Agent Behavior under Risky and Uncertain Conditions.
An Empirical Verification of Irving Fisher's Notion of Time Preference

Roland Azibo Balgah[1] and Gertrud Buchenrieder[2]
[1] Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO),
email: Azibo@iamo.de and
[2] Martin-Luther-University Halle-Wittenberg

Abstract

Irving Fisher's theory on time preference in the 1930s arguably influenced the analysis of agents' current behavior with respect to future outcomes. By suggesting linear discount rates implying rational and self-interested motives of agents, Fisher substantiated neoclassical economic thinking. However, Fisher's notion of time preference, the choice between present and future enjoyment that actually integrates a psychological discounting component has not received similar attention in the scholarly literature. This paper aims at closing this gap. It empirically examines agent behavior under uncertain conditions culminating from natural shocks, and differentiates the psychic from the physical component.

To empirically test Fisher's notion of time preference, we analyze disaster households from the 1986 Lake Nyos natural shock in rural Cameroon. We look at differences in incomes for impatient households, who illegally moved back to the disaster area and more patient and stationary households in official resettlement camps. Results show that, contrary to Fisher's contention, wealth is positively correlated with impatience. Households in the disaster zone display higher incomes than stationary ones. This finding assumes that differences in incomes existed before the movement.

The results lead us to conclude that Irving Fisher's theory is only partially relevant in explaining agent behavior under conditions of risk and uncertainty. Partiality is attributed by the finding that impatience was rather positively correlated with income, with the exception of social capital. The results lead us to conclude that Irving Fisher's theory is only partially relevant in explaining agent behavior under conditions of risk and uncertainty.

Key words: Risks, uncertainty, agent behavior, Fisher, time preference, Cameroon

1. Introduction

Irving Fisher's (1930) scholarly work summarized in his book "The Theory of Interest" is arguably the most important scientific piece of work that impacted social science research in the early 20th century in general and specific interest in the social construct of capital and income thereafter. Fisher differentiated income from capital and stressed its tangible and intangible components. On capital and income, he emphasized that capital is a key component of income, although income is not reducible to capital. Fisher (1930) defined capital in the traditional sense as quantifiable income flowing from goods and services. This capital can be discounted by agents, by matching prevailing market interest rates and future risks and benefits. This form of capital, he explained, is what is often measured as income. To this must be added psychic capital (that Fisher calls enjoyment income) which is a human- social construct, influencing the actual value appended to physical capital (or income), although precise measurement remains illusionary. According to Fisher (1930), the fundamental importance of 'physical' capital as a dimension of income is essentially defined by the psychic component of human enjoyment. To illustrate this conjecture, the generally accepted poverty lines of US$ 1 or 2 a day (see for example Ravaillon 1992) have been established based on a theoretical assumption of the minimum acceptable level of human enjoyment.

To strategically link Irving Fisher's (1930) discourse with decision making process, it is important to make a clear distinction between capital and income and their relation to the rate of interest, as the latter determines decision outcomes. Capital traditionally relates to the factors of production used to create goods and services necessary for consumption, further production or well being. In this sense, capital, quantifiable in monetary terms is not wanted for itself but to catalyze the production of goods and services. Income, at least from a Fisherean perspective, includes also human sensations and experiences (what Fisher (1930) refers to as psychic income); real income (physical or actual costs and standards of living) and money income. The last two categories constitute the basis of 'capital' or 'income' as often used in traditional economic literature. Thus while income from a Fisherean angle is a "heterogeneous jumble" (Fisher, 1930: 12), capital is the quantifiable portion of this jumble. To this end, capital, that is quantifiable income is often discounted into the future, and can be appended interest rates that influence agent decision making.

Defining income from the physical and psychic, and illustrating the key differences and interrelationships between these, is fundamental to Irving Fisher's (1930) theory of interest and its linkage to the discourse on decision making under risk and uncertainty. By reiterating the relative importance of the psychic for the accumulation of the physical, Fisher laid a strong base for a differentiated view of forms of capital and their effects on income. To this end, interest rate defined as the "per cent of premium paid on money at one date – the present in terms of money to be paid in the future" (Fisher 1930:13) must increasingly consider the tangible (real income) and the intangible (enjoyment income) for improved accuracy. For instance, household decision making processes are based on the analysis of the quantifiable and their current and future perception of the psychic. Consequently, decision outcomes in time and space particularly under conditions of risk and uncertainty must be understood as resulting from more complex valuation of entire income streams (that is the physical and the psychic), rather than capital. Thus it is income, and not necessarily capital that affects agents' time preference (or impatience) as emphasized by Irving Fisher. Fisher's (1930) scholarly work arguably is fundamental to a differentiated view of capital and the formalization of the notion of social capital (see for example. Bourdieu 1986). Since then, the importance of social capital has been significantly recognized by economists, psychologists and anthropologists.

Quantitative (physical) income, that is, traditional notion of capital has dominated economic analysis for approximating income, applying interest or discount rates and assessing social and economic well being (Ravaillon 1992). Psychologists and social scientists have continued to stress the relevance of Fisher's psychic income in understanding human behavior, attitude and well being (Binswanger 1980). The acceptance of the notion of psychic income is demonstrated by contemporary science through efforts to quantify and measure social capital (e.g Grootaert et al. 2004), assess its impacts on economic outcomes (Granovetter 1973, 1983; 2005; Moody and White 2003, Goyal 2005, Miguel and Gertler 2006, Syrett and Evans 2007, Akçomak and Weel 2009) and in understanding its relevance on community safety-nets and risk pooling (Conning and Kevane 2002, Berhane et al. 2009). However, specific focus on assessing the effects of enjoyment (psychic) and real (physical) income on decision making under conditions of risk and uncertainty such as covariate natural shocks, are extremely scarce. Approaching decision making from physical and psychic income perspectives can

generate results with implications for social policy design, implementation and evaluation, particularly under risky and uncertain conditions. While it is logical to assume that under shocks conditions, fair and accurate assessment of income effects on decision making can be extremely difficult for the physical and almost impossible for the psychic components, this is not a sufficient justification for the conspicuous deficiency of empirical evidence on Fisher's theory of interest in this domain. Rapid upsurge of sudden, welfare reducing events of natural origin (such as floods, droughts, and earthquakes) in the last two decades causes tremendous and sometimes irreversible negative impacts on victims especially on the poor in developing countries. For instance the period between 1990 and 2005 alone accounted for more than half of all recorded natural disasters, causing global economic losses more than seven fold greater than observed during the 1960s, with the highest occurrence and impacts in Asia, immediately followed by Africa (UNDP 2008, ISDR 2010). Understanding behavior and decision making under conditions of risk and uncertainty can help consolidate, modify or completely re-orientate social policy objectives and interventions.

Irving Fisher (1930) discussed some critical issues which are important in understanding and explaining agent behavior and decision-making, particularly under conditions of risk and uncertainty. Natural shocks occurring especially in developing countries where states and markets often fail, are weak or dysfunctional are typical examples of such conditions under which agents make difficult decisions. Failing states and markets suggest that decision making is not necessary based on some linear discount function, but probably on a more complex hyperbolic decision making process for which the psychic becomes more influential than would have been in the presence of active functioning states and markets.

Of particular interest for this discussion is Fisher's notion of time preference or impatience. It relates decision making as an outcome of a combination of an agent's psychic and real incomes. This concept will be discussed in Chapter 2. To test this notion empirically, we apply it to explain the decision to self-relocate or not, amongst surviving households of the 1986 Lake Nyos disaster in Cameroon. We assume that such a decision is based on a complex decision making process by agents, contingent on their self assessment of the present and the discounted future, influenced by both physical and psychic incomes. Chapter 3 presents the problem setting, research background and methodological issues, stressing their correspondence to the notion of impatience in Fisher's theory of interest. Chapter 4 presents and discusses relevant results, and chapter 5 concludes with possible research and policy implications for the application of this theory in understanding agent decision making under risk and uncertainty.

2. A review of Fisher's theory of interest: the notion of time preference

Time preference is a key concept in Fisher's theory of interest. According to Fisher, time preference or impatience is a psychological construct expressing either preference for present against future goods, future against present goods, or no preference at all. "The degree of impatience is the percentage preference for $1 certain of immediate income over $1 also certain in the future (say one year), even if all income except that dollar is uncertain. This degree of impatience for income depends on the size of the real income stream, its expected distribution over time, its composition and the degree of risk or

uncertainty" (Fisher 1930: 71). These independent variables influencing agent impatience will be briefly discussed.

Poverty or a smaller income resolves into a high degree of impatience, by increasing the need for immediate income more than the need for future income. In other words, preference for present over future gratification is higher for poorer agents, and culminates into the preference for early enjoyment over future (deferred) enjoyment incomes. Early and deferred incomes are mediated by interest rates applicable through discounting. Because income has psychic and physical dimensions, the price in the exchange between present and future goods (that is, the interest rate), in line with the ordinary theory of prices, is necessarily contingent on the comparative marginal desirability of the psychological or subjective component. To illustrate this point Fisher wrote: "In general, all things being equal, the smaller the income, the higher the preference for present over future income [and] the greater the impatience to acquire income as early as possible" (Fisher 1930: 72). Thus in relation to risk taking necessary to increase income, wealth is expected to be negatively correlated with risk taking.

At this stage, it is important to distinguish risk from uncertainty. The term "risk" is used when referring to uncertain (i.e. stochastic) events and outcomes with known or unknown probabilistic distributions (Heitzmann et al 2001, Alwang et al. 2001). The literature identifies two dimensions of risk: objective and subjective risk. Objective risk is the past and likely future occurrence of risks quantitatively measured by experts, often based on econometric or other models. On the other hand subjective or perceived risk is the way the agents anticipate future events in view of past ones. Perceptions of risks are based on subjective beliefs about the occurrence of uncertain events and their uncertain outcomes. Based on the prior definitions of Knight (1921), Fisher used risk to denote the quantifiable and measurable dimensions of 'risk' as conceived in contemporary economic and social sciences literature. On the other hand uncertainty was used to refer to the more subjective aspects of risk which are difficult to quantify. In the Fisherean sense, both risk and uncertainty, that is objective and subjective risk, influence decision making

Empirical evidence on the income-impatience relationship is mixed. Fisher's hypothesis is supported for example by the findings of Binswanger (1980) in his risk experiments amongst households in rural India. Contrary findings are reported by Van den Berg et al. (2009) amongst disaster victims in Peru. However to the best of our knowledge, no such examples exist that try to understand or explain decision making (for example to invest or not, to relocate or not) under conditions of risk and uncertainty, precipitated by aggregate shocks, as an outcome of impatience. Also, the above mentioned case studies concentrate more on objective income and little is mentioned on how for example the size of social capital – as subjective income influences impatience under conditions of imperfect information, risk and uncertainty. A contribution to this effect is presented in the results section of this article.

The time shape of income stream denotes the agent's expected or actual income at each successive period in time. Income time shapes can be uniform or fluctuating over time. According to Irvin Fisher, an increasing income leads to higher preference for future over present, compared to situations with uniform or slackening income flows. To illustrate, he wrote:

"A man who enjoys an income of only $ 5,000 a year but expects to enjoy one of $10,000 a year in ten years will today price a dollar in hand far more than the prospect of

a dollar due in ten years. His expectations increase his impatience. On the other hand, a man with a $ 10,000 salary at present who expects to retire in a few years may even save from his present abundance to provide for coming needs. The relative scarcity of future income appeases present impatience" (Fisher 1930: 74). What Fisher infers here is that smaller incomes are much sensitive to time shape than larger ones. However, in line with his original objectives, Fisher emphasized that a man's real income is "not a simple homogenous flow of money, but a mosaic of psychic [and institutional] experiences" (ibid: 76). To this end, availability of state and market institutions and the provision of public goods (such as roads, and publicly-mandated social protection or insurance) is critically part of real income in the Fisherean sense. When these are missing, weak or dysfunctional as common in developing countries (thereby increasing risk and uncertainty), agents combine objective and subjective discounting in a complex, hyperbolic process for decision making. Based on the theory being examined, a higher degree of impatience should be explained by smaller current income and the lack of hope for future higher incomes. Therefore, persons with lower current incomes, and lower expected future incomes should have higher preference for current than future incomes. If a person is in need of a certain good at the current period, he will value the present higher than any distant, unknown future.

The income composition although mentioned by Fisher, does not seem to be a strong variable on its own right, considering that it is partly engulfed in the income stream and can change over time. However is necessary to mention that an income of $ 5,000 may constitute a different set of enjoyable services for different agents. These differences theoretically influence impatience. To elucidate, Fisher wrote:
"[When] food is a prime necessity, decreasing the proportion of food while maintaining income constant increases impatience" (Fisher 1930:76). For the case study examined below, this will mean that as food is very important for agents (considering that over 80% of all household heads are engaged in subsistence agriculture), the decision to self-relocate or not should be explainable by differences in household consumption, however construed.

The last critical factors influencing impatience discussed by Fisher are risk and uncertainty. By the influence of risk on time preference Fisher meant the level to which uncertainties in anticipated income affect relative valuation of present and future increments, both increments being determinable and certain. Therefore, the influence of risk on impatience is limited to the particular future to which the risk applies. If the future is risk-safe, agents are more likely to be more patient. On the contrary, when the future does not sufficiently account for risks and uncertainty (as in the midst of wars or natural shocks), impatience increases. As recalled by Fisher, when the future is a gamble, "persons who like to take great speculative chances are likely to sacrifice a large amount of their exaggerated expectations for the sake of relatively small addition to their present income. In other words, they will have a high degree of impatience. On the contrary agents receiving an income which is risky for all periods of time [may exhibit] a low, instead of a high degree of impatience" (ibid: 79).

Based on the factors influencing impatience mentioned above, we expect differences in our empirical case study between patient, non-returning households of the 1986 lake Nyos disaster who currently live in government allocated resettlement villages, and more impatient households who have illegally returned into the disaster zone in

search of livelihood resources. The next section briefly presents the background of the case study, and the results are later analyzed based on Fisher's (1930) theory of interest.

3. Case study: The 1986 Lake Nyos Disaster in North West Cameroon

3.1 Problem statement and research background
On August 21 1986, a natural gas explosion from Lake Nyos in North West Region of Cameroon emitted Carbon dioxide and minimal amounts of Hydrogen sulphide asphyxiating and killed about 2,000 inhabitants and an estimated 10,000 livestock in three villages (Nyos, Cha, Subum), located within a diameter of about 25 kilometers around the lake. Subsequent scientific investigations on Lake Nyos revealed that it contains huge amounts of CO_2 (300 million m^3) in the deeper layers, with threats of further release in the future. While scientist were primarily interested in identifying the cause of this natural shock, a high level conference on the Lake Nyos disaster held in Yaoundé – Cameroon in March 1987 proposed that surviving victims should be resettled immediately (Sigvaldson 1989). Between 1987 and 1988, seven resettlement camps were established in Kimbi, Buabua, Yemngeh, Ipalim, Kumfutu, Esu and Upkwa villages. Most households were moved immediately after construction from the affected villages and resettled in the newly constructed village camps.

The shock-affected villages were declared disaster areas by the government and rehabilitation was legally prohibited. In the last decade, a natural experiment has been taking place in the research region. Under conditions of risk and uncertainty, some households from the resettlement camps took the decision to return back into the affected villages, in spite of government restriction. Although Bang (2008) suggests that a major motive for relocation is the deficiency of state post-shock management to jointly address physical, structural and social risk mitigation, self-relocation itself must be seen as the outcome of complex household decision making processes. From a Fisherean perspective, we expect specific differences between impatient, returned households and more patient stationary households. Self- relocation is taking place in the backdrop of the possibility of another covariate shock with potential strong negative impacts in the recipient villages. Thus, the decision to return to the disaster-prone areas must be necessarily seen as a demonstration of a high degree of impatience. This paper comparatively analyzes the degree to which the three factors mentioned in Fisher's (1930) theory of interest explain household decision to return to the disaster zone or not. For this we use data on variables of interest from returned households in all three originally affected villages (Nyos, Cha, Subum) and six of the seven resettlement camps (Kimbi, Buabua and Yemngeh, Kumfutu, Esu and Upkwa). The analysis assumes that households were originally the same after the disaster (Bang 2008), and decision making is strongly influenced by time preference, the latter contingent on both household present and discounted physical and psychic incomes.

3.2 Methodology
The sampling unit is the household. Through random sampling, data was collected with a standardized questionnaire from former disaster-affected households in six out of seven resettlement camps and all three affected villages. A total of 301 surviving households of the 1986 Lake Nyos disaster including 71 impatient, returned households and 230 more

patient, stationary households in the original resettlement camps were surveyed. The questionnaire included indicators based on the World Bank's Social Risk Management framework (Holzmann and Jorgensen 2000; Heitzmann et al. 2001; Holzmann et al. 2003, Grootaert et al. 2004), allowing us to perform a differentiated analysis of physical and psychic income à la Fisher. The decision to move or not is considered sufficient for the matter of risk and uncertainty. Thus, by deciding to forcefully return to the disaster zone, such households demonstrate a high degree of impatience compared to the more stationary households. To this end, and if Fisher's theory of interest would be applicable in analyzing decision making under uncertain conditions of natural shocks, then we expect returned households to match Fisher's characteristics of a high degree of impatience, and stationary households to exhibit a more patient characteristic portfolio. Field data collection took place between November 2009 and February 2010.

4. Results

In this section, an analysis of selected physical income variables for stationary (resettled) and returned households will precede the psychic component. The analysis assumes that returned and stationary households had the same level of assets immediately after the disaster, although the exact values remain unknown due to the absence of panel data. This is a logical assumption, considering that households lost almost all their valued assets to the 1986 disaster (Sigvaldson 1989, Bang 2008). Because relocation is a relatively new phenomenon observed in the disaster area in the last five years, current assets are assumed to represent the value of assets at the time of departure. Again this assumption seems logical, as the current value of assets especially for returned households excludes investments made prior to, or as a result of the decision to relocate (for example in building a new house). The differentiated influence of time will be discussed and the impact of risk and uncertainty on decision making will conclude the results section.

4.1. The effects of physical and psychic incomes on impatience

Table 1 presents results of a differentiated analysis on the mean variance of selected physical income variables. The value of current livestock held by returned, impatient households per capita is higher than for stationary, more patient households, although this difference is not statistically significant. Nevertheless total household expenditures, number of farming plots and annual agricultural expenses per capita are significantly higher for returned than for stationary households. Assuming that illegal self-relocation by returned households into former disaster zone is a demonstration of impatience, then, contrary to Fisher's theory, it is the better-off who are more impatient than the poor. However, based on an assumed exchange rate of US$1 to 500 FCFA, monthly consumption expenditures for both households (less than US$ 1 and US$ 2 for stationary and returned households respectively) places both household types below the globally accepted poverty lines of US$ 1 and 2 respectively. Thus while Fisher's theory is partially right, it seems that under conditions of risk and uncertainty such as natural shocks, it is the better-off amongst the poor (in terms of physical assets) who are more impatient. Higher monthly expenditures for impatient, returned households suggests that impatience has a positive impact incomes as predicted by Fisher.

Table 1 Differentiated analysis selected physical income variables by household

Variable	Household type	Mean	St. D.	P
Per capita livestock holdings (FCFA)	Stationary	167990	4.85899E5	0.306
	Returned	241700	5.46103E5	
Per capita monthly household expenditures (FCFA)	Stationary	12640	12070	0.000
	Returned	25370	22680	
Number of farming plots per capita	Stationary	1.9	1.7	0.000
	Returned	2.9	1.5	
Annual agricultural expenses per capita (FCFA)	Stationary	8365	9655	0.047
	Returned	12615	26965	

Notes: Currency variables have been rounded up to the nearest whole currency values

Table 2 presents the mean variance amongst some variables assumed to contribute to psychic income that also influences time preference amongst sampled households. While the expenditures on clothing and footwear are significantly higher for returned than for households remaining in the resettlement villages, membership in groups and networks is higher for the latter. It seems to suggest that the more connected victims are reluctant to move, that is, they are more patient and benefit from their networks than the less connected impatient returnees. Thus while this finding seems to contradict the general notion of the positive effects of social capital on economic outcomes (Grootaert et al. 2004, Granovetter 2005), it partially supports Fisher's (1930) theory of the relative importance of psychic income in influencing time preference in general, and the specification that its abundance tends to reduce impatience.

Table 2 Mean variance in psychic income

Variable	Household type	Mean	St. D.	P
Per capita annual expenditure on clothing and foot wear (FCFA	Stationary	167990	13510	0.016
	Returned	22165	10800	
Total household membership in groups and networks	Stationary	1.74	1.63	0.080
	Returned	1.38	0.96	
Value of selected household assets per capita	Stationary	151435	4.0512E5	0.199
	Returned	87142	2.03109E5	

Notes: Currency variables have been rounded up to the nearest whole currency values

4.2 The influence of time
The analysis of time shape on impatience demonstrated in our case study by the decision to self-relocate or not is more difficult to assess. The absence of data on real income and the presence of weak state and market risk management institutions rendered attempts towards a real assessment of the expected state of well being in the future. Interest rates are largely inapplicable, and the future assessed by agents is strongly influenced by own subjective perceptions. However to proxy the influence of time on impatience, we

examine time-variant variables such as the number of relatives lost to the 1986 disaster value of livestock, expected shocks and household size. Based on our assumptions, we expect that households with greater losses in the 1986 disaster will be more impatient to get back at least as fast as possible to these levels. Also, a larger household size should reduce impatience.

Table 3 Influence of constructs on household decision to relocate or not

Variable	Household type	Mean	St. D.	P
Number of relatives lost to the 1986 disaster per capita	Stationary	12	15	0.056
	Relocated	17	22	
Per capita value of livestock lost in the 1986 Lake Nyos disaster (FCFA)	Stationary	167990	4.85899E5	0.306
	Returned	241700	5.46103E5	
Expected number of household shocks in the next one year	Stationary	2.3	1.5	0.916
	Returned	2.3	1.7	
Household size	Stationary	7	4	0.011
	Returned	6	4	

Notes: Mean currency and human related variables have been rounded up to the nearest whole numbers respectively.

As shown in Table 3, returned households lost significantly more relatives and more livestock assets to the 1986 disaster than stationary ones. A significantly higher household size for stationary households is a reasonable explanation for its reduced impatience, demonstrated by the decision not to self-relocate. Expected shocks over the next 12 months were the same for both household types.

4.3 Risk and uncertainty
Fisher recalled that future income is always subject to some uncertainty which in turn influences the degree of impatience. The level of risk is determined by the future to which the risk applies. If existing institutional framework guarantee minimum safety and certainty about the future however defined, the assurance of future abundance may reduce current degree of impatience. Since 1986, state-led institutional disaster management in the Lake Nyos area has been suboptimal. While it has focused more on physical risk reduction and less on social and community based dimensions of risk management (Bang 2008), support has decreased drastically over the years. In the last few years for instance, government support has been limited principally to physical risk reduction at the risk source and to sporadic dish outs during yearly disaster commemorative events or during political campaigns (Etaka 2007). Destitution has characterized these households for almost a quarter of a century and the future remains uncertain. But the perception, and therefore behavior in the present in relation to the future is not the same for all households. As mentioned by Fisher, agents with great speculations about the future will sacrifice large amounts of their exaggerated expectations for smaller amounts to present income, thus exhibiting a high degree of impatience (or risk taking). On the other hand, agents receiving incomes that are risky for all periods will be more patient (or risk-averse). The first category corresponds to

returned households in our case study while the second corresponds to stationary households in resettlement camps. Therefore, if risks remain non-assessable and the future largely uncertain (as it has been for the past almost 25 years in the research region), then more households are expected to demonstrate preference for current enjoyment over deferred income, taking the decision to self-relocate into natural resource-rich, disaster-prone areas in the near future, with or without legal permission.

5. Conclusions and implications for research and policy
Irving Fisher's theory of interest has been widely tested an applied on the allocation of market prices, interest and discount rates (Merton 1973, Cumby and Obstfeld 1981, Crowder and Hoffman 1996). However, empirical tests on the specific influence of income size, and time on decision making especially under conditions of risk and uncertainty are scarce. This article has contributed to this subject, by empirically testing the Fisher hypotheses on a sample of 301 surviving households of the 1986 Lake Nyos natural disaster in North West Cameroon. Viewing self-relocation under conditions of risk and uncertainty as the outcome of an analytical process at household level, this empirical case study presents at least two key results relating to Fisher's original hypotheses on impatience of relevance to social and development economics.

First, physical income was found to be inversely related to impatience, contradicting Irvin Fisher's original hypotheses. However an examination of psychic income, particularly the social capital aspect confirms Fisher's hypotheses. Stationary households had higher memberships in groups and networks (and therefore higher psychic-social income) than returned households. Thus household behavior under conditions of risk and uncertainty can be partially explained by Irvin Fisher's theory of interest.

Secondly, self-relocation is interpreted as an influence of time on impatience. Less patient, risk-taking households who lost higher valued livestock assets and number of relatives in the 1986 are relocating after over 20 years of disappointing state-led disaster management, while more patient, risk-averse households with larger household sizes demonstrate higher degree of patience by remaining in the original resettlement villages. This result largely supports Fisher's prediction of the influence of time shape on impatience. However, if current conditions of risk and uncertainty persist, then it is more likely than more patient households may become more impatient and self-relocate.

The above mentioned results suggest a number of implications of Fisher's theory of interest on research and policy. First, Fisher's theory - particularly the concept of time preference - seems robust and useful even if only partially, in understanding and explaining agent behavior under conditions of risk and uncertainty such as natural disasters. However, a combination of the physical and psychic income analysis is crucial for better understanding of the overall influence of income on agent behavior. Focusing only on the physical as commonly applied using econometric models, and therefore neglecting the psychic might produce biased results and generate perverse policy recommendations. Second, Irving Fisher's theory of interest can be very useful in understanding and explaining decision making under conditions of risk and uncertainty such as natural disasters. As demonstrated in this article, this theory-particularly its concept of impatience is strongly applicable for understanding behavior under shock conditions. Research should increasingly focus on understanding under what conditions

relevant theories like Fisher's hold or not, or what explains the fact that lower incomes do not always create higher impatience as predicted by Irving Fisher. Our example suggests that the level of functioning of, and trust in state and market institutions, desperation and uncertainty about the undefined future might be responsible for behavior unusual in the Fisherean sense. However the concept of impatience remains useful for understanding behavior under conditions of risks and uncertainty. More empirical work is needed to strengthen this contention.

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