Family Characteristics and Economic Development

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Abstract

This paper links economic development to age-old family characteristics through the propensity to invest and then, increase human productivity. Three family characteristics are identified as supporting investment. Inequality among siblings favors investment in physical capital whereas a high status of women and strong parental authority favor investment in human capital. To test this theory, we rely on Todd's classification of traditional family types observed around the world. A family score is built according to the presence of these three characteristics in the family type of each country. This family score as well as basic characteristics are significantly associated with higher economic outcomes. These relationships are robust to other factors already identified as playing a role, such as geography, ethnic fractionalization, genetic diversity, religion, quality of institutions and legal origin.

Key words: Economic development, Family model, Cultural Economics, Reversal of fortune.
JEL codes: N 10, N 30, N 50, O 10, O 50, Z 10.

The explanation of the large differences of economic development among human communities remains a fundamental economic issue. Since the work of North, we are aware that institutions play a key role and Williamson (2000) highlighted the forerunner impact of informal institutions. This paper explores the role in economic development of the first and most basic institution providing arrangement among humans: the family. The family institution arranges the relations between wife and husband, parents and children and among children.

However the nature of the links between family members varies significantly across human communities. Contradicting a common belief, families in the past were not always an association of several generations and siblings. Since the 1960s, Peter Laslett has provided evidence that the traditional English family has been a nuclear one (consisting only of parents with non-adult children) since at least the 13th century (Laslett et al., 1972). Traditional families in Germany or Japan for example were different, with a more frequent association of several generations in the same household.

Anthropologists study the organizations of families across the world by identifying characteristics which, when combined, lead to a specific family type. Following Le Play (1884), the work of Todd (1984, 2011) offers a classification based on thousands of anthropological studies, for almost all countries. Moreover, his book of 1984 (English version in 1987) also assumed two theoretical relations between family characteristics and economic development. He claims that economic take-off, especially its first manifestation, literacy, occurs earlier in countries characterized by a high status of women and strong authority of parents over children.

We use this framework to propose three theoretical relationships between family characteristics and the propensity to invest. A family type which is characterized by a high status of women leads to a higher investment in human capital since mothers play a key role in educating the next generation. A similar higher investment in human capital is achieved in a family type characterized by a strong authority of parents over children because this authority helps the transmission of human capital. These two causal links were already assumed by Todd (1984).

We add a third relation using another family characteristic, namely that a family type characterized by the potential inequality of siblings is assumed to favor a high investment in physical capital. This theoretical effect is supported by two mechanisms. First, the potential inequality enables maintaining a critical size of asset since it is transferred to only one child whereas strict equality leads to division into shares of wealth that are too small to invest. This critical size favors investment in physical capital. The second mechanism is that investment choices are not biased by the need to transmit equal shares of wealth. Parents can concentrate their wealth in non-divisible assets and help one child to invest in a project without any consideration of the need to

transmit equal shares. The investment allocation is thus more efficient. These different propensities to make both human and physical investments according to the family characteristics lead to a different level of productivity which is the fundamental explanation of the differences in economic development.

To test, these theoretical relationships we use Todd's classifications (1984, 2011). Todd (1984) proposed four family types. These four family types are used for example by Alesina and Giuliano (2013) and Bertocchi and Bozzano (2014). After adding other characteristics to define family types, Todd (2011) studied Eurasia through fifteen family types. But in our paper, rather than using the family types, we focus on the basic elements, i.e. the family characteristics. We only use the family types to extract the more basic family characteristics. All family structures around the world deal with these three issues, it is thus possible to determine whether a given characteristic is present or not.

From Todd's classifications (1984, 2011), we extract the three family characteristics which are assumed to be relevant for explaining economic development: a relatively high status of women (versus low status), a strong authority of parents over children (versus freedom of children), a potential inequality among siblings (versus a strict equality among siblings at least brothers) building dummy series for each of them. We then add these three series to build a fourth one, the family score, whose values vary from 0 to 3 according to whether there are 0, 1, 2 or 3 characteristics in the family type of a given country.

Consistent with the prediction of the theory, all these series are highly correlated with the expected sign (i.e. positive) with the current GDP per capita in a cross country analysis. Several control measures are applied. We first add geographical variables known to be associated with economic development; percentage of population living in an area who are at risk of contracting malaria, percentage of the population living in tropical areas, the mean distance to the nearest waterway, the time since the Neolithic transition (which is mainly the distance from areas where agriculture was developed), the percentage of arable land, the absolute latitude, an index for the land's suitability for agriculture, a dummy for the members of the OPEC and a continent fixed effect. The family series remain highly significant for explaining current GDP per capita. We then turn to variables measuring the characteristics of people living in a given country. In addition to geographical factors, we control for ethnic fractionalization, genetic diversity and the percentage of the population of European descent. Family series remain highly significant when using these control variables independently or all together. We also run a robustness check to exclude from the dataset those countries in which several family types are observed; previously when there were several family types in a given country we used the dominant one.

Focusing on their effect channels, each of the three family characteristics contributes significantly to explaining GDP per capita when tested together which implied that each of the characteristics plays a specific role. To confirm the respective roles of each characteristic, we use our variables to explain the number of scientific articles per capita and the number of years of schooling as proxies for investment in human capital; both a high status of 'women' and authority of parents were found to be significantly favorable. Regarding the propensity to invest in physical capital, inequality of siblings is found to be associated with a higher level of investment in capital as measured in public accounting across countries.

Since religions provide rules about how a family should be arranged, one might ask whether family type differs from religious affiliation. Religion and family type are indeed closely related but without a systematic causal relationship. We provide a narrative about the three possible relations between religion and family structure: i) independence, ii) religion influences the family type and iii) existing family type influences the development of religions. We also run our regressions again, including geographical and human variables that had been identified as significant in our previous specifications. However this time we include for each country the share of the population belonging to the main religions. The family series remain highly significant for explaining economic development.

Another investigation focused on a potential indirect channel, through formal institutions, of the effect of the family characteristics on economic development. Indeed, we have pointed out the direct theoretical effect of family characteristics on the propensity to invest in capital, both human and physical. But, an indirect (non exclusive) channel could also work if the formal institutions (political and economic) mirror the family structures. To test this potential indirect channel, we add to our regression including geographical and human control variables, an index to measure the quality of institutions. Coefficients on our family series decrease but remain highly significant thus a direct effect of family characteristics cannot be rejected. A similar process is applied to test a potential indirect channel through the legal regime since for countries where the legal regime was not imposed, we may assume a mirror of the family types. Our results remain robust when controlling for various legal origins.

A last concern could come from potential reverse causality, in which case the economic development would lead to specific family types. To reject this hypothesis, we drew on historical anthropology. For most countries, the family type currently observed has been the same for centuries. Worse, the best family types of today (like those which flourish in Europe or East-Asia) appear to be the most primitive and were not the most appropriate for earlier periods. Theses primitive family types benefitted from a reversal of fortune. We also provide a quantitative test across Eurasian countries using the distance from Bagdad and Xi'an as an instrumental variable. Indeed, most innovations

(products, technologies, formal institutions) were initially developed in the Fertile Crescent and China before spreading across Eurasia. Following Todd (2011), the same appears to be true for the informal institution which is the family model. We thus assume that family innovations spread through contagion within Eurasia. Consequently, the higher the distance from the two centers of innovation (the Fertile Crescent and China), the more primitive is the family type, and the higher is its family score (primitive family types benefitted from a reversal of fortune). Thus, a great distance from innovative centers diminishes the influence of innovations thus leaving intact primitive family systems which are today efficient for economic development. This instrumented family score appears to be highly significant in explaining GDP per capita. The direction of the causality is thus, without any doubt, from family characteristics to economic development.

The rest of this paper is organized as follow. The related literature is detailed in (1) before a presentation of the theoretical links between the three family characteristics and the propensity to invest that we propose in (2). The data we used are explained in (3) and the distribution of the family characteristics around the world is depicted in (4). Section (5) contains our empirical tests of these theoretical links. The effects of family characteristics on investments in human and physical capital are more specifically explored in (6). Section (7) deals with controls performed to detect indirect effects though religion and formal institutions. The potential reverse causality is rejected in (8) on the basis of anthropological evidence and an instrumental test before the conclusion.

1. Related Literature

The interest in the link between family and economics is an old one. Adam Smith and Alfred Marshall have used family structure to help explain disparities in economic development (in Scott Smith, 1993: 7). Banfield (1958) used the term "amoral family" to describe the social and cultural environment that was shaping individual decisions in a small village in the south of Italy. Grossbard (1978) called for a marriage between economics and anthropology. A recent literature analyzed the link between marriage and economic outcomes (Jacoby, 1995; Edlund, 1999; Tertilt, 2005).

Todd (1983, 1984), Todd and Le Bras (1981) have identified different consequences of the family types on economic and social outcomes. For example, Todd (1983) argues that certain family structures are more or less favorable to different forms of government since formal institutions mirror family institution.[2] For instance, all countries where communism took power without a foreign intervention (Russia, China,

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[2] Following Todd, we use alternatively family, type, structure, form and model to describe the same reality.

Yugoslavia and Cuba) were not characterized by an important proletarian class but by the same family type (called Communitarian) where brothers are equal among them and remain under the authority of their father. Another relation proposed by Todd (1983) is between democratic regimes as a mirror of nuclear family; Dilli (2015) confirms this relationship.

Following the seminal works of Todd, several authors link traditional family types to socio-economic outcomes currently observed often using the Todd's classification. Mamadouh (1999) uses the Todd's data to explain the difference in political culture within Europe. Dilli et al. (2013) show that long-lasting institutions, especially family types, are important explanations of current variations in gender equality. Bertocchi and Bozzano (2014) identify the family structure as a key factor of the gender education gap in Italy in the late 19th century. Tur-Prats (2014) identifies the complex house-holds (multiple-generations family) as causing lower domestic violence today in Spain. Diebolt et al. (2016) and de la Croix and Perrin (2016) stressed a significant effect of the family types explaining fertility rate and school enrollment in 19th century France.

Others research focus more on economic consequences as done in our paper. De Vries (2008) stressed the role of the nuclear family in the economic development of northern Europe. Algan and Cahuc (2005) show that family culture is responsible for cross-country heterogeneity in employment rates in Europe. Duranton et al. (2009) used Todd's family types to explain regional differences in economic outcomes across Europe such as household size, educational attainment, social capital, labor force participation, sectorial structure, wealth and inequality. Kick et al. (2000) investigate the link between family and economic growth. The main idea of this paper is close to ours since they look for economic growth consequences of family characteristics even if their family variables are really different (e.g. marriage rate, illegitimate births).

An important stream of research using family as an explanatory variable focuses on the difference between nuclear versus large kinship families as leading to different forms of cooperation. Greif (2006) identified in the European family organization, the origin of the large non-familial organizations he called "corporations" (all hierarchical organizations such as state and large firms). Greif and Tabellini (2012) study two different ways of sustaining cooperation in China and Europe: the clan and the city. Greif and Iyigun (2013) also refer to the familial organization especially the differences between Chinese and English families. Alger and Weibull (2010) develop a model explaining the strength of the family ties by the ecological environment; hostile environment leads to weak family ties.

Numerous research demonstrate different consequences of the strength of family ties. Focusing on Europe, Esping-Andersen (1999) argues that where family ties are stronger, social risks are more internalized in the family by pooling resources across

generations. Alesina and Giuliano (2010) show that strong family ties imply more reliance on the family (which provides goods and services) and less on the market and on the government. Alesina et al. (2010) demonstrate that strong family ties are associated with less mobile individuals choosing more regulated labor market while weak family ties are associated with more flexible labor markets which require geographic mobility of workers to be efficient. In the same vein, Alesina and Giuliano (2011) establish an inverse relationship between family ties and political participation since family and political institutions provides similar kind of goods. Galasso and Profeta (2010) exhibit that the family types influenced the design of pension system of one country.

Other studies refer to the concept of European Marriage Pattern (EMP). Hajnal (1965) first identified a marriage pattern specific to the west of a line between St Petersburg and Trieste, characterized by high ages at first marriage, a small gap between wife and husband ages, a high percentage of singles and a low percentage of complex households (i.e. the nuclear family is dominant). For about a decade, several studies attribute to EMP a crucial role in explaining the economic success of western Europe (especially England) compared to the rest of the world (e.g. Voigtlander and Voth, 2006; de Moor and van Zanden, 2009; Foreman-Peck, 2011; Greif and Tabellini, 2010). But, Dennison and Ogilvie (2014) pointed out that the concept of EMP remains unclear, while emphasizing the diverging views about the timing of emergence of the EMP, the geographical area of the EMP and the mechanisms favorable to growth supported by the EMP.

Recent studies agree that there are higher variations in Western Europe, especially the high prevalence of complex households in central Europe, than in Hajnal's original view. Moreover, several areas on the edges of Asia do exhibit similar characteristics (Carmichael and van Zanden, 2015; Todd, 2011). Carmichael and van Zanden (2015) proposed a "Girlpower version" of the EMP which is more ethnographic, characterized by monogamy, exogamy, consensus (no arranged marriages), a low percentage of complex households and a relatively strong position of women in marriage. In this new version of the EMP, the age at which the two people marry and the percentage of singles are only products of the interaction of EMP with economic conditions. Building an index of the "girl power version" of the EMP, Carmichael et al. (2015b) demonstrated a strong relationship between their version of the EMP and economic development in modern Europe.

Today, Hajnal's hypothesis of the EMP can be seen as a special case of the more encompassing theory of the family system (Carmichael et al., 2016).[3] In this current

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[3] Concerning the EMP debate, while the whole of Western Europe is characterized by a relatively high status for women according to Todd's database, European countries differ on other points. England and

paper we add to this theory of the family system. Going back to ethnographic descriptions of family systems, we use basic characteristics (which when combined lead to a specific family type) as explanatory variables rather than using resulting family types. The current paper thus differs from the existing literature by focusing on family characteristics rather than family types and by looking for an effect on worldwide comparative economic development linking family characteristics to human and physical capital investments.

2. A theory of the family origin of the economic development

The level of human productivity constitutes the key explanation of the living standard of a given country over time (Gordon, 2016; Fourastié, 1979). Productivity depends on the investment in both human and physical capital. The role of the investment in physical capital in the economic growth is demonstrated for a long time and formalized by Solow (1956). The importance of human capital formation has been underlined in Unified Growth Theory (Galor, 2011). To explain the divergences among countries on the amount invested in both kinds of capital remains an issue. The family characteristics offer an answer.

The effects of the family characteristics are persistent over time. The family structure in a given population is transmitted from parents to children. For a discussion on the intergenerational transmission of values from parents to children through institutions and beliefs (see Bisin and Verdier, 2000 and Guiso et al., 2006). Cultural traits like the family characteristics are very stable over time as shown in different ways by Alesina and Giuliano (2010), Reher (1998) and Todd (2011). Thus, we assume that traditional family characteristics still exist ("transmitted from generation to generation and they have persisted through history to the present day", Alesina and Giuliano, 2013) and influence current human behavior.

A strong parental authority increases investments in human capital

A first characteristic is the authority of the parents. Family types differ in how parents and children interact. In several types, parents or at least father, exert a strong and long authority on children. Children remain subjected to their parents' authority long after reaching adulthood and even after marrying. In some cases, the new couple lives in the house of the parents under their authority up to inherit. When they get their own children, three generations are able to cohabit (parents, children and

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Netherland are indeed characterized by a combination of nuclear family and inequality among heirs which fits well with the definition of the EMP but other countries are not.

grandchildren). This cohabitation leads to complex households with more than one couple living together.[4]

The authority of the parents has a positive effect on the investment in human capital. This authority, allows the parents to invest in the human capital of their children for a longer time period compared to family where children become independent early. Moreover, when three generations are living together, the grandparents are also able to educate and transmit human capital in complement of parents.[5] The cohabitation with the new couple provides incentive for parents, even non altruist, to invest in human capital of their heirs because they profit directly from the extra income this investment generates. Contrarily, in family types not characterized by this strong authority of parents, children become independent early with looser ties with their parents; they have accumulated a lower stock of human capital through transmission from parents.

A high status of women increases investments in human capital

A second family characteristic affecting the development is the status of women. According to the family types, women can enjoy a more or less equal role in the family compared to men. In some familial types, the father is the only chief with both children and wife being under his authority (patriarchy). In other family types, women enjoy a more equal (or rarely higher) role.

A high status of women has a positive impact on the investment in human capital since the mother plays a key role in the education of the children thus in the formation of the human capital of the next generation.[6] The quality of the education of the children is highly dependent on the level achieved by their mother. In family types where women enjoy a relatively high status, she can choose to be married later according to her personal interest. With a high age of wedding, the wife has accumulated a higher level of human capital before being mother helping the investment in the human capital of the next generation. This investment is concentrated in a more limited number of children due to the reduced period of marital fertility.[7] The potential late

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[4] This relationship between parents and children can be thought of as either 'liberal' or 'authoritarian' leading Todd (1983) uses this characteristic to explain political behaviors of the different countries (favor for authoritarian or liberal regimes).

[5] Carmichael et al. (2015 a) find a positive effect of having a grandparent in a household increasing the chance of schooling a children in the 19th century.

6 De Moor and van Zanden (2009) and Carmichael and van Zanden (2015) assume and explored deeply the same theoretical positive effect of a high women status. This channel is working in the theoretical model of Diebolt and Perrin (2013).

[7] To identify in the traditional family types, the origin of the high status of women offer an answer of the sense of the correlation between women rights and GDP as discussed in Doepke et al. (2011) and Duflo

age of marriage (and thus procreation) allowed by a high status of women favors quality in the trade-off between quantity and quality of children (Becker, 1960, 1992).[8] In family types with a low status for women, girls are often married (with often elderly men) at a young age (closer to the biological age of fecundity) which reduces the human capital she own and can transmit before being mother.

Inequality among brothers increases investments in physical capital

Despite not using the term human capital, Todd (1984) already assumes the positive impact of the authority of the parents and of the high status of women on the economic development. We add a third family characteristic with a theoretical positive impact on development but through the investment in physical capital: the inequality among siblings. Family types are characterized by equality or inequality among siblings (or, at least, brothers). In an equal family system, all the brothers and sometimes the sisters obtain similar rights especially in terms of inheritance. In inequalitarian systems, parents can favor one particular child (often the eldest) at the expense of the others.

The potential inequality among siblings has a positive impact on investment in physical capital for two reasons. The first one is the reach of a critical size of wealth to support investments. Inequality allows a critical size whereas a strictly equal inheritance would lead to a higher number of smaller properties. This critical size helps to invest in new physical goods.[9] The second reason relies on the quality of the asset allocation allowed by inequality. Thanks to the potential inequality, choices of investments are not biased by the need of a future equal inheritance. It helps to grasp the opportunities for both parents and children at any point in time. Parents can choose to concentrate their wealth in a specific asset difficult to share whereas in case of strict equality, there is an incentive to invest on easily fractionnable assets or in

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(2012); Dilli et al. (2013). Dilli et al. (2013) found a strong association between current gender equality and high status of women in traditional family types.

[8] The potential delayed marriage is exogenous to the economic conditions (due to family system) even if realized age of marriage is affected by economic conditions (Carmichael et al., 2016). Contrarily, in family system characterized by a low status of women, the marriage age remain low whatever the economic conditions. de la Croix and Doepke (2003) revisit this trade-off linking economic growth and differences in fertility as a consequence of economic inequality. Families with less human capital tend to have more children less educated leading to lower the average level of human capital.

[9] Kuran (2011) assumes a similar effect. He points out that Islamic rule sharing inheritance among a large kinship make it difficult to keep successful businesses intact across generations and do not allow capital accumulation necessary for a true capitalism. Contrarily, when Western merchants were gaining increasing control over their trade with the Middle East, primogeniture was the dominant inheritance practice in Britain, the Low Countries, Scandinavia, and parts of Austria and France" Kuran (2003).

multiple similar assets.[10] Parents can also choose to finance during their life, the project of one child without having in mind the need to maintain equality.[11]

3. Data

Anthropologic data

To characterize countries, we use the classifications of Todd (1984 and 2011). Todd went through a very large number (about 70 pages of references are cited in his 2011 book) of anthropologic, statistical, historical, archeological and legal studies about families around the world. He crosses his observations to demonstrate his claims about family types. His main sources are anthropologic data on rural areas before the emergence of modernity. Rural areas because the family characteristics can manifest themselves more easily being free of the urban constraints. Period before modernity because in the developed world, especially since the birth of the welfare-state, the nature of the family relations is more difficult to observe even if still existing in a more undercover form.

The data of Todd were partially already used by Duranton et al. (2009), Alesina and Giuliano. (2013), Dilli et al. (2013), Bertocchi and Bozzano (2014) and Galasso and Profeta (2010). This last paper shows the consistency of Todd's classification of family structure with the data used by Alesina and Giuliano (2010) coming from three questions of the *World Value Survey.* Todd's data are also consistent with the anthropologic classification of Murdock (1969) and come out favorably when trying to solve discrepancies between the two dataset according to a careful comparison realized by Rijpma and Carmichael (2016).

Todd classifies countries in family types according to different criterions. To identify family type characterized by authority of parents, Todd looks at statistical prevalence of complex household (cohabitation between three generations). Even in a theoretical world with a systematic look for cohabitation, the prevalence of three-generations household is capped due to infertility, death and others life accidents. But, census allow to identify easily countries were such a cohabitation is frequent compared to others where it is exceptional. Easy is also the way to assess the equality among sibling, Todd

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[10] A potential positive consequence of the division of the inheritance into several heirs is to provide an incentive to cooperate opening the possibility of impersonal cooperation if the asset remains common after few generations. In southern Europe, such positive offshoot is identified as the cause of the development of impersonal cooperation taking the form of pariages paving the way for an early form of corporation (Le Bris et al., 2015).

[11] In terms of cultural values, inequality of siblings facilitates the acceptance of wealthy fellow countrymen whereas in country of egalitarian family tradition, policies in favor of harmonization of the living standard receive more attentions.

uses data on inheritance laws and practices. Inheritance can be strictly equalitarian, strictly inequalitarian (e.g. primogeniture) or to allow inequality (e.g. freedom to test). In the two last cases, family systems are called inequalitarian.

To assess the status of women, two indicators are used by Todd: equality in the inheritance and equality in the choice of the location when a new household settles. Rules and practices of inheritance can transmit the wealth through males (patrilineal), female (matrilineal) or both (bilateral). In the two last forms of transmission, the women enjoy a higher status than in the patrilineal families. Todd uses a second indicator of the status of women by observing the location of the settlement of a new household. When the status of the women is low, the new household settles close to the family of the husband (i.e. the woman moves to where her husband's family is located which is called patrilocal); or even *in* the family of her husband if the model is also characterized by authority (cohabitation of generations) in countries such as Russia and China. When the status of women is high, the new household settles indifferently close to the parents of the wife or of the husband (bilocal) or in few cases close to the family of the wife (matrilocal). For the current period, a third indicator, the sex ratio allows to assess if the women status is low since selective abortion leads, in country characterized by such a low status, to a higher number of male births.

The classification of the familial types by Todd depends on the combinations of these basic characteristics. These combinations lead to a typology of family organizations. The initial classification of Todd distinguished four main family types but in his last book (Todd, 2011) 15 were used.[12] Whatever the number of family types developed, it is always possible to identify the presence or not of these basic family characteristics we focus on. Using the family types of the Todd's classification, we extract the three family characteristics we are interested in. We build three dummy series with a value 1 when the family structure of a given country is characterized by authority of parents, a high women status and the potential inequality among siblings. These three series are used alone and combined in a fourth series called 'Family score' as the sum of the three basic series. The family score is thus comprised between 0 and 3. We concentrate our analysis on this last series Family because it summarizes the three theoretical relations.

For few countries, Todd does not provide any data, we thus exclude these cases (mainly Oceanian islands). For countries where several family types are observed (India, Italy, Ecuador…), we retain the characteristics of the dominant type for the whole country.

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[12] For example, Nuclear, Stem and Communitarian families are each declined in three versions according to the relations of the new household with the families of the husband and the wife (patrilocal, matrilocal or bilocal).

Other data

Most of the others data are from Ashraf and Galor (2013). We retain this data set since it has been constituted for a recent decisive paper in the field using plenty of control variables. Details of this dataset are available in Ashraf and Galor (2013) but we provide few information on the more important variables. As explained variable, we use income per capita in 2000 coming from the *Penn World Table* (Heston et al., 2006). To control for geography we use the share of the population at risk of contracting malaria from Gallup and Sachs (2001), as well as the share of the population living in Koppen-Geiger tropical zones and distance from the nearest coast or sea-navigable river, both from the dataset of Gallup et al. (1999). Others important controls are the share of the population of European descent based on the *World Migration Matrix, 1500–2000* of Putterman and Weil (2010), the shares of the population affiliated with major world religions from the dataset of La Porta et al. (1999), as well as the ethnic fractionalization index of Alesina et al. (2003). On the institutional side, we use the social infrastructure index of Hall and Jones (1999) and legal origin dummies from La Porta et al. (1999)

4. Distribution of the family characteristics across the world

Authority of the parents

This characteristic is frequent where the new household needs the products from the farm of the parent to be able to live. Authority is a feature of Germanic, Russian, Chinese, Japanese, Korean families for example. Family types of Russia and China are different from the one of Japan and Germany despite a common authority of parents over children. Indeed, the Japanese and German families, combines authority of parents to inequality among siblings (combination called the Stem type) whereas Russia and China families require a perfect equality (combination called the Communitarian type). But in the two cases, human capital of the parents can be transmitted for a longer period.

In the Communitarian type (Russian, Chinese but also traditional Gipsy families), all the sons are allowed to marry and bring their spouses in the parental household.[13] This leads to larger families splitting when the sustainable size in crossed. In the Stem type, only one son is allowed to marry and bring his wife in the parental household.[14] In this family type, the ideal is to have only two children well educated: one to transmit the household and a second one to marry with an heir. Todd (1984) highlights that around

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[13] Todd (1983) explains the success of the Communism as an institutional mirror in areas dominated by this family type combining authority of parents and equality of brothers living in large family groups.

[14] On this aspect, the Stem family does not respect the definition of the European Marriage Pattern proposed by Carmichael and van Zanden (2015).

1850 the age of marriage of women in Scandinavia, Germany and Switzerland, which are of the Stem type, is above 27 years. This age means fewer children more educated thanks to a mother herself more educated. Few generations later, the inhabitants of these countries enjoy the world highest standard of living whereas in 1850 they were poor especially compared to France and UK; in 1868, a famine leads to a fall of the population of Scandinavians. Outside Europe, only two areas exhibit the same family structure: Japan and Korea.[15] Todd observes the same late women marriage in Japan about at the same date than in the European cases and later in the 20th century in Korea. Results are similar few generations later.

In family types which are not characterized by authority, such as Anglo-Saxon countries, children enjoy more freedom. Children leave early to settle in a new household and remain more independent from their parents and vice-versa. In the medieval English family for example, the children are able to have their own house easily because of the dominance of the employments of farm workers for large farms owned by few wealthy landowners. This leads to an early labor market which can't exist in areas where agriculture is made by small familial farms without any employees. But the need to settle independently make the formation of new couples sensitive to economic conjuncture allowing adjustment of fertility by delayed marriages (Carmichael et al., 2016). These weak ties between parents and children in the traditional English family leads to early problems of poor which are mainly aged peoples (isolated from their children) explaining the precocity of the Poor Law in England compared to other comparable countries (de Moor and van Zanden, 2009).

In most of the Muslim countries, the family is not authoritarian despite to be clanic. This is due to a specific practice which is endogamy. The "Arab marriage", is a preference for the marriage between first cousins if possible the children of two brothers. Since the day of her birth, a girl is supposed to marry with her older cousin. In many customs, the cousin enjoys a kind of right on his female cousin (Chelhod, 1965). The Koran allows this arrangement because nothing prevents the marriage between first cousins. Today, the rate of marriage between first cousins, close to zero in a large part of the world is, according to Bittles (1994), about 15 % in Turkey and around 50 % in Afghanistan but also in the cities of Karachi (Pakistan) and Khartoum (Sudan). According to Weinreb (2008), the lowest rate of endogamous "Arab marriage" is observed in Algeria with 23 % but countries such as Irak, Jordan, Pakistan, Saudi Arabia exhibit rates above 50 %. Even in the rich Riyadh, capital city of Saudi Arabia, the rate is 42.3 % (Todd, 2011: 517).

As a consequence of these rates, and adding marriage with more distant cousins, almost all individuals are integrated into a large family. This practice leads to large kinship groups that the Koran also supports since the rules of inheritances are not only from

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[15] The traditional Jewish family also respects this same structure.

one generation to the children but states the spread of the wealth in many shares distributed to all the members of the family group. Greif (1993, 2006, 2013) highlights the consequences of the clanic organization, as opposite to individualism of European family structures. This effect of the family model on the way humans cooperate (clan versus groups of individuals) is complementary to our approach. But, the current paper only focuses on the effects of the family structures on the productivity letting the consequences in terms of cooperation for future research.

Paradoxically, this clanic organization does not require any authority. There is no need of a family chief who decided who is allowed to married who since couple formation is only the result of the traditional practice. Contrarily, in the Stem or Communitarian types, when a child brings a spouse in the parental household, the parents are allowed to grant a kind of consent to the "foreign" new member of the family. But, in the "Arab mariage", the choice of the spouse by this custom transforms fathers and uncle into passive executors of rules. There is no an active authority but a passive execution. As a consequence, the Arab family is not characterized by authority of parents nor only father.

Figure 1. Strong authority of parents over children

Note: This figure depicts the countries (in black) were family type exhibits a strong authority of parents on children

High status of women[16]

In most of the Western Christian countries, the status of women is relatively high. In the Roman law of Justinian, girls enjoyed similar rights than boys on inheritance. The Church requires the consent of the wife for marriage since the Antiquity. Women are active actors participating in the society; for example, in large areas of Europe, an active labor market existed for women before the industrial revolution despite low economic development (De Moor and Van Zanden, 2010). Most of the Christian countries are thus characterized by a high status of women. Contrarily, in the countries characterized by the tradition of the "Arab marriage", the status of women is low because she can be excluded from any contact with the society exterior to the clan (whereas exogamic marriage required a minimum of random matching), she can be married very young if she already has a male cousin and the new family don't need a financial independence to settle since the clan provides resources. But, the "Arab marriage" offers some comfort for women because she marries in a known environment, namely the family of her uncle.

But the relation between religion and family types is not so simple (see in Section 7 a deeper investigation). Despite to be Christian, Russia family offers a low status to women. Despite to be Muslim, women of the South-East Asia enjoy a high status because the family type is not similar to the "Arab" one. In sub-Saharan Africa, polygyny is very prevalent with few differences according to the religious affiliation. In those countries, the polygyny is not limited to a minority of wealthy men as in most Arab countries. In black Africa, percentage of women living in polygamous unions varies from 30 to 55 % (Todd, 2011: 42). Comparing these African countries to a similar group of monogamous countries, Tertilt (2005) measures that women in polygynous countries marry, on average, 5.1 years earlier and have 2.2 children more than women in monogamous countries. The average age difference between husband and wife is 6.4 years, compared to only 2.8 years in monogamous countries. Thus, the status of women in African countries is doubtless low. The traditional family types in China and the main part of India also offer a low status of women leading to current observation of the famous "missing women" (Sen, 1990) which is not solve by the economic growth of these countries (Klasen and Wink, 2003).

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[16] Of course the status of women remains low compared to man in these countries despite large changes for the recent decades. But, the point is that the status of the women was even lower in the traditional families of the other group of countries.

Figure 2. High status of women

Note: This figure depicts the countries (in black) were family type exhibits a relatively high status of women.

Inequality among siblings

The potential inequality of siblings is represented in Northern Europe both in German and English families. But, in the German case (as in Scandinavian, Austrian, Japanese, Korean or Swiss cases), this inequality is associated with authority of parents (leading to the Stem family) whereas in England (as in Danemark and Netherland) the children enjoy more freedom (leading to the Todd's Absolute Nuclear type). Most of the inheritances are actually equalitarian but it is not forbidden to transmit the wealth in an inequalitarian way. The freedom to teste is an evidence of this potential inequality. The English family has been exported by immigrants in US, Australia, New-Zealand and less clearly in South-Africa. In most of the countries of the South-East Asia, there is no rules forbidden an inequal transmission. Thus, these countries are also characterized by cases of inequality in inheritances.

In the rest of the world, a strict equality at least among brothers is required. Brothers in the Muslim world are all strictly equal as it is states in the Koran. Russian and China are also equalitarian in terms of inheritance as they are in terms of possibility of each son to bring a wife at the parental home. The Latin Europe is also equalitarian as was the Roman law. Latin America, followed Iberian colonizers, has adopted the rule of equality. This has been reinforced by the adoption of the French civil law where this

equality is clearly affirmed. The potential mixed effect with the legal origin is tested below.
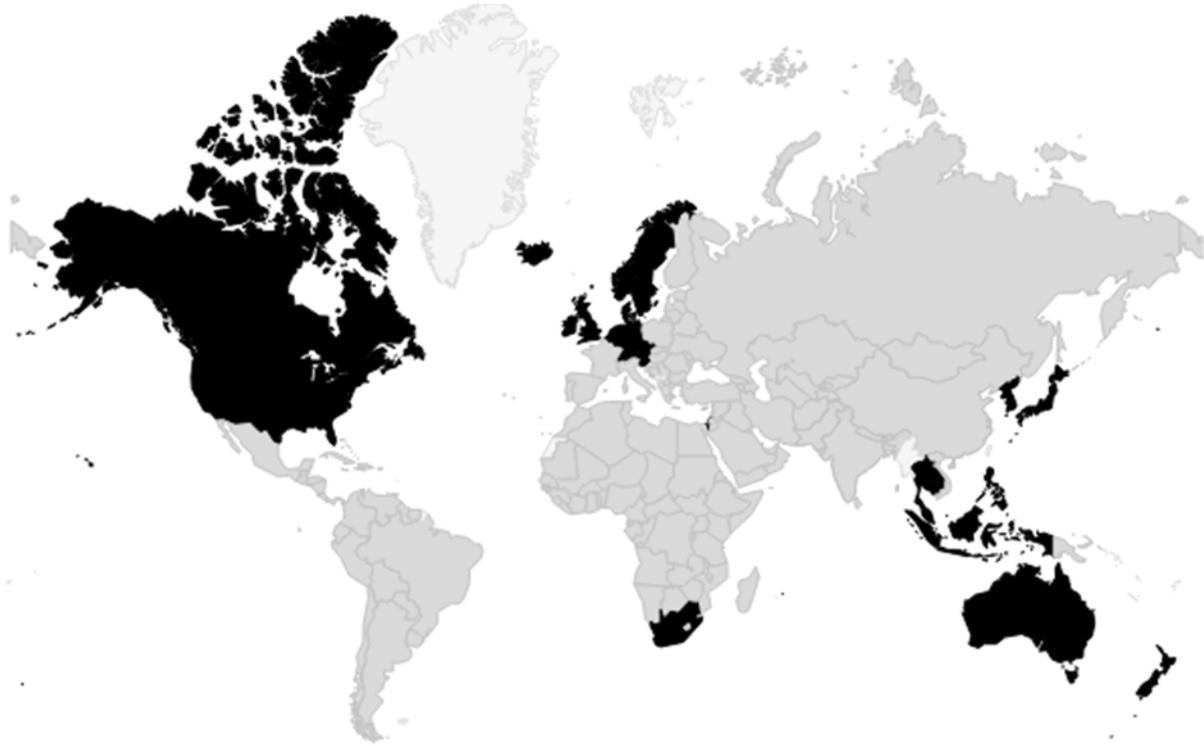
Figure 3. Inequality among siblings

Note: This figure depicts the countries (in black) were family type exhibits a potential inequality among siblings.

Family score

Adding the three series of dummy variables, we build for each country a family score ranging from 0 to 3. Few countries obtained 3. They are the Germanic and Scandinavian countries, Ireland, Israel and in Asia, Japan and the two Koreas. All these countries are among the richest in the world except North Korea where, the high propensity to development has not expressed herself probably due to the socialist regime.

As a result of the presence of two positive family characteristics, another few group of countries achieves a 2 in this family score. England, and thus Anglo-saxon countries, are in this case (they are characterized by high women and inequality among siblings) as well as few other European countries such as Finland and Baltic States. Most of the countries of East-Asia are also affected by a 2 ('women' and 'inequality'). A large group of countries enjoy only one positive characteristic, a high women status for Latin Europe and Latin America, authority of parents for Eastern Europe, Russia, China and

India. Another large group of countries are affected by a zero. It is the case of most of the Muslim and sub-Saharan countries.
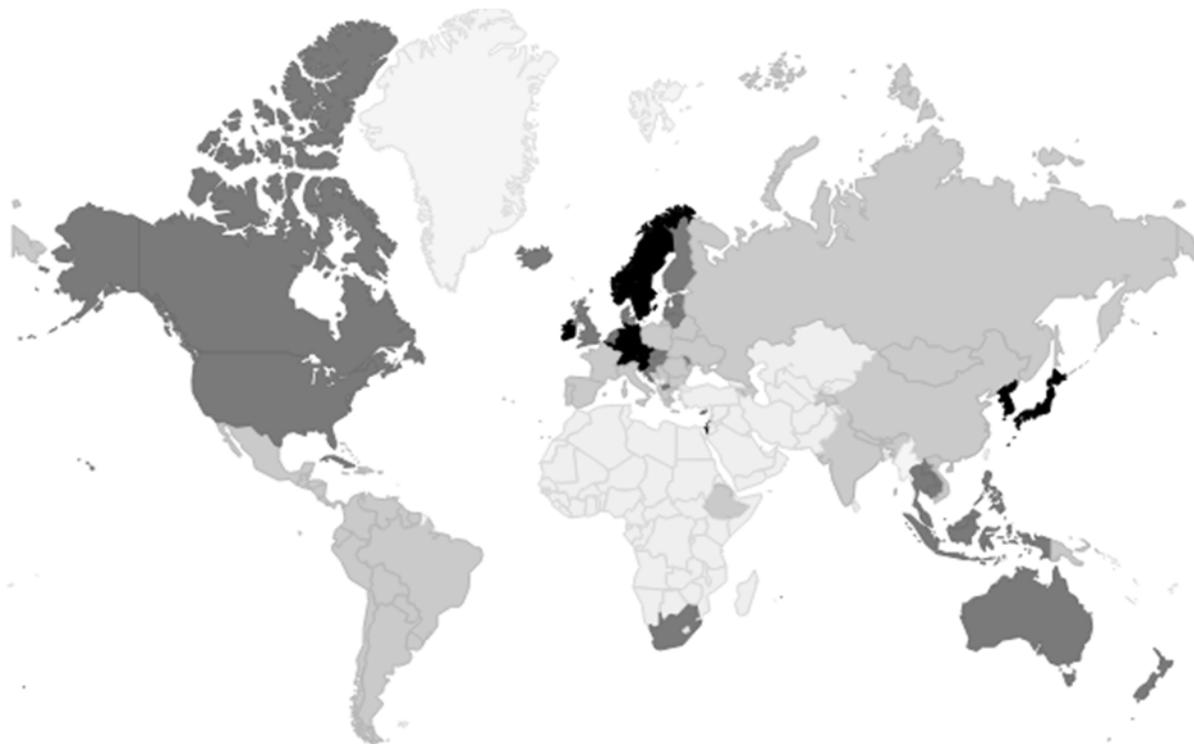
Figure 4. Family score according to the propensity to invest

Note: This figure depicts the family score obtain by each country from 0 in pale grey to 3 in black.

5. Empirical test of the family explanation of the current economic development

Does the family structure is statistically associated with economic development?

To test the effect of the family characteristics on current economic development controlling for other fundamentals factors, we run this kind of regressions:

$$\ln(y_i) = \propto + \beta_1 F_i + \beta_2 X_i + \varepsilon_i$$

where y_i is the income per capita of country i in the year 2000, F_i is a series measuring a family characteristic ('authority', 'women', 'inequality') or the family score of the country i, X_i is a vector of control factors and, finally, ε_i is a country-specific disturbance term.

Table 1 shows the result of simple OLS regressions of log income per capita in 2000 on the four family series without any control. Each of this series appears positively and significantly associated with current economic development on a full sample of 177

countries with data. Each of the three series captures different effects since they remain significant when tested altogether (Column 4). The three series are also significant when summed in the series family score (Column 5). The relationship between this series family score and the GDP per capita is graphically presented in Figure 1.

Table 1. Family characteristics and economic development

	log income per capita in 2000				
	(1)	(2)	(3)	(4)	(5)
Women	1.264***			1.022***	
	(0.1532)			(0.1665)	
Authority		0.697***		0.461**	
		(0.2055)		(0.1774)	
Inequality			1.293***	0.560**	
			(0.2132)	(0.2206)	
Family score					0.724***
					(0.0795)
Observations	177	177	177	177	177
R²	0.28	0.06	0.17	0.33	0.32

Note: This table establishes the significant relationship between observed family characteristics and log GDP per capita in 2000 in the full 177-country sample. Heteroskedasticity-robust standard errors are reported in parentheses. *** Significant at the 1 percent level, ** Significant at the 5 percent level and * Significant at the 10 percent level.
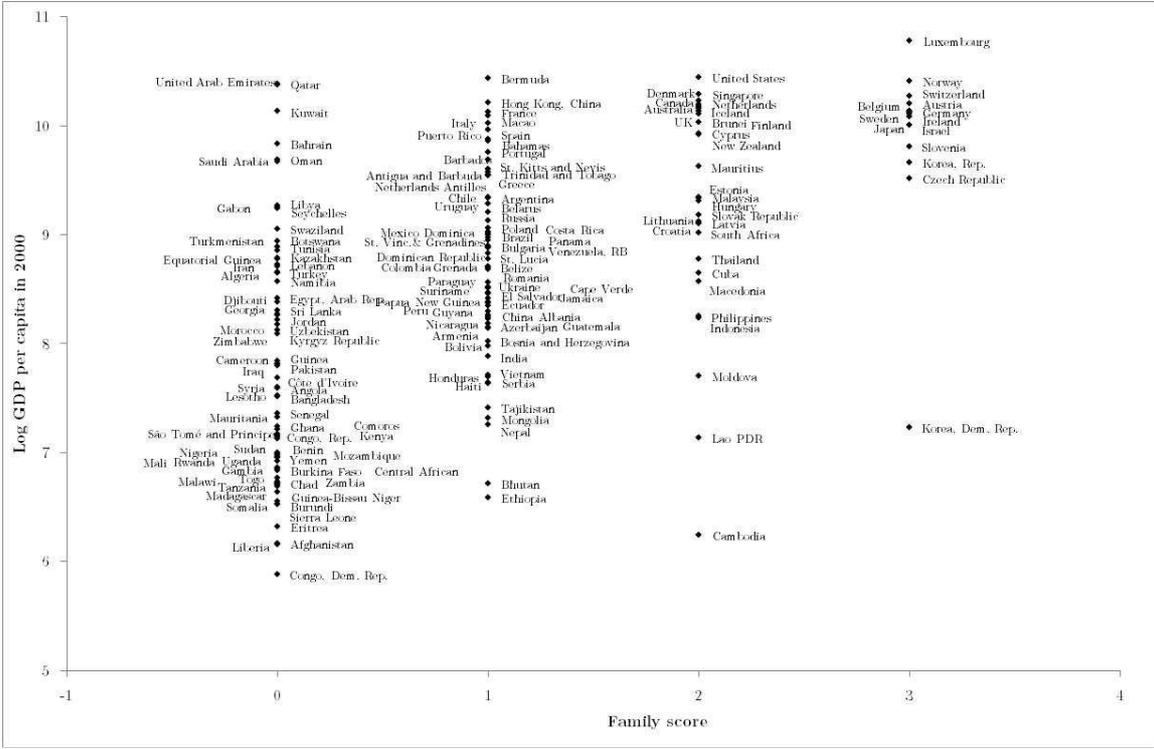
Figure 5. Family score and economic development

Note: This figure depicts the positive relationship between the family score and the GDP per capita across 177 countries.

Does the family explanation is robust to geography?

Apart family characteristics, countries enjoy different geographical conditions. We thus control for several geographical factors that have been identified in the literature as able to explain the current income, (Table 2, Column 1). Following Ashraf and Galor (2013), we control for agricultural productivity of lands using three factors: the percentage of arable land, the absolute latitude and an index gauging the overall suitability of land for agriculture. The absolute latitude is never significant whereas the index for agriculture suitability and the percentage of arable land and are frequently significant but with the unexpected sign for the latter; the same surprising sign for this variable was observed in Ashraf and Galor (2013). Another geographical control factor is the mean distance to waterway since it highly affects the cost of exchange. This factor is always significantly associated with a lower economic development. An important biogeographical factor is the risk of Malaria since the prevalence of this disease is proved to be a burden unfavorable to economic development (Gallup and Sachs, 2001). This negative factor is confirmed to be highly significant in all the specifications we made in this paper. By comparison, the percent of population living in tropical zone and thus suffering other associated diseases is not correlated with the economic development. Last geographic control is a dummy variable for countries belonging to the Organization of the Petroleum Exporting Countries (OPEC) which is, as expected, significantly associated with a higher GDP per capita.

According to Diamond (1997), the main factor explaining the divergence in economic development is the chance to enjoy favorable environment for agriculture centuries ago. The time since the Neolithic transition (ancestry adjusted) can be accepted as exogenous and mainly geographic since agriculture was invented in few places (Middle-East, China, Central America) and then spread. For most of the countries, the date of agriculture is mainly the result of distance from the place of invention. Moreover, Comin et al. (2010) demonstrate the persistent through time of an initial advance. But our test rejects the time since Neolithic transition as statistically linked to current economic development.

Crucially, our variable family score remains highly significant using this combination of geographic factors. The sign is as expected, i.e. higher is the family score, the more the country is economically developed. This combination of fundamental geographic factors and the effect of the family structures explain a large part of differences in the current GDP per capita with a R^2 of 0.64 (Column 1).

A last geographic control is a dummy for each continent. Our family score is partially correlated to continents. Especially most of African countries obtain a zero thus, the family score could be just a proxy for the continents. We thus control using a dummy for each continent (Column 2). It also allows to control for the Eurasian effect since according to Diamond (1997), Asian and European continents beneficiated from specific

advantages. The family score remain significant at 1 % level with a limited decrease of the coefficient. No one continental dummy is significant.

Adding controls for the nature of peoples

Recent literature has identified three factors explaining the difference we observe in economic development related to the nature of peoples. The first one is the ethnic fractionalization that we control using the index of ethnic diversity proposed by Alesina et al. (2003). A second control is the index of genetic diversity developed by Ashraf and Galor (2013). Last control is the share of population from European descent. This factor could be problematic because it is correlated with our measure of family score. Europeans could have brought with them their family structure which, on average, is higher than the rest of the world. However, we use this factor as control because Europeans could also have brought with them other inputs than family structure which then spread in the country.

To control for these factors, we combine them (all together and independently) with the geographic factors previously used (Table 2, Columns 3 to 7). The family score remains significant at 1% when controlled for the three human factors taken together with and without dummies for continents (Columns 3 and 4). This specification combining all geographic and human factors explains 72 % of the GDP per capita worldwide. The R squared of the regression does not rise when controlling for continents, but the coefficient of the family score increases (Columns 3 and 4). Consequently we will not use these continental dummies in the following specifications. The ethnic fractionalization and the share of European descent are confirmed as significant with the expected sign but the genetic diversity exhibits significance only when continents are not controlled for (Column 3). However, as will be demonstrated later in this article, both ethnic and genetic diversity are often significant when taken together meaning that they capture different factors. Reassuringly, the family score is also significant at 1% when controlling for each human factor independently (Columns 5, 6 and 7). Thus, this family score captures other features than ethnic diversity, genetic diversity or the share of European ancestors. This is important for the share of European ancestors since Europeans brought with them several things including their family systems. Thus, our series family score is not just a proxy for the share of European ancestors since both series are significant when combined (Column 7).

Robustness check for countries with various family regimes and GDP in 1950

Our measures could be biased by the choice to affect the dominant family type to a country characterized by different family systems. Indeed, 28 countries exhibit various

family structures; for instance Italy exhibits regional differences in family types (Barbagli and Kertzer, 1990).[17] Thus, we control for this simplification by running again our measures but on a sub-sample after exclusion of countries exhibiting different family types.[18] We focus on the most interesting specification which includes all the control variables excepting the percent of Europeans descent since it could capture a share of the family score. Column 8 of Table 2 presents the result of this regression. The family score remains still highly significant on this sub-sample test with a stable coefficient, we can thus conclude that the simplification of affecting to one country the dominant family type is not problematic.

A last control is for the economic development observed previously in the past rather than in 2000. In Table 2 (Column 9), we use as explained variable, the GDP per capita in 1950 as provided by the updated Maddison's database (Bolt and Van Zanden, 2014). The number of observation is lower but the family score remains highly significant. The family characteristics we focus on are stressed as positive for economic current development but not necessarily for development centuries ago (especially when human capital was not a crucial factor). Thus, it does not make sense to test this theory using age-old measures of economic development.

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[17] See Rijpma and Carmichael (2016) for a discussion of such a simplification.

[18] The countries excluded because of the presence of several family types are Belize, Bolivia, Brazil, Canada, Costa-Rica, Ecuador, El Salvador, France, Greece, Guatemala, Honduras, India, Israel, Italy, Madagascar, Mexico, Netherlands, Nicaragua, Paraguay, Peru, Portugal, Russia, South-Africa, Spain, Sudan, United-Kingdom, United-States and Venezuela.

Table 2. Family characteristics and economic development controlled for geography and nature of peoples

	log income per capita								in 1950
	in 2000								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Family score	0.421***	0.332***	0.243***	0.250***	0.393***	0.435***	0.273***	0.396***	0.345***
	(0.0775)	(0.0893)	(0.0797)	(0.0872)	(0.0767)	(0.0797)	(0.0783)	(0.0845)	(0.0968)
Log percentage of arable	-0.081	-0.104	-0.183**	-0.173**	-0.094	-0.164*	-0.127*	-0.233***	-0.029
land	(0.0691)	(0.0739)	(0.0850)	(0.0764)	(0.0681)	(0.0790)	(0.0700)	(0.0818)	(0.1158)
Log absolute	0.041	0.012	-0.117	-0.095	-0.005	-0.036	0.009	-0.166	0.147
latitude	(0.1140)	(0.1128)	(0.1132)	(0.1161)	(0.1129)	(0.1247)	(0.1084)	(0.1409)	(0.1933)
Log land suitability for	-0.152**	-0.165**	-0.141**	-0.146**	-0.159**	-0.092	-0.165**	-0.076	-0.110
agriculture	(0.0717)	(0.0720)	(0.0688)	(0.0705)	(0.0713)	(0.0746)	(0.0683)	(0.0770)	(0.1112)
Mean distance to	-0.382***	-0.281**	-0.282**	-0.303**	-0.333**	-0.406***	-0.317**	-0.462***	-0.380*
nearest waterway	(0.1397)	(0.1370)	(0.1285)	(0.1348)	(0.1396)	(0.1389)	(0.1323)	(0.1572)	(0.2006)
% of pop at risk of	-1.498***	-1.462***	-1.094***	-1.061***	-1.303***	-1.717***	-1.201***	-1.439***	-1.372***
contracting malaria	(0.2148)	(0.2409)	(0.2382)	(0.2546)	(0.2216)	(0.2350)	(0.2196)	(0.2628)	(0.3207)
% of pop. Living	0.009	0.181	0.045	0.088	0.007	0.045	0.096	0.085	0.417
in tropical zones	(0.2443)	(0.2615)	(0.2463)	(0.2674)	(0.2396)	(0.2714)	(0.2314)	(0.2994)	(0.4211)
OPEC	0.402*	0.458**	0.561***	0.582***	0.466**	0.380*	0.502**	0.583**	-0.115
member	(0.2287)	(0.2212)	(0.2089)	(0.2121)	(0.2281)	(0.2267)	(0.2163)	(0.2407)	(0.2870)
Log neolithic transition	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
(ancestry adjusted)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Ethnic			-0.913***	-0.938***	-0.789***			-1.023***	0.252
fractionalization			(0.2726)	(0.2822)	(0.2972)			(0.3350)	(0.4043)
Genetic			172.2*	140.3		198.6**		430.8**	-205.4
diversity			(88.55)	(100.90)		(97.84)		(172.90)	(126.20)
Genetic diversity			-119.0*	-96.9		-135.4*		-294.8**	153.4*
squared			(62.64)	(71.19)		(69.19)		(120.20)	(89.22)
% of pop. of European			0.954***	1.428**			0.976***		
descent			(0.1922)	(0.5607)			(0.1952)		
Continent fixed effect	No	Yes	No	Yes	No	No	No	No	No
Observations	145	145	145	145	145	145	145	117	135
R²	0.64	0.70	0.72	0.71	0.65	0.65	0.69	0.69	0.51

Note: This table demonstrates the significant relationship between observed family score and log GDP per capita in 2000 (in 1950 in Column 9) controlling for geographic and human factors in samples of countries for which data are available. Heteroskedasticity-robust standard errors are reported in parentheses. *** Significant at the 1 percent level, ** Significant at the 5 percent level and * Significant at the 10 percent level.

6. Exploring the channels of the family characteristics effects

Family characteristics working to explain current GDP per capita

In addition to the result of the global family score, one could wonder which characteristics of the family system are the more related with income per capita. Indeed, authors such as Carmichael and van Zanden (2015) focus on the women status building a "Girlpower index". Other such as Kuran (2011) stressed the equality of inheritance as a crucial factor explaining the backward development of Muslim countries. There is also large literature stressing the importance of human capital accumulation making relevant to observe the impact of authority of parents we suppose favorable to it (e.g. Unified Growth Theory see Galor, 2011). Thus, we use basic family characteristics as explanative variables retaining as geographical control variables only

those previously identified as significant.[19]As control for the nature of peoples, we retain the genetic and ethnic diversity but exclude the share of the population with European ancestors since this variable could theoretically capture a part of the family system of one country since Europeans brought with them their family organizations.

Among the basic family characteristics, a high status of women and inequality among siblings are highly significant when taken alone (Table 3, Columns 1 and 4) and when the three family characteristics are combined (Column 5). On the contrary, the authority of parents over children is not significant (Columns 2 and 5). However, as will be demonstrated below, the authority of parents plays a highly significant positive role in explaining investment in human capital. These paradoxical results can be explained by the fact that countries exhibiting authority of parents are also frequently associated with a socialist legal system (correlation coefficient of 0.57). The potential development of these countries has thus been hampered by the socialist policies applied for decades before the year 2000 when GDP per capita was measured. For the purpose of control, we add a dummy for socialist legal systems which led the series authority of parents to become slightly significant with a strong increase of its coefficient (Column 3). Thus, the positive effect of the high status of women and inequality of siblings is clearly demonstrated whereas the positive consequences of the authority of parents over children are less clear.

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[19] We thus exclude the absolute latitude, the percentage of the population living on tropical areas and the years since the Neolithic Revolution as well as continent dummies since they were never significant whatever the previous specifications.

Table 3. Economic development and basic family characteristics

	log income per capita in 2000				
	(1)	(2)	(3)	(4)	(5)
Women	0.873***				0.589***
	(0.1596)				(0.1746)
Authority		0.022	0.316*		0.150
		(0.1662)	(0.1857)		(0.1724)
Inequality				0.861***	0.502***
				(0.1580)	(0.1794)
Legal origin			-0.611***		-0.397**
socialist			(0.1925)		(0.1773)
Log percentage of arable	-0.149**	-0.164**	-0.154*	-0.198**	-0.166**
land	(0.0744)	(0.0826)	(0.0800)	(0.0747)	(0.0718)
Log land suitability for	-0.119*	-0.062	-0.034	-0.033	-0.065
agriculture	(0.0701)	(0.0766)	(0.0747)	(0.0695)	(0.0682)
Mean distance to	-0.264*	-0.519***	-0.362**	-0.442**	-0.201
nearest waterway	(0.1391)	(0.1447)	(0.1486)	(0.1319)	(0.1396)
% of pop at risk of	-1.328***	-1.597***	-1.679***	-1.630***	-1.500***
contracting malaria	(0.1793)	(0.1981)	(0.1936)	(0.1722)	(0.1838)
OPEC	0.472**	0.328	0.321	0.385*	0.447**
member	(0.2165)	(0.2392)	(0.2316)	(0.2152)	(0.2084)
Ethnic	-0.890***	-0.984***	-0.952***	-0.765***	-0.777***
fractionalization	(0.2857)	(0.3156)	(0.3058)	(0.2882)	(0.2749)
Genetic	233.9***	241.0**	264.1***	194.8**	194.8**
diversity	(84.224)	(93.806)	(91.112)	(83.70)	(83.70)
Genetic diversity	-158.7***	-167.5**	-183.5**	-131.3**	-131.3**
squared	(59.427)	(66.137)	(64.231)	(59.02)	(59.02)
Observations	145	145	145	145	145
R²	0.68	0.61	0.63	0.71	0.71

Note: This table demonstrates the significant relationship between observed basic family characteristics and log GDP per capita in 2000 controlling for geographic and human factors in a 145-country sample for which data are available. Heteroskedasticity-robust standard errors are reported in parentheses. *** Significant at the 1 percent level, ** Significant at the 5 percent level and * Significant at the 10 percent level.

The effects of family characteristics on investments in human and physical capital

A second way to assess the channels of the effects coming from the family characteristics consists in studying their relationships with proxies for investments in human and physical capital in each country. According to our theoretical framework, a high women status and a strong authority of parents is supposed to favor investment in human capital. We rely on the number of scientific articles per capita (1981-2000) and the number of years of schooling as proxies for investment in human capital (the two series are from Ashraf and Galor, 2013). Our women series is highly significant in explaining both the number of scientific articles and the years of schooling after control for geographical and human factors previously identified as significant (Table 4, Columns 1 and 5). Our authority variable is only significant in explaining the number of years of schooling (Columns 6). But as previously explained, authority is highly

correlated with socialist legal origin; controlling for this aspect, the authority series becomes significant as well for explaining the number of scientific articles per capita (Column 3). Both a high status of women and a strong authority of parents have a positive impact on investment in human capital, but in different ways, since the two series are significant when tested together to explain scientific articles and years of schooling (Columns 4 and 7). It is interesting to note that membership of OPEC is now frequently associated with a significant negative sign meaning the income from oil leads to low investments in human capital.

To investigate the theoretical positive effect of inequality of siblings on the investment in physical capital, we add two series to the data of Ashraf and Galor (2013). From *the Penn World Table* (Feenstra et al., 2015), we collect the share of gross capital formation and compute the ratio of capital stock to population to get a per capita figure. These data have been constituted for each country for the year 2000 and are assumed to be good measures of the investment in physical capital. The theoretical positive effect of inequality is verified since this series is highly significant in explaining our two measures of investment in physical capital (Columns 8 and 9).

Table 4. Family characteristics and investments in human and physical capital

	scientific articles per capita 1981-2000				years of schooling			share of capital	capital per capita
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Women	0.240***			0.222***	3.142***		6.109***		
	(0.0436)			(0.0401)	(0.5144)		(0.4729)		
Authority		0.017	0.138***	0.139***		2.013***	1.861***		
		(0.0456)	(0.0483)	(0.0432)		(0.4951)	(0.4193)		
Inequality								0.033**	1.116***
								(0.0152)	(0.1841)
Socialist legal origin			-0.247***	-0.223***					
			(0.0497)	(0.0447)					
Log percentage of arable land	0.016	0.009	0.015	0.019	0.125	-0.158	-0.032	-0.011	-0.214**
	(0.0219)	(0.0247)	(0.0225)	(0.0202)	(0.2377)	(0.2604)	(0.2210)	(0.0075)	(0.0911)
Log land suitability for agriculture	-0.057***	-0.043*	-0.029	-0.043**	-0.102	0.273	-0.030	0.000	-0.046
	(0.0206)	(0.0229)	(0.0211)	(0.0202)	(0.2295)	(0.2436)	(0.2113)	(0.0070)	(0.0849)
Mean distance to nearest waterway	0.020	-0.058	0.010	0.076**	1.583***	0.613	1.508***	-0.021	-0.429***
	(0.0392)	(0.0409)	(0.0398)	(0.0375)	(0.4693)	(0.4822)	(0.4311)	(0.0129)	(0.1559)
% of pop at risk of contracting malaria	-0.058	-0.126**	-0.162***	-0.085*	-3.293***	-4.217***	-2.727***	-0.037**	-2.118***
	(0.0510)	(0.0577)	(0.0211)	(0.0495)	(0.6272)	(0.6406)	(0.5896)	(0.0173)	(0.2090)
OPEC member	-0.104	-0.156*	-0.153**	-0.098	-1.550**	-1.764**	-1.088	0.017	0.413
	(0.0715)	(0.0802)	(0.0732)	(0.0662)	(0.7405)	(0.8035)	(0.6876)	(0.0220)	(0.2653)
Ethnic fractionalization	-0.133*	-0.146	-0.125	-0.112	-0.537	-0.309	-0.193	-0.069**	-0.429
	(0.0790)	(0.0884)	(0.0809)	(0.0723)	(1.0624)	(0.9493)	(0.8029)	(0.0296)	(0.3580)
Genetic diversity	33.74	38.53	47.64**	40.226*	1022**	490.8*	528**	14.71*	312.3***
	(23.19)	(26.15)	(23.95)	(21.45)	(420.20)	(276.05)	(233.48)	(8.63)	(104.22)
Genetic diversity squared	-22.32	-26.75	-33.052*	-26.893*	-704.6**	-341.2*	-359.5**	-10.41*	-215.6***
	(16.38)	(18.45)	(16.89)	(15.14)	(292.93)	(195.31)	(165.16)	(6.09)	(73.63)
Observations	128	128	128	128	128	128	128	133	133
R²	0.34	0.23	0.31	0.45	0.63	0.56	0.69	0.28	0.71

Note: This table demonstrates the significant relationship between observed basic family characteristics and investments in human (scientific articles per capita and years of schooling) and physical capital (share of capital and capital per capita) in samples of countries for which data are available.

Heteroskedasticity-robust standard errors are reported in parentheses. *** Significant at the 1 percent level, ** Significant at the 5 percent level and * Significant at the 10 percent level.

7. Controlling for indirect effects through religious affiliation and formal institutions

Does the family structure is different from religious affiliation?

Family structures and religion are closely related. One can suspects the family structure to only be a proxy of the religious affiliation.[20] Actually, the relation between the two phenomena appears more complex with three kinds of relationships. In some cases, the religion influences the family structure, in other, it is the opposite direction (i.e. the family structures have influenced the religion) and in other, there is a complete independence between religion and the family type observed.

The influence of religion on the family structure is stressed by several authors. This influence seems clear for Islam since the Koran provides a complete set of rules to organize the family leading family types of many countries to be largely influenced by the rules of Islam. According to Todd (2011: 30), the population of Egypt and Maghreb were converted to their current family type at the same time as they were converted to Islam and then to the Arabic language. The Church has been another important source of rules affecting the family structures. According to De Moor and van Zanden (2009), Catholic Church's influence is the crucial explanation of the high status of west European women. The polygamy, especially the Roman practice of *concubina*, is forbidden by the Council of Toledo in 400 leading to the practice of the publication of banns to make public the official wife. The rapt of women is forbidden by the council of Chalcedon in 451.[21] Gradually, the civil laws in Europe are adjusted to the canons of the Church and after the 10th century, the marriage will be only governed by the canonic law and considered as a sacrament. Then, the consent, free of any constraint, of the wife to the marriage is a strict obligation but the consent of the parents is not (Chénon, 1929: I.86).

We do not explore in this paper the impact of exogamous versus endogamous family systems but on this point authors such as Greif (2006) also highlight the effect of the Church. Indeed, Christian attachment to the principle of exogamy was very explicit as appeared in many councils and the canon law. In the City of God, St. Augustine assumes that an enlargement of the taboo incest is a constituent part of the progress

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[20] Todd also excludes any correlation between the family types and the linguistic families. Especially, the Indo-european languages cover many forms of family; For example, Iran has an Indo-european language but an arab family type.

[21] Canon 27, "That we should not force a woman to marry."

(St. Augustine, 413: XV.16). Several Councils banned marriage between cousins at different degrees or even always since a parenthood can be found (Council of Rome of 721, canons 5-9).

But there is also many cases of independence between religion and the family structure. Despite to be Muslim, Albanean remain exogam with few marriages between cousins (Todd, 2011: 467). In contrast, despite to be Christian, the Christians of Beyrouth (Lebanon) are frequently married with cousins (about 10 % of the marriage).[22] Despite to be Christians, the status of women in Georgia and Armenia is very low even today as demonstrated by the sex ratio observed in 2000 which is respectively 118 and 120 boys for 100 girls due to selective abortion (Todd, 2011: 487). The most demonstrative case of independence between religion and family structure is South-East Asia. Most of the inhabitants of Burma, Thailand, Laos, Cambodia, Malaysia, Philippines and Java enjoyed the same family type whatever they are Muslims, Christians and Budhists.

A third form of relationship is cases in which a preexisting family structure has influenced the religion we observe today. Sometimes a religion became dominant in areas where specific family types already existed. For example in Europe, the Protestantism is implemented in areas of the Stem family (combination of 'authority' and 'inequality') according to Todd (1984: 256).[23] It is also difficult to exclude that the family type promoted by the Catholic Church as explained above was a consequence (and not a cause) of a preexisting family model; this direction of the causality would solve the criticism that all Christian areas did not enjoyed similar family type especially regarding the low women status in Eastern Europe (see Dennison and Ogilvie, 2014). According to Todd (1984), Islam became the dominant religion mainly where the "Arab marriage" was already present because the family rules of the Koran are compatible with this specific family type. For instance, the low women's status is anterior to Islam in a large part of the current Muslim world attested by the fact that girls were fully excluded from inheritance even before Islamization. According to the Islamic law in his Sunni version, girls inherit a lower share than boys but in many places, this rule remains not respected with a total exclusion of girls contradicting the Koran.[24]

As a consequence, there is no a single one-way causal relationship between family structure and religion but three possibilities. The family structure as a consequence of the religion is only one on three cases of potential relations. In this case, the family structure is not the fundamental factor reducing the general explanative power of the

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[22] But the rate for Muslims is 21.5 %.

[23] This relationship is confirmed within France since the Protestantism succeeded mainly in the south of France where the family type was similar to the German area whereas the rest of France, under others family types, remained highly catholic (Todd and Le Bras, 1981: 374).

[24] The Shiite law is more favorable (Todd, 2011: 487), see also, Weldon and Htun (2012)

family characteristics. We control for the share of the three main religions in the population of each country to check if the religious affiliation is not the main driver of our observations as fundamental cause (Religion → Family Characteristics → Economic development) or as intermediate channel (Family characteristics → Religion → Economic development).

In the next set of regressions, we run regressions similar to the previous one but with a lower number of observations (Table 5, Column 1) to match the countries were religious affiliation is available and then add, for each country, the share of the population which is Protestant, Catholic and Muslim (Column 2). Column 2 to 5, show that Catholicism and Protestantism are positively and significantly associated with economic development in all specifications whereas Islam is most of the time negative but never significant. The coefficient of the family score decreases by about one fifth after control for religion attesting that a part of the influence of the family system is confound with religion. But, the family score remains highly significant (Column 2). The preservation of a high coefficient of the family score when religious affiliation is controlled for attests that cases of independence between religion and family characteristics are frequent. Turning to the impact of basic characteristics, both the high status of women and inequality among siblings are robust to the inclusion of the religious affiliation but authority of parents is not. Overall, we demonstrate that the family characteristics we identify as theoretically favorable, even if often close to religious affiliation, have an independent and positive influence on economic development.

Table 5. Family characteristics and economic development controlled for religion

	(1)	(2)	(3)	(4)	(5)
	log income per capita in 2000				
Family score	0.410***	0.329***			
	(0.0753)	(0.0803)			
Women			0.529***		
			(0.1785)		
Authority				0.025	
				(0.1594)	
Inequality					0.783***
					(0.1505)
% of pop Catholic		0.765***	0.492**	0.684***	0.812***
		(0.1946)	(0.2080)	(0.2172)	(0.1888)
% of pop Muslim		0.062	-0.138	-0.306	-0.111
		(0.2449)	(0.2408)	(0.2560)	(0.2227)
% of pop Protestant		0.906***	0.903***	1.098***	0.761**
		(0.3211)	(0.3331)	0.339**	(0.3139)
Log percentage of arable land	-0.193**	-0.123*	-0.086	-0.065	-0.118*
	(0.0738)	(0.0715)	(0.0724)	(0.0751)	(0.0685)
Log land suitability for agriculture	-0.078	-0.149*	-0.175**	-0.193**	-0.145**
	(0.0693)	(0.0752)	(0.0767)	(0.0792)	(0.0725)
Mean distance to nearest waterway	-0.372*	-0.315**	-0.292**	-0.412***	-0.360***
	(0.1340)	(0.1246)	(0.1322)	(0.1299)	(0.1187)
% of pop at risk of contracting malaria	-1.399***	-1.419***	-1.469***	-1.614***	-1.640***
	(0.1787)	(0.1679)	(0.1728)	(0.1792)	(0.1550)
OPEC member	0.482**	0.467**	0.470**	0.414*	0.391**
	(0.2159)	(0.2020)	(0.2081)	(0.2144)	(0.1949)
Ethnic fractionalization	-0.714***	-0.587**	-0.683**	-0.672**	-0.531**
	(0.2873)	(0.2672)	(0.2739)	(0.2833)	(0.2590)
Genetic diversity	134.7	236.4***	269.3***	295.8***	216.5***
	(86.461)	(82.834)	(84.321)	(86.70)	(80.30)
Genetic diversity squared	-90.44	-161.6***	-184.5***	-205.2***	-147.5**
	(61.079)	(58.441)	(59.492)	(61.08)	(56.65)
Observations	143	143	143	143	143
R²	0.68	0.73	0.71	0.69	0.75

Note: This table demonstrates that the effect of the family characteristics on GDP per capita do not operate through religious affiliation in a 143-countries sample for which data are available. Heteroskedasticity-robust standard errors are reported in parentheses. *** Significant at the 1 percent level, ** Significant at the 5 percent level and * Significant at the 10 percent level.

Is the effect of family structure direct or via more formal institutions?

As exposed in section 3, the family characteristics are assumed to have theoretical effects on economic development thanks to the different propensity to invest in physical and human capital. But, the family structure could have also influence the society to build specific formal institutions. The formal institutions of one given country may be the mirror of the family characteristics. This idea goes back to Aristotle, explaining the prevalence of the monarchies by the fact that each human is

used to this form of government in his own family with his father as king.[25] Galasso and Profeta (2010) provide strong evidence of this kind of phenomenon. In this case the effect of the family structure would be intermediated through formal institutions: Family characteristics → Formal institutions → Economic development.

We obtain an indication about the importance of the institutional channel compared to the direct effect of family characteristics looking at how β_1 of the family score changes when adding one factor measuring the quality of the institutions. If the family structure is related to current economic development through the formal institutions channel, the coefficient β_1 will decrease when controlling for formal institutions. We run regressions similar to the previous using the global family score (Table 6, Column 1) and then the three basic characteristics (Column 3) but with a lower number of observations to match the institutional data available (108 observations). In columns 2 and 4, we add a measure of the quality of institutions, as captured by the social infrastructure index of Hall and Jones (1999). Coefficients of our family series strongly decrease meaning that a part of their explanative power acts through the quality of the institutions but remains highly significant. When basic characteristics are tested, only the high women status remains significant to the control of institutions quality. The fact that the global family score and the high status of women remain significant after control for the quality of institutions supports the theory of a direct effect on productivity through propensity to invest and not only through the improvement of formal institutions even if this channel is also at work.

A last set of control is for the legal origin since this institutional feature has been identified as able to explain differences in economic development (La Porta et al., 2008). For many countries, especially in Europe or for countries that have chosen freely a legal regime (like Latin America for the French civil law or several countries for Socialist regime), the legal regime could also be the result of the fundamental factors which are the family characteristics. Of course, for countries who have inherited their institutions from colonizers (Acemoglu et al., 2001), the current legal origin is without any link with their family structures.

We run our classical regressions using alternatively the global family score (Column 5) and the three family characteristics (Column 7) but with the full sample of countries. Then, we add a dummy for the British, French and Socialist legal origins.[26] British and French legal origins do not have a significant effect but the Socialist origin is significantly associated with a lower economic development. The variable authority of parents remains insignificant whereas, more importantly, our global family score, the high status of women and the inequality of siblings keep strong significance with only a

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[25] Aristotle, *Politics*, in his introduction and in Part XIII.

[26] We do not use the German and Scandinavian legal origin due to the too limited number of cases.

modest decrease of their coefficients meaning that the legal origin variables is a very limited channel, if any, for the impact of the family characteristics.

Table 6. Family characteristics and economic development controlled for formal institutions

	log income per capita in 2000							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Family score	0.533***	0.262***			0.403***	0.433***		
	(0.0670)	(0.0684)			(0.0765)	(0.0880)		
Women			0.634***	0.474***			0.584***	0.571***
			(0.1741)	(0.1473)			(0.1772)	(0.1778)
Authority			0.203	0.148			-0.054	0.059
			(0.1686)	(0.1408)			(0.1483)	(0.1977)
Inequality			0.674***	0.179			0.593***	0.464**
			(0.1665)	(0.1582)			(0.1774)	(0.1929)
Social infrastructure		1.851***		1.848***				
		(0.2735)		(0.2832)				
French legal origin						-0.057		-0.289
						(0.2992)		(0.3161)
UK legal origin						-0.098		-0.302
						(0.2962)		(0.3074)
Socialist legal origin						-0.632**		-0.609**
						(0.2809)		(0.2829)
Log percentage of arable land	-0.220***	-0.206***	-0.210***	-0.190***	-0.194**	-0.175**	-0.175**	-0.166**
	(0.0630)	(0.0522)	(0.0633)	(0.0529)	(0.0751)	(0.0725)	(0.0727)	(0.0724)
Log land suitability for agriculture	-0.009	0.024	-0.023	-0.002	-0.079	-0.049	-0.080	-0.059
	(0.0626)	(0.0520)	(0.0647)	(0.0541)	(0.0698)	(0.0680)	(0.0689)	(0.0689)
Mean distance to nearest waterway	-0.289	-0.263*	-0.288	-0.245	-0.365***	-0.208	-0.296**	-0.217
	(0.1890)	(0.1564)	(0.1871)	(0.1562)	(0.1351)	(0.1381)	(0.1349)	(0.1412)
% of pop at risk of contracting malaria	-1.295***	-0.984***	-1.262***	-0.913***	-1.352***	-1.501***	-1.455***	-1.511***
	(0.1868)	(0.1612)	(0.1921)	(0.1689)	(0.1796)	(0.1774)	(0.1855)	(0.1852)
OPEC member	0.249	0.343**	0.244	0.356**	0.495**	0.448**	0.455**	0.449**
	(0.1782)	(0.1480)	(0.1763)	(0.1480)	(0.2186)	(0.2118)	(0.2114)	(0.2112)
Ethnic fractionalization	-0.573**	-0.641***	-0.647**	-0.648**	-0.786***	-0.750***	-0.776***	-0.713**
	(0.2688)	(0.2225)	(0.2683)	(0.2238)	(0.2895)	(0.2860)	(0.2790)	(0.2843)
Genetic diversity	261.2***	211.3***	253.3***	223.7***	160.8*	198.9**	170.1**	197.0**
	(73.090)	(60.894)	(73.659)	(61.60)	(86.16)	(84.28)	(84.20)	(84.52)
Genetic diversity squared	-180.2***	-145.9***	-174.0***	-153.8***	-109.1*	-135.1**	-113.9*	-132.9**
	(51.770)	(43.114)	(52.100)	(43.56)	(60.84)	(59.45)	(59.37)	(59.58)
Observations	108	108	108	108	145	145	145	145
R²	0.82	0.88	0.83	0.88	0.67	0.70	0.70	0.70

Note: This table demonstrates that the effect of the family characteristics on GDP per capita do not operate through quality of formal institutions and legal origins for samples of countries for which data are available. Heteroskedasticity-robust standard errors are reported in parentheses. *** Significant at the 1 percent level, ** Significant at the 5 percent level and * Significant at the 10 percent level.

8. The direction of the causality: the reversal of fortune of the primitive family

Historical anthropology evidences that family systems predate economic development

One could ask if the correlation we have demonstrated between family characteristics and economic development is not due to a reversal causality in which the economic development causes specific family characteristics. This potential reversal causality can be easily rejected by the history of the family structures. To study the long-term history of the family structures, anthropologists went through a variety of evidences. This deep analysis is facilitated when documents are available such as old codes (starting with the Hammurabi code which deals with many aspects of the family life), contracts especially sales where we can observe if sales after death include all siblings or one specific heir to assess the inequality among siblings and if the wife signs with her husband for the status of women.

The lack of document implies more original evidences. For example, the prehistoric human remains allow to assess the status of women. Indeed, the genetic kinship of male and female human remains shows the relations among wife and husband (matri, patri or billocality). Statues of women can also be used to measure the status of women according to their number, the importance of the decorations compared to those of men and the activities represented. Same kinds of observations are obtained from tombs. Inequality among brothers can also be supported by family representation where one of the brothers is put forward.

A reversal causality (i.e. from economic development to family structures) can be rejected by the timeline. The family structures we currently observed and we used in this study are, in most of the countries, existing for centuries before economic take-off. The family types precede the economic development thus the causality should play from family types to economic development. It does not mean that family structures are fixed but they move very slowly compared to other more formal institutions (institutions of level 1 according to Williamson, 2000).

A reversal of fortune

Countries characterized by primitive family types (Nuclear and Stem families) enjoyed a complete reversal of fortune (Todd, 2011). The history of the family structures show that characteristics which are today the more adapted for economic growth are actually the most archaic forms of familial organizations. Especially, the English family structure is similar to those of numerous hunter-gatherers peoples (Todd, 2011: 19). Many peoples of hunter-gatherers are association of nuclear families in a horde which is anthropologically similar to the association of nuclear families observed in villages

today in Europe. More generally, Europe and East Asia, due to their peripheral location in Eurasia, are conservatories of the archaic forms of family organizations. The "conservatism of margin areas" is a phenomenon well-known in linguistic that Todd applies to family models.

The losers of yesterday are the winners of today. Date of first writing (the beginning of history) is a good measure of the past success. The oldest text in Japanese (the Kojiki) dates only from 712. It is even later in non-Romanized Europe: during the 8th century for the eastern part of Germany (after the conquest by Carlos Magnus), in the 10th-11th century for Russia, about one century later for the Scandinavian areas and only during the 13-14th century for the Baltic countries. These countries were clearly lagged compared to Mesopotamia (around –3300) or Egypt (-3000). However, these countries are now incomparably wealthier than the winners of yesterday.

This reversal has been studied by scholars such as Borcan et al. (2014) which show that countries with older states (e.g. in the Fertile Crescent) suffer nowadays a relative backward. Several explanations have been proposed: an environmental degradation (Diamond, 2005), old civilizations developed autocratic, hierarchical societies with extractive institutions that were not conducive to modern development (Olsson and Paike, 2013), peripheral regions, were less exposed to raids by roaming armies and to incursions by migrating peoples (Ashraf et al., 2010). In the present paper, we rely on family type history to provide another explanation to this reversal: the archaic forms of family are very efficient to modern economic development.

According to Todd (2011), before the modern economic take-off, there has been a linear history of the family structures from primitive forms to more complex organizations. The primitive type is the nuclear family (typical of hunter-gatherers). Broadly said, there have been three successive innovations to provide stronger ties leading to more complex forms of family. A first step of complexity leads to the Stem family (authority of parents and inequality among siblings since only one son remains married in the parental home), then is the Communitarian family (authority of parents and equality among siblings since all the sons can married and bring his spouse in the parental household). The third and last evolution is the "Arab marriage" in which the children of two brothers marry each other (Todd, 2011: 518). The complexity of the family types run from the nuclear form (one couple), to the Stem form (two couples), the Communitarian (more than 2 couples) and the "Arab family" (a clan of numerous couples). Of course, this constitutes an oversimplification omitting variations around these types such as the exact status of women in each local version.

Even if the long-term history of the family system follows this scheme, there is not any "history law" to observe such a complexification over time. This gradual complexification is not only time-dependent. The environmental constraints and

opportunity can favor one evolution.[27] For instance, the evolution to the Stem family (only one sibling inherits the farm) can express only in a context of limited (land) resources. On this aspect, the gradual complexification view of the family structure can be complementary with ecological view in which evolutionary forces explain the strength of the family ties (Alger and Weibull, 2010) or polygyny prevalence (Alger, 2015).

Complex family forms were adapted to previous economic contexts especially for wars. The complexity of a family structures allows to clearly bind each couple to only one filiation, the one of the father (patriarchy), leading to strong cohesion of several couples. This provides a crucial advantage because the patriarchy deletes the possibility to play a changing or a multiple affiliation which is open when the new household can be close both to the family of the husband and of the wife. The "Arab marriage" in which the children of two brothers marry each other provides an even stronger affiliation since the families of the wife and the husband are the same one and are member of a very extended familial group (a clan). The military efficiency of these forms of family has been recently demonstrated when modern occidental armies fought clan armies in Afghanistan, Irak or Somalia. A complex family form can also be a successful way to do business as demonstrated by for example the medieval Italian bank or the Rothschild in the 19th century with several brothers established in different places but linked thanks to a strong family ties.

But these complex forms of family are disadvantageous for modern economic development. One reason is the drawback of the strong affiliation to the family. This affiliation compromises the building of non-familial cooperation (especially hierarchies such as states or corporations) which is crucial for modern economic development (see the work of Greif and also Seabright, 2010). The clanic structure conflicts with vertical hierarchies making it difficult to build them. Even when a hierarchy appears to exist, it is often in reality controlled by a clan as in many current Arab states. Modern hierarchies need individuals that are free of other ties. Regarding our basic family characteristics, the complexification tends to decrease women's status (the stronger affiliation to husband filiation is achieved at the expense of women's, thus leading to a low status of women in our classification), which in turn reduces investment in human capital which is crucial nowadays.[28] Complexification also implies increasing egalitarian rules among siblings (to be sustainable a large family implies equality among siblings)

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[27] De Moor and van Zanden (2009) hypothetized that the European Marriage Pattern developed according to economic constraints and opportunities such as the Great Plague of 1348.

[28] Hansen et al. (2015) exhibit a strong negative association between years since the Neolithic transition and gender equality which is also consistent with the 'complexification of family system' channel we expose here. Indeed, years since the Neolithic transition and average distance from innovations centers are highly correlated (negative coefficient of 0.45) since the timing of the Neolithic transition depends mainly on the proximity of the places of invention (Diamond, 1997).

thus reducing the amount and quality of investment in physical capital. Concerning the authority of parents, the effect of complexification is not linear with an increase of the authority in the two first steps of complexification before a fall in the ultimate evolution which is the "Arab marriage". Overall, we can assume that the more primitive the family system, the higher will be its family score.

Thus, there is not a family type universally better. But according to the context, the characteristics of one family type can be an advantage or an inconvenient. Another interesting illustration is the English family characterized by inequality among siblings but not by authority of parents. This type would be better for the launch of the industrial revolution since young English are free (no attachment to the parental household) to go to work for the new industries looking for unqualified labor. Young English can easily move from their familial land since the separation of children from parents is the norm; Contrarily, the move from familial land is appreciate as an unnatural rupture in family characterized by authority. It allows a quicker rural exodus to industrial cities in England than in Germany. For the same reason, the English family is also efficient in the process of colonization in which colonizers are supposed to take the opportunities accepting to move and taking risks (in which inequality among siblings is favorable). But, at a later stage of the economic development, the economy required more qualified peoples; the technological changes increases the demand for human capital as assumed for example by Doepke and Tertilt (2009). In this new context, the German model is better because the authority of parents on children staying at home for a longer time, allow a higher investment in human capital. At this stage of development, the family structure of Germany became more suitable to the new needs. This could explain the rise of Germany compared to England during the second industrial revolution.[29]

Instrumental variable test across Eurasia

In addition to the anthropological evidence provided above for the age-old origin of the family system (and thus, the direction of the causality), we design an empirical test using an instrumental variable. Complexification of family systems occurs slowly through contagion (and even invasion) of populations. One innovation (a higher degree of complexification) is invented once and then spread very slowly. Diamond (1997) provided a lot of evidence of the spread of products, technologies and formal institutions across Eurasia after one single invention. We could expect the same process

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[29] This view is consistent with the observations of higher rates of literacy in Germany compared to England which is apparently paradoxical with the fact that the industrialization started later and more generally the lack of evidence that human capital investment was associated with economic growth in pre-industrial Europe (see Denisson and Ogilvie, 2014 for references).

for the informal institution which is a family model but at a very slow speed consistent with a 'slow moving institutions' of Williamson (2000). The hypothesis of a gradual spread of the family complexification is also supported by the observation of another family behavior. Observing statistics at the provincial level in Europe, the Princeton study led by Ansley Coale (European Fertility Project) concluded in favor of a fertility decline across Europe through a gradual diffusion of this practice (Lee, 2015). This diffusionist view is supported by Spolaore and Wacziarg (2014) which found strong relations between genetic and linguistic distance to France (the innovator in terms of fertility decline) and the timing of the fertility decline in one country.

In Eurasia, the main innovations (agriculture, writing, cities, codes, states, empires) appeared independently in to innovative centers: the Fertile Crescent and China. Diamond (1997) relied on "bio-geographic" advantages to explain why these two areas enjoyed these innovations. Whatever the reasons, we could assume, following Todd (2011) that family innovations also emerged in these areas before spreading across Eurasia. This story is consistent with the presence of the more complex family form (the "Arab marriage") around the Fertile Crescent. Away from the Fertile Crescent, less and less complex family forms are observed. Far away from the Fertile Crescent, countries have kept primitive forms of family systems. The same is true around China even if, the complexification has never reached the ultimate level represented by the "Arab marriage". Figure 6 illustrates this modeling of the history of the family system. This is of course a simplification since many other factors can accelerate or slow this diffusion (e.g. invasion, communication pathways, natural obstacles, language, etc.).

As a consequence, a relevant instrumental variable for measuring the archaism of the family type (and thus its family score) of a given country is the distance between this country and the two centers of innovations, the Fertile Crescent and China. While the "evolution via contagion" view of family systems is broadly true, the greater the distance from the centers of innovation, the more archaic should be the family system. Moreover, we have assumed another relationship which is that family models enjoying a high family score are more archaic (reversal of fortune). Combining these two relations, we assume that the distance from innovation centers increases the Family score. In other words: Great distance from innovations → Archaic family model → High Family score → High GDP per capita in 2000.

We focus on Eurasian countries (including neighboring island continents such as Japan and the UK) because the spreading of one family innovation throughout the continent is supposed to be as easy as for other innovations whereas other continents are split up by geographic barriers such as deserts and seas (Diamond, 1997). Moreover, Eurasia includes numerous countries, with almost entirely indigenous (for centuries) populations thus avoiding the need to adjust for controlling post-1500 migrations. History of the spread of innovations across Eurasia is well-known. In addition, focusing

on Eurasia controls for Diamond's hypothesis that this area enjoyed a specific advantage, due mainly to geography.
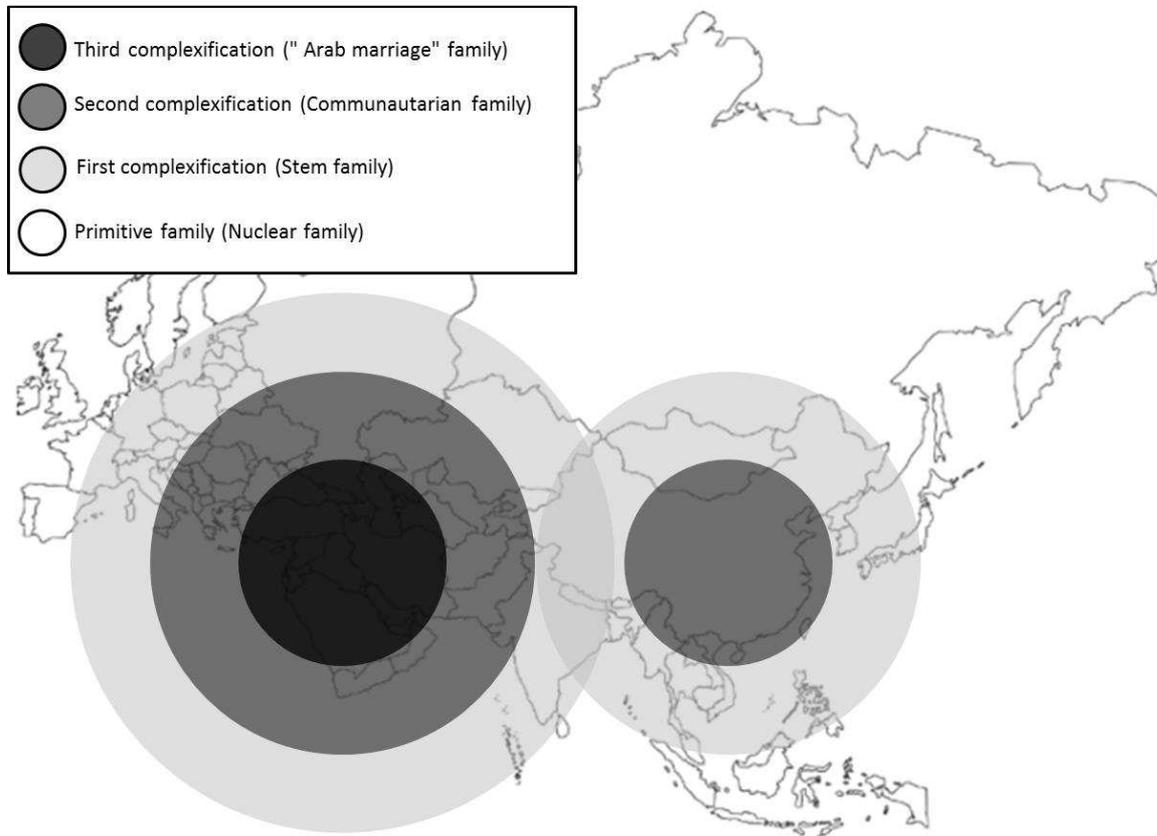

Figure 6. Theoretical diffusion of family complexification

Note: This scheme shows the theoretical diffusion across Eurasia of the successive innovations leading to complexification of family systems from the two centers of innovation, the Fertile Crescent and China. These centers experimented innovations that spread through contagion to the rest of the continent. Far from these two centers, at the margin of the continent, archaic family systems remain dominant. As a consequence, the further away a country from the centers, the more primitive will be its family system.

To build our instrument, we measure the aerial distances in kilometers between the capital city of each Eurasian country and Bagdad (heart of the Fertile Crescent) and the distance between the same capital cities and Xi'an (heart of China and place of the famous Terracotta army of the First Qin emperor). Our instrument is the mean of the distances between each capital and these two cities. We use the mean rather than the distance to the closest center of innovation because the two centers diffuse their innovations. The closest center is not always the origin of the contagion thus we have to take account the two distances. For instance, according to Todd (2011: 307), a first complexification in Eastern Europe has been introduced through the Hunnic invasions thus with a Chinese origin even if the Fertile Crescent is closest. Moreover, an area in

between the two centers, such as Afghanistan, receives the two influences and not only the one of the closest center. These combined effects lead to a complexification higher for a country between the two centers of innovation; a characteristic that the mean distance captures.[30]

As an example of our instrument, for Bangladesh, the distances are 4,583 km between Dacca and Bagdad and 2,144 km between Dacca and Xi'an. Our instrument, the mean distance to innovation centers, is therefore 3,363 km. For Tokyo and Japan, these figures are 8,346 km to Bagdad and 2,796 km to Xi'an thus a mean of 5,571 km. According to our instrument, we assume that Japan has a more archaic family system than Bangladesh and thus a higher family score.

In the first stage, we use the mean aerial distance of one country to the centers of innovations D_i to instrument the family score F_i following:

$$F_i = \propto + \beta_3 D_i + \beta_4 X_i + \varepsilon_i \tag{2}$$

where F_i is the family score of the country i, D_i is the mean distance of the capital city of country i to Bagdad and Xi'an, X_i is a vector of control factors and, finally, ε_i is an error term

As a second stage our standard equation explaining GDP per capita by the family score:

$$\ln(y_i) = \propto + \beta_1 F_i + \beta_2 X_i + \varepsilon_i \tag{3}$$

where y_i is the GDP per capita of country i in the year 2000, F_i is the family score of the country i obtained from equation (2), X_i is the same vector of control factors and, finally, ε_i is a country-specific disturbance term.

The average distance to innovation centers is a good instrument for the family score. This distance alone explains 46 % of the variation in the family score with an F-test of 70 attesting that our instrument is highly correlated with the family score (Table 7, Column 1). Taking into account the potential confounding effects of the control factors previously identified as significant to explain GDP per capita, there is remarkably little effect on the coefficient for distance to innovations centers. Moreover, these control variables affecting GDP per capita are not significant in explaining the family score except for OPEC membership at the 10 % level (Column 2). Our instrument is thus valid since this distance is strongly correlated with the family score and should only

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[30] As a control, we also run the same exercise but using the distance to the closest center of innovation as instrument (see Column 7 of Table 7 below).

affect GDP per capita through its effect on family systems and not through other factors since they exhibit very low correlation.

In the second stage, we use the fitted value of the family score instrumented by the mean distance to innovation centers to again run our regression explaining GDP per capita in 2000 but for a sample limited to 79 Eurasian countries with available data. The instrumental variable is highly significant in explaining GDP both alone (Column 4) and with control variables (Column 5). Figure 7 shows the relationship between GDP per capita and our instrument (mean distance to innovation centers). One might wonder whether the instrument used is not a proxy for latitude since this is a distance from fixed points. We thus add the latitude as a control factor without any impact on the significance of the instrumental variable (Column 6). Interestingly both the coefficient and the R squared of the regression using the instrumental variable are higher than what we observe using the original family score (Column 8). As a purpose of control, we also follow the same process but using as instrument the distance to the closest center of innovation rather than the average distance to the two centers. The result using this second instrumental variable is about similar with a higher coefficient for the family score but a lower adjusted R squared (Column 7).
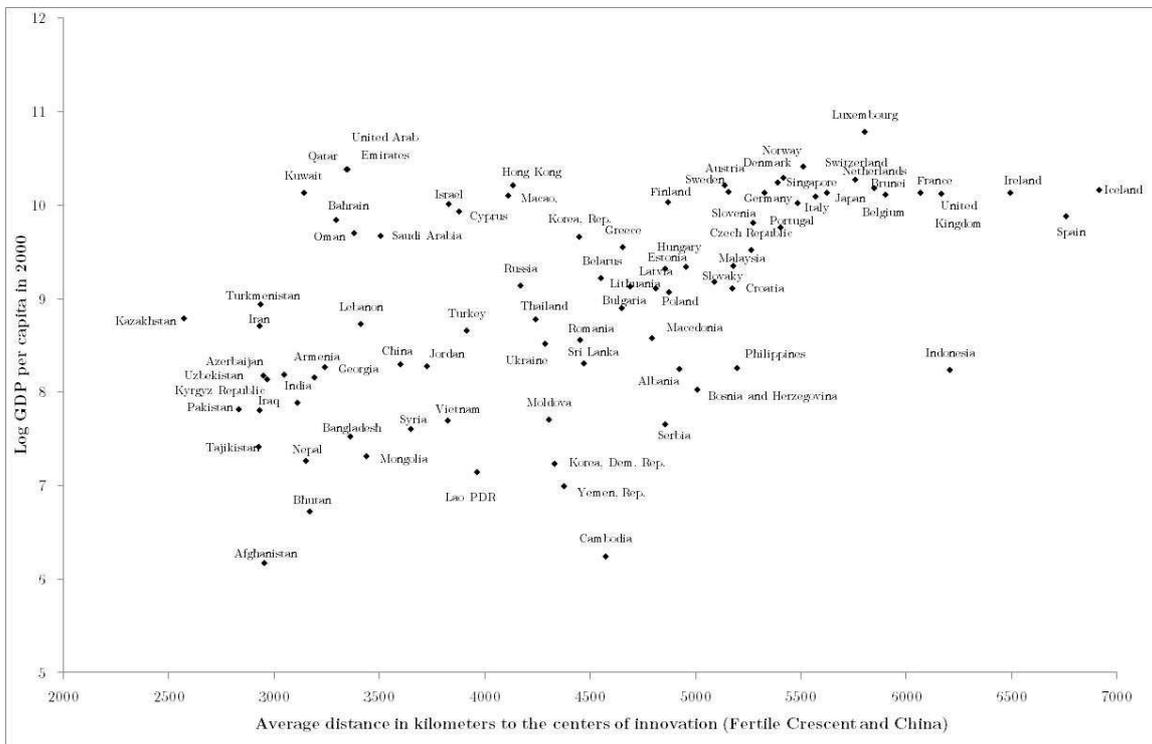

Figure 7. Mean distance to innovation centers and economic development

Note: This figure depicts the positive impact of the mean distance to innovation centers (Fertile Crescent and China) on the GDP per capita across 79 Eurasian countries.

Table 7. Family characteristics and economic development in Eurasia using an instrumental variable

| | First stage (Family score explained) | | Second stage (GDP per capita explained) | | | | Standard OLS |
| | | | IV | IV | IV | IVII | OLS |
	(1)	(2)	(4)	(5)	(6)	(7)	(8)
Family score			0.591***	1.188***	1.201***	1.633***	0.385***
			(0.1461)	(0.1955)	(0.1978)	(0.3060)	(0.1111)
Average distance to innovation centers	0.672***	0.523***					
	(0.0801)	(0.1177)					
Log absolute latitude					-0.132		
					(0.2259)		
Log percentage of arable land		0.017		-0.123	-0.112	-0.118	-0.136
		(0.1520)		(0.1319)	(0.1340)	(0.1380)	(0.1525)
Log land suitability for agriculture		-0.083		-0.191	-0.203	-0.188	-0.195
		(0.1512)		(0.1305)	(0.1328)	(0.1380)	(0.1509)
Mean distance to nearest waterway		-0.246		0.136	0.163	0.486	-0.496**
		(0.2260)		(0.2258)	(0.2318)	(0.2965)	(0.2101)
% of pop at risk of contracting malaria		-0.741		-0.405	-0.484	0.210	-1.520***
		(0.5276)		(0.5175)	(0.5378)	(0.6264)	(0.5322)
OPEC member		-0.826*		1.172**	1.122**	1.579***	0.438
		(0.4543)		(0.4330)	(0.4435)	(0.4984)	(0.4671)
Ethnic fractionalization		-0.248		-0.718*	-0.803*	-0.448	-1.207**
		(0.4797)		(0.4276)	(0.4535)	(0.4681)	(0.4796)
Genetic diversity		-202.4		455.3	494.3	380.8	585.0
		(476.678)		(409.25)	(416.82)	(429.58)	(472.04)
Genetic diversity squared		128.2		-295.9	494.3	-235.6	-401.0
		(331.709)		(284.89)	(289.80)	(299.44)	(328.33)
Observations	79	79	79	79	79	79	79
F-test	70.48	8.81	0.16	14.51	12.95	12.68	9.12
R²	0.46	0.50	16.35	0.63	0.63	0.60	0.51

Note: This table exhibits an instrumental test of the effect of the family score on the GDP per capita. In a first stage, the family score of one country is instrumented by the mean distance of its capital city from the two centers of innovations (Fertile Crescent and China). In a second stage, the fitted value of the family score is used to demonstrate the effect of the family characteristics on GDP per capita, while controlling for other fundamental factors. This exercise was done for a sample of 79 Eurasian countries for which data are available. Heteroskedasticity-robust standard errors are reported in parentheses. *** Significant at the 1 percent level, ** Significant at the 5 percent level and * Significant at the 10 percent level.

Conclusion

This paper makes two contributions. First, we introduce three theoretical links from family characteristic to economic development through the propensity to invest in both human and physical capital. Authority of the parents leads to a higher investment in human capital since children remain under the authority of their parents for a longer period of time. A high status of women allow also to invest more in human capital thanks to the crucial role played by the mother in the education of children. Inequality among siblings allows to invest more in physical capital since a critical size of wealth and the grasp of opportunities is not discouraged.

Second contribution of this paper is to test the explanative power of these theoretical effects on the differences we observe in current economic outcomes in the different

countries across the world. The presence of these favorable characteristics is associated with a higher GDP per capita. This association is robust to the control for factors previously identified by the literature as able to explain comparative development such as geography, ethnic fractionalization, genetic diversity, religious affiliation and legal origin. These family characteristics seem act mainly as a direct effect than through the building of better institutions since the family factor is also robust to the inclusion of an index for quality of institutions.

Among the basic characteristics, a high status of women and, even if less clearly, authority of parents are associated with high investment in human capital proxied by scientific articles per capita and number of years of schooling. Inequality of siblings is associated with higher investment in physical capital as measured in public accounting. The direction of the causality from family system to economic development is demonstrated thanks to anthropologic history and an instrumental variable test using the distance to family innovation centers. It would be interesting to test these familial characteristics within countries characterized by different type of family structures such as France and India or at the ethnic group level in the vein of Ashraf et al. (2015).

One can ask the consequences of the findings presented in this paper in terms of policy recommendations. Here, the economic development appears as a consequence of the deep informal institution which is the family structure. These informal institutions are very slow moving and, even if practically feasible, political decisions to change them could be seen as not rightful. But, maybe changes of family types to converge through the one observed in US is already ongoing? According to Reher (1998), "changes of this past century have tended to make cultures and mentalities more uniform". There is some evidence of a transmission of preferences via television. Chong et al. (2008) find that exposure to soap operas in Brazil led to a decrease in fertility. Oster and Jensen (2009) show how attitudes about the status of women changed with the arrival of cable television in rural India. Maybe Hollywood movies and soap operas have imperceptibly played a crucial role for decades to change family characteristics and thus support economic development?

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