind of narratives (e.g. operas) that are intuitively more likely to contain love stories. In this perspective, Wikipedia makes the inclusion criteria very clear and renders cherry picking more difficult. Fourth, Wikipedia diminishes other potential biases in the constitution of the database or in the summary of the narrative for, unlike academic or traditional anthologies, summaries are usually written by a large number of contributors, more diverse in their culture and background. Finally, compared to the actual text, summaries have the advantage of having been already 'coded' by human readers. For instance, it is well known that in ancient literature emotions are less frequent and that characters talks less openly about their feelings. As a consequence, love stories might be hard to detect with lexicographic techniques. By contrast, their presence is unambiguous in a summary.

Inclusion and exclusion criteria: Love stories are not equally present in all written documents. In particular, because of their function, historical texts (e.g. chronicles, annals, biographies, hagiographies) tend not to tell love stories (for instance, in Plutarch’s Lives, Cleopatra and Anthony’s story is the only example of a love story, despite the fact that, at the same time, love stories are flourishing in the Roman Empire). Since all societies do not produce fictions and non-fictions in equal quantity, we decided to exclude all non-fiction
texts (see Pechenick, Danforth, & Dodds, 2015 for a similar problem in Google Ngram). We thus included all narrative fictions – such as novels, romances, epic poems, epyllions, mimes, operas, ballets, masques, novellas, eclogues – as long as a summary of the content is provided in Wikipedia. We thus excluded texts for which we only have the title (even if the title provided some idea of the content of the text).

Some decisions had to be taken regarding the boundaries of narrative texts in certain cases such as short stories collection (e.g. The Decameron) or inserted stories (“Histoire de Troïlus et de Zelandine” in Perceforest). We considered that a narrative was an independent story when its story line was unrelated to the rest of the work. Thus if the stories were connected, even loosely, to the same plot, they were considered to be part of the same story. The only exception is when it is explicitly said that the story was also independently transmitted.

Wikipedia is organized by lists. We manually surveyed all lists related to “History of Literature” in Wikipedia. This includes lists such “Books by century”, “15th century German Writers” or “Old English Literature” (see Supplementary Materials for a full list of lists). In the case of some well known stories (e.g. Cinderella), the summary is not included in the work’s or the author’s page, but in an independent page that usually presents several versions. When the author’s entry or the work’s entry is linked to this kind of “narrative page”, the summary was also included in our survey (as long as the “narrative page” gave a summary for each version).

We included all languages for which there were more than 10 narrative works summarized in Wikipedia before 1800. We stopped our study at 1800 CE for methodological reasons (there are much more summaries after 1800) and for historical reasons (in Europe, the readership of books starts to change, mixing upper and lower classes).

In most of the cases, entries have a summary or a plot section. When there was no such section (for instance, because the work in described in the author’s page), we manually entered the summary in the database. When the same story has been told by different authors, we only included versions for which we had an independent summary or for which we had information about the similarities and the difference with other versions. In order to use information contained in the commentary or in the analysis of the work, we also gathered the URL of the work (if the work had no entry, we use the URL of the author).
3.2 Variables of Interest

Saints

We recorded their gender, date of birth, date of death, country of birth, country of death, family status, occupation. Regarding their religious activities, we recorded whether they had a conversion episode, they performed miracles, they had visions, they were known as moralizing people. Regarding their catholic identity and contribution from the point of view of the Church, we recorded their intellectual religious activities, their evangelical activities, their ecclesiastical activities, their temporal activities, their religious orders, their charitable activities and whether they were canonized and if so their date of canonization. Following Weinstein and Bell (2010) and Kroll and Bachrach (2005), we distinguished several kinds of asceticism: 1) dietary (fasting, vegetarianism), 2) social (eremitism), 3) sexual (chastity, punctual or prolonged abstinence), 4) clothing (simple clothes, white or grey clothes), 5) poverty (no private property, no common property, mendicant), 6) austerity (very strict rule such as one meal a day, no mattress), and 7) suffering (flagellation), 8) giving away one’s wealth and 9) renouncing to one’s previous life. We gave a score of asceticism to each saint corresponding, from 0 to 8 if the individual was known to have practiced all the categories of asceticism. Because more than X% of all saints were hermits, most saints ended up having at least a score of one. To circumvent this difficulty, we distinguished between weak ascetics (score = 1) and strong ascetics (score > 1). In a first phase, we manually coded all information. To check whether there was any bias in the coding, we did the analysis again automatically. We extracted a list of all the words related to asceticism in our database and automatically compute their occurrence in the Wikipedia URL of each saints (the code and the list are available on our website). The correlation between the two methods was extremely high (NUMBER).

Narrative Fictions

We recorded the country, the author and the date of creation of each narrative. When there was no country of creation (because the author was anonymous or its location unknown), we used the language of the work as an indication of the country. When there was not date for the work, but only a date for the author, we assumed that the work was created in the middle of the life of the author. If there is no date for the work and for the author, we put the date of the oldest known source of the narrative. When there were several conflicting dates, we choose the most consensual (based on citations in Wikipedia). If not possible, we averaged the dates (See Codebook for more details). We recorded the number of words in each summary as well as in each entry. For coding romantic love, a preliminary survey suggested that the word ‘love’ is unambiguous in Wikipedia summaries, and that it is by far the most used word to describe a love story.
(compared to ‘amorous’, ‘infatuated’, etc.). Thus, we counted all occurrences of the word ‘love’ in the summaries, and computed the frequency of its occurrence in each summary.

**Environmental Variables**

Population data are taken from the Historical Atlas of World Population (McEvedy et al., 1978). For education proxies, we used the number of books from Buringh and van Zanden (2009) and the number of universities from Wikipedia (‘list of oldest universities’). As a proxy for the strength of the Christian tradition, we used the number of years since the conversion of the head of state to Christianity, as reported in Wikipedia (for instance, 463 for France with the conversion of Clovis). As a proxy of inclusive institutions, we used the number of autonomous cities (Stasavage, 2014) and the number of years parliaments were in activity during a century (Van Zanden, Buringh, & Bosker, 2012). As a proxy of the importance of the state, we used the size and the population of the biggest state in each area at each time step (computed from EURATLAS for state size, and McEvedy et al. (1978) for population size).

Since the period studied is likely to have been Malthusian (Ashraf and Galor, 2011) increases in agricultural productivity are associated with larger populations. Larger populations would arguably affect the degree of specialization, which could increase urban populations (Galor, 2011). In this (Malthusian) case there would be no increase in income per capita, only more people around.

### 3.3 Samples

Our sampling strategy is to work on the largest possible balanced panel of Medieval European countries. An observation is a country-century for which we have information on our key variables: novels (at least 1) or saints (at least 1), population density, and the fraction of land suitable for the heavy plow (see section 5.1). This results in a panel of 6 countries (England, France, Germany, Iceland, Ireland, and Italy) over 9 centuries (800-1600) for the analysis of romantic love, and a panel of 6 countries (Belgium, England, France, Germany, Spain, and Italy) over 8 centuries (600-1300) for the analysis of asceticism. An observation is a country-century pair. With the novels’ data we begin in 800, use 100-year intervals, end in 1600, for a total of 54 observations. With the saints’ data we begin in 600, use 100-year intervals, end in 1300, for a total of 48 observations.

Descriptive statistics on these two panels are presented in Table 1.
4 Basic Correlations: OLS Estimates

We begin by examining the relationship between population density and the incidence of ‘love’ in novels’ abstracts, and between population density and the proportion of saints described as ascetic, in our panels of European Medieval countries. As shown in Figures 1 and 2, a positive relationship between economic development and love and asceticism is apparent in the raw data.

We further examine this relationship by controlling for the number of novels and the number of words in novels’ abstracts in the regression of love, and symmetrically by controlling for the number of saints and the number of words in saints’ summaries in the regression of asceticism. We also use the panel structure of our data to estimate random and fixed effects’ models. Our baseline estimating equation is

\[ y_{it} = \alpha + \beta_{Density_{it}} + X_{it}\gamma + \theta_i + \theta_t + \varepsilon_{ij} \] (1)

where \( y_{it} \) is the indicator of love (resp. asceticism) in country \( i \) during century \( t \), \( Density_{it} \) is population density in country \( i \) during century \( t \), \( X_{it} \) is a vector that includes the number of novels (resp. saints) and the number of words in novels’ abstracts (resp. saints’ summaries). \( \theta_i \) is a vector of dummies indicating the country, and \( \theta_t \) is a vector of dummies indicating the century. The error term is denoted \( \varepsilon_{it} \). The parameter of interest is \( \beta \), which measures the remaining correlation between population density and love (resp. asceticism).

OLS estimates of (1) are reported in Tables 3 (love) and 4 (asceticism) columns (1) to (4). The first column reports estimates of (1) with \( X_{it} \) only. The estimated relationship between population density and love (resp. asceticism) is positive and statistically significant: a one standard deviation increase in population density leads to a .79 standard deviation increase in the incidence of ‘love’ in novels’ abstracts, and to a .64 standard deviation increase in the proportion of saints described as ascetic. In the second column, we estimate a random effect model and find the same relationship between population density, love and asceticism. In the third column we add the country fixed effects and find that the coefficient on population density remain positive and significant, and the magnitude of the estimated coefficient actually increases. Finally, in column (4), we include both country and century fixed effects. In the regression of love, the coefficient on population density does not vary but the precision is lower and the p-value exceeds a bit conventional levels (\( p\text{-val} = 0.149 \)). In the regression of asceticism, both the coefficient on population density and its standard errors increase a bit so the coefficient remains significant at the 5% level.
5 Causal Impact of Economic Development on Love and Asceticism

Although the OLS estimates show that there is a relationship between economic development and personal development, it remains unclear that increased economic development caused the move in human motivations. An alternative explanation for the relationship is that unobserved time-variant characteristics influenced both economic development and psychological changes (omitted factors bias), or that psychological changes caused economic development (reverse causality). Therefore, we observe a positive relationship between population density and the rise of love and asceticism even though population density did not have any effect on the move in human motivations. Identification of a causal effect requires that we are able to control for all changes which at same time both (i) correlate with population density and (ii) affect love and asceticism. In this section, we use the introduction of the heavy plow as an exogenous source of variation of medieval population density. The IV results confirm the OLS estimates.

5.1 Instrumental Variable

Our instrument builds on the work of Andersen, Jensen, and Skovsgaard (2016) who find that European regions with relatively more fertile clay soils experienced higher economic development after the heavy plow was introduced, which was around AD 1000. As written in this paper, “by allowing for better field drainage, access to the most fertile soils, and saving of labor time, the heavy plow stimulated food production” (Andersen et al. 2016, p. 134), and, as a consequence, “population growth, specialization of function, urbanization, and the growth of leisure” (White 1962, p. 44).

Following Andersen et al. (2016), we adopt a difference-in-difference type strategy to test the impact of the introduction of the heavy plow on population density in Medieval European countries. Our instrument exploits two sources of variation: time variation arising from the adoption of the heavy plow on the one hand, and cross-sectional variation arising from differences in regional suitability for adopting the heavy plow on the other hand. Therefore, our instrument consists in changes in economic development, as measured by population density, in the post-adoption period relative to the pre-adoption period between countries that were able to benefit from the heavy plow and countries that were not. As shown in Andersen et al. (2016), the breakthrough of the heavy plow was around AD 1000 so our instrument is equal to 0 in centuries before 1000, and to the proportion of land suitable for the heavy plow (55VVVVV) times time elapsed since 1000 after 1000. The first stage estimated equation is:

\[ \text{Density}_{it} = \beta \text{PlowFraction}_i \times T^\text{post}_t + \theta_i + \theta_t + \epsilon_{it} \]  
\( (2) \)
In the equation, $t$ denotes time, $i$ denotes country, $Density_{it}$ is population density, and $PlowFraction_i \times T_{i}^{post}$ measures the interaction between the share of heavy-plow-suitable area in country $i$ and time elapsed since 1000, which takes the value 100 in 1100, 200 in 1200, etc. The variable $PlowFraction_i$ is taken from Andersen et al. (2016): it equals to the fraction of land in country $i$ with both a clay soil and a suitability index for growing barley $SI_{i} \geq 55$\footnote{The data are constructed using the suitability map from the Global Agro-ecological Assessment 202 by FAO. See Andersen et al. (2016) for more details.}. The remaining variables include country fixed effects $\theta_i$ and century fixed effects $\theta_t$. The error term is denoted $\varepsilon_{it}$.

A potential concern with the IV estimates is that our instrument may be correlated with time-variant characteristics that are important for personal development.

### 5.2 IV Estimates

#### First-stage estimates

Due to the availability of novels and saints’ summaries in the Medieval period, we implement Andersen et al. (2016)’s test using two different datasets than the ones that are used in their paper. With the novels’ data we begin in 800 , use 100-year intervals, end in 1600, and include England, France, Germany, Ireland, Italy, and Iceland, for a total of 54 observations. With the saints’ data we begin in 500, use 100-year intervals, end in 1300, and include Belgium, England, France, Germany, Italy, and Spain, for a total of 48 observations. Table 2 present the first-stage estimates with the novels’ panel (column 1) and the saints’ panel (column 2). The coefficients for the instrument are positive and highly significant, suggesting that the more suitable the land to benefitting for the heavy plow and the further from 1000, the denser the population, even after neutralizing the country invariant characteristics and the century common trends.

#### Second-stage estimates

The second-stage estimates are reported in column (4) of Table 3 (love) and Table 4 (asceticism). Both first-stage F-statistics (Cragg-Donald F-stat) are high so we are confident that the instrument is not weak neither on the 500-1300 European panel nor on the 800-1600 one. The estimates for population density are positive and significant. The point estimates range from 1.24 to 1.33 standard deviations, which means that a one standard deviation increase in population density leads to a 1.24-1.33 standard deviation increase in the incidence of love in novels’ abstract and the proportion of saints described as ascetic. These magnitudes are substantially larger than the magnitudes of the OLS estimates. This is not surprising, because the measurement error in the population density estimates are expected to bias the OLS estimates downward.
Overall, the IV results confirm the positive relationship between population density and the rise of love and asceticism in human motivations. They also suggest that the OLS estimates may even be a lower bound estimate of the strength of the impact of economic development on personal development.

6 Possible Channels of Causality

We now turn to the channels through which the increase in economic development may have affected personal development. We view this analysis as preliminary and exploratory. With only 48/54 observations, it is not possible to pin down the precise channels and mechanisms underlying the relationships with any reasonable degree of certainty. Our objective here is to simply investigate whether the data are consistent with the existing theories described in Section 2.

A potential effect of economic prosperity is that it increased the demand for education because people have more time out of work and more resources to invest in education. Education may in turn be the source of the change in needs from physiological needs to higher outside goals like romantic love and spirituality, as reading books and learning about the world history, nature, humans, and societies, is likely to change human motivations. We explore whether the data are consistent with this channel by examining the relationship between population density and the number of universities per capita. As shown in Figure 3, the relationship is positive and highly significant, which suggests that education is a good candidate to explain the impact of economic development on personal development. We then add our proxies of education, namely the number of universities per capita and the number of books per capita, as additional control variables in equation (1) and examine the change in population density coefficient. The results are reported in Table 5 columns (1) and (4). We don’t see a drastic change in population density coefficient compared to the benchmark model, which indicates that the data do not support this idea that education is an important channel.

We do the same exercise to test the role of spirituality. As higher economic prosperity frees time, people have more time to devote to spiritual activities. Few people may even not participate at all in agricultural tasks and instead become monks in monasteries. As shown in Figure 4, there is a strong positive and significant relationship between the number of monasteries per capita and population density. To test whether spirituality explain the relationship between population density and the rise of love and asceticism, we thus include the number of monasteries per capita and the number of centuries elapsed since official Christianization as explanatory variables in equation (2). The coefficient on population density is not affected in the regression of our measure of asceticism. However, the coefficient on population density is reduced from .018 down to .005 in the regression of love incidence, and the coefficient is no longer significant.
Our data thus suggest that the development of religious spirituality may be the mechanism through which economic development affects human motivations.

Finally, we test whether the development of political institutions and political stability plays a role. People who live in countries with more stable political institutions are less likely to suffer from internal and external violent conflicts, which creates a safer environment favoring the move in human motivations from physiological and safety needs to higher levels in the Maslow's hierarchy. Since economic prosperity may also induce more stable political institutions through the development of state capacity, we check if our data support the idea that economic development affected personal development through political stability. We include the number of parliaments, the number of autonomous cities, the historical state area, and the historical state population as additional explanatory variables in equation (2). Compared to the benchmark estimates, the coefficients on population density are unchanged, and the loss in statistical significance in the asceticism equation is minimal (the p-value is .105).

Overall, this exploratory analysis supports the idea that economic development caused personal development in part through the development of spirituality. The data do not provide suggestive evidence of the role of education or political stability. However, historical measures of education, spirituality, and political stability are scarce and low quality which raise strong measurement issues, on top of identification issues to isolate the role of a channel from other potential channels, so this modest investigation is only suggestive and does not provide strong conclusions on the channels of causality.

7 Conclusion

This paper provides first macro-economic historical evidence of the impact of economic development on personal development. Our conservative estimates show that a one standard deviation increase in population density leads to a .79 standard deviation increase in the incidence of 'love' in novels' abstracts, and to a .64 standard deviation increase in the proportion of saints described as ascetic. We don't find evidence that this impact is channeled by an increase in education or political stability, however the development of spirituality and Christianity seems to play a role in the relationship between economic development and the rise of romantic love.

This paper contributes to the debate about the role of technology in economic growth. Since the work of Karl Marx, it has been suspected that technological advances play a crucial role in shaping the economies. As Marx famously said "The windmill gives you society with the feudal lord; the steam mill, society with the industrial capitalist". Yet, Marx's approach, as well as those who put more emphasis on technology (e.g.
Lynn White, Marc Bloch), has been criticized for its ‘technological reductionism’. Our paper put forward a mechanism by which technology can lead to change in individual preferences: because humans react in a predictable manner to the increaser of material resources, it could be argued that indeed the introduction of the heavy plough, through the increase in living standard, made people more future oriented which triggered a range of cultural changes such as the rise of romantic love and ascetic practices. In this perspective, the paper contributed to reconcile two approaches in economic history – the materialistic one advocated by Marx and the idealistic one put forward by Weber – by showing that when behavioral mechanisms are taken into account, it possible to explain how technology shape mentalities.

Even more generally, our paper contributes to the growing field of the study of culture in economics. Economists are increasingly interested in cultural transmission and in the origins of preferences (Bisin & Verdier, 2001; Dohmen, Falk, Huffman, & Sunde, 2011). The standard approach is that preferences are transmitted from older generations to younger generations. This kind of approach, however, make difficult to explain generational changes in preferences (i.e. why children oppose their parents) as well as the endogenous emergence of new preferences. Our paper accommodates this difficulty by putting forward a new mechanism based on the transmission of capital, rather than preferences. While we agree that people can shape their offspring preference to some degree, our paper suggests that cultural inheritance could be partly explained by the transmission of capital in the forms of resources, technologies and skills rather than by the transmission of preferences. Since level of resources partly determines the kind of preference individuals adopt, the amount of capital transmitted to the next generation is likely to explain the kind of preference it will adopt. This mechanism has the advantage of explaining the slow change in preference toward slower and slower strategies when prosperity is growing (after 1000 CE) and toward faster and faster strategies during periods of decline (during the fall of the Roman Empire and the Great Invasions). To give an example, the parents of Francis of Assisi did not transmit a preference for a highly ascetic life (they actually opposed the life he choose and disinherited him). They rather gave him a high level of physical, social and human capital which, if we are right, leads Francis of Assisi to adopt a slow life history and to advocate for important change in the way Christians should behave.
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Figure 1: Relationship between Population density and the Incidence of «Love», Novels’ panel

![Graph showing the relationship between Population density and the Incidence of «Love» in novels’ abstracts. The fitted values are plotted with a coefficient of .016, s.e. .004, N=54, R²=.24.]

Figure 2: Relationship between Population density and the Proportion of saints described as ascetic, Saints’ panel

![Graph showing the relationship between Population density and the Proportion of saints described as ascetic. The fitted values are plotted with a coefficient of .0037, s.e. .0009, N=46, R²=.26.]
Figure 3: Relationship between Population density and the Number of universities per capita, Novels’ panel

Figure 4: Relationship between Population density and the Number of monasteries per capita, Novels’ panel
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<td><strong>Novels’ Panel: England, France, Germany, Iceland, Ireland, Italy - 800-1600</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incidence of Love in novels’ abstracts</td>
<td>.26</td>
<td>.38</td>
<td>0</td>
<td>1.94</td>
<td>54</td>
</tr>
<tr>
<td>Number of novels</td>
<td>21</td>
<td>39.96</td>
<td>1</td>
<td>250</td>
<td>54</td>
</tr>
<tr>
<td>Number of words in novels’ abstracts</td>
<td>6853.61</td>
<td>21231.54</td>
<td>31</td>
<td>151486</td>
<td>54</td>
</tr>
<tr>
<td>Population density (inhabitants per km²)</td>
<td>14.98</td>
<td>11.4</td>
<td>0</td>
<td>39.82</td>
<td>54</td>
</tr>
<tr>
<td>Share of land suitable for heavy plow</td>
<td>.08</td>
<td>.07</td>
<td>0</td>
<td>.16</td>
<td>54</td>
</tr>
<tr>
<td>Number of universities per capita</td>
<td>.28</td>
<td>.48</td>
<td>0</td>
<td>1.7</td>
<td>53</td>
</tr>
<tr>
<td>Number of books per capita</td>
<td>3524.07</td>
<td>11088.6</td>
<td>0</td>
<td>5000</td>
<td>48</td>
</tr>
<tr>
<td>Number of centuries elapsed since Christianization</td>
<td>568.72</td>
<td>331.49</td>
<td>0</td>
<td>1288</td>
<td>54</td>
</tr>
<tr>
<td>Number of monasteries per capita</td>
<td>322.93</td>
<td>194.99</td>
<td>0</td>
<td>771.81</td>
<td>40</td>
</tr>
<tr>
<td>Number of parliaments</td>
<td>25.73</td>
<td>36.96</td>
<td>0</td>
<td>100</td>
<td>54</td>
</tr>
<tr>
<td>Number of autonomous cities</td>
<td>.1</td>
<td>.22</td>
<td>0</td>
<td>.8</td>
<td>54</td>
</tr>
<tr>
<td>State area</td>
<td>431.6</td>
<td>1079.07</td>
<td>9</td>
<td>7800</td>
<td>53</td>
</tr>
<tr>
<td>State population (in millions)</td>
<td>4.73</td>
<td>5.8</td>
<td>.03</td>
<td>28.53</td>
<td>53</td>
</tr>
</tbody>
</table>

<p>| <strong>Saints’ Panel: Belgium, England, France, Germany, Italy, Spain - 600-1300</strong> |      |                    |     |     |    |
| Proportion of saints described as ascetic              | .39  | .18                | 0   | .78 | 46 |
| Number of saints                                      | 20.52 | 26.24              | 1   | 144 | 48 |
| Number of words in saints’ summaries                  | 302.23 | 313.25             | 24  | 1110.5| 44 |
| Population density (inhabitants per km²)              | 46.21 | 29.65              | 10.62| 156.25| 48 |
| Share of land suitable for heavy plow                 | .12  | .08                | 0   | .26 | 48 |
| Number of universities per capita                      | .05  | .12                | 0   | .48 | 48 |
| Number of books per capita                            | 133.75 | 194.04            | 0   | 1087.2| 48 |
| Number of centuries elapsed since Christianization    | 454.64 | 292.11            | -218| 1066 | 48 |
| Number of monasteries per capita                      | 290.52 | 183.7              | 0   | 772  | 48 |
| Number of parliaments                                 | 1.57 | 5.68              | 0   | 33.4 | 48 |
| Number of autonomous cities                           | .06  | .17                | 0   | .8  | 48 |
| State area                                            | 410.54 | 335.9             | 14  | 1165 | 48 |
| State population (in millions)                         | 5.32 | 4.41              | .05 | 16  | 48 |</p>
<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Novels' Panel</th>
<th>Saints' Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>PlowFraction * Time after 1000</td>
<td>17.347***</td>
<td>64.067***</td>
</tr>
<tr>
<td>Standard error</td>
<td>(2.648)</td>
<td>(10.865)</td>
</tr>
<tr>
<td>P-value</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Standardized Effect</td>
<td>0.299***</td>
<td>0.541***</td>
</tr>
</tbody>
</table>

Control variables

<table>
<thead>
<tr>
<th></th>
<th>Novels' Panel</th>
<th>Saints' Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of novels</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Number of words in novels' abstracts</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Country FE</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Century FE</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

R-squared | 0.957 | 0.948 |
Adjusted R-squared | 0.938 | 0.924 |
Mean dep. var. | 14.976 | 46.212 |
Observations | 54 | 48 |

Notes: OLS estimates. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.
All regressions include the number of novels/saints, the total number of words in novels'/saints' summaries, country fixed effects, and century fixed effects as control variables.
## Table 3: Impact of Population Density on Love

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>OLS</th>
<th>Random Effects</th>
<th>Fixed Effects</th>
<th>Effects</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population density</td>
<td>0.016***</td>
<td>0.017***</td>
<td>0.020***</td>
<td>0.019</td>
<td>0.026*</td>
</tr>
<tr>
<td>Standard error</td>
<td>(0.004)</td>
<td>(0.005)</td>
<td>(0.007)</td>
<td>(0.013)</td>
<td>(0.014)</td>
</tr>
<tr>
<td>P-value</td>
<td>0.001</td>
<td>0.000</td>
<td>0.005</td>
<td>0.149</td>
<td>0.073</td>
</tr>
<tr>
<td>Standardized Effect</td>
<td>0.790***</td>
<td>0.808***</td>
<td>0.967***</td>
<td>0.896</td>
<td>1.237*</td>
</tr>
</tbody>
</table>

### Additional control variables

- **Number of novels**: YES
- **Number of words in novels' abstracts**: YES
- **Country FE**: NO
- **Century FE**: NO

<table>
<thead>
<tr>
<th>R-squared</th>
<th>Cragg-Donald F-stat</th>
<th>Mean dep. var.</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.260</td>
<td>-</td>
<td>0.261</td>
<td>54</td>
</tr>
</tbody>
</table>

Notes: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. All regressions include the number of novels and the total number of words in novels' summaries as control variables.

In column (5), population density is instrumented by the fraction of land that is suitable for the heavy plow * number of centuries after plow introduction in 1000 (Andersen 2016).
### Table 4: Impact of Population Density on Ascetism

<table>
<thead>
<tr>
<th>Explanatory variable:</th>
<th>OLS</th>
<th>Random Effects</th>
<th>Fixed Effects</th>
<th>Country and Century Fixed Effects</th>
<th>2SLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population density</td>
<td>0.004***</td>
<td>0.004***</td>
<td>0.005***</td>
<td>0.007**</td>
<td>0.008**</td>
</tr>
<tr>
<td>Standard error</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.003)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>P-value</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.019</td>
<td>0.039</td>
</tr>
<tr>
<td>Standardized Effect</td>
<td>0.639***</td>
<td>0.639***</td>
<td>0.818***</td>
<td>1.213**</td>
<td>1.326**</td>
</tr>
</tbody>
</table>

**Additional control variables**

- **Number of saints**: YES
- **Number of words in saints’ summaries**: YES
- **Country FE**: NO
- **Century FE**: NO

**Notes:** *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. All regressions include the number of saints and the total number of words in saints’ summaries as control variables.

In column (5), population density is instrumented by the fraction of land that is suitable for the heavy plow * number of centuries after plow introduction in 1000 (Andersen 2016).
Table 5: Channels

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>Benchmark</th>
<th>(1) Incidence of love in novels’ abstract</th>
<th>(2)</th>
<th>(3)</th>
<th>Benchmark</th>
<th>(4) Proportion of saints described as ascetic</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population density</td>
<td>0.016***</td>
<td>0.018**</td>
<td>0.005</td>
<td>0.015**</td>
<td>0.004***</td>
<td>0.003**</td>
<td>0.004***</td>
<td>0.003</td>
</tr>
<tr>
<td>Standard error</td>
<td>(0.004)</td>
<td>(0.009)</td>
<td>(0.007)</td>
<td>(0.006)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>P-value</td>
<td>0.001</td>
<td>0.050</td>
<td>0.473</td>
<td>0.020</td>
<td>0.000</td>
<td>0.039</td>
<td>0.004</td>
<td>0.105</td>
</tr>
<tr>
<td>Standardized Effect</td>
<td>0.790***</td>
<td>0.841**</td>
<td>0.242</td>
<td>0.731**</td>
<td>0.639***</td>
<td>0.510**</td>
<td>0.677***</td>
<td>0.484</td>
</tr>
</tbody>
</table>

Additional explanatory variables
- Proxies of education: NO, YES
- Proxies of religiosity: NO, YES
- Proxies of political stability: NO, YES

Additional control variables
- Number of novels: YES
- Number of words in novels' abstracts: YES

R-squared: 0.276, 0.335, 0.276, 0.332, 0.326, 0.332
Mean dep. var.: 0.261, 0.388
Observations: 54, 45

Notes: Estimates from an OLS regression. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level. All regressions include the number of novels and the total number of words in novels' summaries as control variables. Proxies of education: Universities per capita, books per capita. Proxies of religiosity: Monasteries per capita and time since Christianization. Proxies of political stability: Parliament, number of autonomous cities, State area, and State population.