Risk and Time Preferences of Poor Urban Households in Saudi Arabia

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Abstract

This article examines the relationship between poverty and risk and time preferences among poor urban Saudi households. It is based on the hypothesis that living in poverty-related stress and anxiety makes people more risk averse and impatient, which, in turn, affects their chances to escape poverty. While this relation has been well established for rural poverty, there is little empirical evidence whether this applies to urban poverty and Arab culture. Therefore, this study conducted a field experiment, with a sample of 166 households, in the poor neighbourhoods of Dammam in 2019. The theoretical foundation for the joint estimation of Saudis' risk and time preferences is based on prospect theory and quasi-hyperbolic discounting. The results demonstrate that Arabs are relatively risk averse and, moreover, patient in the long run, yet, impatient in the short run. Besides, households living in asset poverty are more risk averse and impatient. Yet, contrary to expectations, households living in income poverty take greater risk as there is a u-shaped relationship between income and risk taking.

Keywords

Middle East, risk preferences, time preferences, prospect theory, urban poverty

1. Introduction

Living in poverty has psychological consequences that can trigger behaviour changes, which, in return, make it more difficult to escape poverty (Haushofer & Fehr, 2014). Poverty can affect mental wellbeing by causing stress, anxiety and mental health disorders (Kuruvilla & Jacob, 2007; Santiago, Wadsworth, & Stump, 2011; Bass, 2019), which can influence behavioural dynamics. In particular, the literature discusses in what way living in a state of poverty can impact one's risk and time preferences.

For example, Yesuf and Bluffstone (2008, 2009) find that wealthier Ethiopian farmers tend to be less risk averse and more patient. Likewise, Tanaka, Camerer and Nguyen (2010) discover a positive relationship between income and impatience among rural Vietnamese households, although risk aversion is only correlated with mean village income and not with household income. Moreover, Dohmen et al. (2011) observe in a large representative sample of German households that individuals with higher income are less risk averse. Yet, Cardenas and Carpenter (2013) find no significant relationship between income and risk preference in Latin America.

The reason why researchers are interested in the risk and time preferences of poor households is that being more risk averse and impatient can alter economic decision making and hinder the prospects of escaping poverty. In the case of rural poverty, crop and livestock farmers are exposed to a variety of environmental risks, such as droughts, flooding or pests. Under these circumstances, despite higher expected returns, risk averse and impatient farmers are reluctant to invest in new agricultural technology, such as fertiliser, pesticides, new crops and machinery (Liu, 2013; Streletskaya et al., 2020).

Although the urban poor are much less exposed to environmental factors, risk and time preferences are theorised to be related to their economic decision making as well. Empirical evidence from rural poor and urban non-poor households suggests that risk and time preferences are connected to important economic decisions about education, health, savings, entrepreneurship and migration. Outreville (2015), in his detailed literature review, points out that risk averse and impatient people pursue fewer years of education. Besides, in a study of Danish citizens, risk averse and impatient individuals prefer less challenging, albeit less rewarding, educational paths (Breen, van de Werfhorst, & Jæger, 2014). Furthermore, Caliendo, Fossen and Kritikos (2014) show that, in a sample of German households, highly risk averse individuals are less likely to become entrepreneurs, yet entrepreneurship is often promoted as a way to escape poverty. This is exaggerated by the fact that poor people have limited or no access to insurance and credit markets and rely on family and friends for both.

The literature also debates the impact of risk aversion and impatience on household savings patterns. Regarding impatience, Ashraf, Karlan and Yin (2006) establish that more impatient rural Filipino households save less. Contrary, Lugilde, Bande and Riveiro (2019), in their review of the literature, provide evidence that risk averse households have higher precautionary savings. This makes the overall impact of risk aversion and impatience on saving decisions uncertain. The same applies to the effect of risk aversion and impatience on health investments. On the one hand, a study among US students finds, that risk averse individuals are less likely to smoke, drink excessively and be overweight (Anderson & Mellor, 2008). On the other hand, more impatient individuals in the USA are not as likely to follow a healthy lifestyle (Bradford, 2010). Moreover, internal migration is a key economic decision linked to behavioural dynamics. Internal migration (for example, from small villages to big cities) can increase living standards. However, internal migration also means leaving the security of home and family for an

uncertain future. Therefore, risk averse people are thought to be not as likely to become internal migrants. This notion is supported by empirical studies on German citizens (Jaeger et al., 2010) and rural Chinese households (Dustmann et al., 2017).

A main limitation of the current literature is that the studies are mostly conducted among rural poor or wealthier urban households. Limited empirical evidence exists as to whether these findings can be transferred to urban poverty and different cultural settings. This article, therefore, studies the behavioural dynamics surrounding urban poverty in the Arab context. The research objective of this article is to study the correlation between urban poverty and risk and time preferences in Saudi Arabia.

The article focuses on the Arab domain because this region has thus far been mainly excluded from the literature, with most studies about risk and time preferences focusing on Africa, Asia, Europe or America. However, Arabs' unique cultural and religious values make this domain worth further academic attention. Up to date only the Global Preference Survey (GPS) measured the risk and time preferences in Arab countries. However, the current research is different in the way that it measures risk and time preferences through an experiment using prospect theory and quasi-hyperbolic discounting rather than survey questions. Furthermore, the literature based on the Global Preference Survey, does not focus on the correlation between poverty and behavioural preferences (Falk et al., 2018).

For this research, Saudi Arabia has been chosen as a representative Arab country. Saudi Arabia has lately become more accessible for research, in contrast to other Arab countries. In addition, Saudi Arabia has a high rate of urban poverty; 20% of the Saudi population is estimated to live in poverty[1] (Sullivan, 2013; Koontz,

[1] The poverty line in Saudi Arabia stands at 700 SAR per person per month ($6 per person per day) based on the inflation-adjusted official poverty line.

2015), with the majority of them living in cities (Al Damag, 2014). The study makes two main contributions to the literature. First, it combines the latest knowledge about behaviour dynamics from prospect theory and quasi-hyperbolic discounting to jointly estimate the risk and time preferences of Saudis. Second, the article analyses whether living in a state of poverty correlates with Saudis' risk and time preferences.

The remainder of the article is structured as follows. Section 2 outlines the cultural background. Section 3 and 4 describe the data and the experimental setup. Section 5 summarizes the concepts and methodology used to estimate risk and time. Section 6 discusses the research findings and Section 7 provides concluding remarks.

2. Cultural Background

A key assumption of the article is that the behavioural dynamics surrounding risk and time preferences observed in other cultures cannot easily be transferred to the Arab context. Therefore, it is necessary to first conceptualise Arabs' risk and time preferences before analysing them in greater detail. Saudi culture is mainly shaped by two identities: being Muslim and being Arab (Thompson, 2019).

Risk is a sensitive topic in Islam, which can be seen from the fact that the word for risk itself 'khatar' can also mean danger, hazard or prohibition. According to Noor, Ismail and Shafiai (2018), the Quran's original guidance concerning risk can be seen in the verse, 'And spend in the way of God and do not throw [yourselves] with your [own] hands into destruction' (Qur'an 2:195). In this verse, destruction is often interpreted as an early word for risk, which implies that Muslims should avoid risk whenever possible. Muslim scholars provide a more detailed view, whereby risks associated with entrepreneurship are encouraged, but risks associated with gambling are prohibited (Al Suwailem, 2011). The fine line between the two is often unclear, which can lead to confusion within society. In contrast, the Islamic view of patience is more apparent and can be seen in the verse, 'All men and

women who are patient in adversity […] for them has God readied forgiveness of sins and a mighty reward' (Qur'an 33:35).

Beyond Islam, Arabs' historical roots might also shape risk taking and patience. In the past, the majority of Arabs were Bedouin (nomads) that moved through the desert with their sheep, goat or camel herds. According to Cole (2013), the harsh desert lifestyle exposed Bedouins to many risks. Bedouins had to diversify and spread risk as much as possible to survive. Hence, Cole describes the Bedouin as generally risk averse. Regarding time preferences, Mares (2017) characterises the Arab Bedouin as patient and impatient at the same time, regarding it as a trait that is necessary to survive the contrasts of the desert life. Combining the influences of Islam and the Bedouin past, one would expect Saudis to be overall relatively risk averse and patient.

3. Data Description

This study is based on a field experiment and household survey data collected in Saudi Arabia in 2019. In the household survey, 496 households were interviewed in Dammam – a city in the Eastern province of Saudi Arabia. The majority of poor households are based in the large metropolitan cities, namely Riyadh, Jeddah, Makah, Medina and Dammam (Al Damag, 2014). This study selected Dammam as an appropriate example of a 'typical' metropolitan Saudi city. Inside the city households were randomly selected via systematic sampling across all poor neighbourhoods. In total, through insider knowledge from local charity managers, nine neighbourhoods were identified as neighbourhoods where many poor nationals live. The poor neighbourhoods are all located in central Dammam and are often referred to by the local community as 'the old neighbourhoods'. The household survey focused solely on Saudi nationals, and thereby, dwellings occupied by foreigners were excluded from the study. Also, every third household was randomly selected to take part in a field experiment to determine the household

head's risk and time preferences. In total, 166 household heads took part in the field experiment.

Table 1: Descriptive statistics of the household heads' characteristics

Variable	Description	Mean	SD
Demographics			
Age of the Household Head	Age in Years	45.60	13.02
Gender of Household Head	Dummy: 1 = Female, 0 = Male	0.17	0.38
Household Size	Number of HH Members	6.63	3.60
Head Bedouin	Dummy: 1 = Bedouin, 0 = Non-Bedouin	0.44	0.50
Head Religiousness	1 = Not Very Religious 2 = Moderate Religious 3 = Strongly Religious 4 = Very Strongly Religious	2.33	0.64
Human Capital			
Years of Education Household Head	Years of Schooling	6.96	4.98
Head no Formal Education	Dummy: 1 = Yes, 0 = No	0.28	0.45
Head Primary School	Dummy: 1 = Yes, 0 = No	0.21	0.41
Head Secondary School	Dummy: 1 = Yes, 0 = No	0.20	0.41
Head High School	Dummy: 1 = Yes, 0 = No	0.20	0.40
Head University	Dummy: 1 = Yes, 0 = No	0.10	0.30
Employment			
Head Unemployed	Dummy: 1 = Yes, 0 = No	0.05	0.23
Head Employed by the Military	Dummy: 1 = Yes, 0 = No	0.10	0.30
Head Employed by the Public Sector	Dummy: 1 = Yes, 0 = No	0.14	0.35
Head Employed by the Private Sector	Dummy: 1 = Yes, 0 = No	0.28	0.45
Head Self-Employed	Dummy: 1 = Yes, 0 = No	0.10	0.30
Head Non-Labour Force	Dummy: 1 = Yes, 0 = No	0.34	0.47
Finances			
HH Income	Income per capita in SAR	1,264 ($337)	1,031 ($275)
HH Consumption	Consumption per capita in SAR	1,023 ($273)	617 ($165)
HH Financial Asset	Financial Assets in SAR	6,561 ($1,750)	35,667 ($9,511)
House/Apartment Ownership	Dummy: 1 = Yes, 0 = No	0.19	0.39

Source: Own data. Note: N=166

The description of the characteristics of the 166 household heads that took part in the field experiment can be found in Table 1. On average, household heads were 46 years of age, and 17% of the heads were female. Moreover, the average head went to school for seven years. 28% of the heads received no formal school education, 21% completed only primary school, 20% left education with a high school degree and 10% with a university degree. Additionally, 44% of the

household heads self-classified themselves as Bedouins. Although most of the Bedouins in Saudi Arabia have settled down nowadays, being a descendant of Bedouins has become a form of ethnic identity within Saudi society. Some Saudis even claim to be able to tell from the way people speak and behave whether they are descendants of Bedouins or settlers. Concerning religiousness, on average, Saudis describe themselves as moderately religious. Religiosity was measured on a four-point Likert scale, ranking from very strongly religious to not very religious. The scenario 'not religious at all' was deliberately excluded as all Saudis are Muslims by law. Stating that one is a non-believer is illegal in Saudi Arabia.

In addition, households' average monthly income per capita was found to be 1,264 SAR ($337).[2] Household's monthly per capita income comprises all income received from employment, the government, charity organisations, friends or family members, 'good people' (a local term referring to private individuals who give donations to the poor, often anonymously) and in-kind donations. Because there is no income tax in Saudi Arabia, it can also be interpreted as the households monthly income after taxes and subsidies. 10% of the households earned their livelihood by selling goods or services either from home or outside the house, making them entrepreneurs (self-employed). However, the majority worked in the private and public sector. Household's average consumption per capita stood at 1,023 SAR ($ 273), implying that on average households were able to save some money each month. Households had on average financial assets of 6,561 SAR ($1,750). The variable financial assets includes cash savings, deposits at banks and savings through communal saving schemes.

[2] All currency transformations in this article are based on the country's fixed market exchange rate of 3.75 SAR per dollar. This is in turn based on the notion that the official purchasing power parity (PPP) exchange rate is not a very accurate reflection of purchasing power.

4. Experimental Design

The field experiment's design to estimate risk and time preferences was based on that of Tanaka, Camerer and Nguyen (2010), which was applied by other studies such as Nguyen (2011), Liebenehm and Waibel (2014) and Ackert et al. (2019). The experiment consisted of two parts: one to estimate participants' risk preferences and one to estimate time preferences. Both experiments were programmed in Survey Solutions a software developed by the World Bank for tablet-based data collection. In the risk experiment, participants made a 35 choices 35 between a risky and a less risky lottery. The probabilities of the lotteries were illustrated on the tablet with two coloured balls. For example, if there was a 30% chance to get a payment x and a 70% chance to get a payment y, on the tablet participants would see a 'bag' on the tablet with three blue balls and seven green balls (see Figure A.1 in the appendix). Moreover, to help participants visualise the decision, interviewers showed participants an actual bag with different coloured balls at the beginning of the experiment. The first 28 choices included only positive payoffs. The last choices also included negative payoffs to measure participants' loss aversion. However, because participants received a fixed payment of 50 SAR ($13.3) for taking part in the household survey, participants could not obtain an overall loss for taking part in the research project. Such a practice would have been unethical. The payoff structure of each lottery is shown in Table A.1 in the appendix. After the risk experiment, the second part began. In the time experiment, participants chose 75 times between receiving a smaller amount today or a larger amount at various times in the future. A detailed description of the payoffs chosen is in Table A.2 in the appendix. After respondents completed both experiments, one of the 110 (35 + 75) choices was randomly selected, and the participants received rewards according to the decision they had made. On average, respondents received 110 SAR ($29) for taking part in the experiment (the equivalent to 2.6 times the average daily per capita income). The highest payment a household could

receive was 1,500 SAR ($400) (the equivalent to 1.2 times the average monthly per capita income). For the purpose of the data analysis, households' risk and time preferences were measured based on the first switching point between Option A and B for each series. [3]

5. Concepts and Methodology

5.1 Conceptual Framework

Households' risk and time preferences were estimated based on an approach developed by Nguyen (2011). The foundation for this approach was laid by Andersen et al. (2008), who argue that discount rates tend to be overestimated when households' actual risk preferences are ignored; instead, risk neutrality is assumed. For this reason, they advocate estimating households' risk and time preferences jointly. Nguyen (2011) developed the idea of jointly estimating risk and time preference further, applying prospect theory and quasi-hyperbolic discounting. Thus, the utility of a monetary gain (x) at a time (t) is modelled as follows:

$$(1) \qquad U(x,t) = PT(x)D(t)$$

where PT stands for the utility function in prospect theory, and D is a discount function. The utility function in prospect theory, as developed by Kahneman and Tversky (1979) and Tversky and Kahneman (1992), can be expressed as:

$$(2) \qquad PT(x,p;y,1-p) = \begin{cases} v(y) + w(p)(v(x) - v(y)), & x > y > 0 \text{ or } x < y < 0 \\ w(p)v(x) + w(1-p)v(y), & x < 0 < y. \end{cases}$$

[3] Once a participant switched to Option B, they had to still make all the remaining choices in the series (no monotonic switching was enforced). This was done as a robustness check. Subjects that switched forth and back many times between Option A and B were discarded from the research sample. In total, 5 observations were deleted, bringing the final sample size to 166.

In the above equation, the value of the binary prospect (x, y) with probabilities (p, 1−p) is described based on individuals' value and weighting functions. The value function models losses and gains separately:

$$(3) \qquad v(x) = \begin{cases} x^{\sigma}, & if\ x \geq 0 \\ -\lambda(-x)^{\sigma}, & if\ x < 0 \end{cases}$$

where σ reflects risk aversion and λ reflects loss aversion. For risk averse individuals, sigma is smaller than 1, meaning that the value function is concave for gains and convex for losses. Typically, lambda is greater than 1, as losses loom larger than gains. The weighting function of the model is based on Prelec (1998):

$$(4) \qquad w(p) = \frac{1}{exp[ln(1/p)]^{\alpha}}$$

The parameter α shows probability weighting. If alpha is smaller than 1, individuals underweight the large probabilities and overweight the small probabilities. In addition, the discount function (D) applied in the model follows quasi-hyperbolic discounting (Laibson, 1997; Benhabib, Bisin, & Schotter, 2010):

$$(5) \qquad D(t;\ \beta, \delta) = \beta exp(-\delta t) \qquad \text{for t >0,}$$

where δ is the discount rate, and β is the present bias. The discount rate lies between 0 and 1, and the larger δ, the larger is the discrimination of future values. The present bias β is typically below 1, the smaller beta the larger is the costs associated to future values.

5.2 Methodology

The parameters of the model (α, β, δ, λ, σ) were estimated through a maximum likelihood estimation, as proposed by Harrison (2008). During the experiment, individuals had to make several choices between two prospects, A and B, explained more closely in Section 5. Respondents were assumed to choose Option A

whenever the utility of Option A exceeded that of Option B. The utility from Options A and B for a decision task j received by participant i can be expressed as follows:

(6) $$U_i^{A;j} = PT_i^{A;j}(X_i; Z^{A;j}) D_i(t^{A;j}; X_i) + \varepsilon_i^{A;j}$$

(7) $$U_i^{B;j} = PT_i^{B;j}(X_i; Z^{B;j}) D_i(t^{B;j}; X_i) + \varepsilon_i^{B;j}$$

PT_i^j is the utility function under prospect theory. X_i is a vector of individuals' characteristics observed through the household survey. D_i is the quasi-hyperbolic discounting function. Z^j stands for the probabilities and payoffs of scenario j. ε_i^j is an independent and identically normally distributed error term. The utility of each lottery pair is calculated by the latent index ∇U_i^j

(8) $$\nabla U_i^j = U_i^{B.j} - U_i^{A,j}$$

The latent index, based on concealed preferences, is then linked to the observed choices using a 'probit' function (a standard cumulative normal distribution function) $\Phi(\nabla U_i^j)$. The conditional log-likelihood can then be written as:

(9) $$lnL_i\left(\alpha, \beta, \delta, \lambda, \sigma; X_i, Z^j, y^j\right) = \sum_{j=1}^{110} \left\{ \left[ln\, \Phi(\nabla U_i^j) | y_i^j = 1 \right] + \left[ln\, (1 - \Phi(\nabla U_i^j)) | y_i^j = 0 \right] \right\}$$

Participants' choices y_i were coded 0 for Option A and 1 for Option B. The maximum likelihood estimation of the parameters can be expressed as:

(10) $$(\hat{\alpha}, \hat{\beta}, \hat{\delta}, \hat{\lambda}, \hat{\sigma}) = arg\ max\ L(\alpha, \beta, \delta, \lambda, \sigma;\ X, \mathrm{Z}, \mathrm{y})$$

6. Findings

6.1. Saudi's Average Risk and Time Preferences

This subsection presents the risk and time preferences of Saudis by displaying the maximum likelihood estimations for the five risk and time preference parameters (α, σ, λ, δ, β). The parameters were estimated for the whole research sample and not for each individual separately. Furthermore, tests were conducted to ensure that expected utility theory is not a superior fit to the data (see Table B1 in the appendices).

Table 2: Estimations of risk and time preference parameters

Parameters	Estimate	Robust Standard Error
Probability Weight (α)	0.25***	0.17
Risk Aversion (σ)	0.24***	0.008
Loss Aversion (λ)	2.40***	0.15
Time Preferences (δ)	0.004***	0.005
Present Bias (β)	0.74***	0.02
N = 18,260 (Number of Clusters = 166)		

Note: * p < 0.10, ** p < 0.05, *** p < 0.01

The average parameter estimates of the research sample are shown in Table 2. The probability weighting parameter ($\alpha = 0.25$) is less than 1, indicating that, in general, households overweighted the probability of unlikely events and underweighted the probability of likely events, as assumed in prospect theory. The parameter sigma ($\sigma = 0.24$) approximates risk aversion. Saudi households were, on average, risk averse (sigma smaller than 1). Lambda ($\lambda = 2.4$) measures loss aversion. The greater lambda, the more loss averse households are. Saudis households were discovered to be loss averse (lambda greater than 1).

Households' time preferences are measured by the parameters beta ($\beta = 0.74$) and delta ($\delta = 0.004$). Delta is the discount rate, the greater the discount rate, the more impatient households are. Beta stands for present bias; the smaller β the larger the costs associated with future payments. On average, Saudi households had quite a

low discount rate but a relatively high preference for the present, which means that the cost associated with waiting for a shorter period of time was relatively high, but the cost associated with waiting for a longer period of time was relatively low. To illustrate, having to wait one single day decreased, on average, the value of the payment by 26%.[4] However, households did not care so much how long they had to wait. For example, having to wait for 100 days decreased the value of the payment by 50%[5], which translates to a discount rate of 0.5% per day. In conclusion, on average, Saudis were found to be patient in the long run, yet, impatient in the short run and relatively risk averse. This finding is mostly in line with the expectation, based on the cultural background, that Arabs' Islamic and Bedouin roots discourage risk taking and encourage patience. Moreover, the findings is in accordance with Mares' (2017) observation that the Arab Bedouin is patient and impatient at the same time. Howbeit, the findings contrast Falk et al. (2018) who found Saudis to be among the most risk loving in the world. It should be noted though that the Global Preference Survey (GPS) used by Falk et al., does not focus on poor Saudi households and includes foreign households. Therefore, the findings cannot directly be compared.

6.2. The Correlation of Risk and Time Preferences with Socioeconomic Characteristics

Before the analysis can move on to the study of poverty, the link between risk and time preferences and socioeconomic characteristics needs to be studied. This is because the socioeconomic characteristics theorised to be linked to risk and time preferences, serve as control variables in the poverty model. The results can be seen in Table 3.

[4] $D(t;\ \beta,\delta) =\ \beta exp(-\delta t) = 0.74\exp(-0.004t) = 0.74\exp(-0.004 \times 1) = 0.74$
[5] $D(t;\ \beta,\delta) =\ 0.74\exp(-0.004 \times 100) = 0.50$

Table 3: Correlation between risk and time preferences and socioeconomic characteristics

Independent Variable	Probability Weight (α)	Risk Aversion (σ)	Loss Aversion (λ)	Discount Rate (δ)	Present Bias (β)
Gender	-0.027	0.006	-0.632	0.003	0.025
Age	0.001	0.001	-0.015	-0.0001	-0.0001
Education	0.003	0.002	-0.028	-0.0001	0.018***
Bedouin	-0.068	-0.037	-0.253	0.004*	-0.051
Religiousness	-0.029	0.028**	-0.084	-0.001	-0.076**
N = 18,260 (Number of Clusters = 166)					

Note: * p < 0.10, ** p < 0.05, *** p < 0.01

It was found that people with stronger ***religious*** beliefs are less risk averse. Given that Islam discourages risk taking, this finding at first seems unexpected. Indeed, some studies establish religious people to be more risk averse than non-religious people (Noussair et al. 2013, *sample: Dutch citizen*). This could be because religion discourages risk taking. Alternatively, the decision to become religious itself might be driven by risk attitudes. To illustrate, not being religious could be argued to bear the risk that one is wrong, and God exists. This notion has been supported by Nielsen et al. (2017, *sample: Danish twins*), which finds that the positive relationship between risk aversion and religion is mainly driven by the belief in an afterlife. This suggest that people are mainly concerned about the risk of 'ending up in hell'. To interpret the findings of the current study, one has to be aware that, in the abovementioned two Danish studies, the research sample consists of religious and non-religious people. However, in Saudi Arabia, as all Saudis are Muslims, people vary in their intensity of religious beliefs. In this setting, the believe in an afterlife appears to not be the dominating distinction. Instead, people with a stronger faith in God might believe that an outcome is ultimately independent of the risk parameters and dependent on God's will alone. Hence, a stronger belief encourages risk taking. Other studies conducted in strongly religious countries have confirmed this result (Liebenehm & Waibel, 2014, *sample: West African farmers*; Ahmad, Afzal, & Rauf, 2019, *sample: Pakistani farmers*).

In addition to risk preferences, socioeconomic factors are also correlated with time preferences (Table 4). It was observed that more years of ***education*** are associated with a lower present bias. This is in line with other studies that found a positive relationship between education and patience (Perez-Arce, 2017). Moreover, ***Bedouins*** were discovered to be more impatient, as can be seen from their higher time discounting. Contrary to expectations that Islam values patience, stronger ***religious*** beliefs increase present bias.

6.3. The Correlation of Risk and Time Preferences with Poverty Indicators

In this subsection the focus is now on the interrelation of risk and time preferences with poverty. For this purpose, two welfare indicators are considered: income and assets. All regression models in this section control for heterogeneity in the socioeconomic factors (age, gender, ethnicity, religion and education) discussed in the previous section.

One of the most studied welfare indicators in relation to risk and time preferences is ***income*** (Tanaka, Camerer & Nguyen, 2010; Liebenehm & Waibel, 2014; Gloede, Menkhoff & Waibel, 2015). The findings from the current study show a positive correlation between the risk aversion parameter sigma and income per capita (see Table 4). Furthermore, splitting household income per capita by quantile indicates that households in the highest income quantile took significantly more risk than households in the second and third highest income quantile. This suggest that income had to be relatively high before a household took more risks. Moreover, the fact that households from the lowest income quantile had no different risk attitudes compared to the households from the highest income quantile, implies a u-shaped relationship between income and risk taking. Both the highest and lowest income households took more risk. Perhaps, the households in the lowest income quantile felt a sense of 'having nothing to lose'.

The second most common welfare indicator studied in relation to risk and time preferences is ***assets*** (Binswanger's, 1980, Yesuf & Bluffstone, 2008; Yesuf & Bluffstone; 2009). For this purpose, three asset types are being examined: property assets, financial assets, and consumption assets (see Table 5). Property assets refer to a household owning a house or apartment. It is apparent from the results that households without property assets were less patient. The concept of financial asset poverty is based on Haveman and Wolff (2004). A household is classified as financial asset poor if household's savings are not sufficient to allow the household to live above the poverty line for at least 3 months. For the analysis, the inflation adjusted national poverty line of 700 SAR per person per month is being used (Bin Saeed, 2008; GASTAT, 2019). However, robustness checks have been conducted to ensure the results are not driven by the selection of the poverty line. The findings show that households in financial asset poverty took less risk, had greater loss aversion and were more impatient.

The third type of assets studied are consumption assets. In the case of Saudi Arabia, consumption assets, such as a car, television, oven, or air conditioning are indicators of a households living standards. A detailed overview of the list of assets examined can be found in Table B3 in the appendixes. From the list an asset index is created using the widely adopted method of principal component analysis as designed by Filmer and Pritchett (2001). However, the results reveal no relationship between consumption asset ownership and risk and time preferences. In summary, it was discovered that income poverty was connected to greater risk taking. Overall, both the highest and the lowest income households took more risk compared to 'medium income' households. Furthermore, asset poverty was linked to less risk taking and more impatience. Whereas the results regarding asset poverty are in line with expectations from the literature (Yesuf & Bluffstone, 2008 & 2009), the results regarding income poverty appear to contradict the notion from the literature that poverty is correlated with less risk taking (Haushofer & Fehr, 2004).

Table 4: Correlation between income and risk and time preferences and income

Model	Independent Variable	Probability Weight (α)	Risk Aversion (σ)	Loss Aversion (λ)	Discount Rate (δ)	Present Bias (β)
1	Log income per capita	0.058	0.041*	-0.313	0.001	0.032
2	(Ref= Highest Income Quantile)					
	Second Highest Income Quantile	-0.068	-0.056**	0.774	-0.001	0.032
	Third Highest Income Quantile	-0.148*	-0.080*	0.756	-0.001	-0.090
	Lowest Income Quantile	-0.077	-0.042	0.002	-0.001	-0.005
N = 18,260 (Number of Clusters = 166)						

Note: Additional control variables include Gender, Age, Education, Bedouin, Religion.* p < 0.10, ** p < 0.05, *** p < 0.01

Table 5: Correlation between assets and risk and time preferences and assets

Model	Independent Variable	Probability Weight (α)	Risk Aversion (σ)	Loss Aversion (λ)	Discount Rate (δ)	Present Bias (β)
1	House/Apartment Ownership	0.002	0.004	0.477	-0.002	0.166**
2	Financial Asset Poverty	0.064	-0.072**	1.400***	0.002**	-0.075
3	Principal Component Weighted Consumption Asset Index	0.0006	0.004	-0.022	-0.00007	0.002
N = 18,260 (Number of Clusters = 166)						

Note: Additional control variables include Gender, Age, Education, Bedouin, Religion.* p < 0.10, ** p < 0.05, *** p < 0.01

7. Discussion and Conclusion

This article studied the relationship between behavioural factors and urban poverty in Saudi Arabia. The initial hypothesis was that living in poverty is correlated with greater risk aversion and more impatience. To test the hypothesis, the study first estimated the risk and time preferences of poor and middle-class Arab households in Saudi Arabia. The findings showed that Saudis are patient in the long run, though impatient in the short run and comparably risk averse. Moreover, Arabs' risk and time preferences are related to socioeconomic factors. Saudis with stronger religious beliefs take more risks, and a lack of education and being Bedouin increases impatience.

Next, the article studied the correlation between poverty and risk and time preferences. It emerged that, households living in asset poverty are more risk averse and impatient. This could potentially hinder their prospects of escaping asset poverty. Furthermore, contrary to expectations from the literature on rural poverty, urban households living in income poverty take greater risk. Overall, there is a u-shaped relationship between income and risk taking, with both the highest and lowest income households taking on more risk than 'middle income' households. The high level of risk taking by the income poor households can also be problematic. When a high-risk decision turns out unfavourably to the household, it could fall even deeper into poverty.

The findings highlight the importance of taking cultural variations into account when assessing the relationship between poverty and behavioural dynamics. It is also possible that the u-shaped relationship between income and risk and time preferences is a distinctive feature of urban poverty in general. However, further research into urban poverty in other cultural settings is needed. It should be noted though that one limitation of the research findings is that the field experiments conducted to measure households' risk and time preferences can only imitate real-

world decision making. Nevertheless, the research findings have some relevant implications for development interventions.

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Appendix A Experimental Design

Table A.1: Payoffs in the Risk Preference Experiment

	Series 1				Series 2				Series 3			
Decision	Option A		Option B		Option A		Option B		Option A		Option B	
	30%	70%	10%	90%	90%	10%	70%	30%	50%	50%	50%	50%
1	80	20	136	10	80	60	108	10	50	-8	60	-42
2	80	20	150	10	80	60	112	10	8	-8	60	-42
3	80	20	166	10	80	60	116	10	2	-8	60	-42
4	80	20	186	10	80	60	120	10	2	-8	60	-32
5	80	20	212	10	80	60	124	10	2	-16	60	-32
6	80	20	250	10	80	60	130	10	2	-16	60	-28
7	80	20	300	10	80	60	136	10	2	-16	60	-22
8	80	20	370	10	80	60	144	10				
9	80	20	440	10	80	60	154	10				
10	80	20	600	10	80	60	166	10				
11	80	20	800	10	80	60	180	10				
12	80	20	1000	10	80	60	200	10				
13	80	20	1200	10	80	60	220	10				
14	80	20	1500	10	80	60	260	10				

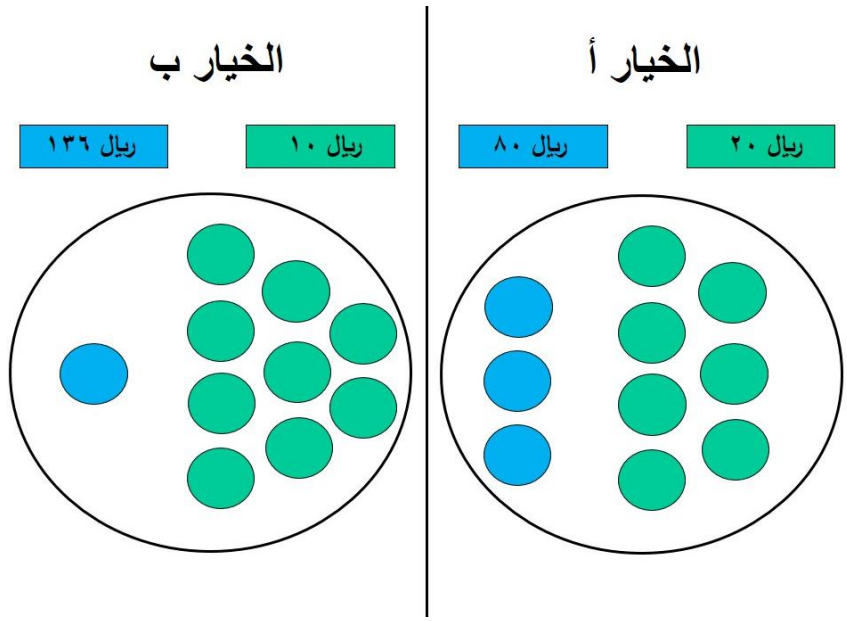
Table A.2: Payoffs in the Time Preference Experiment

Decision	Option A		Option B		Option A		Option B		Option A		Option B	
	Series 1				Series 4				Series 7			
1	120	1 week	20	today	300	1 week	50	today	30	1 week	5	today
2	120	1 week	40	today	300	1 week	100	today	30	1 week	10	today
3	120	1 week	60	today	300	1 week	150	today	30	1 week	15	today
4	120	1 week	80	today	300	1 week	200	today	30	1 week	20	today
5	120	1 week	100	today	300	1 week	250	today	30	1 week	25	today
	Series 2				Series 5				Series 8			
1	120	1 month	20	today	300	1 month	50	today	30	1 month	5	today
2	120	1 month	40	today	300	1 month	100	today	30	1 month	10	today
3	120	1 month	60	today	300	1 month	150	today	30	1 month	15	today
4	120	1 month	80	today	300	1 month	200	today	30	1 month	20	today
5	120	1 month	100	today	300	1 month	250	today	30	1 month	25	today
	Series 3				Series 6				Series 9			
1	120	3 months	20	today	300	3 months	50	today	30	3 months	5	today
2	120	3 months	40	today	300	3 months	100	today	30	3 months	10	today
3	120	3 months	60	today	300	3 months	150	today	30	3 months	15	today
4	120	3 months	80	today	300	3 months	200	today	30	3 months	20	today
5	120	3 months	100	today	300	3 months	250	today	30	3 months	25	today

Table A.3: Payoffs in the Time Preference Experiment (Continued)

Decision	Option A		Option B		Option A		Option B	
	Series 10				Series 13			
1	240	3 days	40	today	60	3 days	10	today
2	240	3 days	80	today	60	3 days	20	today
3	240	3 days	120	today	60	3 days	30	today
4	240	3 days	160	today	60	3 days	40	today
5	240	3 days	200	today	60	3 days	50	today
	Series 11				Series 14			
1	240	2 weeks	40	today	60	2 weeks	10	today
2	240	2 weeks	80	today	60	2 weeks	20	today
3	240	2 weeks	120	today	60	2 weeks	30	today
4	240	2 weeks	160	today	60	2 weeks	40	today
5	240	2 weeks	200	today	60	2 weeks	50	today
	Series 12				Series 15			
1	240	2 months	40	today	60	2 months	10	today
2	240	2 months	80	today	60	2 months	20	today
3	240	2 months	120	today	60	2 months	30	today
4	240	2 months	160	today	60	2 months	40	today
5	240	2 months	200	today	60	2 months	50	today

Figure: A.1: Picture card illustrating the choice between two lotteries



Appendix B Additional Data Analysis Tables

Table B1: Hypothesis theory for expected utility theory

Test	P-Value
H0: $\alpha=1$	0.000
H0: $\lambda=1$	0.000
H0: $\delta=0.078$	0.000
H0: $\beta=1$	0.000

Table B2: Comparison of risk and time preference parameters

Study	(1)	(2)	(3)	(4)	Current Study
Country	Vietnam	Vietnam	Mali and Burkina Faso	USA	Saudi Arabia
Respondents	Rural Villages	Fishermen	Cattle Farmers	Bachelor Students	Poor Urban Neighbourhoods
Probability Weight (α)	0.74	0.96	0.133	0.747	0.25
Risk Aversion (σ)	0.59	1.012	0.112	0.858	0.24
Loss Aversion (λ)	2.63	3.255	1.351	1.602	2.40
Time Preferences (δ)	0.078	0.28	0.001	0.099	0.004
Present Bias (β)	0.82	0.72	0.942	1.023	0.74

Source: (1) Tanaka, Camerer and Nguyen (2010), (2) Nguyen (2011), (3) Liebenehm and Waibel (2014), (4) Ackert et al., (2019)

Table B3: Descriptive Statistics of Household Assets

Asset	Mean	Standard Deviation
Car	0.747	0.436
TV	0.921	0.269
Fridge	0.958	0.201
Stove	0.952	0.214
Oven	0.820	0.385
Microwave	0.458	0.433
Bed	0.765	0.424
Standard Sofa	0.608	0.488
Traditional Sofa (On the Floor)	0.620	0.487
AC	0.922	0.269
Electric Fan	0.584	0.500
Washing Machine	0.886	0.318
Vacuum Cleaner	0.614	0.488
Computer	0.313	0.465
Smart Phone	0.837	0.370
Tablet	0.247	0.433
Gold Jewellery	0.253	0.436