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ESSAYS ON THE ROLE OF SOCIAL STATUS AND BELIEFS ON INTERGENERATIONAL MOBILITY

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Contents

Introduction

The aim of these essays is to contribute both theoretically and empirically to a better understanding of the role of social status in intergenerational income mobility. In the first chapter we focus on social status understood as the self-perceived valuation of the relative position of individuals in their reference group. Specifically, we seek to analyze how reference groups affect intergenerational mobility. In order to advance in this direction, we propose a theoretical model to analyze the role of reference groups and inequality in intergenerational mobility. In the second chapter, we incorporate an additional perspective of social status: social rewards based on how others value the observable actions of individuals. This approach allows us to assess both the role of each status motive separately and their interaction. Finally, this thesis contributes to the empirical economic literature with new evidence on how relative income with respect to the reference group can affect economic satisfaction, testing the assumptions of prospect theory.

The study of intergenerational mobility seeks to measure the extent to which a child's social and economic opportunities depend on their parent's income or social status (Jäntti and Jenkins, 2014; Chetty, 2014b). The issue of intergenerational mobility and its relationship with intragenerational inequality is still one of the most controversial issues, both in policy debates and in academic research by social scientists. Furthermore, there are different theoretical models available to explain intergenerational mobility, which have different implications in terms of social welfare and distributive justice.

The seminal contributions of Becker and Tomes (1979; 1986) suggest that intergenerational income mobility can be explained by a combination of direct family transmission of productive abilities, endowments and parental investment in their children's human capital. Recent research has found that the intergenerational income correlation is considerably higher than most previous estimates had suggested (Solon,1992; 2002; Zimmerman,1992; Björklund and Jäntti,1997; Jäntti and Jenkins, 2014). However, the literature does not provide a consensual view about which mechanism explains the low intergenerational mobility.[1] Solon (2004) suggests that higher intragenerational income inequality may account for lower intergenerational mobility. Recent empirical papers provide evidence that supports this idea (Björklund and Jäntti's, 1997; Mitnik et al., 2014, Chetty et al., 2014b). Chetty et al. (2014b) find that intergenerational mobility varies substantially across areas within the U.S. Areas with less income inequality, less residential segregation, better primary schools, greater social capital and family stability have higher intergenerational mobility.

Intergenerational mobility is characterized by the joint distribution of parent and child income and the marginal distribution describes inequality within each generation. Because people care about their status (relative position) when they take mobility-enhancing investment decisions, movements between both income distributions are mediated by relative deprivation (or relative advantages), which in turn depends on the inequality between individuals with different social backgrounds. For example, inequality in outcome distribution could generate incentives to work hard for most people below the top of the income distribution (Alesina and Giuliano, 2010). However, high income inequality may discourage low background individuals from making adequate mobility-enhancing investments by reducing their economic aspirations or failing in their perception of the connection between their actions and outcomes (Appadurai, 2004; Genicot and Ray, 2014). While

[1]For a review of theories explaining intergenerational mobility see Piketty (2000). Jäntti and Jenkins (2014) provide a detailed survey of the literature on income mobility.

the former predicts a positive relationship between inequality and mobility, the second suggests that it is negative. This difference arises from how inequality and relative concern affect individuals' behavior and income mobility.

There is growing evidence in economics, from experimental and survey research, that highlights the relevance of relative concern in individual behavior (Postlewaite, 1998; Frank, 2005; Heffetz and Frank, 2011, D'Angelo and Clark, 2013).[2] Furthermore, there appears to be certain agreement in economics that the inclusion of relative concern in economic models helps to better predict how people behave (Rabin, 1998; 2002). However, most income mobility models in economics still mainly include assumptions that are not in agreement with these new findings (Rabin, 2002). This gap raises new questions about how relative concern in societies with high income (and social) inequalities could affect intergenerational mobility levels. Relative concern could generate incentives to achieve economic success or, conversely, in contexts of high inequality it could discourage certain behaviors in order to avoid frustration. As a result, relative concern could play a central role in explaining inequality persistence between generations.

Prospect theory suggests that individuals make their valuations relative to a reference level, which confirms individuals' relative concern. The prospect theory represents an inflection point in the modelling of the decision making process of agents under uncertainty and its relevance and validity have been argue in other contexts. Tversky and Kahneman (1991) argue that the reference group represents the natural comparison point for each person to value her income, linking their contributions with reference group theory and the empirical research that has incorporated relative concern into the explanation of individuals' self-reported satisfaction with respect to their reference group.

Reference group theory suggests that individuals compare their social achievements to

[2] These behavioral foundations based on relative comparisons are related with social preferences (Hopkins,2008; Fehr and Schmidt, 2003; Heffetz and Frank, 2011).

the reference group from which they come. As a result, individuals with lower-class origins are less motivated to make mobility-enhancing investments due to the fact that they have lower reference points and they can easily maintain their initial social position (Piketty, 2000, Merton, 1953). Mainstream sociological theories have emphasized the role of social status in the generation of persistent inequality between families. However, this issue has received limited attention in economics. Heffetz and Frank (2011) emphasize that economics is generally ambiguous about social status definitions (and interpretations) and there is a "models overlap", where status is related with other economic concepts. Postlewaite (1998), Weiss and Fershtman (1998) and Heffetz and Frank (2011) discuss how economics has introduced the concept of status and present its main implications.

Bourguignon et al., (2007) suggest that differences in status (expressed in patterns of interaction, behavior and beliefs) could be an additional sociocultural mechanism of inequality persistence between generations, and they emphasize that further economic research, both theoretical and empirical, in this area is needed. They suggest that Piketty (1998) is a notable exception in economics. The author introduces the role of status in intergenerational income mobility. His model suggests that status motives amplify inequality between agents with different social origins, when the impact of social origin on economic success is high compared to the effect of effort and ability.

Piketty's model aims to describe two sociocultural channels of inequality persistence: reference group theory and the self-fulfilling discriminatory beliefs. However, the status motives used in Piketty's model, defined as the public belief about one's smartness, provide a better basis for discrimination theory, if we understand that society treats individuals from different social origins, who are otherwise identical, differently (Fang and Moro, 2011). As a result, the reference group mechanism has not been considered in detail in his model because its utility function does not include how much people care about their gap with respect to a reference point. His model does not allow us to explore

how individuals react to the composition of their reference groups. There is an ongoing debate in economics about what income level individuals take as a reference, as well as which individuals make up the reference group (D'Angelo and Clark, 2013, Heffetz and Frank, 2011; Clark et al., 2008; Clark and Senik, 2010). To date, the implications of the composition of reference groups in terms of income mobility have received little attention.

The purpose of the first chapter is to fill this gap by building a theoretical model to analyze the role of reference group composition and ex-ante inequality in intergenerational mobility. Our model provides a common framework, which allows us to examine the role of the reference group in effort decisions and intergenerational mobility in detail. Our modelling exercise consists of finding the conditions under which individuals from lower class origins could be discouraged from making adequate mobility-enhancing investments, while individuals from higher class origins could be more stimulated. We incorporate the idea that the composition of reference groups defines a reference income level, and agents care about the gap between their income and their reference income when taking decisions. We model rational agents with two different social origins who choose the level of effort that maximizes their expected utility. Based on recent empirical findings and the alternative assumptions of standard theory and prospect theory, we model the effect of reference group income on effort decisions. To gain a first insight, we first consider a simple scenario in which individuals know the composition of their reference group and they also have perfect information about their reference group income (forward-looking agents). In a second exercise, we assume that agents have imperfect information about the expected effort of their reference group and base their choices on *a priori* beliefs about the probability of economic success of different social origins. Beliefs are updated according to Bayes' rule, implying that past mobility affects the expected income of the current generation. These assumptions allow us to derive long term effort equilibrium levels and to examine the effect of relative concern on the dynamics of intergenerational

mobility.

The results that emerge from this chapter confirm that the reference group affects the inequality of economic success between identical individuals with different social origins. Our findings suggest that the size and direction of this effect depend on 4 key issues: (a) the composition of the reference group; (b) assumptions about the functional form of relative concern, where standard assumptions or prospect theory yield different predictions in terms of income mobility; (c) ex-ante inequality and relative effort rewards; (d) expected effort beliefs and past mobility trajectories. Furthermore, we demonstrate that the reference group effect leads to individuals making sub-optimal social welfare decisions.

Finally, this chapter ends by establishing a first bridge between reference group theory and the aspiration model of Genicot and Ray (2014), whose model is related with the contribution of Dalton et al.(2015). Our model discusses the conditions that could explain when individuals from lower class origins face the aspirations failures identified by Ray (2006).

This first chapter considers only one perspective of status concern and focuses on the comparative role of the reference groups. However, previous literature suggests that relative concern can be addressed from different perspectives (Postlewaite, 1998;Weiss and Fershtman,1998; Heffetz and Frank, 2011). Sociologists consider a broader class of rewards, which include different forms of relative or positional concern. In order to advance in this direction we consider how much people care about the esteem of others as "social rewards". For instance, workers are concerned about whether their wage is relatively high (or low) with respect to their co-workers and also whether they receive the esteem of other co-workers or their supervisor. Because Piketty (1998)'s paper focuses on social status rewards, less attention is paid to the different roles played by both status motives. Furthermore, the paper does not provide an analysis of how both status motives interact with each other.

The second chapter aims to contribute to this field and enhance our understanding of the role of status motives in intergenerational income mobility. This chapter begins with a review of the micro foundations of relative concern and the main advances in understanding the role of status from the economic perspective. We then discuss the existing evidence on relative concern, which allows us to formalize the discussion of how relative concern affects an agent's utility. This allows us to present the model and its definitions. Our model extends Piketty (1998)'s model in 3 directions. First, in order to avoid any ambiguity in the definition of status and to discuss how individual effort decisions are affected by them, two status perspectives are considered: *self-perceived valuation of their relative position in their reference group* and *the social rewards based on how others value their visible actions.* This approach allows us to discuss the role of each status motive separately, and how they interact with each other, in order to explain the intergenerational transmission of economic inequality. Second, the composition of the reference groups and the assumption of upward looking comparisons generate a leader-follower dynamics between agents with high social origins and low social origins. Third, we discuss how informational assumptions about peer behavior affect inequality persistence. Both status motives incorporate the expected decisions of others in the individual utility function. We first assume forward-looking homogeneous agents, which reflect a situation in which there is perfect information. In a second step, we incorporate heterogeneity among agents with low social origins and assume imperfect information on peer decisions. In this case, beliefs about peer decisions are updated by an adaptive backward-looking learning process.[3] This establishes an additional interaction between beliefs and mobility, and allows agents to learn about the effectiveness of effort with regard to upward mobility.

The model demonstrates that, even when all agents are identical in their abilities, their effort levels differ in the long run due to status motives which, in turn, affect long term

[3]This section demonstrates the robustness of the results of chapter 1, incorporating an alternative backward-looking learning process about expected peer effort.

income mobility. The predictions are consistent with the "self-fulfilling belief model" and a low mobility trap when each agent from a lower-class background compares himself only with agents with the same origin, and when expected peer effort is low (which leads to low status rewards). Namely when agents share public beliefs and assume, ex-ante, that they belong to a reference group whose members have a low social origin, they adopt a behavior that validates their reference group expectations. However, reference groups and status rewards generate an "encouragement effect" which could reduce economic success inequalities. The effect which dominates depends on 5 key issues: (a) the composition of the reference group; (b) social rewards; (c) expected peer effort; (d) the trade-off between both status motives; (e) informational assumptions and learning processes.

Finally we show that the implications of status motives on social optimal decisions depend on informational assumptions. An intergenerational peer learning process could mitigate the sub-optimal rat-race effect.

The first two chapters show that the response in the effort decisions to changes in expected relative income mainly depends on the reference group composition, relative social rewards and on the concavity or convexity of the relative concern curve. The model predicts that when relative concern is concave, people respond by reducing their effort when facing a more demanding reference group income, while they respond in the opposite way if it is convex. Prospect theory suggests that relative income concern has an asymmetric shape, which implies that it is convex for those with relative deprivation and concave for those with positive relative income. While generally confirming the asymmetry of relative concern, previous empirical research on the levels of satisfaction, considering the peers income as a reference point, is ambiguous with respect to its concavity or convexity (Vendrik and Woltjer, 2007; Ferrer-i-Carbonell, 2005).

The third chapter seeks to close this gap by providing evidence on the validity of the assumptions of prospect theory in the modelling of relative concern with respect to

a reference level. It provides new evidence to the economic literature on how people valuate their economic situation in relation to a reference income, testing two of the main assumptions of prospect theory: (HI) the asymmetric valuation of gains and losses; (HII) diminishing marginal sensitivity as one moves away from the reference point (convexity vs concavity). There are few studies that attempt to provide answers on this issue based on self-reported satisfaction, or experienced utility. As a secondary objective, this chapter provides evidence on how individuals with similar characteristics may present differences in the reference income level they consider. Finally, it also provides preliminary evidence on how a relatively unfavorable situation can result in a reduction of economic aspirations.

To test these hypotheses, unlike previous research which mainly focuses on life satisfaction, we use economic satisfaction as a dependent variable. This type of variable provides valuable information for a better understanding of the economic behavior of people (Kahneman and Krueger, 2007; Frey and Stutzer, 2002; Clark, Frijters and Shields, 2008; Ferrer-i-Carbonell, 2011).[4] To explain economic satisfaction, we adapt the empirical strategy applied in Ferrer-i-Carbonell (2005) and Vendrik and Woltjer (2007). In our case, the asymmetric relative concern is modelled by means of a polynomial function which provides a flexible and direct way of evaluating the validity of the assumptions of asymmetry and diminishing sensitivity.

The estimates are based on three waves of the Uruguayan panel survey, "Multidimensional Well-being Trajectories in Childhood" (MWTC). Some questions in this survey were specifically designed to address these hypotheses and to measure some personal traits. The sample is representative of households in Montevideo and the metropolitan area with children attending the first year at public primary schools in 2004 (90% of the

[4]For example, measures of self-reported satisfaction have been used to evaluate behavioral assumptions, to examine differences in preferences and tastes, to value non-market goods and to measure inequality aversion, risk attitudes and income comparisons. However, there is a debate in economics on the advantages and limitations of using these measures and their consistency with "utility" or with observed choice behavior (Diener and Lucas, 1997; Clark et al. 2008; Kahneman and Krueger, 2006; Ferrer-i-Carbonell, 2011).

cohort). The majority of the previous papers use data from developed countries, so this research provides new evidence for a developing country.

The results presented in this chapter were estimated using random effect models, extended random effect models (which includes a Mundlak term) and fixed effects models (Ferrer-i-Carbonell and Frijters, 2004; Mundlak, 1978). They confirm the importance of relative income in the levels of economic satisfaction and the asymmetry hypothesis. Unlike the findings in Vendrik and Woltjer (2007), convexity is confirmed between people facing relative deprivation, which corresponds to diminishing marginal sensitivity as they move away from the reference income. That is to say, relative concern is more important among those who are close to the reference income level, and its sensitivity is greater for those in the area of relative deprivation. These results are consistent with the assumptions of prospect theory (Kahneman and Tversky, 1979; 2000).

There is an ongoing debate about reference group composition, which is generally defined exogenously by the researcher, based on observable characteristics. However, there is some evidence that individuals take different social groups as a reference. This aspect has not received enough attention within the economic literature, and to some extent is associated with the endogeneity of the reference group. This issue could generate problems in identifying the individual's reference point income and therefore on testing individual's relative concern.

To address this problem, we use alternative reference points to assess the validity of the assumptions of prospect theory. First, we consider the perception of individuals about their position in the income distribution in order to define reference income. Second, we consider the level of income that each person identifies as the minimum necessary for a household not to fall into poverty (subjective poverty line) as a reference point (Stutzer, 2004). This strategy avoids defining a reference group exogenously, while introducing heterogeneity in the reference income set by each individual. The results that arise from

these alternatives prove, on one hand, the robustness of the validity of the assumptions of prospect theory and, on the other hand, confirm heterogeneity in the reference points.

Our findings confirm the convexity of relative concern between people facing relative deprivation and provide preliminary evidence for heterogeneity in the income level that each person takes as a reference. Both issues were identified as key factors to explain low mobility traps and aspiration failures. In addition, if the subjective poverty line is considered as an approximation of economic aspirations, it provides complementary evidence on the assumptions used by Genicot and Ray (2014) to model aspirations. In order to advance on this issue, in chapter 3 we consider Rotter's Locus of Control (LOC), which allows us to explore how an individual's expectation about the connection between his personal characteristics and experienced outcomes affects economic satisfaction. That decision allows us to analyze how some aspects of personality or individual beliefs may affect relative concern and economic satisfaction.

Locus of Control measures the individual's perception of their control over his life, which is explained as the degree to which an individual believes that his life is under his control or rather depends on external factors (actions of others, luck, etc). These personality traits could affect economic satisfaction and aspirations and the responsiveness to social comparisons. We analyze three domains of LOC separately (*internality*, *powerful others* and *chance*) which are statistically more independent of one another than previous dimensions used in Rotter's scales.

The results confirm the relevance of LOC in explaining economic aspirations and suggest that the sign and magnitude of the correlation between economic satisfaction and LOC dimensions are not the same. An increase in *internality* and *powerful others* dimensions leads to higher economic satisfaction, which is consistent with the previous evidence. However, higher LOC-Chance has a negative incidence on economic satisfaction, which shows that more fatalistic individuals are more conformist. Furthermore, we confirm the

incidence of fatalistic beliefs on relative concern. Our results show that among fatalistic individuals, *ceteris paribus*, a higher relative deprivation increases economic satisfaction. These results are in line with recent findings presented in Proto and Rustichini (2015) and Budria and Ferrer-i-Carbonell (2012), which suggest that some personality characteristics affect the marginal satisfaction of income and the income comparisons. This would be consistent with a reduction in their aspirations due to the unfavorable situation in their reference group and the perception of a low chance of economic improvement. These results represent preliminary evidence about the aspiration failures predicted in the models developed by Ray (2006), Dalton et al., (2015) and Ray and Genicot (2014).

1 Intergenerational income mobility, the role of the reference group.

Abstract

This chapter models the role of reference groups as a mechanism for inequality persistence across generations. Reference group theory suggests that culturally shaped processes alter individuals' ambition. As a result, relative deprivation effects may discourage (encourage) low-background individuals from making adequate mobility-enhancing investments. The model confirms that reference groups could be an inequality transmission mechanism across generations, and demonstrates that both the size and direction of this effect depend on, (a) the composition of the reference group, (b) the intensity and functional form of income comparisons, (c) the ex-ante inequality between agents with different social origins and the reward of effort, and (d) the information about their peers and past income mobility. This model is more general than previous models and its findings are in stark contrast to models based upon self-fulfilling beliefs and fatalistic predictions. Finally, our model explicitly links two fields of literature for the first time, the reference group theory and aspiration failure models.

Keywords: Reference group, prospect theory, intergenerational mobility, aspirations failure.

1.1 Introduction

This chapter proposes a theoretical model to analyze the role of reference groups and the ex-ante inequality in intergenerational mobility. Our modeling exercise consists of finding the conditions under which individuals from lower class origins could be discouraged from making adequate mobility-enhancing investments, while individuals from higher class origins could be more stimulated. The origin of that difference would be the composition and trajectory of the reference groups, the relative effort rewards and the ex-ante inequality.

Mainstream sociological theories have emphasized the role of social status, discriminatory beliefs and related cultural attitudes in the generation of persistent inequality between dynasties. The idea that reference groups play a crucial role in explaining income mobility has a long history in the social sciences but it has received less attention in economics. Reference group theory suggests that culturally shaped processes may affect the ambition of individuals. People define different economic aspirations when their social origins and reference groups are heterogeneous. For example, poorer reference groups may transmit less ambition and taste for economic success to lower-class families than upper-class families with richer reference groups. As a result, social origins and reference groups could reduce individual's aspirations, thus becoming an additional mechanism for the persistence of inequality across generations (Piketty, 2000).

According to mainstream economics, persistence of inequality across generations can be explained by a combination of direct family transmission of productive abilities, endowments and parental investment in their children's human capital. The seminal contributions of Becker and Tomes (1979; 1986) suggest that the intergenerational income correlation depends on various parameters, but the theory does not provide a consensual

view about the magnitude of them (Solon, 1999).[1] Recent research has found that intergenerational earnings elasticity is considerably higher than most previous estimates had suggested. These findings raise new questions about what mechanisms could explain the low intergenerational mobility. Mitnik et al. (2014) use the US General Social Surveys to analyze intergenerational mobility. Their results suggest that the increase in income inequality in the US may account in part for the decline in intergenerational mobility. Chetty et al. (2014) use US administrative records to explore the factors correlated with upward mobility. They found that areas with less residential segregation, less income inequality, better primary schools, greater social capital and family stability have higher intergenerational mobility.

Bourguignon, et al. (2007) suggest that sociocultural inequalities could partly explain inequality persistence and they emphasize that further economic research, both theoretical and empirical, in this area is needed. The seminal paper of Piketty (1998) is a notable exception within economic research.[2] It suggests that status motives amplify disparities between agents with different social origins when the impact on individuals' economic success of social origin is high, compared to the effect of effort and ability. Piketty's model provides a general framework which embeds two sociocultural channels of inequality per-

[1]Until 1992 the empirical evidence showed that the correlations between fathers' and sons' incomes were significantly positive, but quite short, indicating that family background was not a key factor to economic success (Becker and Tomes, 1986; Behrman and Taubman,1990). These findings contrast with Solon (1992; 2002), Zimmerman (1992), Björklund and Jäntti (1997), who suggest that previous studies have underestimated the intergenerational earning elasticity. Furthermore, the empirical literature on sibling correlation in earnings suggests a quite important role of family background and community origins. Solon (1999) argues that these findings suggest that most of the relevant factors about family transmission are uncorrelated with parental income. Chetty et al. (2014) use US administrative records to measure intergenerational mobility. Their estimates show that the intergenerational income elasticities in US is 0.45, but that magnitude is sensitive to alternative specifications. Furthermore, they found that on average a 10 percentile increase in parent income is associated with a 3.4 percentile increase in a child's income. Jäntti and Jenkins (2014) provide a detailed and updated review on the literature on income mobility.

[2]Another important precedent is Borjas (1992), who proposed a model to analyze the link between socioeconomic performance and the external effect of ethnicity through ethnic neighborhoods. On the other hand, Akerlof (1997) models the role of social distance in social decisions, and analyzes the mobility between social positions.

sistence, reference group theory (Boudon, 1974) and the statistical discrimination theory (Bourdieu and Passeron, 1964; 1974). However, the status motives used in Piketty's model provide a better basis for the discrimination theory than for the reference group theory. His utility function does not allow for people caring about their relative position with respect to a reference point. Additionally, Piketty's model does not allow us to explore how individuals react to different compositions of their reference group and to examine the conditions under which reference groups might affect income mobility.

This chapter provides a common framework to explain the role of reference groups on income mobility and to identify the incidence of ex-ante inequalities and reference group composition on effort decisions. Furthermore, it allows us to explore the conditions under which richer reference groups might increase income mobility or else increase inequality persistence.

Our approach incorporates the idea that the agents' objective function considers the self-perceived valuation of their relative position in their reference group. The composition of reference groups defines a reference income level, and agents care about the gap between their income and their reference income. We model rational agents with two different social origins, who choose the level of effort that maximizes their expected utility. Furthermore, they know the relative importance of effort and predetermined factors for achieving economic success. Based on the alternative assumptions of standard and prospect theory, we model the effect of reference group income on effort decisions. To gain a first insight, we first consider a simple scenario where individuals know the composition of their reference group and they also have perfect information about their reference group income (forward-looking agents). In a second exercise, we assume that agents have imperfect information about the expected effort of their reference group and base their choices on *a priori* beliefs about the probability of economic success of different social origins. Beliefs are updated according to Bayes' rule, implying that past mobility

affects the expected income of the current generation. This framework allows us to derive long term effort equilibrium levels and to examine the effect of relative concern on the dynamics of intergenerational mobility.

Furthermore, our model allows us to examine the role of the reference group on effort decision and income mobility in detail. We consider four aspects of reference groups separately. First, the intensity of relative concerns and the implications of standard assumption or prospect theory on effort decisions.[3] Second, the incidence of the composition of reference groups for agents with different social origins. Third, the incidence of the beliefs about the expected effort of peers, and we consider how it could be affected by previous mobility. Fourth we analyze how ex-ante inequality between agents with different social origins affects effort decisions through relative deprivation.

The results that emerge from our model confirm that the reference group affects the inequality of economic success between individuals with different social origins, because of the relative income effect and aspiration conformation. The individual characteristics of relative concern, the composition of reference groups and past mobility trajectories for agents with different social origins may easily generate multiple equilibrium in effort levels. Consequently, even when all agents could be identical in their abilities, their effort levels differ in the long term, which affects long term income mobility. Results suggest that the size and direction of this effect depend on 4 key issues, (a) the composition of the reference group, which is relevant regardless of inheritance patterns; (b) assumptions about the functional form of relative concern being keys issues to answer regarding the effect of reference groups on income mobility, where standard assumption or prospect theory explain situations in which the income mobility would be very different; (c) ex-ante inequality and relative effort rewards; (d) expected effort beliefs and past mobility perceptions.

[3]Rabin (2002) suggests that reference-dependence is used in economics. However, other behavioral findings such as loss aversion or diminishing sensitivity, have received less attention.

Finally, our theoretical model allows us to discuss the implication of reference groups on social welfare. We demonstrate that the reference group effect leads to individual decisions on welfare that are suboptimal. This inefficiency is explained by a "between" social origin effect and a "within" social origin effect, and it is higher the higher the inequality between agents with different social backgrounds is. We show the relevance of informational assumptions to explain the implications of reference group on social optimal decisions.

Five pieces of evidence lead us to think that this model is of some importance. First, empirical evidence suggests the relevance of relative concern regarding human motivations (Frank, 2005) and economic satisfaction (Card et al., 2012). Furthermore, experimental results support the reference-dependent utility suggested by prospect theory (Kanheman and Tversky, 1979). Second, the model could help explain why societies with more equality in income distribution and less polarization show higher intergenerational mobility (Solon, 2002; Mitnik et al., 2014). Third, it allows us to interprete the evidence about heterogeneous aspirations and adaptive preferences hypothesis (Festinger, 1975; Sen 1985a; 1985b; Elster, 1985; Clark, 2009). Fourth, this model could help explain situations of low mobility for certain social groups and contribute to explain why agents with a similar family background and abilities obtain different economic achievements. Fifth, relative earning information is relevant in explaining effort worker decisions (Huet-Vaughn, 2013).

Finally, because the impact of reference groups on income mobility is through the formation of aspirations, this model establishes a first bridge between reference group theory and the aspiration model of Genicot and Ray (2014). People form economic aspirations based on their past experience and their interactions with their reference group (Appadurai, 2004; Genicot and Ray, 2014). Our model is useful for exploring the conditions that lead to aspirations failure. First, a poorer reference group could reduce an agent's economic aspirations and could lead to low effort levels. In this case, agents with low social

origins do not include agents with high social origins in their reference group, which leads to aspirations failure type I (Ray, 2006). Second, under certain circumstances, previous inequality and relative concerns could lead to low aspiration. In this case agents with low social origins include individuals from richer origins in their reference group but the relative costs of effort is too high, and the relative reward too low. As a result they reduce their aspirations and effort level in order to avoid frustration, which Ray (2006) named aspiration failure type II. However, under certain conditions reference groups could reduce inequality of economic success, which is in stark contrast to other models of inequality based upon self-fulfilling beliefs and fatalistic predictions.

The issue of intergenerational mobility is still one of the most controversial issues, both in policy debates and in academic research by social scientists. Piketty (2000) argues that sociocultural inequalities could generate extra inequality persistence, where intergenerational mobility would be inefficiently low. In this context, appropriate corrective policies (or alternative wealth distribution) could raise intergenerational mobility and output at the same time. As a result, these models break with the equality efficiency trade – off, so corrective policies can raise intergenerational mobility and improve efficiency simultaneously. Piketty's conclusions are ambiguous when persistence is explained by reference group theory. In this case policy intervention could be driven solely by distributive justice considerations because individual do not respond to economic incentives. In contrast, Ray (2006) argues that it is perfectly possible for an unequal society to create local attainable incentives among the poorest individuals. Affirmative action and public education may be policy tools that could be used to create higher local connectedness and to affect aspiration conformity. Our model allows us to advance in this discussion. The ability to better understand this phenomenon will increasingly allow researchers to make public policy recommendations based on new theoretical models and new empirical applications.

The rest of this chapter is organized as follows. The next section reviews the micro

foundation of status concern (2.1) and the main theoretical advances in this topic from the Economic perspective (2.2). The third section focuses on the role of income comparisons and their implications in terms of effort decision and income mobility when we assume forward-looking agents. The fourth section considers backward-looking agents under imperfect information and introduces an updating beliefs rule to describe the long term effort equilibrium. Finally we conclude.

1.2 Relative concern from the economic perspective

1.2.1 Microfoundations of relative concern

Postlewaite (1998) and Frank (2005) suggest that evolutionary theory provides a strong argument for an innate concern for relative standing. In this case, agent's relative concern is explained by competition for relative position in their evolutionary past. The evolutionary explanations argue that when agents have achieved relatively high positions in the past, they will have better opportunities in the future. Hopkins (2008) points out that there are at least three different evolutionary explanations. The "rivalry story" (the success of others agents reduces own opportunity), "information story" (the experiences and success of other agents is useful information about potentially profitable activities) and "perception story" (because preferences are incomplete, relative comparison is a fundamental psychological mechanism to evaluate goods, resources, or opportunities).[4]

Finally, aspiration conformation may offer an alternative explanation of relative concern. The anthropologist Appadurai (2004) suggests that aspirations are always formed in interaction and in social life. In other words, individual goals don't exist in social

[4]An alternative explanation would be that relative concern arises from current social arrangements and not have to arise from social preferences and past arrangements. In this case relative concerns do not arise because agents have competitive social preferences, but the nature of economic competition of the institutions lead that individuals make relative comparison. In this case, although agents only care about themselves, relative concern is instrumental to material benefits (Hopkins, 2008).

isolation, they depend on the distribution of income and wealth.

1.2.2 Exploring the role of status in economic literature

Sociologists have a long standing interest in the concept of social status to study social interactions (Weber, 1922). However, this concept has received little attention in economics. Postlewaite (1998) and Weiss and Fershtman (1998) discuss how economics has introduced status. People's ranking could be an argument of the utility function, even if people derive no clear economic benefits from them.[5] Sen (1985; 2000) and Frank (1985; 2005) argue the relevance of status for well-being. People care about their relative performance compared to others, so individuals' self-assessment of their relative position should be considered as an argument of their utility function (Postlewaite,1998; Weiss and Fershtman, 1998).

Social status is the relative position of individuals in a given social group. People could have different status rankings, and it will depend on whom they compare themselves to (and what they are comparing) in the reference group in which each individual is evaluated. The reference group could comprise their friends, work's colleagues or society at large. As a result, when people compare with others they assign different weights to the individuals of their reference group (Weiss and Fershtman, 1998; Clark, 2008; Van Praag and Ferrer-i-Carbonell, 2008; Clark and Senik, 2010). However, the empirical literature regarding the selection process of the reference group is inconclusive. Clark and Senik (2010) suggest that this process seems to be partly endogenous and agent's benchmarks are related to the type of their regular social interactions. However their findings are not consistent with this hypothesis.

[5]One central issue is whether status is a direct argument of the utility function or its relevance is only instrumental. In this chapter we assume that status has intrinsic value and we focus on relative income with respect a reference group. In the second interpretation, status is relevant because it indirectly affects their opportunities and could be interpreted as an investment decision. In this case, status could be analyzed within the traditional economic paradigm, which assumes agents optimizing with stable preferences (Postlewaite,1998).

Because the person's willingness to pay for social status could be very high, this issue is also relevant to understand important aspects of economic behavior. Although, it is difficult to accurately establish the importance of status in economic performance, higher significance would be expected when the markets are thin. Hence, status may act as a social reward or punishment and it could be a corrective mechanism for some market failures such as externalities, transaction cost or monitoring problems. In this case, social status could raise efficiency. However, some approaches emphasize the role of status as an instrument to restrict entry and impose modes of belief. In this case, it becomes a means to maintain the advantages of privileged groups. As a result, status changes agent's behavior and may affect efficiency and allocation of outcome. However, the direction of these effects is not clear (Weiss and Fershtman, 1998, Frank, 2005; Heffetz and Frank, 2011).

1.2.3 Economic modeling of relative income concern

Hopkins (2008) summarizes the main models of relative income concern and distinguished two groups of models. First, the author identifies a set of models which support relative concern based on three foundations: envy, pride or compassion. Second, other groups of studies support relative income concern based on inequality aversion.[6] Because later models do not consider relative care with respect to a reference point, this section focuses on the first groups of models. According to the envy effect, the utility of an agent declines when an increase in the income of people richer than them occurs (namely $\frac{\partial U(.)}{\partial dy} > 0 \, if \, y^{RG} > y$, where $U(.)$ is the utility function, y^{RG} and y are reference group income and agent's income respectively and $y^R = y - y^{RG}$). Duesenberry (1949) argues that poorer individuals are negatively influenced by the income of their richer peers, while the opposite is not

[6] In this case, agents dislike the difference between their income and that the others. The extensive literature on social preferences supports these assumptions. The original model of Fehr and Schmidt (1999) assumes that agents dislike others having more (envy) but low income for others reduces their utility (compassion).

true ($\frac{\partial U(.)}{\partial y^R} > 0 \; if \; y^{RG} > Y, \frac{\partial U(.)}{\partial yR} = 0 \; if \; y^{RG} < y$). However, literature suggests the pride effect (also named competitiveness), which assumes that the utility of an agent decreases with any improvement in others' income ($\frac{\partial U(.)}{\partial y^R} > 0$). Secondly, some authors assume that an agent is better when there is an improvement in the income of those agents below them ("compassion effect"$\frac{\partial U(.)}{\partial yR} < 0 \; if \; y^{RG} < y$).[7]

The expected utility approach for decision-making under uncertainty (prospect theory) developed by Kahneman and Tversky (1979), raises some issues for relative concern modelization. It suggests that welfare depends more on deviations from a reference level than on absolute levels. Negative changes generate a higher impact on utility than gains of equal magnitude (loss aversion), and that preferences could be convex in the loss area (principle of diminishing sensitivity). Finally, this theory suggests that individuals make decisions based on subjective probability assessments. According to Tversky and Kahneman, (1991) reference group income provides a natural reference point for an income comparison. Based on prospect theory assumptions, Genicot and Ray (2014) propose a modelization of aspirations formation. They assume economic aspiration as a reference point, which depends on one's own historical living standard and also on the lifestyle of others. As a result, they suggest a relationship between the formation of aspiration and distribution of income. In this relationship the "aspiration window", which defines the individual's cognitive world, is central (Ray, 2006; Mookherjee, et al., 2010).

In summary, most of the studies assume $\frac{\partial U(.)}{\partial y^R} > 0$ and there is a consensus on the asymmetry in the income comparison with respect to reference income. In general, models assume the standard assumption of diminishing marginal utility of relative income when

[7]There are models that combine these effects on the basis of different functional forms. Some models assume that utility includes a relative component where agents compare their income with the average income of others. These models are called mean-dependence models (Duesenberry,1949; Abel,1990; Boskin and Sheshinski,1978; Clark and Oswald,1996; 1998; Van Praag 2011). Other authors include relative income concern based on rank (Layard,1980; Robson,1992; Clark et al.,2009a; 2009b). Hopkins (2008) demonstrates that mean dependent models are a special case of the Fehr and Schmidt (1999) model, where there is no compassion, and the pride effect is as strong as the envy effect.

$(\frac{\partial^2 U(.)}{\partial^2 y^R} < 0\,)\; y^{RG} < y$. However, there is less agreement on the sign of the second derivative with respect to relative income for those individuals with relative deprivation ($y^{RG} > y.$). Vendrik and Woltjer (2007) argue that the objective function could be convex or concave in relative income, for those agents with negative relative income. On one hand, the standard assumption of diminishing marginal utility of income in neoclassical theory suggests concavity of the objective function in relative income ($\frac{\partial^2 U(.)}{\partial^2 y^R} < 0\, if\, y^{RG} > y$). On the other hand, if relative income concern with respect reference group is based on prospect theory assumptions, it is plausibly to argue that utility function exhibit convexity in relative income, reflecting diminishing marginal sensitivity to larger deviations from the reference group income ($\frac{\partial^2 U(.)}{\partial^2 y^R} > 0\, if\, y^{RG} > y$). These assumptions about relative concern (and their empirical support) allow us to discuss the role of reference group in income mobility.

1.3 A model of effort choice considering reference group

1.3.1 The agent's objective function

In order to discuss how optimal effort decisions are affected by income comparison, an additional argument in an individuals' utility function is included in the standard basic model, the self-perceived valuation of their relative position. Therefore, the objective function of an agent i is given by,

$$U_i(y_i, y_i^R, e_i) = (1-\alpha)y_i - \alpha G(y_i^R) - C(e_i) \tag{1.1}$$

where U_i is the utility function for agent i. Agents enjoy their income (y_i) for consump-

tion reasons, dislike effort e_i because they enjoy leisure (agents perceive that effort is a cost defined by the function $C(e_i) = e_i^2/2a$, with $a > 0$).[8] Agents care about their relative deprivation (RD) which arises from a comparison between their income and that of their reference group, and they dislike unfavorable income comparisons. Function $G(y_i^R)$ is an attempt to formalize the discussion of how reference group income and RD affect an agent's utility, where y_i^R represents the difference between his own income (y_i) and expected reference group income (y_i^{RG}), $y_i^R = y_i - y_i^{RG}$. [9]

For simplicity reasons, first we assume that the utility function is additively separable, and that status motive is a direct argument of the utility function due to its intrinsic value, where $0 < \alpha < 1$ measures the extent to which agents care about it. Following the assumption discussed in section 1.2.3, $G(y_i^R)$ is defined as,

$$G(y_i^R) = \begin{cases} G(y_i^R) = G(y_i^R) > 0;\ G_{y_i^R}(.) < 0;\ G_{y_i^R y_i^R}(.) > 0 & if\ y_i^R < 0 \\ G(y_i^R) = c & if\ y_i^R \geq 0 \end{cases} \tag{1.2}$$

As in previous studies, we assume asymmetry in the income comparison.[10] Function $G(y_i^R)$ incorporates the envy effect and concavity of relative income when $y_i^R < 0$ (Hopkins, 2008). Agents care about having a low gap between their income and their reference group

[8] Because this chapter focuses on the incidence of relative income on effort decision, with the aim of simplifying, it assumes a lineal relationship between absolute income and utility. However, other approaches assume a non-lineal relationship, and they explain the implications in terms of income mobility (Lewis and Ulph, 1998; Antman and McKenzie; 2007; Carter and Barrett; 2006).

[9] We assume a cardinal perspective of relative income concern, a decision based on previous papers. This allows us to build a bridge between relative concern literature and aspiration models. As is noted in Bilancini and Boncinelli (2008), cardinal and ordinal approaches have different implications. Nevertheless, it must be emphasized that assumptions about second and third derivatives of G(.) incorporate ordinal concern (Kolm, 1976a; 1976b).

[10] Other studies have already used this assumption. Stark et al. (2012) used the same assumption to formalize the link between human capital choices and social location choices. Bowles and Park (2005) used it to model the "Veblen effect". Genicot and Ray (2014) also suggest upward looking aspirations formation to describe the relationship between social interaction and aspiration formation. Dalton, et al. (2015) use a similar framework to explain aspiration failure. Dusenberry (1949) postulated and tested the hypothesis that relative income comparisons are asymmetric. Finally, this assumption is supported by Bowles and Park (2005), Stuzter (2004) and Ferrer-i-Carbonell (2005).

income. Furthermore, this function is more general than previous studies because $G(y_i^R) = c$ when $y_i^R \geq 0$, which leaves open the possibility that agent - relative concern is supported by the "pride effect" or the "compassion effect". Note that the asymmetry in the income comparison is also considered in the differences in the derivatives, where $G_{y_i^R}(y_i^R) < 0$ and $G_{y_i^R y_i^R}(y_i^R) > 0$ when $y_i^R < 0$ and $G_{y_i^R}(y_i^R) = 0$ when $y_i^R \geq 0$. Namely the disutility is constant with respect to the relative income when the pride or compassion effect exists, but the marginal utility increases when the envy effect operates. Following both theoretical and empirical literature, this assumption recognized that agents are upward looking when making comparisons and that the envy effect dominates relative comparison. With the aim of simplifying, first we assume that the pride effect on relative concern dominates, as a result $c \leq 0$.

Finally, other studies support relative income concern based on social preferences (Fehr and Schmidt, 1999) [11] As we focus on the reference group effect and social rewards through public beliefs, inequality aversion is not included in the utility function. Furthermore, we assume that agents are risk neutral.

1.3.2 Social origin and expected income

We assume an economy in which agent's income is a random variable and there are two possible income levels, y_0 and y_1 ($0 < y_0 < y_1$ and $\Delta y = y_1 - y_0$). That economy is made up of a continuum of agents $I = [0; 1]$, who can be divided into two social backgrounds, lower class origin (I_L; i.e. whose parents' income level was y_0) and upper class origin (I_U; i.e. whose parents' income level was y_1). The probability that agent i obtains a high income level depends positively on their ability (β), their effort (e_i) and luck (π). Furthermore this probability is conditioned by social origin and it is given by,

[11] Bolton and Ockenfels (2000) provide an alternative model to explain a wide variety of experimental results.

$$\begin{aligned} Pr(y_i = y_1|I_L) &= \pi + \theta\beta e_i \\ Pr(y_i = y_1|I_U) &= \pi + \Delta\pi + \theta\beta e_i \end{aligned} \tag{1.3}$$

where, $Pr(.)$ defines the probability of the event in brackets occurring and $\Delta\pi$ measures previous inequality between agents with different social backgrounds.[12] Meanwhile, $\theta > 0$ is the same for all agents and measures the extent to which higher effort and higher ability can translate into higher probabilities of high income. Because they receive inheritance from previous generations, for the same effort the expected probability of economic success is higher for agents with origin I_U than for those with origins I_L. Agents have perfect information about the parameters that determine the probability of economic success (π, $\Delta\pi$ and θ) (*Assumption A.I*). As a result, the expected income for those with lower class origins and higher class origin is respectively defined as follow,

$$\begin{aligned} E(y_i|I_L) &= (\pi + \theta\beta e_L^b)y_1 + (1 - \pi - \theta\beta e_L^b)y_0 \\ E(y_i|I_U) &= (\pi + \Delta\pi + \theta\beta e_U^b)y_1 + (1 - \pi - \Delta\pi - \theta\beta e_U^b)y_0 \end{aligned} \tag{1.4}$$

We assume that individual effort levels are not publicly observable, everybody expects that agents with lower class origins put effort e_L^b and those with upper class origins put effort e_U^b (*A.II*). Ex-ante agents do not have any information about their ability β_i and they assume the mean β_M of the ability distribution $f(\beta_i)$, with $0 < \beta_i \leq B$ (*A.III*). Following Piketty (1998) we make two natural assumptions. There is an exogenous maximum effort level $\bar{E} > (1 - \alpha)a\theta\beta_M\Delta y$ *(A.IV)*. Furthermore, we assume $\pi + \Delta\pi + \theta B\bar{E} < 1$ *(A.V)* . Finally, we assume that the expected income of agents with higher class origins is

[12]This parameter could explain the inequality of family transmitted human capital and/or inequality of collateral in case of credit constrains (Piketty,1998).

at least equal to the expected income of agents with lower class origins, because $\Delta\pi$, $(\pi + \theta\beta E)y_1 + (1 - \pi - \theta\beta E)y_0 = Max(E(y_i \mid I_L) = E(y_i \mid I_U)$ *(A.VI)*. This assumption implies that the effect of the differential in expected effort on economic success never outweighs the effect of previous inequality.

1.3.3 The reference group income

Now we consider an analytical form to introduce reference groups. The idea is that the composition of reference groups defines a reference income level and agents care about the gap between their income and their reference income. The set of agents $P_i(I_U)+(1-P_i)I_L$ form the reference group of agent i. Each agent i knows his P_i, which is a random variable with the distribution function $F(P_i)$ for all $P_i : 0 \leq P_i \leq 1$.[13] Agent i with social origin I_L compares only with his peers when $P_i = 0$, and he only compares with upper-class agents when $P_i = 1$. As a result, the expected income of the reference group, y^{RG} , is defined as $y^{RG} = P_i(E(y|I_U)) + (1 - P_i)E(y|I_L)$.

The expected relative deprivation depends on the expected income of agents with different backgrounds and on the composition of the reference groups. Consider first the case of agent i with lower-class origin (I_L). The ex-ante expected relative deprivation is defined as,

[13]This assumption is simplistic but it is in agreement with the current empirical findings about the individual's group reference choice. This assumption would be lifted in future research to analyze the role of hereditable reference groups or an endogenous choice of reference group. Falk and Knell (2004) propose a model where the agents optimize their choice between alternative reference standards. However, an economic model of identity such that developed in Akerlof and Kranton (2005) may suggest that the reference group selection is not a rational choice.

$$E(y_i^R \mid I_L) = E(y_i \mid I_L) - E(y_i^{RG}) = \Phi(e_i, e_L^b, e_U^b, P_i)$$

$$\underbrace{P_i}_{Composition} \quad \underbrace{(E(y \mid I_L) - E(y \mid I_U)}_{\substack{Expected\,income\,gap \\ between\,agents\,I_L and\,I_U}} \quad + \quad \underbrace{E(y_i \mid I_L) - E(y \mid I_L)}_{\substack{Expected\,income\,gap \\ of\,agent\,i,\,with\,his\,peers}} \tag{1.5}$$

where $E(y_i \mid I_L)$ is the expected income of agent i, given that he is I_L, and $E(y \mid I_L)$ is the expected income for agent with origin I_L, which was defined in equation 1.3. Relative deprivation is composed by three terms, the width of the reference group (P_i), the expected gap between agents with low and high social origin ($E(y_i \mid I_L) - E(y_i \mid I_U)$, and the expected gap with respect to peer income. Observe that relative deprivation has a random component P and a hereditable component, the expected income conditional to the origin.

On the other hand, we assume that $P = 1$ *(A. VII)* for agents with upper-class origins, which is consistent with the previous literature that income comparisons are not downward-looking.[14] We assume that social comparisons are upwards, which in this model represents the idea that the richest agents only compare with their peers. For agents with origin I_U, the expected relative deprivation is defined as,

$$E(y_i^R \mid I_U) = [E(y_i \mid I_U) - E(y \mid I_U] \qquad (1.5.b)$$

Observe that if $e_U^b < e_L^b$, we arrive at the conclusion that $(E(y_i^R \mid I_L) \leq E(y_i^R \mid I_U)$,

[14]This assumption is not essential. The conclusions of section 1.3.4, which assume forward-looking agents, do not change if we assume that $0 \leq P \leq 1$ for agents with upper-class origins.

namely, regardless of the value of P_i relative deprivation is equal or higher for agents with origin I_L than for agents with origin I_U.

1.3.4 An agent's effort decision process

We assume that agents live for one period, are rational and act to maximize their expected utility based on the parameters of the Economy and their beliefs. Further the decisions are decomposed in a two-step process. First, they identify their reference group income and expected relative deprivation, taking as given their beliefs (this step allows us to find the domain where relative deprivation function $G(y^r)$ works for each agent). In a second step, they maximize expected utility and take their decision.

As a benchmark, consider an agent optimization, where e_L^b and e_U^b are exogenous and agents know their values (each agent takes others' effort as given). Then they know the expected income of their reference group. For an agent i with lower-class origin, the optimization problem is defined as,

$$\begin{cases} Max\, E\left[U_i(y_i, y_i^R, e_i) \mid I_L\right] = (1-\alpha)E\left[y_i \mid I_L\right] - \alpha E\left[(G(y_i^R \mid I_L))\right] - C(e_i) \\ S.a.\, E(y_i^R \mid I_L) = \Phi(e_i, e_L^b, e_U^b, P_i) \end{cases} \tag{1.6}$$

The first order condition is.

$$e_{Leq}(P_i) = \begin{cases} e_{Leq}^* = (1-\alpha)a\theta\beta_M\Delta y & if\, E(y^R \mid I_L) \geq 0 \\ e_{Leq}^{**} = e_{Leq}^* - \alpha a\theta\beta_M\Delta y G_{y^R}(y_{Leq}^R \mid I_L) & if\, E(y^R \mid I_L) < 0 \;\&\; e_{Leq}^{**} < \bar{E} \\ e_{Leq} = \bar{E} & if\, e_{Leq}^{**} \geq \bar{E} \end{cases} \tag{1.7}$$

All agents with the same reference group will choose the same optimal effort. Namely, agents with origin I_L and the same P_i, will choose the same optimal effort, where index i identifies the reference group composition $e_{Leq}(P_i)$. However, agents with the same origin may choose different long term effort levels because they vary with the composition of the reference group. This result deviates from Piketty (1998), where all agents with the same origin arrive to the same long term effort level.

For agents with origin I_U the optimization problem is defined as,

$$\begin{cases} Max\, E\left[U_i(y_i, y_i^R, e_i) \mid I_U)\right] = (1-\alpha)E\left[y_i \mid I_U\right] - \alpha E\left[(G(y_i^R \mid I_U))\right] - C(e_i) \\ S.a.\, E(y_i^R \mid I_U) = \Phi(e_i, e_L^b, e_U^b, P_i) \end{cases} \tag{1.6.b}$$

As a result, the first order condition is:

$$e_{Ueq} = \begin{cases} e_{Ueq}^* = (1-\alpha)a\theta\beta_M\Delta y & if\, e_U^b \leq e_{Ueq}^* \\ e_{Ueq}^{**} = e_{Ueq}^* - \alpha a\theta\beta_M\Delta y G_{y^R}(y_{Ueq}^R \mid I_U) & if\, e_U^b > e_{Ueq}^* \\ e_{Ueq} = \bar{E} & if\, e_{Ueq}^{**} = \bar{E} \end{cases} \tag{1.7.b}$$

The second order condition $\left[-\alpha(\theta\beta_M\Delta y)^2 G_{y^R y^R}(y_{eq}^R \mid I_L) - \frac{1}{a} < 0\right]$ holds because of the convexity of $G(y^R)$ (in accordance with Standard assumptions) and $c(e)$. Hence $e_{Leq}(P_i)$ and e_{Ueq} constitute optimum solutions.

Now we can discuss if relative deprivation generates differences in the effort decisions between agents with different social origins. First, note that when $\alpha = 0$ (i.e. without any relative deprivation), 1.7 and 1.7.b trivially define a unique equilibrium where all agents

make the same effort. When $\alpha \neq 0$, the effort equilibrium depends on e_U^b and e_L^b.

First, there are two extreme cases, (a) if $Max(e_U^b, e_L^b) \leq (1-\alpha)a\theta\beta_M\Delta y)$, then $e_{Ueq} = e_{Leq}$. (b) If $e_U^b \geq \bar{e}_U^b$ and $e_L^b \geq \bar{e}_L^b$, then $e_{Leq} = e_{Ueq} = \bar{E}$. Both results predict the same effort for agents with social origin I_L and agents with social origin I_U. Furthermore, these results are consistent with "self fulfilling belief". In the first case, both for agents with origin I_L and agents with origin I_U, expected efforts are low, and they choose a low effort, in the second case, the expected efforts are high and they choose a high effort. Observe that, although $e_{Leq} = e_{Ueq}$, both scenarios establish that $E(y_i \mid I_L) < E(y_i \mid I_U)$ and $E(y_i^R \mid I_L) \leq E(y_i^R \mid I_U)$.

However, apart from these extreme cases ($Max(e_U^b, e_L^b) > (1-\alpha)(a\theta\beta_M\Delta y)$ and $e_j^b < \bar{e}_j^b$), any inequalities in expected efforts and relative deprivation yield different optimal choices. On one hand, when $e_U^b < e_L^b$ and $P_i \neq 0$, the effort of agents with origin I_L is higher than the effort of agents with origin I_U ($e_{Leq}(P_i) > e_{Ueq}$). Then, the incorporation of relative deprivation increases the optimal level of effort chosen by an agent. This effect generates an upward jump in levels of optimal effort, when $E(y^R \mid I_L) \geq 0$ changes to $E(y^R \mid I_L) < 0$ (Observe that $\alpha \left[G_{y^R}(y^R) < 0\right]$, $G_{y^R y^R}(y^R) > 0$ and then $e_{Leq}^* = e_{Ueq}^* < e_{Ueq}^{**}$). When there is inequality in expected effort ($e_U^b < e_L^b$), the effort of agents with I_L social origin equals the effort of agents with I_U social origin, only when $P_i = 0$. This condition represents a situation where agents with origin I_L only compare with their peers, and their expected effort (and income) is low.

Finally, on the other hand, if $e_U^b > e_L^b$, the differences in effort decisions depend essentially on P_i. There is a P^* such as $\frac{-P^*\Delta\pi}{1-P^*} = \theta\beta_M \left[e_L^b - e_U^b\right]$, which leads to $E(y^R \mid I_L) = E(y^R \mid I_U)$ and $e_{Leq}(P^*) = e_{Ueq}$. However, a more demanding reference group (higher P_i) leads to higher effort of agents with origin I_L, and, $e_{Leq}(P_i) \geqq e_{Ueq}$ when $P_i > P^*$. On the other hand, if P_i is lower than P^*, and agents with origin I_L compare mainly with their

peers, $e_{Leq}(P_i) < e_{Ueq}$ [15].

Forward-looking agents

The previous discussion is the most simple case. First, agents don't internalize ex-ante beliefs when they take effort decisions. Second, the discussion does not consider the interaction between individual effort decisions and the expected effort of peers. An equilibrium is a vector of consistent effort decisions and effort beliefs. To analyzes this case, we assume agents with fully forward-looking behavior, then they anticipate the actions of others when they take effort-decisions (an extreme Cournot - Nash assumption satisfied). As a result, agents have the same public beliefs about their expected income. Furthermore, we assume that agents' decisions are composed of a two-step process. First, they identify their reference group income and expected relative deprivation (this step allows them to find the domain where the relative deprivation function, $G(.)$, works). In a second step, they maximize expected income, taking the reference group income as given and choosing their optimal level of effort.

We observe that, if we assume that ex-ante agents share the public beliefs about their expected income $E(y_i \mid I_J) = E(y \mid I_J)$, then $E(y_i^R \mid I_U) = 0$ and $E(y_i^R \mid I_U) \leq 0$.

First, observe that agents with origin I_U do not expect to face relative deprivation ($E(y_i^R \mid I_U) = 0$). Therefore, for agents with origin I_U, the equilibrium is $e_{Ueq} = (1 - \alpha)a\theta\beta_M\Delta y = e^b_{Ueq}$. Meanwhile, for agents with origin I_L, $E(y_i^R \mid I_U) \leq 0$ and the equilibrium is defined by $e_{Leq}(P_i)$ and $e^b_{Leq} = \int pe_{Leq}(P)dp$. Regardless of e^b_{Leq}, observe that $e_{Leq}(P_i) > e_{Ueq}$ when $P_i \neq 0$ and that $e_{Leq}(0) = e_{Ueq}$. The predictions are consistent with "the self fulfilling belief model" in a particular case, if each agent from lower-class backgrounds compares himself only with agents with the same origin ($P_i = 0$). Namely when agents share public beliefs and assume ex-ante that they belong to a reference

[15] Observe that when $\theta\beta_M \left[e^b_L - e^b_U\right] < \frac{-P_i\Delta\pi}{1-P_i}$, then $E(y^R \mid I_L) < E(y^R \mid I_U))$

group whose members are all I_L, they adopt a behavior that validates their reference group expectations. When the structure of reference groups is heterogeneous, agents with lower-class origins always have incentives to assume strategies to improve their opportunities to achieve a better life.[16]

An additional analytical result stems from differentiating implicitly in Eq. (1.7) to give the individual's effort response to an exogenous change in y^{RG} among agents with relative deprivation ($E(y_i^R \mid I_L) < 0$).

$$de^{**}_{Leq}/dy^{RG} = \frac{\alpha a \theta \beta_M \Delta y G_{y^R y^R}(.)}{1 + \alpha a (\theta \beta_M \Delta y)^2 G_{y^R y^R}(.)} \, if \; E(y_i^R \mid I_L) < 0 \, and \, e^{**}_{Leq} < E \tag{1.8}$$

This expression is always positive, because the denominator in Eq.1.8 is positive (by the second order condition) and the numerator is positive because of the convexity of $G(.)$. The derivative is zero when effort reaches its maximum level ($e^{**}_{Leq} = E$). As a result, for lower-class agents, a richer (or more demanding) reference group provides higher effort incentives. This effect is larger when agents care a lot about their relative position (high α) and when their marginal utility is more sensitive to changes in relative deprivation (high $G_{y^R y^R}(.)$).

Given agent i with lower-class origins, when $P_i \neq 0$, he has high economic incentives to increase the amount of his effort and the effect is stronger when P_i, $\Delta\pi$,Δy, e_U^b and e_L^b are higher. These incentives disappear if $E(y_i \mid I_L) \leq E(y_i^{RG})$, in this case $e^*_{Leq} = (1-\alpha) a \theta \beta_M \Delta y$.

[16]These results depends on the two step decision process, but general predictions do not change if we assume a one-step process. When agents do not share beliefs, for agents with origin I_L the equilibrium is defined by $e_{Leq}(P_i) > (1-\alpha) a \theta \beta_M \Delta y$ if $F(P_i) \neq 0$. Namely, reference group income always motives higher optimal effort of agents with low social origins when there is heterogeneity in the composition of their reference groups. But the composition is still relevant because $de_{Leq}/dP > 0$. Furthermore, if $P_i = 0 \, \forall i \in I_L$, $e_{Leq} = (1-\alpha) a \theta \beta_M \Delta y$.

However, it may seem less intuitive that higher ex-ante inequality ($\Delta\pi$) always motives higher optimal effort. Previous literature found that the source of inequality explains, in part, preferences for income redistribution (Durante et al., 2014; Alesina and Angeletos, 2005). Experimental evidence has shown that agents are willing to punish unfair situations, even at some immediate cost to themselves (Henrich et al., 2010; Fehr and Hoff, 2011). Based on the same argument, it is possible to argue that people could change their perception of the cost of effort because they think that the initial distribution is unfair. In our model, higher $\Delta\pi$ represents the stronger role of inheritance (unfair circumstance?) in the income level, which could decrease motivation, inducing lower effort. In short, the assumptions presented above model the encouragement effect, but do not capture the frustration or complacency effect.

One point worth noting here is that these results depend critically on the assumption about the diminishing marginal sensibility of relative deprivation ($G_{y^R y^R}(.) > 0$). However, evidence from prospect theory suggests that $G_{y^R y^R}(.) < 0$ when $E(y^R) < 0$, which reflects diminishing marginal sensitivity to larger deviations from the reference group income (see section 1.2.3). This assumption is also supported by Kuziemko et al., (2014), who argue that in the presence of last-place aversion, the utility of the agents in the bottom of the income distribution may be convex with respect to relative position. In this case, when $G_{y^R y^R}(.) < 0$ and $\alpha\theta\beta_M\Delta y \left[G_{y^R y^R}(.) < \frac{1}{a}\right]$, in a range of values of y^R, the optimality condition still holds and then $^{de^{**}_{Leq}}/_{dy^{RG}}$ will be negative.[17] In this case, more demanding reference groups lead to lower effort. Both results are predictable. The marginal utility function ($U_{y^R} = \alpha G_{y^R}$) measures how much marginal utility will change in response to a change in the level of relative deprivation (marginal sensitivity). When $G_{y^R y^R}(.) > 0$, higher relative deprivation increases the marginal utility of relative income,

[17]The implication of the expression $\alpha\theta\beta_M\Delta y \left[G_{y^R y^R}(.) < \frac{1}{a}\right]$ is that effort always is perceived as a cost. In other words, an increase of the marginal utility due to a decrease in the relative deprivation is lower than the increase of the marginal cost due to a higher effort.

therefore motivation is higher. When $G_{y^R y^R}(.) < 0$, better relative income increases individual marginal utility, but this increase will be higher when y^R is lower. We have arrived at the following proposition:

Proposition 1. When $E(y^R) < 0$, under additive comparisons and asymmetry in the income comparison:
(i) The relative deprivation effect increases the optimal level of effort chosen by an agent with relative deprivation compared to an agent without relative deprivation ($e^*_{Leq} < e^{**}_{Leq}$).
(ii) When the utility function is concave in relative income ($G_{y^R y^R}(.) > 0$), higher reference income always leads to additional effort ($^{de^{**}_{Leq}}/_{dy^{RG}} > 0 \, with \, e^{**}_{Leq} < \bar{E}$).
(iii) When the utility function is convex in relative income ($G_{y^R y^R}(.) < 0$), higher reference income always leads to lower effort equilibrium level $^{de^{**}_{Leq}}/_{dy^{RG}} < 0 \, with \, \bar{E} > e^{**}_{Leq} > e^*_{Leq}$).

Proof. direct from Eq. 1.8 and the functional form of $G(.)$.

Assumptions about the sign of $G_{y^R y^R}(.)$ reflect the difference between prospect and standard theory, and are central in explaining the effect of reference groups, while allowing us to model both the encouragement effect and the frustration or complacency effect. However, this specification is simplistic because agents have fixed reaction rules when responding to changes in the reference group income.

1.3.5 An extension of the model

In the previous section, the relative component is only considered through relative (income) deprivation. However, reference group theory considers relative deprivation as a

social and psychological experience, in which individuals take the standards of other individuals as a comparative "frame of reference". This defines "the patterns of expectations", but also the perception of "comparable sacrifice" and, in this way, it contributes to explain why attitudes differ among individuals (Merton, 1953; Clark and D'Ambrosio, 2014; Heffetz and Frank, 2011). To address this issue we leave aside the additive comparisons assumption and include a more general function $G(y_i^R, e_i)$, which includes both relative income and relative effort (with respect to relative deprivation). This function incorporates the part of the cost of effort that is cultural and endogenous, where $C(e_i)$ is the part of effort that is exogenous to the relative situation. As a result, this function considers the way in which relative deprivation affects the perception of effort and how effort affects the sensitivity of relative deprivation.[18] In this way, we capture the idea that reference groups establish the "effort norm", which could affect individual motivation [19].

We include the function $G(y_i^R, e_i)$ in the agent's objective function and arrive at,

$$U_i(y_i, y_i^R, e_i) = (1-\alpha)y_i - G(y_i^R, e_i) - C(e_i) \tag{1.9}$$

[18]To make this assumption a little more concrete, consider an example of the function $G(y_i^R, e_i)$, $G(y_i^R, e_i) = g(y_i^R)v(e_i)$, with $g(y_i^R) > 0$, $g`(y_i^R) < 0$, $g``(y_i^R) > 0$ and $v(e_i) > 0$. Note that $v(e)$ is constant and equals 1 in the basic model. By making explicit assumptions about $v(e_i)$, we clarify the exact nature of the tastes required to explain a particular behavior. On the one hand, when effort increases, the marginal utility of relative deprivation in the reference group will decrease. Namely $v'(e_i) < 0$, which implies $G_e(.) > 0$. On the other hand, the sensibility for relative deprivation might decrease with higher effort, if $v'(e_i) > 0$, which implies $G_e(.) < 0$. This function also captures how relative deprivation affects the perception of the cost of effort. For example, perception of the cost of effort could be lower when relative deprivation is low, because agents believe that reference group income is an achievable outcome and they are motivated ($v'(e_i) > 0$). Alternatively, given a high relative deprivation, when effort is very high, agents could perceive that the goal is unattainable, they are discouraged and perceive that effort is less effective (or more costly, $v'(e_i) < 0$). Based on the notions of cognitive dissonance, relative deprivation and social comparison, Festinger (1957) argues that individuals compare their own input-to-output ratio with respect to a reference level. According to equity theory, if the comparison is perceived as "unfair", the individual may be motivated to change his behavior and restore his cognitive perception of equality (Adams, 1965).

[19]Kandel and Lazear (1992) or Akerlof and Kranton (2005), incorporate the notion of social norms and analyze how it affects work incentives.

Following the previous sections $G(y_i^R, e_i)$ is decreasing and convex in its first argument. However, in the second argument the situation is more flexible, and its functional form allows us to model different individual responses and include some convex parts of function $G(.)$.

$$G(y_i^R) = \begin{cases} G(y_i^R, e_i) = G(.) > 0;\ G_{y_i^R}(.) < 0;\ G_{y_i^R y_i^R}(.) > 0 & if\ y_i^R < 0 \\ G(y_i^R) = c & if\ y_i^R \geq 0 \end{cases} \tag{1.10}$$

When we assume forward-looking agents and consider Eq. 1.9 in the optimization problem defined in Eq. 1.6 and 1.6.b, we can derive a new optimal effort conditions of agents with origin I_L and I_U.

$$e_{Leq}(P_i) = \begin{cases} e^*_{Leq} = (1-\alpha)a\theta\beta_M\Delta y & if\ E(y^R \mid I_L) \geq 0 \\ e^{**}_{Leq} = e^*_{Leq} - \alpha a\theta\beta_M\Delta y G_{y^R}(.) - a\alpha\left[G_e(.)\right] & if\ E(y^R \mid I_L) < 0\ \&\ e^{**}_{Leq} < \bar{E} \\ e_{Leq} = E & if\ e^{**}_{Leq} \geq \bar{E} \end{cases} \tag{1.11}$$

$$e^*_{Ueq} = (1-\alpha)a\theta\beta_M\Delta y \tag{1.11.b}$$

We assume that the problem has an optimal solution and the following second order

conditions always hold,

$$-\alpha G_{ee}(.) - 2\alpha\theta\beta_M \Delta \mathrm{y} G_{y^R e}(y_i^R, e_i) < \frac{1}{a} + \alpha\theta^2\beta_M^2 \Delta y^2 G_{y^R y^R}(y_i^R, e_i) \tag{1.12}$$

As a result, $e_{Leq}(P_i)$ and e_{Ueq} constitute optimum solutions. The FOC remains unchanged for agents with lower reference group income, when $E(y^R \mid I_L) \geq 0$ "relative deprivation" has no effect on optimal effort level. However, this condition changes when $E(y^R \mid I_L) < 0$. If we only focus on interior solutions, an agent with origin I_L will choose the level of effort e^{**}_{Leq}. In this case, the sign of $G_{e_i}(.)$ characterizes the agent's response to reference group income and relative deprivation. The next proposition summarizes three types of individuals' situations.

Proposition 2. When $E(y^R) < 0$, under non additive comparisons and asymmetry in the income comparison, we arrive:

Positional self - encouraged agent, when $G_e(.) < 0$ (Condition I), relative deprivation increases the optimal level of effort chosen by an agent with relative deprivation compared to the level chosen by an agent without relative deprivation (with $e^{**}_{Leq} \leq \bar{E}$).

Positional stimulated agent, when $G_e(.) > 0$ and $G_e(.) < -\theta\beta_M \Delta y G_{y^R}(.)$ (Condition II), relative deprivation increases the optimal level of effort chosen by an agent with relative deprivation compared to the level chosen by an agent without relative deprivation (with $e^{**}_{Leq} \leq \bar{E}$).

Positional discouraged agent, when $G_e(.) > 0$ and $G_e(.) > -\theta\beta_M \Delta y G_{y^R}(.)$

(conditions III), relative deprivation decreases the optimal level of effort chosen by an agent compared to the level chosen by an identical agent without relative deprivation (with $e^{**}_{Leq} \leq \bar{E}$).

Proof. direct from equations 1.11 and the functional form of $G(y_i^R, e_i)$.

When $G_e(.) < 0$, the equilibrium effort level e^*_{Leq} is always lower than e^{**}_{Leq}. Under condition I, given the same level of effort, agents with relative deprivation perceive a lower cost for additional relative effort and, therefore, they make a higher effort. In this case, function $G_e(.)$ can be interpreted as implying that agents get utility from relative effort. As such, it is not surprising that more effort is the outcome (self-motivated effect).[20]

Meanwhile, when $G_e(.) > 0$, the reasoning is somewhat different, because relative effort is always a cost. Namely, given an expected income gap with respect to a reference group, relative deprivation generates lower utility among those agents who have made a greater effort. However, if $G_e(.) < -\theta\beta_M \Delta y G_{y^R}(.)$ the higher disutility of high relative effort is compensated by a lower relative income gap. In this case, high relative deprivation increases marginal utility and it mitigates the additional marginal cost of effort. Therefore, the encouragement effect dominates because there is high opportunity for income mobility ("relative effort pays" because $\theta\beta_M \Delta y$ is high). However, if $G_e(.) > -\theta\beta_M \Delta y G_{y^R}(.)$, then e^*_{Leq} is higher than e^{**}_{Leq}. In this case, when agents suffer high relative deprivation, they perceive a higher cost for additional relative effort. Therefore, the marginal utility of a reduction in relative deprivation is lower than the marginal disutility of a higher effort in the relative component. The reduction of relative deprivation is more demanding in terms of effort and agents are discouraged.

We can now consider the effects of an exogenous increase in reference group income

[20]Kandel and Lazear (1992) use a similar argument to explore how peer pressure operates on worker effort. They suggest that the peer pressure function can be interpreted as implying that workers get utility from effort.

among agents who care about their relative deprivation ($E(y^R < 0)$). By differentiating the individual's first order condition for the choice of effort we find the following expression,

$$de^{**}_{Ueq}/dy^{RG} = \frac{\alpha a \left[\theta \beta_M \Delta y G_{y^R y^R}(.) + G_{y^R e}(.)\right]}{1 + \alpha a G_{ee}(.) + \alpha a (\theta \beta_M \Delta y)^2 G_{y^R y^R}(.) + 2\alpha a \theta \beta_M \Delta y G_{y^R e}(.)} \tag{1.13}$$

The expression in the numerator of Eq. 1.13 determines the sign of de^{**}_{Ueq}/dy^{RG}(the denominator is positive due to the second order condition). First, note that $G_{y^R y^R}(.)$ is positive, therefore, the sign of this expression depends on the sign of $G_{y^R e}(.)$. What can we say about the sign of $G_{y^R e}(.)$?. When the inverse of effort and relative income are complements in the relative deprivation term, the sign of $G_{y^R e}(.)$ is positive.[21] Under this condition, a higher income gap leads to higher effort. If they are not complements, the sign of de^{**}_{Ueq}/dy^{RG} is ambiguous, and it depends on the magnitude of $\theta \beta_M \Delta y G_{y^R y^R}(.)$, namely, the sign depends on relative rewards and ex-ante inequality. We can express these ideas in more formal way:

[21] These ideas are used in Bowles and Parker (2005) to discuss the importance of the "Veblen effect" in the individual's allocation of time between labor and leisure. Dalton, et al. (2015) assume a similar assumption to incorporate income aspiration on the utility function.

Proposition 3. When $E(y_i \leq y^{RG})$, under non additive comparisons and asymmetry in the income comparison:

Income gap self - encouraged agent, when $G_{y^R e}(.) > 0$ (Condition IV), higher reference income always leads to additional effort ($^{de^{**}_{Leq}}/_{dy^{RG}} > 0$ with $e^{**}_{Leq} \leq \bar{E}$).

Income gap - stimulated agent, when, $G_{y^R e}(.) < 0$ and $\theta\beta_M \Delta y G_{y^R y^R}(.) > -G_{y^R e}(.)$ (Condition V), higher reference income always leads to additional effort ($^{de^{**}_{Leq}}/_{dy^{RG}} > 0$ with $e^{**}_{Leq} \leq \bar{E}$).

Income gap - discouraged agent, when, $G_{y^R e}(.) < 0$ and $\theta\beta_M \Delta y G_{y^R y^R}(.) < -G_{y^R e}(.)$ (Condition VI), higher reference income always leads to lower effort ($^{de^{**}_{Leq}}/_{dy^{RG}} < 0$ with $0 \leq e^{**}_{Leq} \leq \bar{E}$).

Indifferent agents, when $G_{y^R e}(.) < 0$ and $\theta\beta_M \Delta y G_{y^R y^R}(.) = -G_{y^R e}(.)$ (Condition VII), individuals do not respond to changes in reference group income ($^{de^{**}_{Ueq}}/_{dy^{RG}} = 0$).

Firstly, we observe that the reference group composition is relevant in explaining effort levels. The relationship between effort and P depends on whether leisure and relative income are complements. Furthermore, the intensity of the relative deprivation effect on effort decisions is higher when expected differences between individuals with different social origins are higher.[22]

Secondly, conditions IV or V establish a positive relation between effort and reference income, but there is a difference between them. In the former, higher reference group income decreases the marginal cost of relative effort (relative effort generates utility). As

[22]Note that differentiating the individual's first order condition for the choice of effort with respect P we find the following expression, $^{de^{**}_{Ueq}}/_{dP} = \frac{-\alpha a \Delta y (e^b_L - e^b_U - \Delta\pi)\left[\theta\beta_M \Delta y G_{y^R y^R}(.) + G_{y^R e}(.)\right]}{1 + \alpha a G_{ee}(.) + \alpha a (\theta\beta_M \Delta y)^2 G_{y^R y^R}(.) + 2\alpha a \theta \beta_M \Delta y G_{y^R e}(.)}$. Observe that $-\alpha a \Delta y (e^b_L - e^b_U - \Delta\pi) > 0$.

a result, higher reference group income can increase effort levels through two channels, the higher marginal utility of relative income and the lower marginal cost of relative effort. In the second case, higher relative deprivation induces a higher marginal cost of relative effort (relative effort represents a cost). However, this effect is dominated by the higher marginal utility of the relative income gap. On the contrary, condition VI establishes a negative relation between effort and reference group income ($^{de^{**}_{Ueq}}/_{dy^{RG}} < 0$). In this case, higher relative deprivation increases the marginal utility of $G(.)$, but this effect is dominated by an increase in the marginal disutility of relative effort, causing a reduction in effort levels. As a result, a higher relative income reduces the effort levels.

Thirdly, under conditions V and VI, relative effort represents a cost, in accordance with standard economic models, but agents' effort responses are ambiguous. In this case, the parameters of economic inequality are more relevant in explaining agents' effort responses. Therefore, when returns of effort and ability (θ), expected ability (β), and income premium are higher ($\triangle y$), the feasibility income gap - discouraged agent is lower. We will discuss this issue in the next section.

The role of effort rewards and ex-ante inequality on relative deprivation and attitude toward effort

If we assume that relative effort represents a cost ($G_e(.) > 0$), we are able to examine how the magnitude of effort rewards encourages (or discourages) agents. Observe that condition VI defines the locus where individuals face relative deprivation, but they do not respond to a change in reference group income ($^{de^{**}_{Ueq}}/_{dy^{RG}} = 0$). An interesting analytical result stems from differentiating condition VI with respect to θ.[23] This allows us to identify the region of "indifferent agents", and thus the regions of stimulates and discouraged agents.

The locus which defines "indifferent agents" depends essentially on the sign of $G_{y^R y^R y^R}(.)$.

[23]To simplify, we assume that G_{ey^R} is constant and $e^b_{Ueq} < e^b_{Leq}$.

When $G_{y^R y^R y^R}(.) < 0$ (Principle of diminishing transfers), there is a function $f(G(.), \theta, e_{Leq}, \triangle\pi) : \tilde{\theta}(\theta) = d\theta G_{y^R y^R y^R}(.) = -\theta G_{y^R y^R}(.)^{dy^R}/_{d\theta}$, which defines the condition that must be met for ${}^{de^{**}_{Ueq}}/_{dy^{RG}} = 0$ for alternatives values of parameter θ.[24] Therefore, given $G(.)$ and $\triangle\pi$, ${}^{de^{**}_{Ueq}}/_{dy^{RG}} < 0$ if $\theta^{Low} < \tilde{\theta}(\theta)$ and ${}^{de^{**}_{Ueq}}/_{dy^{RG}} > 0$ if $\theta^{high} > \tilde{\theta}(\theta)$. Observe that there is no monotonous relationship between the sign of ${}^{de^{**}_{Ueq}}/_{dy^{RG}}$ and θ. How agents respond to an increase in θ depends on $G_{y^R y^R y^R}(.)$ and $G_{y^R y^R}(.)$. The increase of θ has a direct positive effect on effort, because it improves expected relative deprivation (${}^{dy^R}/_{d\theta} > 0$). However higher relative income decreases the sensibility of the marginal utility of relative deprivation ($\downarrow G_{y^R y^R}(.)$ because $G_{y^R y^R y^R}(.) < 0$), which reduces the incentive to increase effort (utility gains are higher when $y^R$is low). Given these effects in opposite directions, it is ambiguous how individuals respond to higher θ (See Figure 2.1 in the section 1.A).

However, this ambiguity disappears when $G_{y^R y^R y^R}(.) > 0$, because function $\tilde{\theta}(\theta)$ does not exist. In this case, given the function $G(.)$ and $\Delta\pi$, only one value of θ, $\tilde{\theta}$, meets (${}^{de^{**}_{Ueq}}/_{dy^{RG}} = 0$). Therefore, regardless of the functional form of $G_{y^R y^R}(.)$ and $G_{y^R y^R y^R}(.)$, ${}^{de^{**}_{Ueq}}/_{dy^{RG}} < 0$ if $\theta < \tilde{\theta}$ and ${}^{de^{**}_{Ueq}}/_{dy^{RG}} > 0$ if $\theta > \tilde{\theta}$. In this case, an increase of θ increases expected relative deprivation and the sensibility of marginal utility of relative deprivation. Both effects play in the same direction, and effort will increase.

In the latter case, it is useful to examine the relationship between θ and $\Delta\pi$ (effort rewards and ex-ante inequality rewards) when ${}^{de^{**}_{Ueq}}/_{dy^{RG}} = 0$. There is a function $f(G(.), \theta, e_{Leq}, \triangle\pi) : \tilde{f}(\theta, \triangle\pi)$, which defines the set of all values of θ and $\triangle\pi$ where individuals do not respond to changes in reference group incomes. Given previous assumptions, we can conclude that $\frac{\tilde{f}_\theta(\theta,\triangle\pi)}{\tilde{f}_{\triangle\pi}(\theta,\triangle\pi)} > 0$. In this case, higher θ generates incentives

[24] Under the Principle of diminishing transfers, given two identical individuals, i and j, who only differ in their expected absolute income level ($E(y_i < y_j)$, the same reduction in the relative income gap, generates a higher increase in an individual's utility for i than for j. Namely, the same reduction in relative deprivation causes a higher increase in utility when an individual earns 1000, than when he earns 10000. This principle is not true when $G_{y^R y^R y^R}(.) > 0$ (Kolm, 1976a;1976b).

to increase effort, which can be compensated with a higher $\triangle\pi$. To make this result a little more concrete, assume two economies A and B, with $\tilde{f_A}(\theta_A, \triangle\pi_A) = \tilde{f_B}(\theta_B, \triangle\pi_B)$, but the former presents higher ex-ante inequality ($\triangle\pi_A > \triangle\pi_B$). In order for there to be a stimulated income gap effect on effort decisions, economy A will require higher effort reward levels θ such $\theta > \theta_A > \theta_B$ (See Figure 1.A.2 in the section 1.A). The proof of these results is presented in section 1.A, where we also demonstrate that the sign of $\frac{\tilde{f}_\theta(\theta,\triangle\pi)}{\tilde{f}_{\triangle\pi}(\theta,\triangle\pi)}$ is indeterminate when $G_{y^R y^R y^R}(.) < 0$.

1.3.6 An analysis of efficiency and income mobility

It is useful to consider the properties of an equilibrium in which many effort decision-makers act as in the presented model. Economic outcomes are then appropriately thought of as a Cournot-Nash equilibrium, so each agent takes others' choices as given. Assume a continuum of agents with origin I_L, differentiated by the composition of reference group (P_i). We retain the assumption A.VII *1.3.3* ($P_i = 1$ for the agents with origin I_U) and, to simplify, henceforth we assume $e_U^b \leq (1-\alpha)a\theta\beta_M\Delta y$ (A.VIII) and therefore, for agents with upper-class social origins $E(y^R \mid I_U) \geq 0$. As the expected income of agents with I_U affects the utility of agents with origin I_L, but the inverse is not true, the former could be interpreted as leaders and the latter as followers (Clark and Oswald, 1998). Under these conditions, the expected social welfare is given by,

$$\begin{gathered} W = E(U \mid I_U) + n \int E(U \mid I_L) = \\ (1-\alpha)\Delta y(\theta\beta_M e_U + \Delta\pi + \pi) - \tfrac{e_U^2}{2a} + \\ n \int \left[(1-\alpha)\Delta y(\theta\beta_M e_L(P) + \Delta\pi + \pi) - \alpha G(y^R(P), e_L(P)) - \tfrac{e_L(P)^2}{2a}\right] dp \end{gathered} \tag{1.14}$$

where the number of agents with origin I_U was normalized to unity, and $n > 0$ represents

the number of agents $I_L$for each agent with origin I_U. Under perfect information the expected effort is $e^b_{Ueq} = e_{Ueq}$ and $e^b_{Leq} = \int pe_{Leq}(P)dp$.

For society to be at an optimum,

$$e_{Ueq\,opt} = [(1-\alpha)\theta\beta_M\Delta y - \lambda_1]\,a \tag{1.15}$$

$$e_{Leq\,opt}(P) = a\left[(1-\alpha)\theta\beta_M\Delta y - \alpha\theta\beta_M\Delta y G_{y^R}(y^R(P), e_L(P)) - \alpha G_e(y^R(P), e_L(P)) - \frac{\lambda_2}{s}\right] \tag{1.16}$$

$$\lambda_1 = -s\int\left[f(P)(1-P)\alpha\theta\beta_M\Delta y G_{y^R}(y^R(P), e_L(P))dp\right] \tag{1.17}$$

$$\lambda_2 = -s\int\left[f(P)P\alpha\theta\beta_M\Delta y G_{y^R}(y^R(P), e_L(P))dp\right] \tag{1.18}$$

$$\int pe_{Ueq\,opt}(P))dp - e^b_{Ueq\,opt} = 0 \tag{1.19}$$

$$\int pe_{Leq\,opt}(P))dp - e^{b}_{Leq\,opt} = 0 \tag{1.20}$$

where λ_1 and λ_2 are the multipliers on constrains (1.19) and (1.20) respectively. Therefore, if we compare equations 1.16 and 1.15 with the previous equations 1.7 and 1.7.b for private effort choices, the expected equilibrium is not optimal. Due to the concavity of (1.14) and due to λ_1 and λ_2 being positive (from Eq. 1.17 and 1.18), socially expected desirable levels of effort are below those which agents make individually. This is because effort decisions affect the relative deprivation of others and because of the well-known 'rat-race' effect induced by the status motive. Because agents ignore the externalities that their decisions generate, the equilibrium based on individual decisions will be sub-optimal. This result is in accordance with the findings of economic models in which individual utility depends on relative situation (Clark and Oswald, 1998; Piketty, 1998; Frank,1997; 2005). However, these derivations allow us to distinguish two possible sources of externalities. On one hand, Eq. 1.15 demonstrates that the effort of agents with origin I_U (leaders) generates a negative externality on the decisions of agents with origin I_L(followers). Furthermore, this externality "between" social origins, will be higher when $\Delta\pi$ is higher. As a result, regardless of the effort decisions of agents with origin I_L, a lower ex-ante inequality reduces expected inefficiency [25]. On the other hand, there is a "within externality", which comes from the effort decisions of the peer with origin I_L. Finally, note that the source of inefficiency is that agents make too much effort. Obviously inefficiency will be lower when unstimulated effect plays a role, but in this case, the expected upward

[25]Observe that equilibrium based on individual decisions will be optimum when $P_i = 0$. But in this case, effort decisions reduce income mobility. Furthermore, aggregate inefficiency will be higher when more agents with origin I_L present high reference income ($F(P_i)' > 0$).

mobility will be lower for agents with origin I_L.

1.4 A model of effort choice with reference group and intertemporal learning

The results of the previous section could be interpreted as a benchmark, which considers a situation in which there is perfect information (expected effort is known, constant and exogenous) or fully forward-looking agents. Now we assume that agents with origin I_L do no know the effort of the peers of their generation and they choose their effort based on their beliefs (e_L^{b}). Each generation updates their beliefs with respect to the previous generations' beliefs by trial and error methods using local knowledge based on their peers' past experience. Beliefs are updated by a backward-looking learning process, that is, in light of the recent experience of peers with the same social origin from a previous generation. This establishes a connection between expected effort and performance in terms of the income mobility of a previous generation. Bowles (2004) argues that the backward-looking learning approach has advantages when compared to the forward-looking learning process.[26] We assume that agents incorporate information of the economic performance of the previous generation when they update their *a priori* public beliefs, which are transmitted from previous generations.[27] Finally, this learning process seems useful to explain the formation of aspirations based on social interactions, where individual economic aspiration is conditioned by the experiences of other agents in their cognitive neighborhood (Appadurai, 2004, Genicot and Ray, 2014).

[26] Bowles (2004) considers backward-looking learning process inside evolutionary game theory. In contrast to the forward-looking agents in classical game theory, this approach addresses the history of the agents.

[27] Other papers have used this learning procedure and they place an emphasis on the information transmission between generations and the significance of past trajectories in order to explain heterogeneous beliefs equilibrium. Piketty (1995) used Bayesian learning to update the belief about the parameters of the economy, Piketty (1998) to explain the public beliefs about status, and Breen and García-Peñalosa (2002) to describe the difference in preferences across genders.

In this section we focused on agents with a low social background as the best case study. The assumptions of the previous section establish a dynamic leader-follower between agents with origin I_L and agents with origin I_U. Therefore, in order to analyze the role of the reference group as a determinant of income inequality persistence, we can retain assumption A.VIII ($\overline{e}_U^b \leq (1-\alpha)a\theta\beta_M\Delta y$ and is exogenous) because agents with origin I_L can't affect the effort decision of agents from I_U. This implies that the optimal effort of agents with origin I_U is $e_{Ueq} = (1-\alpha)a\theta\beta_M\Delta y$, which represents a benchmark for agents with origin I_L. In the remainder of this section, we focus on agents with origin I_L (for notational simplicity we omit the social origin sub-index L and U for the rest of this section).

1.4.1 The information structure

We assume that agents are uncertain about the real effort of their peers when they choose their effort level. Each agent takes others' effort as given within the same period, but they update their beliefs about e^b between generations. Informational assumptions A.I, A.II and A.III from section 1.3 remain the same. Individual effort levels are not publicly observable, but agents know that they are between a certain "high effort level" ($\overline{e} \leq \bar{E}$) and a certain low effort level" ($\underline{e} \geq 0$), with ($\overline{e} \geq \underline{e}$) (A.IX). The current generation know the social mobility experienced by the previous generation which represents a signal of their effort levels (A.X). Public beliefs about effort are transmitted across generations, therefore generation $t+1^{th}$ has *a priori* information based on the real beliefs of generation t^{th} (A.XI).

Given assumption A.IX, the expected effort for their peers in generation t^{th} is defined as,

$$e_t^b = \mu_t \overline{e} + (1 - \mu_t)\underline{e} \tag{1.21}$$

where μ_t is the public belief of generation t about the participation of high effort agents among economically successful agents from the previous generation with origin I_L.This parameter could be interpreted as the subjective probability attached by the entire generation that $\overline{e}$ was the effort of agents with origin I_L (prospect theory suggests that agents weigh their options based on the subjective distribution function).

For each agent with origin I_L there is a latent variable which describes the relation between economic success and effort, which is defined in equation (1.3) as $Y'_{it} = \pi + \theta\beta e_{it}$. An agent i from generation t does not observe e_{it}, but he knows the individual social mobility trajectories (y_1 or y_0) of all agents from generation $t - 1^{th}$(A.X). For this reason, for the belief of generation $t + 1$, the mobility outcome of agents I_L from generation t represents a signal about the effort of agents with origin I_L.

It is useful to consider that the economic performance is stochastically related to effort, incorporating a random variable v_{it}. Therefore, the expected probability that n agents with origin I_L from generation t reach y_1 is defined as,

$$E(Pr(y_{1t} = y_1, y_{2t} = y_1, ...y_{nt} = y_1 \mid i = 1...n \in I_L)) = \prod_{\forall i \in I} (\pi + \theta\beta_M e_{it} + v_{it}) \tag{1.22}$$

where v_{it} represents an idiosyncratic shock (which reflects income realization) for each generation t and agent i , with $E(v_{it}) = 0$ and $0 \leq \pi + \theta\beta e_{it} + v_{it} \leq 1$, for $0 \leq e_{it} \leq E$. Taking x_t as the real share of successful agents with origin I_L from generation t, agents

can derive the probability of the signal $x_t = x'_t$, conditional on the state being v'_t,

$$Pr(x_t = x') = \Omega(\varepsilon'_t, \nu'_t \mid \nu'_t) = \alpha(e_{M_t}(\varepsilon'_t), \nu'_t \mid \nu'_t) \tag{1.23}$$

where ε_t and ν_t are vectors of n dimensions, which respectively reflect individual efforts in t $(e_{1t}, e_{2t}.., e_{nt})$ and n random variables $(v_{1t}, v_{2t}.., v_{nt})$, and ε'_t and ν'_t are particular realizations of both vectors. For notational simplicity, we introduce the function $\alpha(.)$, whose argument is the mean effort of agents with origin I_L in t (e_{M_t}), which is a linear function of each element in the vector ε_t. As agents know π, θ, β_M, Δy and Δy, given e_{M_t} they know the distribution of signals (A.I, A.II and A.IX), which describes the expected share of successful agents with origin I_L from generation t, conditional on the state v'_t.

1.4.2 Intergenerational learning

Agents with origin I_L from generation $t+1$ know the real percentage of economically successful agents with origin I_L in the previous period (x_t), but they do not observe which of them made a high effort (A.X). Accordinto to assumption A.XI the previous generation transmitted their beliefs, therefore the current generation have *a priori* beliefs $e_{t+1}^{apriori}$ about $e_{M_{t+1}}$, which is defined as, $e_{t+1}^{apriori} = e_t^b = \mu_t \overline{e} + (1 - \mu_t)\underline{e}$ (Note $\mu_{t+1}^{apriori} = \mu_t$). Each generation $t+1$ observes a signal x'_t, which is received from the previous generation. Since mobility performance is only stochastically related to effort, "evaluation errors may occur". If $x`_t \neq \alpha(e_t^{apriori}, \nu'_t \mid \nu'_t)$ there is an error in *a priori* beliefs. As a result, even if agents do not know the latent variable Y_t', based on the signals x'_t generation $t+1$ could update their *a priori* beliefs about the effort of their peers (and their effectiveness for economic success) according to Bayes' rule.

Observe that the importance of those errors depends on the correlation between e_{it}

and v_{it}. On one hand, when $\overline{\sigma} = Corr(e_{it}, v_{it}) > 0$ the shock does not "redistribute" economically successful agents between low and high effort agents. As a result, the "effort pays" and high effort agents dominate between successful agents. On the other hand, an alternative hypothesis is that $\underline{\sigma} = Corr(e_{it}, v_{it}) < 0$, in which case the shock "redistributes agents", namely some agents with low effort achieve economic success. In this second case, although effort has a positive impact on the probability of high income, the effort reward is relatively lower compared to the first case. As a result, the proportion of low effort level is relatively high among economically successful agents, and then e_t^b (and μ_t) should be lower. Observe that the sign of this correlation represents two states of the world.[28]

The distribution function of signals depends on the real state of the world. The probability that the public signal x'_t is realized conditional on the state being $\overline{\sigma}$ or $\underline{\sigma}$ is defined as,

$$Pr(x_t = x') = \alpha(e_{M_t}(\varepsilon'_t), \nu'_t \mid \overline{\sigma}, h_{t-1}) = \overline{\alpha}(e_{M_t}(\varepsilon'_t), \nu'_t \mid h_{t-1}) \tag{1.24}$$

$$Pr(x_t = x') = \alpha(e_{M_t}(\varepsilon'_t), \nu'_t \mid \underline{\sigma}, h_{t-1}) = \underline{\alpha}(e_{M_t}(\varepsilon'_t), \nu'_t \mid h_{t-1}) \qquad (1.24b)$$

where h_{t-1} describe the decisions history of all agents I_L from previous generations $(t-1, t-2, ...)$.

As $\mu_{t+1}^{apriori}$ is an *a priori* probability (subjective weight) assigned to high effort $\overline{e}$, it also represents the subjective probability attached by a generation $t+1$ that $\overline{\sigma}$ is the true state

[28] Correlation could be interpreted as an expression of the heterogeneous capacity of the agents to respond to different shocks, given their effort.

of the world. Following Piketty (1995, 1998) and Breen and García-Peñalosa (2002), we assume that intergenerational learning takes the form of Bayesian updating, with beliefs being updated by the current generation from the previous generations. An individual from generation $t+1^{th}$ uses mobility results to update their *a priori* beliefs.

The sequence of events is as follows. The agents with origin I_L from generation t base their effort decisions on their beliefs about the expected effort of their peer in the current generation (e_t^b). They choose their effort levels and, after the realization of ν_t, they obtain y_0 or y_1(they generate the public signal x_t'). The belief of generation t (e_t^b) is inherited by the next generation ($e_{t+1}^{apriori} = e_t^b$ and $\mu_{t+1}^{apriori} = \mu_t$). The updated belief of generation $t+1$ (e_{t+1}^b) combines that *a priori* information with the mobility outcome of generation t. After the output of mobility income of generation t is realized, the next generation updates their *a priori* beliefs and they choose their effort level based on their updated beliefs. Bayesian learning implies that the outcomes of the previous generation are interpreted in the light of the *a priori* beliefs. As a result, an effort belief (e_{t+1}^b) combines *a priori* information transmitted from previous generations e_t^b and information about the mobility experienced by the previous generation x_t'. The posterior beliefs of the following generation which observe the signal x_t' is given by Bayes' rule,

$$\mu_{t+1} = \frac{Pr(\bar{\sigma} \cap x_t' | h_{t-1})}{Pr(x_t' | h_{t-1})} = \frac{Pr(\bar{\sigma}|h_{t-1}).Pr(x_t = x_t'|\bar{\sigma}, h_{t-1})}{Pr(\bar{\sigma}|h_{t-1})Pr(x_t = x_t'|\bar{\sigma}, h_{t-1}) + (1 - Pr(\bar{\sigma}|h_{t-1}))Pr(x_t = x_t'|\underline{\sigma}, h_{t-1})}$$
$$\frac{\mu_t Pr(x_t = x_t'|\bar{\sigma}, h_t)}{\mu_t Pr(x_t = x_t'|\bar{\sigma}, h_{t-1}) + (1 - \mu_t)Pr(x_t = x_t'|\underline{\sigma}, h_{t-1})} \tag{1.25}$$

where the *a priori* belief $\mu_{t+1}^{apriori}$ is equal to μ_t, and the terms $Pr(x_t = x_t' \mid \bar{\sigma}, h_{t-1})$ represent the conditional probability of the public signals x_t' given that h_{t-1} occurs and that the true state is $\overline{\sigma}$. These probabilities were defined when we introduced the distribution function of signals (Eq. (1.24) and (1.24).b). Agents know the functions of

the distribution of signals, so, by replacing them in Eq.(1.25) we arrive at the following expression,

$$\mu_{t+1} = \frac{\mu_t \overline{\alpha}(e_t^b, \nu_t' \mid h_{t-1})}{\mu_t \overline{\alpha}(e_t^b, \nu_t' \mid h_{t-1}) + (1-\mu_t)\underline{\alpha}(e_t^b, \nu_t' \mid h_{t-1})} (1.25b)$$

This function describes the evolution of a generations' beliefs over time. Note that this function depends on *a priori* beliefs, as a result, the same mobility outcome can give rise to different posterior beliefs. If we consider equations (1.21) and 1.25b together, the effort beliefs are updated according the following rule,

$$\begin{cases} \overline{\alpha}(e_t^b, \nu_t' \mid h_{t-1}) > \underline{\alpha}(e_t^b, \nu_t' \mid h_{t-1}) & \iff \mu_{t+1} > \mu_t \iff e_{t+1}^b > e_t^b \\ \overline{\alpha}(e_t^b, \nu_t' \mid h_{t-1}) < \underline{\alpha}(e_t^b, \nu_t' \mid h_{t-1}) & \iff \mu_{t+1} < \mu_t \iff e_{t+1}^b < e_t^b \end{cases} \quad (1.26)$$

Whether the updated weight placed on $\bar{e}$ is greater than the *a priori* probability depends on whether, for the level of effort chosen by the previous generation, the signal observed is more likely to have occurred for $\bar{\sigma}$ than for $\underline{\sigma}$. If a generation t^{th} experienced a relatively high mobility outcome with respect to his *a priori* beliefs, the conditional probability of this event given previous history h_{t-1}, is greater for $\bar{\sigma}$ than for $\underline{\sigma}$. As such generation $t+1$ places a higher weight on $\bar{e}$. The opposite holds for the case of low mobility results. The rationality of the updating belief rule is the following, when agents of generation $t+1$ have an *a priori* belief that their peers had made a high effort but were not rewarded with upward mobility, there will be some downward adjustment of the expected effort for their current peers. For example, if $x_{t+1}^{apriori}$ is the a *priori* belief in generation $t+1^{th}$

about expected successful agents with origin I_L and if $x_t^{'}$ is the realization in period t, the updating rule for beliefs determine $e_t^b > e_{t+1}^b$ when $x_{t+1}^{apriori} > x_t'$. In contrast, high achievable performance in the previous generation should induce rational agents to expect higher effort in their next generation peers, namely $e_t^b < e_{t+1}^b$ if $x_t^{apriori} < x_t'$.

A general property of this form of Bayesian learning is that the stochastic process μ_t describes a martingale, what generation t expects its successors to know next period is exactly what generation t knows today. Namely, the agent's best guess in generation $t+1$, as to his posterior in any later period is his posterior beliefs in period t, namely $E(\mu_{t+m} \mid \mu_t, h_t)$ with $m > 1$ (Aghion et al., 1991; Piketty, 1995; Smith and Sørensen, 2000). As a result, $E(e_{t+m}^b \mid \mu_t, h_{t-1}) = E(\mu_{t+m}^b \mid \mu_t, h_{t-1})\overline{e}+(1-E(\mu_{t+m}^b \mid \mu_t, h_{t-1}))\underline{e} = e_t^b$. Assume, without loss of generality, that the true state of the world is $\bar{\sigma}$ (namely "effort always pays").[29] Therefore $\mu_t = 1$ is equivalent to allocating full weight to the truth. Pick $\overline{\sigma} \neq \underline{\sigma}$, with $\mu(e_{t-1}^b, \overline{\sigma}, \nu_t) > 0$, and define for any $t > 1$ the likelihood of $I_t = \frac{\mu(e_{t-1}^b, \overline{\sigma}, \nu_t)}{\mu(e_{t-1}^b, \underline{\sigma}, \nu_t)}$, wich follows a stochastic process $\{\mu_t\}$, which describes a martingale conditional on the true state of the world. As a result, standard martingale convergence results can be applied (Aghion et al., 1991; Piketty, 1995, Smith and SØrensen, 2000 and Breen and García-Peñalosa, 2000). Piketty (1995) and Breen and García-Peñalosa (2000) derived three propositions about this process, which could be interpreted in terms of our learning process.

First, the martingale convergence theorem implies that the likelihood ratio, and hence beliefs, converge in the long term. For any initial beliefs, μ_0, in the long term beliefs converge toward some stationary beliefs, μ_∞ with a probability of one. Therefore, there is a stable solution about the level of expected effort, which is defined as, $e_\infty^b = \mu_\infty\overline{e}+(1-\mu_\infty)\underline{e}$. Second, given the true state of the world $\bar{\sigma}$, the Bayesian updating function defined in Eq.1.25 has three fixed points. One of them is not stable $\mu_{1\infty} = 0$. There are two stable

[29] Piketty (1995) discusses extensively the reasons that justify that assumption.

long term equilibrium beliefs, one is an interior fixed point $\mu_{2\infty} > 0$ and the other is a corner solution $\mu_{3\infty} = 1$. As a result, both stationary beliefs allocate a positive weight to the true state of the world. In terms of effort beliefs, $e^b_{\infty} = \underline{e}$ is not a stable solution, meanwhile, $e^b_{2\infty} = \mu_{2\infty}\overline{e} + (1-\mu_{2\infty})\underline{e}$ and $e^b_{3\infty} = \overline{e}$ are stable solutions. Finally the interior solution $\mu_{2\infty}$ holds,

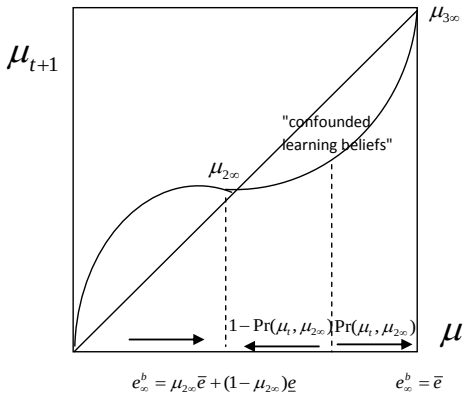
$$\overline{\alpha}(e^b_t(\mu_{2\infty}), \nu'_t \mid h_{t-1}) = \underline{\alpha}(e^b_t(\mu_{2\infty}), \nu'_t \mid h_{t-1}) \Longleftrightarrow \mu_{t+1} = \mu_t \Longleftrightarrow e^b_{t+1} = e^b_t \tag{1.27}$$

this expression implies that when agents hold the *a priori* belief $\mu_{2\infty}$, the resulting expected probability is the same under $\bar{\sigma}$ or $\underline{\sigma}$. If initial beliefs are $\mu_0 < \mu_{2\infty}$, then it converges to $\mu_{2\infty}$ with a probability of one. As a result, $e^b_{2\infty} = \mu_{2\infty}\overline{e} + (1-\mu_{2\infty})\underline{e}$. In contrast, if the initial beliefs are higher than $\mu_{2\infty}$, then they will be attracted with positive probability, $Pr(\mu, \mu_{2\infty})$, by $\mu_{3\infty} = 1$, and with positive probability $1 - Pr(\mu, \mu_{2\infty})$, by $\mu_{2\infty}$. Breen and García-Peñalosa (2002) named $\mu_{2\infty}$ as "confounded learning beliefs". At this point nothing can be learned from the previous generations' signals, and *a priori* beliefs are equal to the posterior beliefs. They demonstrated that the probability of converging to the true belief is given by,

$$Pr(\mu, \mu_{2\infty}) = \frac{\mu_0 - \mu_{2\infty}}{\mu_0(1-\mu_{2\infty})} \tag{1.28}$$

As a result, long term equilibrium beliefs depend on the initial beliefs and the quality of the public signal information. This result is due to the fact that the same mobility outcome can give rise to different posterior beliefs depending on the probabilities initially attributed to each situation. Successive learning across generations may be complete, as

Figure 1.1: The equilibrium of beliefs



a result, generations will access the true value of σ, $\overline{\sigma}$. In this case, an equilibrium belief about the expected effort of an agent with origin I_L is $e^b_{3\infty} = \bar{e}$. Namely, in this case "effort always pays" in the long term, and agents with origin I_L expect their peers to exert a high level of effort. One point worth noting here is that $\bar{e}$ may not be the "true" mean effort. This expected level of effort is the most likely value given that $\overline{\sigma}$ is the true state of the world, h_{t-1} the history of generations with social origins I_L and μ_0 the initial beliefs. In other terms, evidence shows that effort pays, and that successive learning across generations leads to the highest expected effort. However, the learning process across generations may be incomplete, in this case agents perceive that effort rewards are relatively low, even if this is not true. As a result, agents place a strictly positive weight on the true state of the world ($\overline{\sigma}$), and long term equilibrium of the expected effort $e^b_{2\infty}$ is lower than $\bar{e}$, but is higher than $\underline{e}$. Although "effort pays" and promotes high income mobility, initial beliefs and mobility trajectories lead, in the long term, to relative lower expected effort for agents with origin I_L.

1.4.3 An equilibrium analysis with intergenerational learning with self-motivated agents

In section 1.3 we characterized different individual responses to the relative income effect depending on agent characteristics and circumstances. We interpret these characteristics to be part of the personality of the agent and they are explained by idiosyncratic term. To simplify, in this section we assume that all agents are identical and they are self-motivated agents (Conditions I and V). Even though this assumption simplifies the analysis, it is worth noting that in this scenario, the relative income effect always motivates a high effort. Therefore, it allows us to explore how an agent's effort decision is affected by income mobility results and expected relative deprivation.

Under imperfect information, the relative deprivation with respect to reference group income establishes a relationship between generations in two ways. On one hand, the probability of economic success depends on social origin. On the other hand, there is an indirect channel, because the experience of previous generations affects the beliefs about expected effort, and they determine the incidence of reference groups through their expected relative deprivation. Equation 1.26 provides a rational updating process, where society learns from the mobility outcome. The Bayesian learning mechanism implies that history is important in determining equilibrium beliefs and public expected effort and therefore the reference group income level.

In a steady state agents with origin I_L and the same P_i will choose the same optimal effort $e_{L\infty}(P_i)$ and it is constant, $e_{Leq\,t-1}(P_i) = e_{Leq\,t}(P_i)$ and $e^b_{t-1} = e^b_t$. In steady state $e^b_L = e^b_{L\infty}$, considering $E(y^R_\infty \mid I_L) = \Phi(e_{Leq}(P), e^b_{L\infty}, \overline{e^b_U}, P)$ in Eq. 1.11, we arrive at the following expression,

$$e_{L\infty}(P_i) = \begin{cases} e^{*}_{L\infty} = (1-\alpha)a\theta\beta_M\Delta y & if\ E(y^R_\infty \mid I_L) \geq 0 \\ e^{**}_{L\infty} = e^{*}_{L\infty} - a\theta\beta_M\Delta y G_{y^R_\infty}() - a\alpha G_e() & if\ E(y^R_\infty \mid I_L) < 0\ \&\ e^{**}_{L\infty} < E \\ e_{L\infty} = E & if\ e^{**}_{L\infty} \geq E \end{cases} \tag{1.29}$$

In the steady state, the Bayesian learning function leads to social beliefs $e^b_{L\infty}$. As a result, for self-stimulated agents with origin I_L the models predict two possible scenarios about effort level in the long term. First, when $\mu_0 > \mu_{2\infty}$ agents' beliefs will be attracted with probability $Pr(\mu, \mu_{2\infty})$ by $e^b_{L\infty} = \overline{e}$. In this case, agents with higher P choose a high effort level because their relative deprivation and reference income are relatively high. They are stimulated by the expected income of agents with origin I_U but also by their peers with origin I_L. When P is relatively low (agents with origin I_L compare with their peers), they tend to choose higher effort levels, because expected effort for agents with origin I_L is high. In this case, the expectation of peer's effort will increase, and so will individual effort for the future. The intensity of this effect is higher among agents whose reference group composition has a low P_i. However, the effort in a steady state will always be equal or higher for those agents with higher P_i, because they include more agents with origin I_U in their reference group. When $P_i > 0$, reference groups promote higher income mobility, while, when $P_i = 0$ results are consistent with the "self fulfilling belief" of Piketty's model.

On other hand, due to the initial condition and the past trajectories of the previous generation of agents with origin I_L, the long term social belief could be $e^b_{2\infty}$. In this case, the expected effort for agent with origin I_L is relatively low and reference group income will be low if P is low. In this case, relative deprivation leads to lower long term effort

level compared to those agents without relative deprivation (agent with origin I_U) and with respect agent with $P > 0$. Observe that in this case there are two possible dynamics. On one hand, when $\mu_0 < \mu_{2\infty}$, the expected effort will increase, and so will individual effort for the future. However, those optimist beliefs have a threshold and the steady state of effort beliefs will be relatively low. On the other hand, when $\mu_0 > \mu_{2\infty}$, agents will be attracted with probability $1 - Pr(\mu, \mu_{2\infty})$ by $\mu_{2\infty}$(and $e^b_{2\infty}$). Because agents believe that their peers (all agents are I_L) in the reference group will decrease their effort, their income reference will be lower (relative income effect is lower) and they choose a lower effort level. This situation determines a "self fulfilling belief" due to effort beliefs.

When the learning function leads to social belief $e^b_{2\infty}$, the reference group effect reduces income mobility. Furthermore, because $\overline{\sigma}$ is the true state of the world, the lower effort level for agents with origin I_L would be suboptimal. Although "relative effort pays" and promotes high income mobility, agents with origin I_L are inefficiently discouraged from trying to move up, due to social beliefs, mobility trajectories and inequality.

1.4.4 An equilibrium analysis without self-motivated agents

In the previous section we assume "self-encouraged agents", therefore the relative deprivation effect always motivates higher effort regardless of effort rewards and ex-ante inequality. However, Conditions III, IV, VI, and VII, assume that relative effort is a cost, which establishes an ambiguous relationship between effort and reference group income. In this case, ex-ante inequality and circumstances are more relevant to explain the agent response. To be more concrete, we assume that there is a y^{R*}, which holds $\theta\beta_M \Delta y G_{y^{R}*y^{R}*}(y^{R}*, e) = -G_{y^{R*}e}(y^{R}*, e)$, and when $E(y^R < y^{R*} \mid I_L) \Rightarrow \theta\beta_M \Delta y G_{y^{R}*y^{R}*}(y^{R}*, e) < -G_{y^{R*}e}(y^{R}*, e)$, and when $E(y^R > y^{R*} \mid I_L) \Rightarrow \theta\beta_M \Delta y G_{y^{R}*y^{R}*}(y^{R}*, e) > -G_{y^{R*}e}(y^{R}*, e)$. Under this assumption the composition of reference groups and ex-ante inequality is even more important for social mobility.

By following analogous reasoning as above, we will arrive to a long term effort level. Under these assumptions, higher expected effort of agents with origin I_L leads to higher steady state effort ($e_{L\infty}$). Therefore, conclusions about previous section remain unchanged. Given P, higher e^b_∞ motivates higher effort levels for agents with origin I_L (Observe that $\frac{d(E(y^R|I_L)}{de^b_L} > 0$).

Focus now in the role of ex - ante inequality between social origins, which was measured by $\Delta\pi$. Let $P = 1$ and $\Delta\pi'$ such that $E(y^R < y^{R*} \mid I_L)$. In this case agents with low social origins include individuals from richer origins in their reference group but they face a high relative deprivation. They perceive that the relative costs of effort are too high compared to relative reward. As a result they reduce their effort level in order to avoid frustration. If $\Delta\pi$ is lower, such that $E(y^R > y^{R*} \mid I_L$, relative deprivation might lead to a high effort level. Finally, note that the intensity of this effect is lower when P is low. In this case, a lower P could lead to a higher effort level, but that depends on the expected effort of their peers.

Under this assumption there is a non-linear relationship between ex - ante inequality and the effort level of agents with origin I_L. Namely, there is an inverted-U shape relationship between long term effort and $\Delta\pi$.

1.4.5 Reference groups and aspiration failure.

It would be interesting to build a first bridge between reference group theory and the aspiration model proposed by Genicot and Ray (2014). Authors argue that the formation of aspiration is ones of the most relevant factors in explaining upward mobility. They define aspiration as a realistic and attainable target, which, ex-ante, is beyond an agent's possibilities, but which are potentially achievable. They emphasize the role of social interactions and assume that aspirations are based on the current and past achievements of an agent's socioeconomic neighborhood, which is located within some exogenously given

social window ("aspiration window"), defined as $\psi(y_i, D(y_i))$. As a result, an agent's aspirations are determined by his income and the distribution of wealth ($D(y_i)$) in his cognitive window, which could includes his peers or individuals far richer than he. As a result aspiration formation is defined as $a : a(\psi(y_i, D(y_i)))$. Then, they assume that an agent's objective function considers the "aspiration gap" ($ag = y - a$), namely the income difference between his income and his economic aspiration.

$$U(y_i, ag_i) = U(y_i, G(y_i - a(\psi(y_i, D(y_i)) \tag{1.30}$$

Based on these ideas, Ray (2006) identifies two types of aspiration failure. Aspiration failure type I occurs when agents with low social origin do not include agents with high social origin in their aspiration window. As a result, the aspirations gap is low, as will be individual investments for the future. In aspiration failure type II, agents with low social origins include individuals from richer origins in their aspiration window, but the previous inequality and the relative costs of effort are so high that agents perceive the goal to be unattainable and they are discouraged. As a result they reduce their aspirations and investment level in order to avoid frustration.

If we include a more explicit function of aspiration formation in our model, we can advance in this discussion.[30] If we assume that $a = y^{RG}$, and that P represents the bandwidth of the aspiration window, we could explore the conditions that lead to these types of failures. Furthermore, Ray (2006) argues that an aspiration window depends on how much perceived mobility there is in society, the higher the extent of mobility, the broader the aspirations window. The intergenerational learning proposed in section 1.4.3 seems adequate to deal with this issue.

[30]The results of this model, are also related with the model proposed by Dalton et al., (2015).

On one hand, when individuals are self-motivated, a very low P represents a restricted aspiration window, which leads to aspirations failure type I. In this case, the expected aspiration gap is low, and agents with origin I_L are not encouraged to increase their effort. This will especially be the case if there is economic polarization or other forms of stratification.

On the other hand, there is aspiration failure type II when individuals from I_L include individuals I_U in their "aspiration window" (high P). Failure type II seems less consistent with "self-motivated" individuals, although when $P \neq 1$, a low e^b_∞ would reduce the effort of agents with origin I_L. When the effort beliefs of agents with origin I_L is low, the expected "relative deprivation" will be lower, which induces a decrease in the levels of effort. Although "relative effort pays", agents with origin I_L reduce their effort because they believe that their peers in the reference group will decrease their effort.Therefore, the expected mobility is low (peer effort "does not pay"), and the aspiration gap leads to a lower long term effort level compared to a those agents with $P = 1$ or a situation with $e^b_{L\infty} = \overline{e}$. This effect will be higher if P is low, which is related with failure type I.

When individuals are not self-motivated, reference groups may directly explain failure type II. First, strong ex-ante inequality between agents with different social origins would lead to lower effort. In this case the relatively poor individuals do aspire to be like the rich, but the income gap is simply too large (see section 1.4.4). The costs of effort (or investment) is too high, and the reward (in terms of a relative narrowing of the aspiration gap) too low. The reference group leads to aspirations, but the feeling is widespread that such aspirations are largely unreachable. Second, when leisure and relative income are not complements, an agent with social origin I_L is more easily satisfied with his performance and less motivated to achieve high income positions than agents with a less demanding reference group or upper-class origin. As a result, higher reference group income leads to lower effort because agents perceive the goal to be unattainable. Therefore, a high

relative deprivation reduces the agent‘s income aspirations and effort level in order to avoid frustration.

1.5 Conclusion

Our model shows how sociocultural inequalities, in general, and reference groups, in particular, shape inequality persistence. Expected relative deprivation with respect to a reference group determines optimal effort decision, which is a key determinant of inequality persistence. We show that the size and direction of these effects depend on, (a) the direction of the income comparisons (to whom individuals compare, "(P)"); (b) their intensity (how much, α and $G(.)$); (c) ex-ante inequality between agents with different social origins and relative effort reward; and (d) the information about their peers and past income mobility. Furthermore, this model represents a first bridge between reference group theory and the aspiration failure approach by Genicot and Ray (2014). We identify the conditions under which aspiration failures type I and type II are stable solutions.

(a) The composition of the reference group is relevant regardless of its inheritance pattern. When the reference group of low-class origin individuals consists only of low-class origin individuals, and their peers' expected effort is low, their reference income is closely aligned to their expected income. Therefore, they have little incentive to increase their effort, relative deprivation will be low, as will their investments for the future. This leads to a "self fulfilling belief" and determines an aspirations failure type I. However, this effect could be compensated when their peers' expected effort is high.

(b) When agents with low-class origins include individuals from high-social origins in their reference group, their expected income gap is larger. In this case, the impact of relative deprivation on the optimal effort level is ambiguous, and assumptions about the functional form of relative concerns are key. When relative concern is additive in the utility functions, standard assumption or prospect theory explain situations in which the effort response (and income mobility) are very different. The former assume self-motivated agents, while the latter assumptions describe discouraged agents. Under non-additive assumption, the incidence of reference groups depends on the sign of two functions, G_e,

which describes how effort affects relative deprivation assessment, and G_{ey^R}, which defines whether leisure and relative income are complements. If relative income and leisure are complements, the reference group always promotes higher effort levels. Individuals from lower class backgrounds are self-motivated by a larger income gap and work harder in the pursuit of personal economic success and social ascent. In this case, reference group income promotes high income mobility, a result that is in stark contrast to predictions from other models of inequality based upon self-fulfilling beliefs and fatalistic predictions.

(c) However, when relative income and effort are substitutes, relative deprivation has an ambiguous effect on effort. In this case, the expected income gap between the individual and her reference group may encourage or discourage a lower-class agent. Ex-ante inequality and expected relative deprivation are key determinants in explaining that ambiguity. There is an inverted-U shape relationship between long term effort, and P on one hand, and ex-ante inequality, on the other hand. If the income gap is due to the expected effort of their peers, high reference income may increase effort and mobility. However, high ex-ante inequality and low relative effort rewards could reduce the effort of low social origin individuals. This situation, which reduces income mobility, is related with aspiration failure type II.

(d) As expected reference group income is contextual, its effects depend on how much mobility is perceived. In considering this issue we assume imperfect information and we model beliefs using a Bayesian learning process. There are two stable solutions for effort beliefs that depend on whether individuals from low-class origins choose a high or low effort. In the latter case, because individuals from low-class origins believe that their peers in the reference group will reduce their effort, their income reference will be lower and they will choose a lower effort level. This situation determines a "self fulfilling belief" due to effort beliefs.

The reference group effect leads to individual decisions on welfare that are suboptimal.

When we assume forward-looking individuals, this inefficiency is explained by the "between" and "within" social origin effects, and it is higher the higher $\Delta\pi$. If we assume backward-looking individuals, the results are ambiguous. In this case, even if we assume that "relative effort pays" and promotes high income mobility, agents from low-class origins would be inefficiently discouraged from trying to move up, due to social beliefs, mobility trajectories and inequality. As a result their economic aspirations would be inefficiency lower.

Our conclusions are more general than other models of inequality based on self-fulfilling beliefs and fatalistic predictions. A more integrated society, one in which there is greater economic diversity in the reference groups and income inequality is relatively low, would open the possibility that the reference group effect increases intergenerational mobility.

Haushofer and Fehr (2014) and Congdon et al. (2011) suggest that extreme poverty may have psychological consequences, which affect economic behavior and could lead to people being discouraged from making the best mobility-enhancing investments available, contributing to poverty persistence. Our theoretical contribution helps to better understand these issues, discussing how some decisions that would increase the levels of mobility may be discouraged (or encouraged) due to the role of reference groups and the unequal initial conditions. A first implication is that this behavioral dimension is a key issue in designing better policies (Dalton et al., 2015; Haushofer and Fehr, 2014; Congdon et al., 2011).

Ray (2006) suggests some policies for reducing low mobility due to the presence of low economic aspiration in an unequal society. Ray argues that affirmative action or public education could be policy tools to help create local, attainable incentives at the lower end of the wealth or income distribution. For example, if there is residential or public space segregation, which reduces the opportunities of connectedness and promotes social polarization, public intervention could mitigate this effect. Other possible interventions to

close the social origin aspiration gap could include convening young people and enrolling them in programs (example, school or kindergarten) away from their communities (Austen – Smith and Fryer, 2005). Our model supports these policies in order to promote high intergenerational income mobility.

On the other hand, if reference group and social interactions are primary determinants of individual aspirations, it may be necessary to ask how redistributive policies can affect group memberships. For example, conditional cash transfer programs to reduce poverty could affect the composition of reference group and change effort decisions, which could affect long term income mobility. Finally, our model suggests that anti-discriminatory and affirmative action could amplify reference group composition, which in turn affect income mobility.

The results of this chapter suggest a number of new avenues for empirical research. On one hand, they provide a theoretical framework to evaluate the reaction of agents empirically, in terms of effort, when their relative situation and rewards change. On the other hand, they describe how relative concern could affect income mobility through the formation of aspirations. One problem of empirical studies on this issue is that they fail to explain the implications of self selection into reference groups. In our model, we avoid discussing this issue and consider the parameters that define reference group integration to be a random variable. Our model demonstrates that reference groups affect income mobility even in this hypothetical situation. However, a model which focuses on endogenizing reference group choice is a possible direction for future research. A number of important issues remain to be addressed. First, our approach assumes only two social origins, but this model can be extended to a model in which society has multiple-social origins. Second, in our model the possibility of strategic behavior on the part of agents with different social origins or reference groups is ignored. Third, this chapter proposes a bayesian updating belief process, but different learning processes could also be considered.

Finally, in this chapter we consider only one perspective of status, the comparison role of the reference group, but there are other perspectives of relative or positional concern. The two latter issues will be addressed in the next chapter.

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Appendix

1.A The role of effort rewards and ex-ante inequality. Discussion and proofs

We focused on the situation in which relative effort represents a cost ($G_e(.) > 0$) as the best case study. To analyze he role of effort rewards and ex-ante inequality on attitudes toward effort we incorporate two simplifying assumptions, G_{ey^R} is constant and $e^b_{Ueq} < e^b_{Leq}$.

"Indifferent agents" holds, $\theta\beta_M \Delta y G_{y^R y^R}(.) + G_{y^R e}(.) = 0 = I(G(.), \theta, e_{Leq}, e_{Ueq}, \triangle\pi)$. Then:

$^{dI(.)}/_{d\theta} = d\theta G_{y^R y^R}(.) + \theta G_{y^R y^R y^R}(.)^{dy^R}/_{d\theta} = 0.$

Observe that $G_{y^R y^R}(.) > 0$ and $^{dy^R}/_{d\theta} > 0$ (because $e^b_{Ueq} < e^b_{Leq}$.). Then when $G_{y^R y^R y^R}(.) < 0$ there is a function $f(G(.), \theta, e_{Leq}, e_{Ueq}, \triangle\pi) : \tilde{\theta}(\theta) = d\theta G_{y^R y^R}(.) = -\theta G_{y^R y^R y^R}(.)^{dy^R}/_{d\theta}$.

When $G_{y^R y^R y^R}(.) < 0$, that function does not exist and $^{dy^R}/_{d\theta} = 0$ holds only for one value of θ.

We focus now in the relationship between θ and $\triangle\pi$ when $^{dy^R}/_{d\theta} = 0$. There is a function $f(G(.), \theta, e_{Leq}, \triangle\pi) : \tilde{f}(\theta, \triangle\pi)$, which defines the set of all values of θ and $\triangle\pi$ where individuals do not respond to changes in reference group incomes. The total derivative of the function $I(.)$ with respect θ and $\triangle\pi$, allows us to analyze the sign of the derivatives of $\tilde{f}(\theta, \triangle\pi)$.

$^{dI(.)}/_{d\theta} + {}^{dI(.)}/_{d\triangle\pi} = d\theta \left[\beta_M \Delta y G_{y^R y^R y^R}(.) + \theta\beta_M \Delta y G_{y^R y^R}(.)^{dy^R}/_{d\theta}\right] +_{(cont)}$

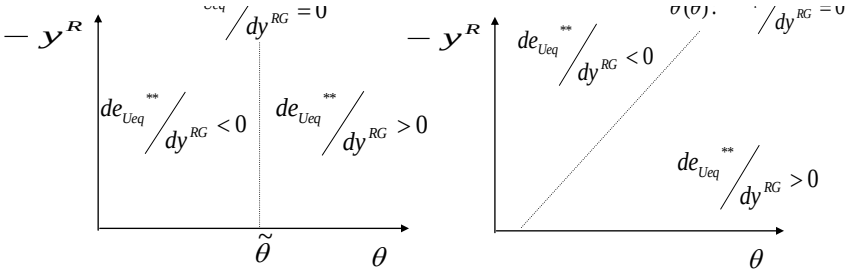
$$_{(cont)}\theta\beta_M\Delta y G_{y^R y^R}(.)^{dy^R}/_{d\triangle\pi} = 0$$

$$d\theta\left[G_{y^R y^R y^R}(.) + \theta G_{y^R y^R}(.)^{dy^R}/_{d\theta}\right] = -\theta\left[G_{y^R y^R y^R}(.)^{dy^R}/_{d\triangle\pi}\right] d\triangle\pi$$

$$^{d\theta}/_{d\triangle\pi} = \frac{-\theta G_{y^R y^R y^R}(.)^{dy^R}/_{d\triangle\pi}}{G_{y^R y^R y^R}(.)+\theta G_{y^R y^R}(.)^{dy^R}/_{d\theta}}$$

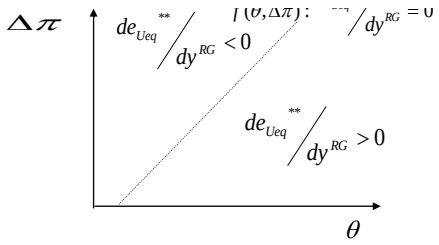
Figure 1.A.1: The role of effort rewards on relative deprivation and attitude toward effort

1.*a*) $G_{y^R y^R y^R}(.) < 0$ 1.*b*) $G_{y^R y^R y^R}(.) > 0$



When $G_{y^R y^R y^R}(.) > 0$, both numerator and denominator is positive and $^{d\theta}/_{d\triangle\pi} > 0$ and $\frac{\tilde{f}_\theta(\theta,\triangle\pi)}{\tilde{f_{\triangle\pi}}(\theta,\triangle\pi)} > 0$ (observe that $^{dy^R}/_{d\triangle\pi} < 0$). The signs of $^{d\theta}/_{d\triangle\pi}$ and $\frac{\tilde{f}_\theta(\theta,\triangle\pi)}{\tilde{f_{\triangle\pi}}(\theta,\triangle\pi)}$ are undetermined when $G_{y^R y^R y^R}(.) < 0$. The increase of θ improves relative deprivation ($^{dy^R}/_{d\theta} > 0$), which reduces the marginal utility of relative deprivation ($G_{y^R y^R}(.) > 0$), but at a decreasing rate ($G_{y^R y^R y^R}(.) < 0$). Given these effects in opposite directions, it is unclear which is the relationship between θ and $\Delta\pi$. To ensure that the condition is met $\theta\beta_M\Delta y G_{y^R y^R}(.) + G_{y^R e}(.) = 0$, when θ increases, it may be necessary a higher relative deprivation (higher $\Delta\pi$) to increases the sensibility of the marginal utility of relative deprivation $G_{y^R y^R}(.)$, and then the marginal utility $G_{y^R}(.)$.

Figure 1.A.2: The role of effort rewards and ex-ante inequality on relative deprivation and attitude toward effort ($G_{y^R y^R y^R}(.) > 0$)



2 Status and intergenerational mobility

Abstract

This chapter aims to enhance our understanding of the role of status motives in intergenerational income mobility. It develops an extension of Piketty's (1998) model in order to consider two different perspectives of individual status: the *self-perceived valuation of the relative position of individuals in their reference group* and *the social beliefs about them.* Piketty's work mainly deals with the second perspective through self-fulfilling discriminatory beliefs. However, our model allows us to analyze the different roles played by both status motives in inequality persistence in detail. It confirms that "status motives" could be a channel for transmitting inequality across generations and identifies 3 different mechanisms: mobility could be low because the poor are not sufficiently motivated to move up due to the reference group composition; they are being discouraged by society as a whole because of low status rewards; they are discouraged by low expectations, because their peers failed past attempts to move up. However, under certain circumstances, reference groups could reduce economic success, which is in stark contrast to previous inequality models based upon self-fulfilling beliefs. Finally, implications of status motives on optimal social decisions depend on informational assumptions. An intergenerational peer learning process could mitigate the sub-optimal rat-race effect.

Keywords: Social status, intergenerational mobility, aspirations failure.

2.1 Introduction

This chapter proposes a theoretical model to analyze the role of status in intergenerational income mobility. People care a lot about their relative situation or status when they take decisions regarding their effort, their human capital investment or their occupation, regardless of whether or not this has a direct effect on their opportunities. Economic models are generally ambiguous about social status definitions (and interpretations) and there is a "models overlap", where status is related with other economic concepts. Our approach identifies status as a relative concern and considers two perspectives of status separately: *the self-perceived valuation of an individual's relative position in their reference group* and *the social rewards from public beliefs about them*. On the one hand, the reference groups define a reference income level, which affects economic aspiration and motivation. On the other hand, individuals are concerned about the opinions of others about them. If economic success is perceived as a "signal" of individual attributes, social rewards depend on the social mobility experienced in a society. Both status motives interact with each other through social beliefs, reference groups and experienced mobility, which could generate multiple equilibrium levels in the choice of effort and may amplify economic success inequalities among agents with different social origins. This is the issue which this model aims to analyze.

The idea that social status, reference groups, social rewards and related cultural attitudes play a crucial role in explaining income mobility has a long history in sociological theories. On the one hand, reference group theory suggests that culturally shaped processes may lead to a reduction (or an increase) in ambition among those that share them. Attitudes to inequality depend critically on the reference groups, which may play two roles: "comparative", they define the benchmark of comparisons, and "normative", they are a source of norms, attitudes and values (Clark and D'Ambrosio, 2014).[1] For example, poorer ref-

[1] According to Merton (1953) reference groups represent the benchmarks to which individuals compare themselves and evaluate individual attributes. These groups become the point of reference which indi-

erence groups may transmit less ambition and taste for economic success to lower-class families than richer reference groups do to upper-class families (Boudon, 1974). On the other hand, there is the influential work of the sociologist Bourdieu, who suggests that lower-class individuals adopt behaviors that validate their original status because they internalize the low probability of social ascent within the structure of social inequality. Both approaches provide an additional sociocultural mechanism of inequality persistence between individuals with equal characteristics and unequal social origins, but they differ in the cause. While in the former the lower incentives are explained by the reference group, in the latter people from a low-class origin remain poor because they end up not being sufficiently motivated by society due to discriminatory beliefs, stigmatization mechanisms or low social rewards (Bourdieu and Passeron, 1964, 1974).

According to mainstream economics, persistence of inequality across generations can be explained by a combination of direct family transmission of productive abilities, endowments and parental investment in their children's human capital (Becker and Tomes 1979; 1986). The idea that status plays a crucial role in explaining income mobility has received far less attention from economists. Bourguignon et al. (2007) suggest that sociocultural inequalities could partly explain inequality persistence and they emphasize that further economic research, both theoretical and empirical, in this area is needed. They suggest that if beliefs and preferences are transmitted by one's own family, then "empowering" and "fatalistic" beliefs may be inherited, contributing to the persistence of inequality. Differences in the status, expressed in patterns of interaction, behavior and beliefs, sustain and amplify the initial inequality.

The seminal papers of Piketty (1998) is a notable exception within Economics. Piketty (1998) introduces the role of status motives in intergenerational income mobility and

viduals refer to in order to evaluate their achievements, their performance, aspirations and ambitions. They orient the behavior and define the social role to which the individuals aspire, but to which they do not necessarily belong.

suggests that status motives amplify the inequality between agents with different social origins, when the impact of social origin on economic success is high compared to the effect of effort and ability. Piketty's model provides a general framework, which aims to describe two sociocultural channels of inequality persistence: reference group theory and the self-fulfilling discriminatory beliefs. However, less attention is paid by Piketty (1998) to the different roles played by both status motives. Furthermore, the status motives (defined as social beliefs) used in Piketty's model provide a better basis for discrimination theory, if we understand that society treats individuals from different social origins, who are otherwise identical, differently (Fang and Moro, 2011). As a result, the reference group mechanism has not been considered in detail in his model because its utility function does not include how much people care about their relative position with respect to a reference point. Furthermore, his paper does not allow an analysis of how both status motives interact with each other.

People care a lot about their relative position, which affects their behavior (Postlewaite, 1998; Frank, 2005; Heffetz and Frank, 2011; Clark and D'Angelo, 2013). Empirical findings about relative concern allow us to formalize the discussion of how reference group income affects an agent's utility. Both the prospect theory and happiness literature confirm that agents make their valuations relative to a reference level: *mean dependence model*. Tversky and Kahneman (1991) argue that reference group income represents the natural comparison point for each person to value their situation. Furthermore, empirical research generally also confirms the asymmetry of relative concern, which suggests that agents are upward looking when making comparisons (Duesenberry, 1949; Ferrer-i-Carbonell, 2005). However, there is a current debate on what income level should be taken as a reference, as well as the possibility that individuals with similar characteristics may present differences in their reference income (Heffetz and Frank, 2011; Clark et al., 2008; Clark and Senik, 2010; Clark and D'Ambrosio, 2014).

In a context of high social inequalities, relative concern could play a central role in explaining inequality persistence between generations. Our primary objective is to provide a common framework to explain the role of both status motives in effort decisions. We model rational agents with two different social origins who maximize their expected utility. Agents know that the probability of them obtaining a high income level depends positively on their ability, their effort and their social origin. Furthermore, their utility function includes two additional arguments to consider relative concern: the *self-perceived valuation of their relative income* and *the social rewards from public beliefs about them*. We assume both to be additively separable, which allows us to analyze them in detail. Agents choose their effort based on the structural parameters of the economy and their beliefs.

The main contribution of this chapter is to jointly discuss the role of social status rewards and reference group income as mechanisms behind the intergenerational transmission of economic inequality. We consider both dimensions as "*status motives*", which allows us to distinguish the role of discrimination and reference groups in inequality persistence and to explore how they interact with each other. Our modeling exercise consists of describing the conditions under which individuals from lower-class origins could be discouraged by status from making adequate mobility-enhancing investments, while individuals from higher-class origins could be more stimulated. Furthermore we explore the circumstances where individuals from lower-class origins could be encouraged to increase their mobility-enhancing investments by status motives.

An additional contribution is to discuss how informational assumptions about peer behavior affect inequality persistence. Both status motives incorporate the expected decisions of others in the individual utility function. We first assume forward-looking homogeneous agents, which reflects a situation in which there is perfect information. The composition of the reference groups generates a leader-follower dynamic between agents with high so-

cial origins and low social origins, which is a contribution with respect to Piketty (1998). In a second step we incorporate heterogeneity among agents with low social origins and assume imperfect information about peer decisions. In this case, beliefs about peer decisions are updated by a backward-looking learning process, that is, in light of the recent experience of peers with the same social origin from a previous generation. As a result, current beliefs are based on previous beliefs and the social mobility experienced by the previous generation. This establishes an additional interaction between beliefs and mobility, and allows agents to learn about the effectiveness of effort with regard to upward mobility.

The results that emerge from our model confirm that both status motives could amplify (or reduce) the inequality of advantage success between agents with different social origins. Even when all agents are identical in their abilities, their effort levels differ in the long term due to status motives, which affect long term income mobility. Status motives may reduce intergenerational mobility through three mechanisms: i) mobility could be low because the poor are not sufficiently motivated to move up due to the reference group composition; ii) they are being discouraged by society as a whole because of low status rewards; iii) they are discouraged by expected peer effort, because their peer group failed in past attempts to move up. However under certain circumstances, reference groups and status rewards generate an "encouragement effect" which could reduce economic inequalities. This situation is in stark contrast to previous inequality models based on self-fulfilling beliefs and fatalistic prediction. The mechanism that dominates depends on 5 key issues: (a) the composition of the reference group; (b) social rewards; (c) expected peer effort; (d) trade-off between both status motives; (e) informational assumptions and learning processes.

The predictions are consistent with the "*self-fulfilling belief model*" and a low mobility trap when each agent from a lower-class background compares himself only with agents with

the same origin, and when expected peer effort is low, which might happen if informative content of economic success is low, which leads to low status rewards. Namely when agents share public beliefs and assume, ex-ante, that they belong to a reference group whose members all have a low social origin, they adopt a behavior that validates their reference group expectations. These circumstances lead to self-fulfilling beliefs. However, when the structure of reference groups is heterogeneous, agents with lower-class origins always have incentives to assume strategies to improve their opportunities to achieve a better life. When both status motives are complements, the "reference group encouragement effect" is reinforced by status rewards. This is the case when the informativeness of economic success is high, and higher peer effort increases effort decisions. Even the effects of a reference group comprising agents with a lower-class background could be compensated by high social reward payoff, because peer effort beliefs lead to higher effort.

The leader-follower dynamic and the peer effect explain that individual decisions determine a socially inefficient equilibrium. We show that this result depends on the informational assumption about expected effort. We consider the relevance of the intergenerational learning of beliefs, which allows each generation to update public beliefs about expected peer effort. The observed social mobility experienced by the previous generation provides valuable information for agents to form beliefs on the effectiveness of effort decisions to achieve economic success. That intergenerational peer learning process could mitigate sub-optimal rat-race effect.

The rest of this chapter is organized as follows. The next section reviews the micro foundation of status concern (2.1), the main advances in this topic from the Economic perspective (2.2) and relative concern evidence (2.3). The third section focuses on the role of both status motives in terms of effort decisions and income mobility when we assume forward-looking agents. In the fourth section we present an extension and we assume a

backward-looking learning process. Finally we conclude.

2.2 Literature review

2.2.1 Micro-foundations of relative concern

Postlewaite (1998) and Frank (2005) suggest that evolutionary theory provides a strong argument for an innate concern for relative standing. In this case, an agent's relative concern is explained by competition for relative position in their evolutionary past, which affect his opportunities. Hopkins (2008) points out that there are at least three different evolutionary (or psychological) explanations. The "*rivalry story*" (the success of other agents reduces own opportunity), "*information story*" (the experiences and success of other agents is useful information about potentially profitable activities) and "*perception story*" (because preferences are incomplete, relative comparison is a fundamental psychological mechanism for evaluating goods, resources, or opportunities).

A second argument is that relative concern is explained by social preferences and reciprocity (Fehr and Schmidt, 2003). There is experimental evidence that people are motivated by fairness and reciprocity, and they are willing to reward (or punish) other people even if there is a cost to themselves. On the one hand, when agents have social preferences their utility depend on the own material payoff but they also care about how much other people receive. That concern could be explained by inequality aversion, altruism or relative payoff and envy. On the other hand, reciprocity assumes that people care about the intentions of the behavior of others. If an agent feels treated well, he will treat the others in the same way (Fehr and Schmidt, 2003).

An alternative explanation would be that relative concern arises from current social arrangements and not from social preferences or from intrinsic relative concern. In this case, although agents only care about themselves, relative concern is instrumental to material benefits. The nature of economic competition of the institutions is what leads to

individuals making relative comparison. For example, people could care about social inequality purely for selfish reasons, when high inequality generates negative externalities in education or crime (Alesina and Giuliano, 2010; Hopkins,2008).

Finally, aspiration conformation may offer an alternative explanation of relative concerns. The anthropologist Appadurai (2004) suggests that aspirations are always formed in social life. Genicot and Ray (2014) argue that aspirations are socially determined, and are drawn from the past own experience of individuals and their social environment. Therefore individual goals do not exist in social isolation, they depend on the distribution of income and wealth.[2]

2.2.2 Exploring the role of status in economics

Sociologists have a long standing interest in the concept of social status in the study of social interactions (Weber, 1922). They consider a broader class of rewards, which include different forms of relative concern or positional concern. However, this concept has received little attention in economics and has been interpreted from different economic fundamentals. Postlewaite (1998) and Weiss and Fershtman (1998), discuss how economics has introduced the concept of status. Basic economic models assume that *Homo-economics* is concerned with payoff (wage), but not whether it is relatively high (or low) with respect to peers (co-worker wages) or whether they receive the esteem of others (the respect of their supervisor or co-worker). Heffetz and Frank (2011) argue that there are many interpretations of status in economics (even in sociology) and status models (and their implications) overlap with other economic models which consider other issues: externalities, discrimination, social interaction, positional goods, relative concern, preferences for status. Economics treats status with ambiguity, sometimes it is related with relative concern or social interaction. We follow the definition of Weiss and Fershtman

[2]Genicot and Ray (2014) suggest a model of relative concern based on the formation of aspirations with respect to a reference point. Furthermore, they suggest a relationship between the formation of aspiration and distribution of income (Ray, 2006 and Mookherjee et al. 2010).

(1998), who define status "as a position or rank in relation to others". They argue that people "seem to care about their ranking and the esteem of others"... and "are willing to pay respect to others and to modify their behavior accordingly, without receiving any direct benefit".

First, the quote points out that people's ranking and the esteem of others could be an argument of the utility function, even if people derive no clear economic benefits from them. In this case, status has intrinsic value for well-being (Sen,1985; 2000). However, one central issue is whether status is a direct argument of the utility function or its relevance is only instrumental. In the second case, status is relevant because it indirectly affects an individual's utility.[3] Heffetz and Frank (2011) mention the difference between intrinsic and instrumental status, although the authors recognize that they are closely related. In this review (and in the rest of the chapter) we focus on the intrinsic value of status.

A second aspect to be noted is that social status presents two different perspectives or dimensions. On the one hand, individuals are concerned about the opinions and beliefs of others about them. On the other hand, people care about their relative performance compared to others (Postlewaite,1998; Weiss and Fershtman, 1998; Piketty,1998). We will discuss both perspectives in more detail.

Status as social rewards: Smith (1776) recognizes the relevance of the social dimensions of commodities; Veblen (1899) notes the intrinsic utility of social esteem and reputation; Nussbaum and Sen (1993) argue that a basic dimension of individual well-being is participation in social life, which he illustrates with Smith´s reference of appearing in public without shame. People care a lot about the opinions of others because of considerations about reputation, social recognition, shame, fear of punishment, stigma, etc (Moffit, 1983; Heffetz and Frank, 2011; Piketty, 2000; Bourguignon et al. 2007). These types of social

[3] Instrumental status could be interpreted as status investment decision. In this case, it could be analyzed within the traditional economic paradigm, which assumes agents optimizing with stable preferences (Postlewaite,1998).

rewards have received little attention in economics or have sometimes been used to explain certain economic outcomes or irrational behavior. All these issues represent a form of individual social rewards based on how others value their visible actions. Finally, observe that social reward represents a specific form of relative concern, because the beliefs of others affect the decisions of individuals.

Status as position and relative situation: Another perspective of status focuses on relative or positional individual concern with respect to different domains as income or consumption. In this case, status focuses on how individuals evaluate their economic performance by comparing themselves with others, namely the rankings that individuals assign to themselves. In this case, the reference group (or peer group) is the standard to which individuals compare themselves for self-appraisal.

These two perspectives of status are different but could be closely related and interact with each other. For example, the status seeking model developed by Frank (1985), introduces the idea that people derive utility from status, which depends on others' beliefs about their wealth. Because it is unobservable, relative consumption on positional (or visible) goods represents a signal of status.[4] This relationship is also present in the work of Kelley (1965), who distinguishes two roles of reference groups: comparative and normative. We have presented the former, while the second role provides the frame of reference for individuals: norms, attitudes and values of the individuals concerned. As a result, the normative role of reference is related with status as social rewards perspective. Another example is Piketty (1998), who defines status as the public belief about one's smartness. He considers only one perspective of status motive in the utility function, but he interprets both dimensions jointly as "*status motives*" when he describes how the discrimination of society or the

[4]Heffetz and Frank (2011) analyze the role of status based on the idea of "preference for status". In this approach they define status as a positional concern. However, they distinguish between "status preferences" and preferences where the opinions of others are important (reputation, pro-social behavior, shame, etc). Observe that this interpretation of status is more restrictive than that used in Weiss and Fershtman (1998).

reference group income could affect income mobility.

However, when status concerns have intrinsic value, social rewards and relative situation should be considered separately in the utility function. In the first case, the additional argument of the individual's utility function is the social beliefs about them. In the second case, the individuals' self-assessment of their relative position is considered as an argument of their utility function. Both perspectives have different behavioral implications.

One central question is who compares (rewards) to whom?. Social status is the relative position of individuals or social rewards in a given social group. People could have different status rankings or social reward, depending on the reference group in which each individual is evaluated. The reference group could be their family, friends, work colleagues or society at large. As a result, when people compare with others or when they care about other people's beliefs, they assign different weights to the individuals of their reference group (Weiss and Fershtman, 1998; Clark, 2008; Van Praag and Ferrer-i-Carbonell, 2008; Clark and Senik, 2010; Clark and D'Ambrosio, 2014). In this sense, individuals with the same observable characteristic may have heterogeneity in their reference groups, for example, as a consequence of income mobility (Genicot and Ray, 2014; Knight at al, 2011, Clark and Senik, 2010, Clark and D'Ambrosio, 2014; Clark et al., 2008). In the next section of this chapter, social rewards will be related with societal beliefs, meanwhile we assume that people compare their income with respect to the income of their reference group.

Finally, as the person's willingness to pay for social status could be very high, this issue is also relevant in understanding important aspects of economic results. Although it is difficult to accurately establish the importance of status on economic performance, its higher significance would be expected when the markets are thin. Hence, status may act as a social reward or punishment and it could be a corrective mechanism for some market failures such as externalities, transaction cost or monitoring problems. In this case, social status could increase efficiency. However, some approaches emphasize the role of status

as an instrument to restrict entry and impose modes of belief. In this case, it becomes a means to maintain the advantages of privileged groups. Frank (1985) shows another source of inefficiency through the consumption of positional goods. In this case, the higher individual consumption of these goods imposes a negative externality on others. As a result, status affects an agent's behavior, which may affect efficiency and allocation of outcome. However, the direction of these effects is not clear (Weiss and Fershtman, 1998). Hopkins (2008) points out that relative concern has significant implications for the link between equality and efficiency. However, their implications have received far less attention in the economic literature.

2.2.3 Evidence for relative concern

On the one hand, there is limited evidence about the relationship between income mobility and relative income concern. Piketty (1998) suggests there is indirect evidence about status motives based on social preferences for redistribution and beliefs about the origins of income inequality. Hoff and Pandey (2004) carried out an experiment in Northern India, in which they find that *lower-caste* children's cognitive tasks are unrelated to their social position. They have the same results as their *high-caste* counterparts when their *caste* identity is not publicly known, but obtain worse results once their *status caste* is known. The authors interpret this result as children reducing their effort when they believe that they could be discriminated against. Similar conclusions are reported by Afridi et al. (2015) for China's *Hukou System*. Fehr et al. (2011) found that willingness to punish social violations is lower among members of low *status caste* than among high *status caste*. They argue that this behavior could affect income mobility. Fehr and Hoff (2011) review evidence about the influence of society on individual preferences and explore the potential consequences on the persistence of inequality between social groups.

On the other hand, there is growing evidence that supports the fact that economic behavior could be affected by interpersonal comparisons and the esteem of others. Therefore

one central issue is that the behavior of individuals is often motivated by relative concern (Rabin, 1998; 2002). Heffetz and Frank (2011) review anecdotal, experimental and survey evidence, which shows that social status affects individual behavior. From economics there are at least four areas of empirical research that account for the importance of relative position in economic decisions. First, there is the literature on happiness or more in general, the empirical literature on subjective well-being measures. This literature studies how individuals' relative position and the environment where individuals live could affect their level of satisfaction or their economic aspirations (Clark, et al. 2009a, 2009b, Stutzer, A., 2004, Ferrer-i-Carbonell, 2005; Vendrik and Woltjer, 2007). Most of these studies highlight the opportunities provided by these types of variables for a better understanding of economic behavior.[5] Second, there is literature that measures the effect of relative position on "objective" output as consumption (Charles et al., 2009; Kaus, 2013; Brown, et al., 2010). These studies confirm the effect of reference groups on the consumption of visible goods, which crowds out other investments. Third, there are valuable research contributions in experimental economics which confirm that there are significant income comparison effects (Kanheman and Tversky, 1979, Galanter 1990; McBride,2010; Fliessbach et al., 2007; Alpizar, et al. 2005; Johansson - Stenman et al., 2002). Finally, there is empirical literature on how social status, relative situation and the visibility of decisions affect behavior and achievements (Ball and Eckel,1996; 1998, Ball et al., 2001; Rege and Telle, 2004; Ariely et al. 2009, Hoff and Pandey 2004).

Furthermore, empirical findings about relative concern allow us to formalize how reference group income affects an agent's utility. Evidence confirms the relevance of relative concern with respect to a reference point: *mean dependence mode*l.[6] Furthermore, Ferrer

[5]There is a debate in economics on the consistency of self-reported measures with "utility" and with observed choice behavior (Clark et al. 2008, Kahneman and Krueger, 2006, Ferrer-i-Carbonell, 2011).

[6]Hopkins (2008) distinguishes two families of relative concern models. On the one hand, he identifies *mean dependence models* where relative concern is defined as the difference between own performance and the reference level (Boskin and Sheshinski,1978; Abel,1990; Harbaugh,1996, Clark and Oswald,

i Carbonell (2005), McBride (2001), Di Tella et al., (2010) Vendrik and Wotjer (2007) found evidence on asymmetry of comparisons and loss aversion. Vendrik and Woltjer (2007) relate these empirical findings with the prospect theory developed by Kahneman and Tversky (1979). According to Tversky and Kahneman (1991), reference group income provides a natural reference point for income comparison. prospect theory suggests that welfare depends more on deviations from a reference level than on absolute levels. Negative changes generate a higher impact on utility than positive changes of the same magnitude (loss aversion), and preferences could be convex in the loss area (principle of diminishing sensitivity).[7]

Hopkins (2008) identifies a set of models and reviews evidence that supports relative concern based on three behavioral foundations: envy, pride (also named competitiveness) or compassion. According to the *envy effect*, the utility of an agent declines when an increase in the income of people richer than them occurs (namely $\frac{\partial U(.)}{\partial dy^R} > 0 \, if \, y^{RG} > y$, where $U(.)$ is the utility function, y^{RG} and y are reference group income and agent's income respectively and $y^R = y - y^{RG}$). Duesenberry (1949) argues that poorer individuals are negatively influenced by the income of their richer peers, while the opposite is not true ($\frac{\partial U(.)}{\partial y^R} > 0 \; if \; y^{RG} > y$, $\frac{\partial U(.)}{\partial y^R} = 0 \; if \; y^{RG} < y$). However, the *pride effect* (also named competitiveness) suggests that the utility of an agent decreases with any improvement in the income of others ($\frac{\partial U(.)}{\partial y^R} > 0$). Secondly, some authors assume that agents are better off when there is an improvement in the income of those agents below them ("*compassion effect*" ($\frac{\partial U(.)}{\partial yR} < 0 \; if \; y^{RG} < y$).[8]

These behavioral foundations based on relative comparison are related with social pref-

1996;1998, Futagamia and Shibata,1998; Ferrer-i-Carbonell, 2005; Card et al., 2012; Van Praag 2011). On the other hand, an alternative specification considers relative concern based on *income rank* (Layard, 1980; Frank, 1985 and Robson, 1992; Clark et al. 2009a; 2009b). In the next section we use the mean dependence models, because seem useful to model the role of reference group as a benchmark.

[7]This theory also suggests that individuals make decisions based on subjective probability assessments.

[8]There are models that combine these effects on the basis of different functional forms using reference-dependence model or ranking concern.

erences, which supports some of the presented assumptions (Hopkins, 2008; Fehr and Schmidt, 2003; Heffetz and Frank, 2011).[9] The original model of Fehr and Schmidt (1999) assumes that agents dislike others having more (*envy effect*) but low income for others reduces their utility (*compassion effect*). Alesina and Giuliano (2010) discuss the "*incentive effects*" of inequality aversion. They suggest that inequality generates incentives to work hard for most people below the top of the income distribution of the group.

The above findings provide some central issues for relative concern modelization. In sum, most of the studies assume $\frac{\partial U(.)}{\partial y^R} > 0$ when $y^R < 0$ and there is a consensus on the asymmetry in the income comparison with respect to reference income. In general, models assume the standard assumption of diminishing marginal utility of relative income when $y^{RG} < y$ ($\frac{\partial^2 U(.)}{\partial^2 y^R} < 0$). However, there is less agreement on the sign of the second derivative with respect to relative income for those individuals with relative deprivation. Vendrik and Woltjer (2007) argue that the objective function could be convex or concave in relative income, for agents with relative deprivation. On the one hand, the standard assumption of the diminishing marginal utility of income in neoclassical theory suggests concavity of the objective function in relative income ($\frac{\partial^2 U(.)}{\partial^2 y^R} < 0 \, if \, y^{RG} > y$). This effect would imply a rising marginal sensitivity to more negative values of relative income, which implies a "positional self - encouraged agent" (chapter 1). On the other hand, in prospect theory it is plausible to argue that the utility function is convex, reflecting diminishing marginal sensitivity to larger deviations from the reference group income ($\frac{\partial^2 U(.)}{\partial^2 y^R} > 0 \, if \, y^{RG} > y$). This implies a "positional discouraged agent" (chapter 1).

Furthermore, these findings suggest the relevance of status in explaining income mobility and its effect on individual behavior and support the relevance of theoretical studies to explore the link between status and intergenerational mobility. The next chapter addresses

[9] In this model, agents dislike difference between their income and that the others. In general, that type of models do not consider relative care with respect a reference point. However different types of aversion models have been formulated, and some of them incorporate relative payoff, which could be adapted to be interpreted as reference point (Hopkins, 2008; Charness and Rabin, 2002).

this issue.

2.3 Model and definitions

2.3.1 Social origin

Following Piketty (1998), we assume an economy made up of a continuum of agents $I = [0; 1]$, who only live for one period and are divided into two social backgrounds: lower-class origin (I_L) and upper-class origin (I_U). We assume homogenous characteristics (e.g. in terms of abilities) among the individuals that integrate both social groups. In this economy there are two possible income levels y_0 and y_1 ($\Delta y = y_1 - y_0 > 0$). Income is a random variable and the probability that agent i obtains a high income level depends positively on their ability (β), their effort (e_i) and luck π. Furthermore this probability is conditioned by social origin and it is given by:

$$\begin{aligned} Pr(y_i = y_1|I_L) &= \pi + \theta\beta e_i \\ Pr(y_i = y_1|I_U) &= \pi + \Delta\pi + \theta\beta e_i \end{aligned} \tag{2.1}$$

where, $Pr(.)$ defines the probability of the event in parentheses occurring and $\Delta\pi$ measures previous inequality between agents with different social backgrounds.[10] $\theta > 0$ is the same for all agents and measures the extent to which higher effort and higher ability can translate into higher probabilities of high income. The distribution of abilities ($f(\beta)$) is defined over some compact support $[b; B]$, where $0 < b < \beta_i < B$. That distribution presents mean β_M and varianceσ^2.

2.3.2 Status motives

In order to avoid any ambiguity in the definition of status and to discuss how optimal

[10]This parameter could explain the inequality of family transmitted human capital and/or inequality of collateral in case of credit constrains (Piketty, 1998).

effort decisions are affected by both status motives separately and how they interact with each other, two additional arguments in an individual's utility function are included in the standard basic model: the *self-perceived valuation of their relative position in their reference group* and *the social rewards based on how others value their observable actions.* As a result, the objective function of agent i is given by:

$$U_i(y_i, y_i^R, \beta_i^b, e_i) = (1 - \alpha - \lambda)y_i + \lambda\beta_i^b - \alpha G(y_i^R) - C(e_i) \tag{2.2}$$

where U_i is their utility function. Agents enjoy their income (y_i) for consumption reasons ($1-\alpha-\lambda > 0$), and dislike effort e_i because they enjoy leisure (agents perceive that effort is a cost defined by the function $C(e_i) = e_i^2/2a$, with $a > 0$). Individual utility is affected by the absolute level of income and effort. But behavioral economic and happiness literature shows that people have reference-dependent preferences (relative concern) and they care about the opinions of others about them (status rewards). We consider both perspectives separately and for simplicity reasons we assume that both are additively separable.

On the one hand, following Piketty (1998), we consider that an agent cares about *the public belief about him* (β_i^b). They care about being viewed as smart by others, where β_i^b is the expected ability of agent i according to public beliefs. We define this term as social rewards and it captures how the opinions and esteem of others about him affect his utility function. On the other hand, the utility depends on his *self-perceived valuation of his relative position* (y_i^R). Agents care about their relative deprivation (RD) which arises from a comparison between their income and their reference group income, and they dislike unfavorable income comparisons. The RD that agent i faces within his reference group is defined as a function $G(y_i^R)$, where ($y_i^R = y_i - y_i^{RG}$) represents the difference between his own income (y_i) and expected reference group income (y_i^{RG}). Finally, $0 < \alpha < 1$ and $0 < \lambda < 1$ measure the extent to which agents care about both status motives separately.

The function $G(y_i^R)$ is an attempt to formalize the discussion of how reference group income affects an agent's utility and it is defined as:

$$G(y_i^R) = \begin{cases} G(y_i^R) = G(y_i^R) > 0;\ G_{y_i^R}(.) < 0; & if\ y_i^R < 0 \\ G(y_i^R) = c & if\ y_i^R \geq 0 \end{cases} \tag{2.3}$$

As in previous studies, we assume an asymmetry in the income comparison,[11] which is also considered in the differences in the derivatives, where $G_{y_i^R}(y_i^R) < 0$ and $G_{y_i^R y_i^R}(y_i^R) > 0$ when $y_i^R < 0$ and $G_{y_i^R}(y_i^R) = 0$ when $y_i^R \geq 0$. Namely the dis-utility is constant with respect to the relative income when the pride or compassion effects exist, but the marginal utility increases when the *envy effect* exists. Following both theoretical and empirical literature, these assumptions recognize that agents are upward looking when making comparisons and that the *envy effect* dominates relative comparison.

The expected utility approach for decision-making under uncertainty (prospect theory) developed by Kahneman and Tversky (1979), provides evidence which supports our relative concern modelization. It suggests that welfare depends more on deviations from a reference level than on absolute levels, and that valuations with respect to relative income are asymmetric. These issues are included in the function $G(y_i^R)$ defined by 2.3.[12]

These assumptions allow us to define the concept of status more precisely. Note that Piketty (1998) assumes $\alpha = 0$. Furthermore, the term $\lambda\beta_i^b$ used in his paper provides a

[11] Other studies have already used this assumption. Stark et al. (2012) used the same assumption to formalize the link between human capital choices and social location choices. Bowles and Park (2005) used it to model the "*Veblen effect*". Genicot and Ray (2014) also suggest upward looking aspirations formation to describe the relationship between social interaction and aspiration formation. Dalton et al. (2015) use a similar framework to explain aspiration failure. Dusenberry (1949) postulated and tested the hypothesis that relative income comparisons are asymmetric. Finally, this assumption is supported by Bowles and Park (2005), Stuzter (2004) and Ferrer-i-Carbonell (2005).

[12] However, prospect theory suggests that the value function could be convex in the loss area: the principle of diminishing sensitivity ($G_{y_i^R y_i^R}(y_i^R) < 0$ if $y_i^R < 0$). In this chapter we do not consider this assumption and we assume standard concavity assumption. The implications are discussed in chapter 1.

better basis for the discrimination inequality persistence mechanism ("the social beliefs") than for modelling the reference group effect. As a result, his framework does not allow us to explore how agents react to the composition of their reference group and to analyze the trade-off between both status motives. To address this limitation, we assume $\alpha \neq 0$ and that agents care about obtaining a low gap between their income and their reference group income. This assumption allows us to distinguish the role of discrimination and reference groups in inequality persistence.

Finally, other studies support relative income concern based on social preferences (Fehr and Schmidt, 1999).[13] As we focus on the reference group effect and social rewards through public beliefs, inequality aversion is not in the utility function. Furthermore, we assume that agents are risk neutral.

2.3.3 Informational structure and status motives

Agents have perfect information about the parameters that determine the probability of economic success (π, $\Delta\pi$ and θ). As a result, the expected income for those with lower-class origins and higher-class origins is defined respectively as follow:

$$\begin{aligned} E(y_i|I_L) &= (\pi + \theta\beta_M e_L^b)y_1 + (1 - \pi - \theta\beta_M e_L^b)y_0 \\ E(y_i|I_U) &= (\pi + \Delta\pi + \theta\beta_M e_U^b)y_1 + (1 - \pi - \Delta\pi - \theta\beta_M e_U^b)y_0 \end{aligned} \tag{2.4}$$

Because they receive inheritance from previous generations, for the same effort the expected probability of economic success is higher for agents with origin I_U than for those with origins I_L (Assumption A.I). We assume that individual effort levels are not publicly observable, everybody expects that agents with lower-class origins make effort e_L^b and those with upper-class origins make effort e_U^b (A.II). Ex-ante agents do not have any in-

[13] Bolton and Ockenfels (2000) provide an alternative model to explain a wide variety of experimental results.

formation about their ability β_i and they assume the mean β_M of the ability distribution $f(\beta_i)$, with $0 < \beta_i \leq B$ (A.III). Following Piketty (1998) we make two natural assumptions. There is an exogenous maximum effort level E, and in the absence of any status motives, the unique equilibrium effort level is e_{eq}=$a\theta\beta_M\Delta y < E$ *(A.IV)*. Furthermore, in order to avoid corner solutions in probabilities, we assume $\pi + \Delta\pi + \theta BE < 1$ *(A.V)*. Finally, because agents are homogeneous we assume that ex-ante (before those agents choose their optimal effort level) agents share the public beliefs about their expected income, namely $E(y_i \mid I_J) = E(y \mid I_J)$ *(A.VI)*.

We assume that the expected income for agents with higher-class origins is at least equal to the expected income for agents with lower-class origins, because $\Delta\pi$, $(\pi + \theta\beta E)y_1 + (1 - \pi - \theta\beta E)y_0 = Max(E(y_i \mid I_L)) = E(y_i \mid I_U)$. This assumption is consistent with the presence of two social origins and it implies that the effect of the differential in expected effort on economic success $(e_L^b - e_U^b)$ never outweighs the effect of previous inequality, but with a high effort it is possible to reach the income of agents with origin I_U. This implies that e_U^b is higher than the certain minimum value $\underline{e_U^b}$ *(A.VII)*.

The set of agents $P_i(I_U) + (1 - P_i)I_L$ integrates the reference group of agents i. Agents know P_i, which is equal among agents with the same social origin and it is defined as $0 \leq P_i \leq 1$.[14] Therefore, agents know the expected income of their reference group, y^{RG}, which is defined as $y_i^{RG} = P_i(E(y|I_U)) + (1 - P_i)E(y|I_L)$. The idea is that the composition of reference groups defines a reference income level. Agents care about the gap between their income and their reference income, which depends on the expected income for agents with different backgrounds and on the composition of reference groups. Consider first the case of agent i with lower-class origin (I_L). Ex-ante agents do not have any information

[14] We assume that P is exogenous to agents' decisions. This assumption is simplistic but it is in agreement with the current empirical findings about the individual's group reference choice. Agents with social origin I_L compare only with their peers when $P = 0$ $(y_i^{RG} = y_0)$, and they compare only with upper-class agents when $P = 1(y^{RG} = y_1)$. Falk and Knell (2004) proposed a social comparison model with endogenous reference standard .

about their ability β_i relative to the ability of others agents, so they assume the mean β_M of the ability distribution $f(\beta_i)$ in both cases. The ex-ante expected relative deprivation is defined as:

$$
\begin{aligned}
& E(y_i^R \mid I_L) = E(y_i \mid I_L) - E(y_i^{RG}) = \\
= \underbrace{P_i}_{Composition} & \underbrace{(E(y \mid I_L) - E(y \mid I_U)}_{Expected\,income\,gap} + \underbrace{E(y_i \mid I_L) - E(y \mid I_L)}_{Expected\,income\,gap} = \\
& between\,agents\,I_L and\,I_U \qquad of\,agent\,i,\,with\,his\,peers \\
& = \Phi(e_i, e_L^b, e_U^b, P_i)
\end{aligned}
\tag{2.5}
$$

where $E(y_i \mid I_L)$ is the expected income of agent i, given that he comes from a family with origins I_L, and $E(y \mid I_L)$ is the expected income for agent with origins I_L, which was defined in equation 2.1. Observe that relative deprivation is composed of three terms, the composition of the reference group (P), the expected gap between agents with low and high social origins and the expected gap with respect to peer income. The latter is zero by assumption A.VI2. Therefore, they face a larger relative deprivation when the income gap (Δy) and previous inequality ($\Delta \pi$) are higher and when the impact of differential expected effort in social origins on economic success is lower ($\theta \beta_M \left[e_L^b - e_U^b\right]$). As a result, regardless of the value of P the expected relative deprivation of agents with lower-class origins is non-positive, $E(y_i^R \mid I_L) \leq 0$ (assumption A.VII2).

On the other hand, we assume that agents with upper-class origins I_U only compare with their peers. This assumption is consistent with the hypothesis that social comparisons are made upwards to a richer reference group (Bowles and Parker, 2005). As a result, the expected relative income is defined as:

$$E(y_i^R \mid I_U) = [E(y_i \mid I_U) - E(y \mid I_{\mathrm{U}})] \qquad (2.5.b)$$

Because of assumption A.VI2 agents with upper-class origins do not expect to face relative deprivation ($E(y_i^R \mid I_U) = 0$).

To model status as social rewards from the public belief, we follow Piketty (1998). We assume that individual social mobility trajectories are publicly observable. Agents know that economic success is informative about the agent's ability and the effort of previous generations. As a result, the social beliefs β_i^P about agent i depend indirectly on that agent's social mobility trajectory. The public beliefs after everybody has observed the mobility trajectories are given by the application of Bayes' rule, where the expected ability parameters β_i^P are given by:

$$\begin{aligned}
\beta_{01}^P &= \beta_M + \theta e_L^b \sigma^2/(\pi + \theta\beta_M e_L^b) \\
\beta_{00}^P &= \beta_M - \theta e_L^b \sigma^2/(1 - \pi - \theta\beta_M e_L^b) \\
\beta_{11}^P &= \beta_M + \theta e_U^b \sigma^2/(\pi + \Delta\pi + \theta\beta_M e_U^b) \\
\beta_{10}^P &= \beta_M - \theta e_U^b \sigma^2/(1 - \pi - \Delta\pi - \theta\beta_M e_U^b)
\end{aligned} \tag{2.6}$$

Observe that β_{01}^P defines the social status β_i^P associated with an upwardly mobile agent i with origin I_L ($i \in I_L, y_i = y_1$) and β_{00}^P the social status associated with agents with the same origins who remain poor ($i \in I_L, y_i = y_0$). Similarly, we consider β_{11}^P and β_{10}^P, for agents with upper-class origins who remain rich ($i \in I_U$, $y_i = y_1$) and for agents with upper-class origins who become poor ($i \in I_U, y_i = y_0$). Therefore, the expected social reward payoffs of economic success are defined as:

$$\beta_{01}^P - \beta_{00}^P = \frac{\theta e_L^b \sigma^2}{(\pi + \theta\beta_M e_L^b)(1 - \pi - \theta\beta_M e_L^b)} = \Delta\beta_L^P(e_L^b) \tag{2.7}$$

$$\beta_{11}^{P} - \beta_{10}^{P} = \frac{\theta e_U^b \sigma^2}{(\pi + \Delta\pi + \theta\beta_M e_U^b)(1 - \pi - \Delta\pi - \theta\beta_M e_U^b)} = \Delta\beta_U^P(e_U^b) \; (2.7b)$$

Observe that the social reward payoff for agents with origin I_L and I_U depends on their expected effort, e_L^b and e_U^b respectively. Note that these expressions summarize the information content of economic success, and establish a relationship between beliefs about social rewards and the expected income mobility of agents with different social origins. Note that, economic success are more informative about individual's ability when higher is the expected effort, the variance of the distribution of abilities (σ^2) and the return of effort (θ).

Finally, note that both expected relative deprivation and social rewards depend on expected effort. A higher expected effort increases expected reference income on the one hand, and it increases social reward payoff, on the other hand.

2.3.4 Effort choices

We assume rational agents, who act to maximize their expected utility based on the structural parameters of the economy and their beliefs. Agents maximize their expected utility (eq. 2.2), given their social origin (eq. 2.1), their reference group (eq. 2.4 or 2.4 $.b$), and their social rewards (eq. 2.7). If we formulate the explicit optimization problem in terms of expectations, add eq.2.7 and 2.3 in eq. 2.2, and consider the constraint defined by eq. 2.4 and 2.5 *(or* 2.4.b), the individual decision for an agent with origin I_L is described as:

$$\begin{cases} Max\, E\left[U_i(y_i, y_i^R, e_i) \mid I_L)\right] = (1-\alpha-\lambda)E\left[y_i \mid I_L\right] + \lambda\beta_i^b - \alpha E\left[(G(y_i^R \mid I_L))\right] - C(e_i) \\ S.t.\, E(y_i^R \mid I_L) = \Phi(e_i, e_L^b, e_U^b, P) \end{cases} \tag{2.8}$$

If we consider eq. 2.3, the first order condition allows us to derive a function, where effort depends on expected efforts and the reference group composition:

$$e_{Leq}(e_L^b, e_U^b, P) = \begin{cases} e_{Leq}^* = a\theta\beta_M(1-\alpha-\lambda)\Delta y + \lambda a\Delta\beta_L^P & if\ E(y^R \mid I_L) \geq 0 \\ e_{Leq}^{**} = e_{Leq}^* - \alpha a\theta\beta_M\Delta y\left[G_{y^R}(y_{Leq}^R)\right] & if\ E(y^R \mid I_L) < 0\ \&e_{Leq}^{**} < E \\ e_{Leq} = E & if\ e_{Leq}^{**} \geq E \end{cases} \tag{2.9}$$

For agents with origin I_U the optimization problem is defined as:

$$\begin{cases} Max\, E\left[U_i(y_i, y_i^R, e_i) \mid I_U)\right] = (1-\alpha-\lambda)E\left[y_i \mid I_U\right] + \lambda\beta_i^b - \alpha E\left[(G(y_i^R \mid I_U))\right] - C(e_i) \\ S.t.\, E(y_i^R \mid I_U) = \Phi(e_i, e_L^b, e_U^b, P_i) \end{cases} \tag{2.8.b}$$

The first order condition allows us to derivative the following expression.

$$e_{Ueq}(e_U^b) = \begin{cases} e_{Ueq}^* = a\theta\beta_M\left[1-\alpha-\lambda)\Delta y + \lambda\Delta\beta_U^P\right]\ if\ e_{Ueq}^* < E \\ e_{Ueq} = E \qquad if\ e_{Ueq}^* \geqslant E \end{cases} \tag{2.9.b}$$

The second order conditions ($\left[-\alpha(\theta\beta_M\Delta y)^2 G_{y^R y^R}(y_{eq}^R \mid I_L) - \frac{1}{a} < 0\right]$or $(-\frac{1}{a} < 0)$ hold

because of the convexity of $G(y^R)$ (in accordance with standard assumptions) and $c(e)$. Hence $e_{Leq}(P)$ and e_{Ueq} constitute individual optimum solutions.

2.3.5 The multiplicity effect of social rewards and reference groups

An equilibrium is defined as a vector ($\Delta\beta_L^P$, $\Delta\beta_U^P$) given by equations 2.7 and 2.7b such that the utility maximizing effort levels (eqs. 2.8 and 2.8b) generated by these social reward payoffs coincide with the expected effort level for agents with lower-class origins and upper-class origins (e_L^b,e_U^b)=(e_{Leq}^*,e_{Ueq}^*).

First of all, as the expected effort of agents with I_U affects the decisions of agents with origin I_L, but the inverse is not true, the former could be interpreted as leaders and the seconds as followers (Clark and Oswald,1998). For this reason, we first show the effort solution of agents with origin I_L. Furthermore, that effort level represents a benchmark for the effort decision of agents with origin I_L, when their reference group has $P \neq 0$.

Eqs. (2.9.b) and (2.7.b), and the above assumptions imply that an effort level e_{Ueq}^* will be an equilibrium for agents with upper-class origins if and only if:

$$e_{Ueq}^* = min(h(e_{Ueq}); E)$$

where $h(e_U) = a\theta\beta_M \left[(1-\alpha-\lambda)\Delta y + \lambda\Delta\beta_U^P(e_U)\right]$

Note that $\forall e\ h'(e) > 0$, which leaves open the possibility of multiple equilibrium. To simplify, we assume $\pi > 1/2$, which implies that $h''(e) > 0$ and makes the analysis of equilibrium multiplicity easier. Only three cases are possible:

(a): $a\theta^2\beta_M\sigma^2 < \zeta_U^{min}$. There is a unique low level equilibrium:$e_U^{low} = e_{Ueq}^*$.

(b): $a\theta^2\beta_M\sigma^2 \geqslant \zeta_U^{max}$. There is a unique high effort level equilibrium: $E = e_{Ueq}^*$.

(c): $\zeta_U^{min} \leq a\theta^2\beta_M\sigma^2 < \zeta_U^{max}$. There are two stable equilibrium levels, one is the low equilibrium level ($e_U^{low'} = e_U^*$), and the other is the high effort level $E = e_U^*$. There is one unstable equilibrium effort level $e_U^{unstable}$.

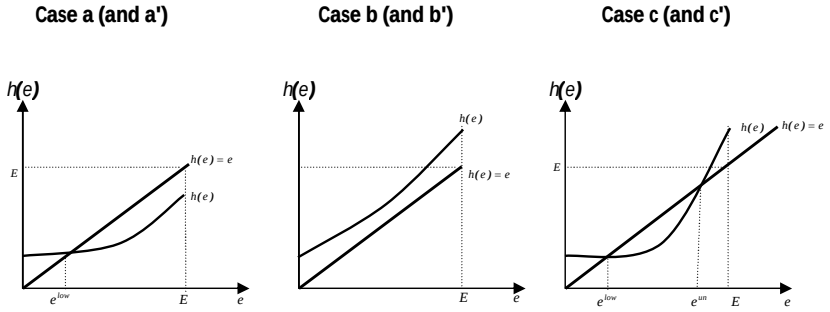
$where: \ \zeta_U^{min} = \left(\frac{E-(1-\alpha-\lambda)a\theta\beta_M\Delta y)}{\lambda}\right)(\pi + \Delta\pi + \theta\beta_M E)(1 - \pi - \Delta\pi - \theta\beta_M E) and \, \zeta_U^{max} = (\pi + \Delta\pi)(1 - \pi - \Delta\pi)$

Intuitively, in case a, the informative content of economic success is sufficiently small that the social status rewards will be low. As a result, low expected effort is self-fulfilling if agents care about the opinions of others about them (See Figure 2.1 case a). In case b the quality of the information about economic success is good, and economic success represents a strong signal of "smartness". In this case, higher expected effort leads to high social status rewards, so high expected effort is self-fulfilling (See Figure 2.1 case b). Finally, case c establishes the possibility of multiple equilibrium, because the informative content of economic success varies with e_U^b (See Figure 2.1 case c). Higher effort improves the quality of information about economic success regarding "smartness", and so, higher expected effort leads to higher effort equilibrium. But lower expected effort reduces the informative content of economic success, and leads to low effort equilibrium. That explains a multiple equilibrium based upon self-fulfilling beliefs.

Now, we focus on the effort equilibrium condition for lower class-agents. In this case social rewards are defined by equation 2.7, while expected relative deprivation is defined by eq. 2.5. Rearranging equation 2.9, the equilibrium for agents with lower-class origins is defined as:

$$e_{Leq}^* = min(h(e_L^b, e_U^b, P); E)$$

Figure 2.1: Equilibrium effort decisions under alternative circumstances



Notes: Figure 2.1 is based on Piketty (1998) and describes the equilibrium for upper-class agents. The equilibrium condition for lower-class agents is similar (replace $\pi + \Delta\pi$ by π). As a result, this Figure describes the equilibrium for lower-class agents when $\alpha = 0$. The feasibility of case a (and a') is higher when λ is low, while for case b (and b') is higher when λ it is high, namely when individuals care a lot about social rewards.

where $h(e_L, e_U^b, P) = a\theta\beta_M \left[(1-\alpha-\lambda)\Delta y + \lambda\Delta\beta_L^P(e_L) - \alpha\Delta y \left[G_{y^R}(y_{Leq}^R \mid I_L)\right]\right] = \hat{h}(e_L) - \alpha\Delta y \left[G_{y^R}(y_{Leq}^R \mid I_L)\right]$

First of all, if $\alpha = 0$, the equilibrium condition for lower-class agents is analogous to the upper-class agents (replace $\pi + \Delta\pi$ by π).[15] The effort decisions of agents with origin I_L are explained by the three situations presented above and ζ_L^{min} and ζ_L^{max}.

(a): $a\theta^2\beta_M\sigma^2 < \zeta_L^{min}$. There is a unique low level equilibrium: $e_L^{low} = e_L^*$.

(b'): $a\theta^2\beta_M\sigma^2 \geqslant \zeta_L^{max}$. There is a unique high effort level equilibrium:$E = e_L^*$.

(c'): $\zeta_L^{min} \leq a\theta^2\beta_M\sigma^2 < \zeta_L^{max}$. There are two stable equilibrium levels, one is the low equilibrium level ($e_L^{low'} = e_L^*$), and the other is the high effort level $E = e_L^*$. There is one unstable equilibrium effort level $e_L^{unstable}$.

[15]The function $\hat{h}(e_{Leq})$ shares the same properties as the function $h(e_{Ueq})$ ($\hat{h}'(e_{Leq}) > 0$ and $\hat{h}''(e_{Leq}) > 0$).

where: $\zeta_U^{min} = \left(\frac{E-(1-\alpha-\lambda)a\theta\beta_M\Delta y)}{\lambda}\right)(\pi + \theta\beta_M E)(1 - \pi - \theta\beta_M E)$ and $\zeta_U^{max} = (\pi)(1-\pi)$

When $\alpha \neq 0$ both status motives affect the effort decisions of agents with origin I_L, and their equilibrium is explained by $h(e_L, e_U^b, P)$. In this case, their decisions depend on the composition of the reference group and the expected effort of agents with origin I_U and I_L. We can make some predictions about how the equilibrium changes when we consider both status motives.

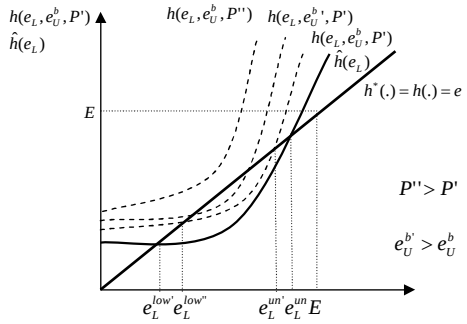
On the one hand, when $P \neq 0$ an encouragement effect based on the reference group leads to a higher effort of agents with origin I_L. Higher reference group income increases agent motivation leading to an increase in effort levels. The intensity of this effect depends on the expected income of agents with origin I_U and how both status motives interact with each other. In the case b', we can conclude that $\hat{h}(e_L)$ leads to a unique high effort equilibrium $E = e_U^*$.[16] The difference with respect to agents with high social origins is that in this case two channels lead to a higher effort: on the one hand, a high expected social rewards payoff; on the other hand, a higher reference group income due to both the effect of a higher income of agents with origin I_U and the high expected effort of peers.

In case a', low expected social status rewards lead to a relatively low effort equilibrium, but this effect might now be compensated by a reference group encouragement effect ($h(e_L, e_U^b, P) \geqslant \hat{h}(e_L)$). This leads to a higher effort level compared to the situation when $\alpha = 0$.[17] In this case the inclusion of relative deprivation could even lead to situation b' of high effort level equilibrium, or to situation c', with two possible effort equilibrium. Compared with the situation described in the previous paragraph, the effect of the reference group is expected to be lower. Given the low informative content of economic success, peer expected effort is lower, and so is the reference group income, which reduces the "encouragement effect". However, when $P = 1$, the reference group

[16] Observe that $\hat{h}(0) > 0$, $\hat{h}(E) > E$ and $h(e_L, e_U^b, P) \geqslant \hat{h}(e_L)$.

[17] This is clear, because adding $-\alpha\Delta y\left[G_{y^R}(y_{Leq}^R \mid I_L)\right]$ shifts the function $h(e_L, e_U^b, P)$ upward and to the left compared to $\hat{h}(e_L)$. As a result, the reference group effect leads to an upward shift of the curve $\hat{h}(e_L)$.

Figure 2.2: Equilibrium effort decisions of agents with lower-class origin when $\alpha \neq 0$ and $\lambda \neq 0$



encouragement effect is higher, and it leads to higher effort when e_U^b and $\Delta\pi$ are higher.

In case c' there are two possible situations, one leads to two equilibrium, $e_L^{low''} = e_{Leq}^*$ and $E = e_{Leq}^*$, but now $e_L^{low''} > e_L^{low'}$ (see Figure 2.2). The other situation leads to a unique high effort level $E = e_{Leq}^*$, because the reference group effect generates high displacement in function $h(e_L, e_U^b, P)$. That will be the case when $-\alpha\Delta y \left[G_{y^R}(y_{Leq}^R \mid I_L)\right] > E - \hat{h}(e_L)$, namely a high marginal utility of relative deprivation leads to high effort.[18]

On the other hand, the "reference group encouragement effect" disappears when $P = 0$, where $h(e_L, e_U^b, 0) = \hat{h}(e_L)$ and results are analogous to the situation with $\alpha = 0$. In this case, the effect of the reference group and social reward only depend on e_L^b and with the same sign. In general, when P is relatively low and social reward payoff is low, agents with origin I_L choose a lower effort level because the expected income of the reference group is low.

The predictions are consistent with *the self-fulfilling belief model* in a particular case

[18]Given the function $G(y_i^R)$, the feasibility that agents with origin I_L will choose $E = e_L^*$ will be higher when e_U^b and $\Delta\pi$ are higher.

namely, if each agent from lower-class background compares himself only to agents with the same origin ($P = 0$). The low effort equilibrium also requires e_L^b to be low, which might happen if the informative content of economic success is low. Namely, when agents share public beliefs and assume ex-ante that they belong to a reference group whose members are all I_L, they adopt a behavior that validates their reference group expectations.

When the structure of reference groups is heterogeneous, agents with lower-class origins always have incentives to assume strategies which improve their opportunities to achieve a better life. That "reference group encouragement effect" is reinforced by social rewards when the informative content of economic success is high, and higher peer effort increases effort decisions. A low P could even be compensated by a high social reward payoff, because peer effort beliefs motivate higher effort (case b' and potentially case c'). In this case, both status motives are complementaries.

2.3.6 The effect of social rewards and reference groups on intergenerational inequality persistence

The previous section discusses how both status motives affect effort decisions. Now we will discuss if these decisions could amplify the inequality between agents with different social origins. First, note that when $\alpha = 0$ and $\lambda = 0$ (i.e. without any status effect), equations 2.9 and 2.9.b trivially define a unique equilibrium where all agents make the same effort. In this case, effort decisions do not amplify income inequality between agents with different social origins.[19]

Although solutions are open in some cases, we can predict some important results about the effect of status on inequality, when $\alpha \neq 0$ and (or) $\lambda \neq 0$. We present the results in

[19]In this case $e_{Leq} = e_{Ueq} = a\theta\beta_M\left[(1-\alpha-\lambda)\Delta y\right]$. This situation establishes that $E(y_i \mid I_L) < E(y_i \mid I_U)$, because there is inequality of economic success between agents with different social origins due to the exogenous parameter $\Delta\pi$.

three steps to facilitate the presentation; first, we only consider the role of the reference group; then we only discuss the role of social reward; finally we consider both status motives together.

The role of reference groups ($\alpha \neq 0$ and $\lambda = 0$.)

In this case, the effort equilibrium depends on e_U^b, e_L^b, $\Delta\pi$ and P. We find two different situations where the composition of reference groups is a key issue. If $P \neq 0$, agents with origin I_L face more demanding reference groups. The "*relative deprivation effect*" encourages agents with origin I_L to make a higher effort. They amplify their economic aspirations because income goals are sufficiently challenging without being perceived as unattainable. The relative deprivation effect raises the optimal effort levels of agents with origin I_L, while the "relative deprivation effect" of agents with origin I_U is null. As a result, reference groups promote higher intergenerational mobility $e_{Leq} > e_{Ueq}$. When $P = 0$, reference groups do not affect effort decisions, and $e_{Leq} = e_{Ueq}$. This result is consistent with "self fulfilling belief", but in this case the inequality transmission is explained by the reference group. They only compare themselves with their peers, which reduces economic aspirations. Therefore, they adopt a behavior that validates their reference group expectations.

The role of expected social reward ($\alpha = 0$ and $\lambda \neq 0$)

We cannot really say in general whether social rewards reduce or amplify the inequality persistence of economic success between agents with different social origins. However, in some cases the model has unambiguous predictions. On the one hand, observe that if $a\theta^2\beta_M\sigma^2 \geqslant max(\zeta_L^{max}, \zeta_U^{max})$, social reward payoff is high, so agents from origin I_L and I_U choose high effort levels ($E = e_L^* = e_U^*$), and, status rewards do not amplify inequality persistence. On the other hand, when $\theta^2\beta_M\sigma^2 < min(\zeta_L^{min}, \zeta_U^{min})$, both agents from origin

I_L and I_U choose low effort levels, but $e_U^{low'} > e_L^{low'}$. As a result, status rewards amplify inequality persistence between agents with different social origins.

Finally, expected social rewards also amplify the inequality between agents with different social origins when the impact of social origin on economic success is high compared to the effect of effort and ability. As such, social rewards reduce mobility when $\zeta_U^{max} < a\theta^2\beta_M\sigma^2 < \zeta_L^{min}$. The latter is one of the most important results of Piketty (1998). In this case, people with lower-class origins make a low effort, which reduces the opportunity of social ascent, while, the effort of people with upper-class origins is high in order to maintain their original position. To put it another way, self-fulfilling discriminatory beliefs can make the initial inequality between social groups more persistent than it would otherwise have been.

In the rest of the situations, at least one of the origins faces multiple equilibrium effort levels, so one cannot identify which equilibrium gets selected for which social origin.[20]

When both status motives matter ($\alpha \neq 0$ and $\lambda \neq 0$)

In this case the results depend essentially on the composition of the reference group, which seems to play a key role in the promotion of aspirations and social mobility. When agents with origin I_L only compare themselves with their peers $P = 0$, the results are analogous to the situation described in the previous section (when $\alpha = 0$). This result is consistent with "self fulfilling beliefs" and low mobility traps, when agents expect their peers to choose low effort levels, their decisions confirm their *a priori* expectations. The origin of that confirmation relies both on a low status rewards payoff and the reference group composition.

However, when $P \neq 0$ reference group income encourages a higher effort of agents with

[20] Strictly speaking, we also know that $e_U^* > e_L^*$ when $\zeta_U^{min} < \zeta_L^{max}$. However, because agents with origin I_U face multiple equilibrium effort levels, we do not quantify the magnitude of the differences in the effort by social origin.

origin I_L. Their effort is not decreasing in P, because when higher P, they include more agents with origin I_U in their reference group. The relevance of this effect depends on the expected reference income and the functional form of the function $G(y_i^R)$. It is difficult to predict how effort differences between social origins affect intergenerational mobility, but in this case it is clear that agents with lower-social origin have higher motivation to increase their effort. They will even increase their effort in the extreme case identified in Piketty (1998), when social reward payoff establishes strong differences in the incentives ($\zeta_U^{max} < a\theta^2\beta_M\sigma^2 < \zeta_L^{min}$). Because agents with origin I_L include agents with origin I_U in their reference groups, they are encouraged. Observe that their incentive became higher when e_U^b=E=e_{Ueq}^*.

Second, observe that if $-G(y_i^R \mid I_L) > \frac{(\pi+\theta\beta_M e)(1-\pi-\theta\beta_M e)}{(\pi+\Delta\pi+\theta\beta_M e)(1-\pi-\Delta\pi-\theta\beta_M e)}$, the effort equilibrium of agents with origin I_L ($e_L^* \neq E$) will always be higher than the effort equilibrium of agents with origin I_U ($e_L^{low'} = e_L^* > e_U^{low'} = e_U^*$). This condition describes a situation where the marginal utility of a reduction in relative deprivation is higher than the ratio of social reward payoff between agents with different origins. Namely, under this situation, the reference group effect compensates the differences in incentives due to low status rewards for agents with social origin I_L. As a result, status motives reduce intergenerational inequality persistence. As is noticed in the previous paragraph, even when the expected relative deprivation effect is higher, agents with a low-social origin will choose a high effort level, in the extreme case, E=e_{Leq}^*. Namely, agents with social origin I_L respond by increasing their effort when agents I_U present high effort equilibrium.[21] It is worth noting that they are encouraged by the expected income of agents with origin I_U but also by their peers with origin I_L.

Finally we can predict that the effort of agents with origin I_L will be higher than or

[21] Agents with origin I_L and higher Y^{RG} choose a high effort level because their relative deprivation and economic aspirations are relatively high. As is discussed in chapter 1 that response depends critically on assumption of $G_{y^r y^r}(y^r) > 0$.

equal to agents with origin I_U when $-\alpha\Delta y\left[G_{y^R}(y^R_{Leq} \mid I_L)\right] > E - \hat{h}(e_L)$. In this case, the reference group of agents with origin I_L leads to high effort, due to its composition and expected effort. As such, both status motives are complementaries, high expected peer effort due to social rewards reinforces the effects of reference group composition, and income mobility is increased.

2.3.7 A discussion on status motives and optimal social decision

It is useful to consider the properties of an equilibrium in which many effort decision-makers act as in the model presented. Observe that both status motives affect individual effort decisions. As agents ignore the externalities that their decisions generate, the equilibrium based on individual decisions will be sub-optimal. This is because effort decisions affect the relative deprivation of others and the social status rewards. This prediction is in accordance with the findings of economic models in which individual utility depends on relative situation (Clark and Oswald, 1998; Piketty, 1998; Frank, 2005), and status motives lead to sub-optimal decisions.

As a result, the equilibrium defined by equations (2.9b) and (2.7b) are never first-best efficient because of the status-induced externality of social rewards and the rat-race effect induced by the reference group. As Piketty (1998) and chapter 1 noted, the socially optimal effort level is lower than the effort level chosen by agents individually. The additional effort of agents with origin I_L generated by expected social status rewards and reference group effect is inefficiently, while the effort level chosen by agents with high social origin is higher than the socially optimal effort level. This is because the social reward that agents with origin I_U receive due to economic success is supported by beliefs, and it does not depend on their real effort. Furthermore, their effort is socially sub-optimal because it affects the reference group income of agents with origin I_L, which induces an additional inefficient effort from them. Finally, when there are multiple equilibrium (cases c and c'), as Piketty (1998) demonstrated low-effort equilibrium are always less inefficient

than high effort equilibrium.

2.4 An extension: Heterogeneity in reference groups and intergenerational learning

In the previous section we assume identical agents who only differ in their social origins. Furthermore agents with origin I_L have the same reference group, which leads to the same and unique effort decision. They anticipate the actions of others identical agents when they take effort-decisions, which implies perfect forward-looking agents and that public beliefs about e_L^b and e_U^b are known. As a result, we do not care about how they form their expectation about their peer effort.

Now we introduce an analytical form to consider heterogeneity in the reference group of agents with origin I_L. We assume that each agent i knows his P_i, which is a random variable with the distribution function $F(P_i)$ for all $P_i : 0 \leq P_i \leq 1$. Observe that P_i incorporates the idea that individuals with similar characteristics may present differences in their reference group. As a result, the expected income of the reference group, y^{RG}, is defined as $y^{RG} = P_i(E(y|I_U)) + (1 - P_i)E(y|I_L)$.

As there are differences in the reference group composition of agents with social origin I_L, there could be differences in the effort decisions among them. An implication of this is that the expected effort of agents with origin I_L represents an average of their effort decisions.

$$\int Pe_{Li}(P)dp = e_L^{mean} \tag{2.10}$$

Assumption A.II stated that individual effort levels are not publicly observable (e_L^{mean} is unknown) and agents choose their effort based on the public beliefs e_L^{b} about e_L^{mean}.

Agents with origin I_L do not know the effort of the peers of their generation, but each generation updates their beliefs with respect to previous generation belief by a backward-looking learning process, that is, in light of the recent experience of peers with the same social origin from a previous generation.[22]

The updating effort belief function is defined as an adaptive process (Assumption VIII):

$$\triangle e^b_L = e^b_{L\,current} - e^b_{L\,parents} = \Phi(real\,mobility_{parents} - Expected\,mobility_{parents}) \quad (2.11)$$

where "current" and "parents" indicate the beliefs of current and previous generations respectively. The mobility experienced by the previous generation is observable by the "next generation" ($real\,mobility_{parents}$), and it represents a signal of peers' effort levels (observable from previous generation).[23] On the other hand, the $Expected\,mobility_{\,parents}$ are transmitted from previous generations (intergenerational inherited beliefs) and represents *a priori* public beliefs for the current generation. As a result, the current generation knows the arguments of the updating belief function. To simplify, the real mobility and expected mobility of the parents' generation, are expressed as a function of their real mean effort and their expected mean effort respectively.

$$\triangle e^b_L = \phi(e^{mean}_{L\,parents} - e^b_{L\,parents}) \quad (2.12)$$

[22] Bowles (2004) argues that backward-looking learning approach has advantages when compared to the forward-looking learning process.

[23] Observe that the signal of previous generations, not only provides information about peer effort, but also provides valuable information about the effectiveness of the effort of agents with low social origins to achieve economic success and social ascent.

The parameter ϕ represents the speed of error correction and we assume that $0 < \phi < 1$. Finally, we assume that agents know that there is an exogenous maximum effort level E. Under these assumptions the updating effort belief function is defined as:

$$e^b_{Lcurrent} = min(\phi(e^{mean}_{L\,parents} - e^b_{L\,parents}) + e^b_{L\,parents}\,;\, E) \tag{2.13}$$

The rationality of the updating belief rule is the following: when the current generation has an *a priori* belief that their peers in the past had made a high effort but were not rewarded with upward mobility, there will be some downward adjustment of the expected effort for their current peers $\triangle e^b_L < 0$. A high achievement performance in the previous generation should induce rational agents to expect higher effort in their next generation peers, namely $\triangle e^b_L > 0$, or $\triangle e^b_L = 0$ if $e^b_{Lparents} = E$.

2.4.1 Long term effort equilibrium with learning processes and heterogeneous reference groups.

The assumptions presented in section 2.3.4 establish a leader-follower dynamic between agents with origin I_L and agents with origin I_U. We have already discussed the equilibrium decisions of agents with high-class origins. Furthermore, we assume homogeneity in the reference group of agents with origin I_U and they do not face intergenerational learning. For this reasons, in this section we focus on agents with a low social background as the best case study, and we assume $e^b_U{=}e^*_{Ueq}$ as exogenous.

A long term equilibrium is a vector of consistent effort decisions and effort beliefs, where $e^b_U{=}e^*_{Ueq}$, $e^b_{Lss}{=}\int Pe_{Liss}(P_i)dp$ and $e_{Lss}(P_i) = e^*_{Leq}(P_i)$. Where $e^*_{Leq}(P_i)$ represents the individual effort equilibrium of agents with social origin I_L and with a reference group composition defined by P_i, and ss defines the steady state. The effort decision of agents

with origin I_L is defined by:

$e^*_{Leq}(P_i) = min(h(e^b_{Lss}, e^b_{Uss}, P_i); E)$.

To simplify the long term equilibrium and its implications, we assume that signals from previous generations are always in the right direction (Assumption A. IX). Namely if $\triangle e^b_L > 0$, the effort of current generation agents with origin I_L will increase, and that investment will return a higher income mobility. On the other hand, if $\triangle\ e^b_L < 0$, agents will reduce their effort and income mobility will decline. This establishes that the sign of $^{\partial \triangle e^b_L}/_{\partial e^{mean}_{Lparents}}$does not change and is positive.

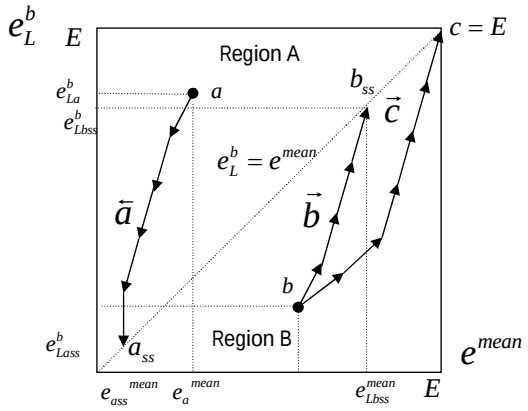
Given assumptions of section 2.3.4 and assumption A.VIII and A.IX, Figure 2.1 describes the dynamics of effort beliefs and mean effort for agents with social origin I_L. The long term equilibrium and the dynamics depend on the initial beliefs and the "initial mistake" about mobility expectations.

First, observe that in point a, initial beliefs e^b_{La} lead to effort e^{mean}_{La}. In this point, the effort of agents with origin I_L are not rewarded in terms of upward mobility. As a result, the expected effort of agents with origin I_L will decline, as well as their effort level decisions. Then the curve $\underleftarrow{a}$ describes the dynamics of effort beliefs as a function of mean effort, and establishes a long term equilibrium in point a' of lower effort $e^b_{La'}$.

Second, if we assume that the initial beliefs and effort outcome lead to point b, the beliefs dynamic is described by curve $\underrightarrow{b}$. In this case, the high mobility outcome with respect to initial beliefs, leads to an increase in expected effort and effort decisions. As a result, long term effort beliefs explain a high mean effort for agents with social origin I_L. Observe that this dynamics may lead to high equilibrium effort, where $e^{mean}_L = E$ (observe the dotted line $\underrightarrow{c}$).

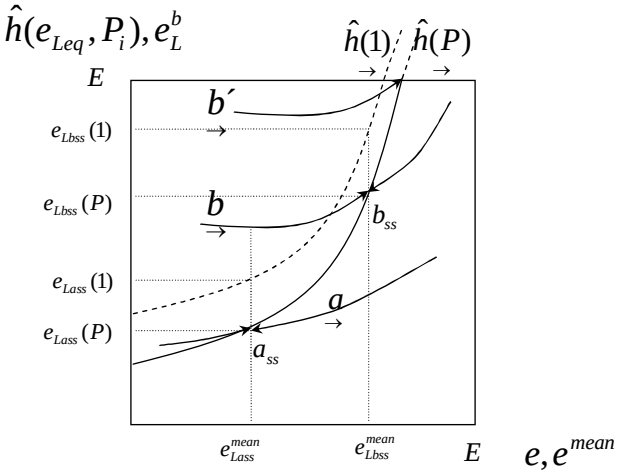
Figure 2.2 describes the long term equilibrium in terms of the individual effort of agents with origin I_L. The individual effort equilibrium depends on P_i, e^b_L and e^b_U. As already

Figure 2.1: Long term belief and effort of agents for lower-class agents



Notes: In Figure 2.1, the first bisectrix represents a situation where $\triangle e_L^b = 0$. Above this line (region A), $e_L^{mean} < e_L^b$ $\triangle e_L^b < 0$. Below this line (region B) $e_L^{mean} > e_L^b$, then $\triangle e_L^b > 0$ or $\triangle e_L^b = 0$ if $e_L^{mean} = E$.

Figure 2.2: Long term effort decision for lower-class agents



mentioned $h_{e_L^b}(e_{Li}, e_L^b, e_U^b, P_i) > 0$ if $P \neq 0$, and because $\frac{\partial e_L^b}{\partial e_L^{mean}} > 0$ and $\frac{\partial e_L^{mean}}{\partial e_{Li}} > 0$, we can describe the effort decisions of this agents in the curve $\underrightarrow{h(P)}$ in Figure 2.2. Observe that $h_{e_L^b}(e_{Li}, e_U^b, 1)$ do not depend on e_L^b ($h_{e_L^b}(e_{Li}, e_L^b, e_U^b, 1) = 0$), $h(1) \geqslant \underrightarrow{h(P_i.)} \forall P_i$. For this reason, this effort level represents a benchmark.

When we consider how the dynamics of peer effort beliefs affect long term effort decisions, we identify three general cases. First, when the relationship between effort beliefs and mean effort is described by a curve type $\underrightarrow{a}$, where expected effort is too high with respect to income mobility outcome, expected effort will decrease, and so will effort level decisions. In this case, the long term equilibrium will be $e_{Lass}^{low}(P_i)$. The effort levels of agents with origin I_L are low, because their reference group income is low, but also because their peers failed past attempts to move up. Observe that those agents, with higher P, will choose a relatively higher effort level.

The second case is described by $\underrightarrow{b}$, where "effort pays", and the high effort of previous generations, leads to higher expected effort and results in a relatively high effort of current generation. As a result, the long term equilibrium is $e_{Lss}^{bigh}(P_i)$. In the extreme case,

learning about peer effort and mobility results could lead to $e_{Lss}(\tilde{P}_i) = E$ (observe the dotted line $\underrightarrow{b}$'). In this case, both status motives are complementaries. However, because $e^b_{ssL} < E$, agents with lower $P_i < \tilde{P}_i$ will chose a lower effort, while those with $P_i \geq \tilde{P}_i$ will chose E.

Third, when e^b_{Lss}=E, the intergenerational learning process leads to high expected effort. In this case, the individual effort equilibrium for all agents with origin I_L is E, regardless of P_i. This situation determines a "self fulfilling belief" due to high peer effort beliefs.

This discussion allows us to conclude that the composition of reference groups, the social rewards and the expected peer effort are key issues to explain individual effort decisions. These results are consistent with conclusions from the previous section. But now we consider the relevance of intergenerational learning of beliefs about peer effort, which allows each generation to adjust its effort decision. The updated public beliefs about expected effort (e^b_L) depend upon the observed social mobility experienced by the previous generation. The backward-looking learning allows agents with I_L to learn about the mobility experience of previous generations, which will be more relevant in explaining current beliefs when ϕ is high. That process leads to changes in expected reference group income, and affects individual effort decisions and intergenerational mobility.

2.4.2 A review of sub-optimal social decisions.

The incorporation of learning processes allows us to review some comments about section 2.3.7 regarding the implications in terms of optimal social decisions. Income mobility outcomes from the previous generation allow agents to learn about the effectiveness of effort decision to achieve economic success, and represents valuable information to learn about the expected effort of peers. The learning process could have strong implications in terms of efficiency, compared to the previous section. In this case, the additional effort as consequence of both status motives could be less inefficient compared with the situation without learning.

Observe that the intergenerational learning process through income mobility mitigates the status-induced externality of social rewards and the reference group rat-race effect when "effort does not pay" (situation $e^{low}_{Lass}(P_i)$). When expected peer effort is low because of a relatively low income mobility outcome (and the information about the effectiveness of economic success is low), social status rewards and reference group income will be low, which leads to low effort decisions of agents with origin I_{L}. In this case, the additional inefficient effort will be reduced. On the other hand, when "effort pays", agents will adjust expected peer effort upward. That increases the effort decisions of agents with origin I_L, who perceive that they are rewarded by status and upward mobility. Furthermore, the expected peer effort is high and encourages a higher effort. However, in this case the implications in terms of efficiency are ambiguous. The higher effort generates positive consequences in terms of income mobility, which could generate more efficiency in ex-post terms because "effort pays", and higher upward mobility increases social welfare. However, this reinforces both the status induced-externality and the rat-race effect, and could lead to effort decisions which are too high (as well as inefficiency). New research on this topic is necessary to analyze the differences between ex-ante and ex-post optimal social decisions.

2.5 Final comments

There is a consensus that relative concern changes economic incentives and affects individual behavior. Limited research has been done on the implications of this on income mobility. To address this issue, this chapter adopts two alternative perspectives of social status, "social rewards" and "reference groups", and it proposes a framework to analyze their role in intergenerational income mobility. This framework allows us to define status motives in a more precise way, which allows us to distinguish the role of discrimination and reference groups in inequality persistence and to explore how both status motives

interact with each other. This is a contribution with respect to Piketty (1998), which models status motives in a general way. Furthermore, this chapter considers the reference group in more detail and incorporates the idea of a leader - follower dynamic between agents from high social origins and low social origins. An additional contribution is considering heterogeneity among agents with low social origins and a discussion of the role of learning between generations.

Our model confirms the importance of social status to explain effort decisions and allows us to discuss under what circumstances both status motives could be an additional mechanism for the persistence of inequality between generations. We identify 3 different mechanisms of inequality persistence: mobility could be low because the poor are not sufficiently motivated to move up due to the reference group composition; they are being discouraged by society as a whole because of low status rewards; they are discouraged by expected peer effort, because their peer group failed past attempts to move up.

However, under certain circumstances, reference groups could reduce economic inequalities. This is the case when reference groups of agents with a low social origin include agents from a high social origin or when the social rewards of economic success are high. Also, when effort of agents with low social origin is rewarded with high income mobility and social rewards. In this case, peer effort is high, which induces a high reference income level. Furthermore, social beliefs lead to high social reward for those agents who achieve economic success. As a result, both status motives encourage higher effort. This finding is in stark contrast to previous inequality models based upon self-fulfilling beliefs and fatalistic prediction.

The mechanism that dominates depends on 5 key issues: (a) the composition of the reference group; (b) social rewards based on how society values the effort and observable actions such as intergenerational mobility; (c) expected peer effort; (d) the trade-off between both status motives; (e) informational assumptions and the intergenerational

learning process about the effectiveness of effort with regard to upward mobility.

The results of our model emphasize that, it is not only the condition of lower-class backgrounds which determine the low mobility and aspirations failure. It is the unequal initial status condition, together the social polarization, the lack of connectedness, distorsive social rewards and the unequal distribution of opportunities to pursue upward mobility, which are responsible for low economic aspirations. Therefore, a more integrated society, one in which there is greater economic diversity in the reference groups and income inequality is relatively low, might open the possibility that the effects of reference group and status rewards increase intergenerational mobility.

These results are related with Ray's aspiration model predictions and the role of the social polarization in determine aspiration failures. The concept of aspiration failure is related with a variant of fatalistic models, where people believe that their destiny is pre-ordained and beyond their control (Ray, 2006; Genicot and Ray, 2014). Ray (2006) distinguishes two types of aspiration failure. Aspiration failure type I occurs when agents with low social origins do not include agents with high social origins in their aspiration window. As a result, the aspiration gap is low, as will be individual investment for the future. In aspiration failure type II, agents with low social origins include individuals from richer origins in their aspiration window, but the previous inequality and relative costs of effort are so high that agents perceive the goal to be unattainable and they are discouraged. The income mobility will be higher in a connected society, one in which there is high heterogeneity in each reference group, diversity in which every individual can reasonably think of himself as being on the attainable fringes (Ray, 2006).

Finally, the implications of status motives on optimal social decisions are reviewed. The conclusions depend on the informational assumptions. An intergenerational peer learning process could mitigate the sub-optimal status effect. However, more research in this issue is necessary to distinguish the difference between ex-ante and ex-post perspectives.

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3 The effect of relative concern on economic satisfaction

Abstract

A central issue in individual economic behavior is that an individual's satisfaction depends on their relative income with respect to their reference level. The aim of this chapter is to contribute to a greater understanding of how relative income with respect their reference group can affect economic satisfaction, contrasting the assumptions of prospect theory. This is tested with alternative measures for the reference income for Uruguayan three waves panel survey on "Multidimensional Well-being Trajectories in Childhood" (MWTC). Relative income is defined as the difference between household income and a reference level, and its effect on the economic satisfaction of the adults in this sample of households is evaluated empirically.

Our findings are consistent with 3 key assumptions of prospect theory. The importance of relative income in determining economic satisfaction, and the asymmetric valuation comparisons, is confirmed. In contrast to what was found for Germany, there is evidence of diminishing marginal sensitivity.

The results are robust to alternative reference levels. In addition, the findings provide evidence for heterogeneity in the income level that each person takes as a reference when assessing their relative position. The latter may provide preliminary evidence about reference group composition. These findings could have very important implications in terms of mobility in light of the predictions from the models developed in the first chapters. In this sense, this chapter provides preliminary evidence of a reduction in the economic aspirations among those faced with unfavorable relative income.

Keywords: Economic satisfaction, relative income, prospect theory, aspirations.

3.1 Introduction

The prospect theory developed by Kahneman and Tversky (1979) represents an inflection point in the modelling of decision making under uncertainty in economics. It suggests that when agents make decisions based on a value function that reflects their expected utility, they assign greater weight to the return relative to a reference point than to the result in absolute terms. This function incorporates 4 assumptions that explain the main differences between this approach and conventional decision making models: (a) reference dependence, an assumption that suggests that well-being depends more on income relative to a reference point than on its level in absolute terms; (b) the asymmetric valuation between gains and losses, which states that the intensity of the valuation of a loss is greater than that of a gain of equal magnitude; (c) the principle of diminishing sensitivity, which implies that the value function may be convex in the area of loss; (d) subjective probability assessments, under uncertainty, people weigh their options based on subjective distribution functions (Kahneman and Tversky, 1979; 1992).

While the prospect theory was originally developed to contribute to a greater understanding of the decision making of agents under uncertainty, the relevance and validity of these assumptions have been argued in other contexts to explain economic behavior. Tversky and Kahneman (1991) argued that the average income of the reference group represents the natural comparison point for each person to value their income, which establishes a bridge between their contributions and the empirical research in economics that has incorporated relative concern into the individual's objective function. Relative concern has been considered into economic literature in deterministic contexts, using, among other basic ideas, the reference group theory of Merton (1953).[1] These approaches incorporate relative concern assuming that, in their objective function, agents make their valuations relative to a reference level: "mean dependence model". Duesenberry (1949)

[1]For a review about microfundations of relative concern see Hopkins, (2008) and chapter 2 section 2.2.1.

argues that social comparisons are not symmetric, which suggests that an unfavorable relative situation generates disutility, while a favorable relative situation has no significant impact on utility. This discussion is closely linked with assumptions a and b. Moreover, the marginal sensitivity of the relative concern (assumption c) has been associated with people's attitude toward risk (Di Tella et al., 2010).

Another example of the application of the assumptions of the value function of prospect theory is present in the Genicot and Ray model (2014) on aspiration formation. Based on the contributions of behavioral economics, the authors incorporate a reference point in the individual's objective function, which is interpreted as the aspirations set by each individual. They define the aspiration gap as the difference between individual income and aspiration level. Those individuals located below the reference point (negative aspiration gap) face disutility due to their relative situation, while a positive aspiration gap generates utility. Furthermore, prospect theory assumptions imply that the marginal sensitivity of the aspiration gap increases as people approach their aspiration level.

Experimental economics has contributed abundant evidence supporting the assumptions of the value function of prospect theory. In general, these papers take responses to expected utility into account. There are fewer studies that attempt to provide answers on the field based on self-reported satisfaction, or experienced utility. Vendrik and Woltjer (2007) use panel data from Germany (1984-2001) to test the assumptions of prospect theory. The authors take the average income of the peers as a reference point, and measure relative concern as a fraction between the income gap and the individual's reference income group. They associate the relative position with percentage gains and losses in relation to this reference point, finding that life satisfaction has an asymmetric valuation between individuals with and without relative deprivation, and its functional form is concave in both cases. The results are consistent in relation to assumptions a and b, but reject assumption c. Evidence to the same effect on the first two assumptions is given in the

papers by Ferrer-i-Carbonell (2005) and Di Tella et al. (2010).[2]

The results on marginal sensitivity from Vendrik and Woltjer (2007) are consistent with the traditional assumptions of the neoclassical theory. The authors argue that a concave function is possible for those in the area of relative deprivation, if a greater gap from the reference point means it is increasingly costly to access the resources necessary to participate in the social activities of the reference group. The existence of rising costs in social participation when the distance between income and the reference point is higher implies increasing marginal sensitivity with respect to the gap.

Moreover, Vendrik and Woltjer (2007) suggest that the contradiction between their findings and prospect theory could be explained by problems in the way that they define reference income, which is only adjusted if there are changes in the average income of the reference group. However, situations of high mobility or differences in the perception of the relative position could affect the integration of the reference group and in turn affect reference income (Clark and D'Angelo, 2013; Cruces et al., 2013). This issue is related with the social-filter function considered by Van Praag and Ferrer-i-Carbonell (2008). This function describes the reference group, and it assigns much weight to individuals who are nearby socially speaking, and negligible weight to people who are far away. Even, prospect theory results suggest that people weigh their options based on subjective distribution functions, which could explain differences in the reference group income set by each individual (assumption d). Consequently, the reference income level used in Vendrik and Woltjer's paper may be inadequate to test the hypothesis of diminishing marginal sensitivity. Up to now, this aspect has not received enough attention within economic literature, and to some extent is associated with the endogeneity of the reference group. The model of Genicot and Ray (2014) on the aspirations window, and its impact on aspiration formation, has some suggestions on how to approach the issue.

[2]These papers do not propose testing the assumptions of prospect theory.

The previous empirical research which studies the levels of satisfaction considering the income of peers as a reference point, while generally confirming the asymmetry of relative concern, is ambiguous with respect to its concavity or convexity (Vendrik and Woltjer, 2007; Ferrer-i-Carbonell, 2005). Moreover, there is debate about the income level taken as a reference, as well as the possibility that individuals with similar characteristics may present differences in their reference income (Clark and D'Angelo, 2013). This chapter seeks to close this gap by providing evidence on the validity of the assumptions of prospect theory in the modelling of relative concern with respect to a reference level.

To this end, we first propose to test two of the main assumptions of prospect theory: (HI) the asymmetric valuation of gains and losses; (HII) diminishing marginal sensitivity as one moves away from the reference point.

As a secondary objective, from the basics provided by Genicot and Ray (2014) on the importance of the aspirations window, this chapter provides evidence that individuals with similar observable characteristics choose different reference points. We discuss our results in light of the predictions from the models presented in the first chapters. It is these arguments that lead us to explore how unfavorable situation can result in a reduction of economic aspirations. In order to analyze how the relationship between fatalistic beliefs and relative deprivation affect economic satisfaction, we use three dimensions of Locus of Control measures (Rotter, 1966; Levenson, 1981). Lefcourt (1991) states that LOC refers to individual beliefs about the causal connection between personal characteristics (and/or actions) and experienced outcomes; therefore its link with aspiration seems immediate. This allows us to provide preliminary evidence on the role of the LOC and reference group on income aspirations.

To test these hypotheses, unlike the previous research, we use economic satisfaction as a dependent variable. Previous papers highlight the opportunities provided by this type of variable for a better understanding of the economic behavior of people (Kahneman

and Krueger, 2006; Frey and Stutzer, 2002; Clark et al., 2008; Ferrer-i-Carbonell, 2011). Instead of a model with ordinal relative concerns, it is assumed that the objective function depends on an income gap with respect to the reference level. As we will argue later, these two decisions provide a more appropriate strategy for evaluating the validity of the assumptions of prospect theory. To explain economic satisfaction, we adapt the empirical strategy applied in Ferrer-i-Carbonell (2005) and Vendrik and Woltjer (2007). In these papers the authors present specifications of life satisfaction to test the hypothesis of asymmetry in the valuations (Ferrer-i-Carbonell, 2005) and the assumptions of prospect theory (Vendrik and Woltjer, 2007). Unlike Vendrik and Woltjer (2007), relative concern is modelled from a polynomial function which provides a flexible and direct way of evaluating the validity of the assumptions of asymmetry and diminishing sensitivity. To analyze the robustness of the results, alternative reference points are used in an attempt to mitigate the problems suggested by Vendrik and Woltjer (2007) in their study, which opens the possibility of evaluating the heterogeneity of the reference points.

The estimates are based on the "Multidimensional Well-being Trajectories in Childhood" survey (MWTC- TBMI in Spanish). The sample is representative of households in Montevideo and the metropolitan area. This source of information has some advantages when addressing the issues proposed, where some questions were specifically designed to address these hypotheses. Furthermore, the majority of the previous papers use data from developed countries, so this research provides new evidence for a developing country. In order to test these hypotheses, the extended random effect model (which includes a Mundlak term) and the fixed effects model are estimated (Ferrer-i-Carbonell and Frijters, 2004; Mundlak, 1978).

This chapter contributes new evidence to economic literature on how people valuate their economic situation in relation to a reference income, a key issue in explaining decisions that affect levels of social mobility. The results confirm the importance of relative income

in the levels of economic satisfaction. When relative concern is considered as the difference between the individual's income and that of their reference group, there is evidence of an asymmetric valuation of relative deprivation. Unlike the findings in Vendrik and Woltjer (2007), convexity is confirmed between people facing relative deprivation, which corresponds to diminishing marginal sensitivity as they move away from the reference income. That is to say that relative concern is more important among those who are close to the reference income level, and its sensitivity is greater for those in the area of relative deprivation. These results are consistent with the assumptions of prospect theory (Kahneman and Tversky, 2000).

In addition, this chapter provides evidence of differences in the conformation of the reference point. Alternative reference income levels are considered, which attempt to capture the potential heterogeneity that may exist between individuals with similar observable characteristics (Clark and D'Angelo, 2013). To do this, we consider the perception of individuals about their position in the income distribution to define reference income, and additional variables are included which approximate the real and perceived levels of mobility as controls. Moreover, we consider the level of income that each person identifies as the minimum necessary for a household not to fall into a poverty situation (subjective poverty line) as a reference point (Stutzer, 2004). This strategy avoids defining a reference group exogenously, while introducing heterogeneity in the reference income set by each individual. The results that arise from this strategy, on one hand proof the robustness of the validity of the assumptions of prospect theory and, on other hand, confirm heterogeneity in the reference points. In addition, if the subjective poverty line is considered as an approximation of economic aspirations, it provides complementary evidence on the assumptions used by Genicot and Ray (2014) to model aspirations.

There are several arguments that support the relevance of these findings. Firstly, the results confirm how the levels of self-reported satisfaction are affected by the relative

position in relation to a reference income, which has important consequences on the decisions of individuals (Frank, 2005), with particularly important implications in terms of the results of economic mobility (Piketty, 1998 and 2000, Austen-Smith and Fryer, 2005, Bourguignon et al., 2007). The central argument of these papers is that some decisions that would increase the levels of income mobility may be discouraged by the relative position that each individual occupies in society.

The evidence on the hypotheses analyzed in this research contributes to a greater understanding of the level of income aspirations and its formation process, so its link with economic mobility is quite direct. Genicot and Ray (2014) argue that the consideration of the aspirations gap can generate incentives to achieve economic success, or discourage certain behavior to avoid frustration. The first chapters discuss on one hand, the importance of the functional form of relative concern (assumptions b and c), on the other hand, the importance of reference group composition. First, it shows that for those people who are below the reference point, the response in the effort decisions to changes in the income of the reference group depends, fundamentally, on the concavity or convexity of the relative concern curve. The model predicts that when relative concern is convex, when facing a more demanding reference group income, people respond by reducing their effort, while they respond in the opposite way if it is concave. Therefore, the evidence on the assumption of diminishing sensitivity in the relative concern curve could have very important implications in terms of the effort decisions of agents and potential mobility outcomes. Second, it suggests that poorer a reference group could lead to lower mobility-enhancing investments. The evidence on heterogeneity in the reference points is consistent with the basics of Genicot and Ray (2014) on the importance of the aspirations window, and provides preliminary evidence on reference level formation. On the other hand, it raises questions about the consequences of taking the income of a group of individuals with similar characteristics as a reference point, a strategy adopted by the majority of

the researchers on the issue, in the absence of information about reference groups. While some previous research has managed to identify information about what group of people are relevant to make the comparisons (Knight at al, 2009, Clark and Senik, 2010), their empirical approach still has some problems. This chapter provides new evidence to advance this discussion.

The rest of the chapter is organized as follows. Firstly, we present the hypotheses and previous findings in Section 2. Section 3 describes the empirical strategy. Section 4 presents the variables used and the empirical strategy. In section 5 the main results are presented and the main conclusions are summarized in section 6.

3.2 Hypotheses

Experimental results support the reference-dependence of preferences suggested by prospect theory, which is the first key assumption incorporated in the value function suggested by that theory (Kanheman and Tversky, 1979). It postulates that well-being depends more on the outcome relative to a reference point than on its level in absolute terms. There is a consensus in the literature on the reference-dependence preferences. Psychological research suggests that people's preferences are often determined by changes in outcomes relative to their reference level, and not merely by absolute levels of outcomes (Rabin, 1998). Furthermore, both experimental and non-experimental economic evidence confirm that hypothesis.[3] Indeed, previous studies confirm that the incidence of income in absolute terms is lower than the incidence of the relative income with respect to a reference level (McBride, 2010).

This chapter tests two additional assumptions about the functional form of relative concern used in the value function proposed by the prospect theory. The first hypothesis

[3]For a review on evidence for relative concern see chapter 2, section 2.2.3 and Heffetz and Frank (2011).

tests assumption *b* of prospect theory**:**

- **Hypothesis HI.** *Asymmetry of comparisons and loss aversion (b).* The valuations with respect to relative income are asymmetric, and changes in relative income have a greater impact for those who face relative deprivation than for those who have a positive relative income. Namely, relative deprivation is felt more strongly than relative advantage.

This assumption is consistent with the Duesenberry proposition (1949) on the different valuations between those above and below the reference income. Ferrer-i-Carbonell (2005), McBride (2001), Card et al., (2012) and Vendrik and Woltjer (2007), have found evidence on this.

The second hypothesis to contrast refers to the marginal sensitivity of the relative concern and the existence of asymmetric responses among those facing relative deprivation with respect to those who have a positive relative income.

- **Hypothesis HII.** *Diminishing sensitivity (c).* Marginal sensitivity of the utility function to relative income has an asymmetric shape, which implies that it is convex for those with relative deprivation and concave for those with a positive relative income.

Confirmation of this hypothesis means that the sensitivity of the marginal utility diminishes as individuals move away from the reference point, which would be consistent with the value function suggested by Galanter (1990) in the framework of prospect theory, and with the aspirations model proposed by Genicot and Ray (2014). Finally, confirmation of this functional form is key to understanding how people might respond to changes in the reference point (see chapter 1).

In the field of happiness literature the evidence for the third hypothesis is inconclusive. Vendrik and Woltjer (2007) reject diminishing marginal sensitivity for those with relative deprivation. The authors indicate that the contradiction between their findings and assumption *c* of prospect theory may arise from the way in which the reference income level is defined. They argue that individuals with relative deprivation may respond by choosing a new social reference group with a lower average income (see Clark and D'Ambrosio; 2014 and Heffetz and Frank, 2011). Moreover, reference group composition could be affected by social mobility (Genicot and Ray, 2014). This aspect is not considered in their research, where individuals who share certain observable characteristics are treated with the same income reference level. All of this leads them to view their results with a degree of caution.

In this chapter, as a first step, reference income is defined analogously to Vendrik and Woltjer (2007). In consequence, individuals with similar observable characteristics have the same reference group income. In order to mitigate the problems in estimating the reference income level identified by Vendrik and Woltjer (2007), two alternatives are proposed.[4] The first is to use perceptions about relative position in the whole income distribution to correct the reference income. This allows us to incorporate a certain degree of heterogeneity in the reference income within each reference group. A second strategy is to consider an adaptation of a subjective poverty line (Flik and Van Praag, 1991). Each individual identifies one income amount which corresponds to a minimum welfare level for a "hypothetical benchmark household", which describes the boundary between "poor" and "not poor". This threshold is considered as a reference level. What each person considers as a minimum necessary to live depends on their socioeconomic background and incorporates an essentially relative component (Sen, 1985). In this sense, the valuations

[4]Some authors suggest the endogeneity of the choice of reference groups (Ferrer-i-Carbonell, 2011; Clark and Senik, 2010). There is also some evidence that individuals take different social groups as a reference (Knight et al., 2009, Clark and Senik, 2010).

of income requirements depend on the past and present income of each individual and on their reference group (Van Praag, 1985), which is consistent with the ideas of Genicot and Ray (2014) about income aspirations. The second alternative has three advantages. First, it is not necessary to identify the reference group with exogenous criteria. Second, it introduces heterogeneity between the reference income of individuals with the same observable characteristics. Finally, it is expected that this threshold incorporates the reference level adjustments which are not considered in the strategy used by Vendrik and Woltjer (2007).

In section 3.3 we discuss and describe both strategies in greater detail. They provide a test of robustness for the results when the reference income is defined as in the previous literature.

Finally, our approach allows us to discuss a first bridge between reference group theory and the aspiration model proposed in Ray (2006) and Genicot and Ray (2014). Stutzer (2004) suggests that adaptations of the subjective poverty line could be useful as a proxy for minimum economic aspirations. Furthermore, reference group income could be a good proxy of individual income aspiration.[5] So the testing of the income gap with respect these thresholds tests the prospect theory assumptions used in aspiration model proposed in Genicot and Ray (2014) and Ray (2006).

Previous empirical literature has examined aspiration formation based on self-reported information. On one hand, Stutzer (2004) uses people's income evaluation measures as proxies for their aspiration levels, on the basis of Swiss data. He focuses on the relationship between subjective well-being on the one hand, and aspiration and income on the other hand. His findings postulate that higher income aspiration decreases subjective

[5]Clark and D'Ambrosio (2014) highlight the comparative role of the reference group. According to Merton (1953) reference groups represent the benchmarks to which individuals compare themselves and evaluate individual attributes. These groups became the point of reference to which individuals refer to evaluate their achievements, their performance, aspirations and ambitions. They orient the behavior and define the social role to which the individuals aspire, but to which they do not necessarily belong. Therefore reference group income could be a proxy of the income aspiration.

satisfaction. Castilla (2012) carried out a similar study using data from Mexico. Leyden School proposed a measure of the degree of adaptation to income based on the relationship of an individual's past income and their required income level (Van Praag and Frijters, 1999). [6]

On the other hand, happiness literature uses self-reported satisfaction to indirectly measure aspiration, and the results suggest three factors to describe how aspirations are formed (Ferrer-i-Carbonell, 2011; Mc Bride, 2010). First, a higher past income leads to higher aspirations and lower levels of satisfaction (Burchardt,2005; Pudney, 2011; Di Tella et al., 2010; Ferrer-i-Carbonell and Van Praag, 2009; Easterlin, 2005; Clark and D'Angelo, 2013).[7] The second factor in aspiration formation is the incidence of the reference group, where evidence suggests that an individual's aspiration depends positively on the outcomes of their comparison group (Clark and Oswald, 1996, Mc Bride, 2001, Luttmer, 2005, Clark and Senik, 2010). Finally the third factor, which has received less attention in empirical research, suggests that aspirations depend on the expected result (Clark et al. 2009a; 2009b, Senik, 2004).

Previous papers define the reference groups with exogenous criteria. The confirmation that the "corrected reference income" and "the minimum economic aspirations threshold", play a role as a reference point would represent preliminary evidence that individuals with similar observable characteristics have different reference points. These results could be explained by differences in the composition of the reference groups, or what Ray identifies

[6]Other empirical papers use experimental design to explore economic aspiration. Card et al., (2012) provide experimental evidence about the relevance of peers' wages in explaining economic satisfaction. Mc Bride (2010) proposes a game to measure aspirations. His work shows that players are more satisfied when: the more they win; the less others win; and their initial aspiration level is lower. Bernard et al. (2014) carried out an experiment in rural Ethiopia to measure aspirations. The treatment is people being shown a short documentary in which people with similar backgrounds to the audience talk about successful experiences in their lives. It shows that treated individuals improve their aspirations, and the effect is higher among those with higher aspiration at the beginning.

[7]One of the major consensus on the happiness literature is the Easterlin Paradox, which postulates a small effect of a country's economic growth on long term happiness (Easterlin, 1974). Clark et al. (2008) suggest that aspiration adaptation could explain that Paradox.

as the importance of the amplitude of the "aspirations window" and shared contextual experiences.[8] The "aspirations window" has a key role in the aspiration formation and whether individuals perceive their goal to be accessible or unattainable (Ray, 2006). These ideas are related with a variant of fatalistic models, where people believe that their destiny is pre-ordained and beyond control, which leads to low economic aspiration (Ray, 2006).

As argued in the first chapter, low reference income level or the presence of convex functions in relative concern for those with relative deprivation, could represent preliminary evidence on this phenomenon. In order to advance in this issue we focus on the role of Rotter's Locus of Control (LOC), which provides information about how individuals perceive the causal connection between their actions (and personal characteristics) and experienced outcomes (Lefcourt, 1991). Therefore its link with aspiration seems immediate, which allows us to explore how individual perceptions and relative deprivation affect economic satisfaction.

LOC is one important aspect of personality. It measures the individual's perception of their control of their life, which is explained as the extent to which an individual believes that his life is under his control or depends on external factors (Rotter, 1966). The LOC refers to assumed internal states that explain why certain individuals willingly try to deal with difficult circumstances, while others have low resilience and they fail to adopt strategies to improve their opportunities to achieve a better life.

Although happiness literature agrees about the role of an individual's personality in explaining individual heterogeneity in subjective responses (Ferrer-i-Carbonell and Frijters, 2004; Boyce, 2010), the relationship between happiness and Locus of control has received less attention in the income-happiness literature from economists.[9] Previous literature

[8]Reference group theory suggests that culturally shaped processes may lead to a reduction (or an increase in) ambition among those that share them (Merton, 1953). Therefore, reference group is closely related with the aspiration window used in Genicot and Ray (2014).

[9]For a review of the relationship between personality and subjective well-being, see Diener and Lucas (1999), Lucas and Diener (2009) and DeNeve and Cooper (1998).

suggests that these personality traits could affect economic satisfaction and aspiration, the responsiveness to social comparisons, individual attitudes towards relative position or income inequality (Rotter, 1966; Budria et al., 2012; Wheeler and Miyake, 1992; Boyce and Wood, 2011; Blázquez and Budria, 2014; Budria and Ferrer-i-Carbonell, 2012; Proto and Rustichini, 2015). Boyce and Wood (2011) and Budria and Ferrer-i-Carbonell (2012) found that the marginal utility of income differs across personalities. Furthermore, the second paper found differences in income comparison depending on individual personality.

Previous research found a positive correlation between individuals with internal locus and happiness (Argyle, 2001; Myers,2001; Lu, 1999; Cummings and Communistic, 2002). There is some evidence suggesting that people with internal locus of control are more active in setting and pursuing valued goals, (Shah and Higgins, 2001; Caliendo et al.; 2015) and tend to invest more in their future (Coleman and DeLeire, 2003; Cobb-Clark et al., 2014; Lekfuangfu et al., 2014) which could explain the positive relationship with economic satisfaction.

However, the sign of the relationship between happiness and LOC is debatable. DeNeve and Cooper's (1998) meta-analysis found that correlations between personality traits and subjective well-being are only weak to moderate. Pannells and Claxton (2008) reject a correlation between locus of control and happiness and suggest that this correlation is affected by life experiences. Levenson (1981) suggests that LOC is composed of different dimensions, which could be independent of each other. The reviewed literature generally uses an aggregate indicator of LOC as a control variable. An exception is Bernard et al. (2014), who found that the treatment of the experiment has an effect only on the *internality* scale, but not on the other dimensions. Furthermore, their aspiration measure is negatively and significantly correlated with *internality*, but not significantly correlated with *powerful others* and *chance*.

In sum, the previous literature suggests a positive relationship between internal indi-

viduals and happiness on one hand, and aspiration on the other hand, but has also found a negative relationship between aspiration and satisfaction. However, there is ambiguous evidence about the role of the different LOC dimensions in economic satisfaction. These issues raise new questions about which mechanisms explain the relationship between an individual LOC, their aspiration formation and satisfaction. As a secondary objective, from the basics provided by Genicot and Ray (2014), we contribute preliminary evidence on how unfavorable situations could result in a reduction of economic aspirations.

3.3 Empirical Strategy

3.3.1 Assumptions

To respond to the hypotheses mentioned, measures of satisfaction will be used. Some papers interpret the survey responses about satisfaction as a proxy for experienced utility (Easterlin, 1974, Blanchflower and Oswald, 2004, Stutzer 2004, Ferrer-i-Carbonell, 2005, Vendrik and Woltjer, 2007).[10] There is a debate in economics on the advantages and limitations of using measures of self-reported satisfaction, their consistency with "utility" and with observed choice behavior (Diener and Lucas, 1999; Clark et al. 2008; Kahneman and Krueger, 2006; Ferrer-i-Carbonell, 2011). Some papers highlight the opportunities provided by this type of variable for a better understanding of the economic behavior of people (Kahneman and Krueger, 2006; Frey and Stutzer, 2002; Clark et al., 2008; Ferrer-i-Carbonell, 2011). For example, they have been used to evaluate behavioral assumptions, to examine differences in preferences and tastes, to value non-market goods and to measure inequality aversion, risk attitudes and income comparisons. Furthermore, for different domains there is evidence for the correlation between reported satisfaction and objective measures (Blanchflower and Oswald, 2008; Steptoe and Wardle, 2005; Urry et al., 2004). The dependent variable used in this research is satisfaction with economic conditions

[10]This interpretation has been criticized from a normative perspective (Sen, 1985).

(Economic Satisfaction - ES). In this case the responses indicate an individual's evaluation of their economic achievement relative to a certain objective. Several arguments support this choice. Firstly, as economic needs and aspirations can be expressed in monetary terms, this variable has the advantage that subjective responses can be expressed in the same metric. Secondly, it could better reflect how individuals respond to situations of relative income deprivation, and therefore provide a better comparison with the results of experimental economics on the asymmetric valuations of gains and losses. Thirdly, this research aims to contribute to the work of Genicot and Ray (2014) on the conformity of economic aspirations, understood as a reference point in the objective function of individuals. We assume that people evaluate their economic achievement with respect to their objectives. As a result, people's answers provide indirect information about their economic aspiration. Finally, there are fewer papers that utilize this dependent variable (An exception is Clark et al., 2009b).

However, the previous literature finds a positive correlation between reported satisfaction with different domains (Ferrer-i-Carbonell, 2011 and Van Praag and Ferrer-i-Carbonell, 2008). As a test of robustness, life satisfaction will be used as a dependent variable, which will allow a comparison of our results with the findings of Vendrik and Woltjer (2007) findings. Following their papers, relative concern is defined in terms of income.

The self-reported satisfaction information have two main limitations, being discrete ordered categorical variables and containing non random measurement errors (Ferrer-i-Carbonell and Frijters, 2004 and Van Praag and Ferrer-i-Carbonell, 2008). In general, studies that utilize subjective variables assume an ordinal perspective, where subjective responses indicate a range of categories. In economic literature this type of choice is estimated by means of ordered Probit models (Maddala, 1983).[11] Based on the latent variable

[11]These models imply a strong simplification, but provide an approximation of the possible behavioral responses of individuals. The parameters are estimated by the maximum likelihood method and the marginal effects can describe how the probability of the subjective valuation reacts to changes in an explanatory variable, keeping everything else constant.

Z, it is possible to identify which are the factors that influence economic satisfaction, that is, how, when facing equal economic circumstances, individuals change their ES.

$$E(Z) = \alpha + \bar{\beta} ln(Y) + \bar{\delta} X + \bar{e} \tag{3.1}$$

Where ln(Y) is the logarithm of income, X a set of control variables which reflect individual and household characteristics, and $\bar{e}$ represents an error term which is normally distributed with $E(\bar{e}) = 0$ and constant variance. Given X', the chance that an individual with Y' chooses economic satisfaction ES' can be represented as:

$$\begin{gathered} P(ES') = P(\mu_p < Z' < \mu_{p+1}) = \\ P(\mu_p - \alpha - \bar{\beta} ln(Y') - \bar{\delta} X' < \bar{e} < \mu_{p+1} - \alpha - \bar{\beta} ln(Y') - \bar{\delta} X') \end{gathered} \tag{3.2}$$

The economic satisfaction reported depends on a latent variable (Z), which reflects different aspiration thresholds.[12] This procedure allows us to identify which are the factors that affect the determination of the thresholds and the relationship between aspirations and outcomes.

Vendrik and Woltjer (2007) discuss the problems of using an ordinal perspective for testing hypotheses of convexity and convexity of relative income concern. Their argument is that while Z and ES have the same ordinal properties, they may not have the same cardinal properties. Nonetheless, the authors propose using a cardinal approach, assuming that self-reported satisfaction contain reliable cardinal information. As we discuss in

[12]The equations are defined using economic satisfaction as a dependent variable. However, analogous reasoning could be used to equations of life satisfaction.

section 3.4.3, we estimate our model assuming alternatively, interpersonal ordinality and cardinality of the economic satisfaction answers. In Ferrer-i-Carbonell and Frijters (2004) the implications of this assumption are explained in more detail. They also show that the estimates that assume interpersonal ordinality obtain the same results as estimates which assume cardinality in self-reported satisfaction, which supports our decision.

3.3.2 Specifications

Given the assumptions of the previous section, the standard empirical model of self reported satisfaction presents the form:

$$ES = \alpha + \tilde{\beta} ln(Y) + \delta X + e \tag{3.3}$$

where Y is household income and X a vector of control variables, while the Greek letters represent the parameters to be estimated. The logarithm of household income is incorporated, following the previous literature which demonstrates that income has a positive but decreasing effect. When relative concern with respect to the income of the reference group is included (Y^{rg}), equation 3.3 becomes:

$$ES = \alpha + \tilde{\beta} ln(Y) - \tilde{\gamma} ln(Y^{rg}) + \delta X + e = \alpha + (\tilde{\beta} - \tilde{\gamma}) ln(Y) + \tilde{\gamma} \left(ln(Y) - ln(Y^{rg}) \right) + \delta X + e \tag{3.4}$$

where $\tilde{\gamma} > 0$ and the relative income is defined as the difference between household income and the average income of the reference group ($Y^R = Y - Y^{rg}$). This specification falls within the models that Hopkins (2008) classifies as "mean dependence", which assume

that utility is increasing relative to income in absolute terms, but also with respect to income relative to a reference point.[13]An alternative specification considers relative concern based on income rank (Layard, 1980; Frank, 1985 and Robson, 1992). However, the first alternative seems the most appropriate to test the assumptions about the asymmetric response to gains and losses, but in this case, linked to an asymmetric valuation of the advantage and disadvantage relative to the reference point. Moreover, this model is consistent with the model of Genicot and Ray (2014) on aspirations formation. If we consider the income of the reference group as a good approximation of the aspirations threshold, the specification of relative concern as ($\mathrm{Y}^R = Y - Y^{rg}$) has a direct link to what the authors refer to as the aspirations gap. The same does not occur when considering the relative concern in terms of the income rank within the group where, among other things, the magnitude of the gap in monetary terms disappears. This is a key aspect, considering that we want to analyze how economic satisfaction responds to variations in the magnitude of relative deprivation.

In general, relative concern is considered in logarithmic terms (Ferrer-i-Carbonell, 2005). Considering the hypotheses to be tested in this chapter, such transformation is not applied as it means assuming a specific form of relative concern. We consider a more general functional form about how relative income affects levels of economic satisfaction ($\mathrm{G}(\mathrm{Y}^R)$), with $\mathrm{G'}(\mathrm{Y}^R) > 0$. Substituting leads to the following equation:

$$ES = \alpha + \beta ln(Y) + \gamma G(Y^R)) + \delta X + e \tag{3.5}$$

[13]A similar specification of relative concern arises from the fraction between own income and the reference income. Among the papers that use this specification are Boskin and Sheshinski (1978), Abel (1990), Harbaugh (1996), Clark and Oswald (1996 and 1998), Futagamia and Shibata (1998), Ferrer-i-Carbonell (2005).

At this point it should be mentioned that function $G(.)$ used in this chapter differs from the "power function" used in Vendrik and Woltjer (2007) and from the specifications used in prospect theory (Tversky and Kanheman, 1992). In this chapter a polynomial specification is used, which provides sufficient flexibility to test the hypotheses and, at the same time, gives an intuitive interpretation of the estimated parameters. Moreover, as income can have diminishing returns, we include its version in logarithmic terms. If we do not consider this issue, the degree of convexity or concavity of the relative concern may be distorted by the absolute income effect (for a discussion Vendrik and Woltjer, 2007). In 3.6, function $G(.)$ has a linear form and substituting into the economic satisfaction equation we arrive at the simplest model in which the levels of satisfaction depends on the relative income (3.7). It is expected that $\tilde{\beta} > \beta$ and that $\gamma > 0$.

$$G^1(Y^R) = (Y - Y^{rg}) \tag{3.6}$$

$$ES = \alpha + \beta ln(Y) + \gamma\,(Y - Y^{rg}) + \delta X + e \tag{3.7}$$

However, 3.6 is restrictive, because it imposes symmetry in income comparison. We use the function $\mathrm{G}^{1*}(\mathrm{Y}^R)$, which proposes a more general specification, allowing the impact of relative income to affect individuals with relative deprivation differentially in relation to those with positive relative income. This function is defined in equation 3.8, where I is the indicator function, which is 1 when $\mathrm{Y}^R > 0$ and is 0 when $\mathrm{Y}^R < 0$. If function $\mathrm{G}^{1*}(\mathrm{Y}^R)$ is assumed, we reach a specification similar to that of Ferrer-i-Carbonell (2005),

where the incidence of the relative concern is associated with two parameters γ_+ and γ_-.

$$G^{1*}(Y^R) = \gamma_+ \left(Y - Y^{rg}\right) (\mathrm{I}) + \gamma_- \left(Y - Y^{rg}\right) (1 - \mathrm{I}) \tag{3.8}$$

$$ES = \alpha + \beta ln(Y) + \gamma_+ \left(Y - Y^{rg}\right) (\mathrm{I}) + \gamma_- \left(Y - Y^{rg}\right) (\text{1-I}) + \delta X + e \tag{3.9}$$

Equation 3.10 assumes that relative concern has a quadratic form and, therefore, its incidence is associated with γ and θ, where the sign of the second parameter allows us to analyze the presence of convexity or concavity.

$$G^2(Y^R) = \gamma \left(Y - Y^{rg}\right) + \theta (Y - Y^{rg})^2 \tag{3.10}$$

$$G^{2*}(Y^R) = \gamma_+ \left(Y - Y^{rg}\right) (\mathrm{I}) + \gamma_- \left(Y - Y^{rg}\right) (1 - \mathrm{I}) + \theta_+ \left(Y - Y^{rg}\right)^2 (\mathrm{I}) + \theta_- (Y - Y^{rg})^2 (1 - \mathrm{I}) \tag{3.11}$$

A more general specification of equation 10 arises from equation 12, which opens the possibility of asymmetric valuations among individuals with relative deprivation, in relation

to those with positive relative income. In this case, there are four parameters that explain how the relative income affects the levels of economic satisfaction and the presence of asymmetry (γ_+, γ_-, θ_+ and θ_-). In addition the sign and the magnitude of θ_+ and θ_-, indicate the presence of convexity or concavity in the function of relative concern and opens the possibility that the marginal sensitivity of the relative concern valuations are asymmetrical.

$$\begin{aligned} ES = \alpha + \beta ln(Y) + \gamma_+ \left(Y - Y^{rg}\right)(\mathrm{I}) + \gamma_- \left(Y - Y^{rg}\right)(1 - \mathrm{I}) + \\ \theta_+ \left(Y - Y^{rg}\right)^2 (\mathrm{I}) + \theta_-(Y - Y^{rg})^2(1 - \mathrm{I}) + \delta X + e \end{aligned} \tag{3.12}$$

This model assumes that the researcher knows the income of the reference group Y^{rg}. However, the literature is inconclusive about how reference groups are formed and generally assume that the individuals compare themselves with other individuals who share observable characteristics. This leads to the constraint that individuals with similar characteristics have the same reference group. There is some evidence that individuals take different social groups (Knight at al., 2009) or co-workers (Clark and Senik, 2010), or parents (Clark and D'Angelo, 2013) as a reference. Social mobility situations, the presence of information problems or misconceptions about one's relative position could cause problems in identifying the reference point (Ferrer-i-Carbonell, 2011; Vendrik and Woltjer, 2007; Clark and D'Angelo, 2013). This would cause problems in testing the validity of the assumptions of prospect theory, as it would not be approaching the reference point of each individual in a precise way. The issue of how to deal with this problem has not been resolved in the empirical literature.

In this chapter two possible solutions are tested. The first alternative considers the presence of biases in individuals' evaluations of their own relative position in the income

distribution. Argentina Cruces et al. (2013) found significant biases in individuals' evaluations in Argentina and suggest that the reference group selection process is the source of those biases. We attempt to correct the reference income using this idea, and the strategy is based on two assumptions. First, for each person i it is assumed that the average income of the reference group based on observable characteristics (Y_i^{RG}) provides relevant, but insufficient information, because it may differ from what each individual really considers when making their valuations ($Y_i^{RG-real}$). The exogenous definition of the reference group may be imputing thresholds which are more (or less) demanding than the real ones. The second assumption involves assuming that this difference is associated with the biases in individual's evaluation of their own relative position in the income distribution. For the individual i, ${P_i}^R$ is defined as their real position in the income distribution and ${P_i}^P$ their perceived position, which allows us to define the error of perception as the difference between the perceived position and the real position: ${e^p}_i = {P_i}^P - {P_i}^R$. If $e^p>0$, individuals perceive themselves to be in a better position than that observed, with the opposite occurring when $e^p<0$, while the individuals do not make mistakes when $e^p=0$. Following the hypothesis of Cruces et al. (2013), we assume that biases about relative position depend on with whom each individual interacts and on the threshold taken as a reference. The fact that individuals perceive themselves to be in a better relative position than their real position may be due to the fact that they compare with a lower reference threshold because the individuals within their reference group are located on the left tail of the income distribution. Moreover, individuals who only take high-income groups as a reference possibly underestimate their position in the income distribution, because they attach greater consideration to those in the upper tail of the distribution. Finally, when the perceived position coincides with the real position, no correction is applied to (Y_i^{RG}).[14] Based on these two assumptions, it is possible to use the predicted biases to correct the

[14]Implies that these people have a greater amplitude in the integration of the reference group and have a better perception about their real position in the income distribution.

reference income arising from the mean of individuals who share the same characteristics. The corrected reference income Y^{rgcorr} is defined as follows:

$$Y_i^{rgcorr} = \frac{Y_i^{rg}}{\psi_i} \tag{3.13}$$

The function $\psi(e_i)$, and their properties are presented in section 3.A. It is assumed that those who are not mistaken about their relative position compare themselves to their peers with similar observable characteristics. If individuals perceive themselves to be in a better relative position than their real position, in their reference group individuals located to the left of the distribution have a higher weighting (consideration), so the reference income on the basis of the observable characteristics of the peer group would overestimate the reference point. In the opposite situation are those individuals who perceive a worse relative position, where the reference income should be adjusted upwards.
Incorporating this correction in the reference income allows us to arrive at the following equation:

$$\begin{aligned} ES = \alpha + (\beta) ln(Y) + \gamma_+ \left(Y - Y^{rgcorr}\right) (\mathrm{I}) + \gamma_- \left(Y - Y^{rgcorr}\right) (1 - \mathrm{I}) + \\ \theta_+ \left(Y - Y^{rgcorr}\right)^2 (\mathrm{I}) + \theta_- (Y - Y^{rgcorr})(1 - \mathrm{I})^2 + \delta X + e \end{aligned} \tag{3.14}$$

A second alternative to approximate the reference income level is to consider the minimum income levels for a hypothetical household (composed of two adults and two children) that each individual identifies as being necessary to avoid poverty, which represents a minimum income aspiration level (MIA). I adapt the strategy of Stutzer (2004), who used two versions of the subjective poverty lines to establish economic aspiration. The evidence shows that the subjective poverty line varies between individuals and their level increases with

household income. This reflects that the level that each individual declares depends on their past income and their relative income. In this sense, the subjective poverty line has a direct link with economic aspirations and, as such, could play a role as a reference point for evaluating economic satisfaction (Genicot and Ray, 2014). This allows us to define the relative position as an aspirations gap, based on the difference between household income and MIA. Considering the relative position through this gap has some advantages compared to the approach of Vendrik and Woltjer (2007). On one hand, it does not assume a reference group exogenously, on the other hand, it incorporates potential heterogeneity in reference income levels among individuals with similar observable characteristics. The MIA consideration allows us to arrive at the following equation:

$$\begin{aligned} ES = \alpha + (\beta) ln(Y) + \gamma_{+} \left(Y - MIA\right) (\mathrm{I}) + \gamma_{-} \left(Y - MIA\right) (1 - \mathrm{I}) \\ + \theta_{+} \left(Y - MIA\right)^{2} (\mathrm{I}) + \theta_{-} (Y - MIA)(1 - \mathrm{I})^{2} + \delta X + e \end{aligned} \tag{3.15}$$

Equations 3.14 and 3.15 provide alternative specifications to address the problem of identifying the reference level and test the assumptions of prospect theory. Furthermore, it provides indirect evidence that individuals with similar observable characteristics have different reference points.

Previous empirical research uses self-reported satisfaction to indirectly measures aspiration (Clark et al.,2008; Stutzer, 2004) and the incidence of the reference group (Clark and Oswald, 1996, Mc Bride, 2001, Luttmer, 2005, Clark and Senik, 2010). When people evaluate their economic satisfaction they consider two issues, on one hand, how much they have (outcome level), on the other hand, how much they have with respect to their reference level (economic aspiration). This approach has the advantage of avoiding the use of direct aspiration measures and their accompanying problems.[15] We assume that

[15]Clark et al. (2008) suggest the problems involved in obtaining an accurate measure of income aspiration.

the differences between self-assessment and economic results are not random, that they respond to heterogeneous economic aspirations. Given the same objective situation, those individuals with higher economic aspirations will declare lower levels of satisfaction.

Finally, we propose an additional specification in order to analyze the correlation between satisfaction (and aspiration) and LOC domains proposed by Levenson (1981).[16] Rotter (1966) argues that people's perception of personal control over the results of their own behavior could be explained as the degree to which an individual believes that their behavior is associated with either internal or external reinforcements. The extended empirical model is:

$$\begin{aligned} ES = \alpha + \beta ln(Y) + \gamma_+ \left(Y - Y^{rg}\right)(\mathrm{I}) + \gamma_- \left(Y - Y^{rg}\right)(1 - \mathrm{I}) + \theta_+ \left(Y - Y^{rg}\right)^2 (\mathrm{I}) \\ + \theta_-(Y - Y^{rg})^2(1 - \mathrm{I}) + \lambda_C LOC_C + \lambda_{IP} LOC_{IP} + \delta X + e \end{aligned} \tag{3.16}$$

where LOC_j and the vector λ_J, represent the jth dimension of the LOC and their association with economic satisfaction respectively. Previous findings suggest that $\lambda_J > 0$, which establishes a positive relationship between internal individuals and ES. On the other hand, Lefcourt (1991) states that LOC refers to individual beliefs about the causal connection between personal characteristics (and/or actions) and experienced outcomes. The relationship between aspiration and economic satisfaction seems immediate, when people believe that outcomes are not contingent upon their effort, they reduce their targets. This channel suggests a negative (positive) relationship between internal (external)

Direct measurements of economic aspirations could be subject to measurement error. One issue is that the measurement could reflect the individual's expectation rather than aspiration. On the other hand, individuals could respond strategically on aspiration questions. Finally, experienced utility is about past enjoyment, while aspiration refers to future outcome. This opens the question of how people consider the uncertainty of their future when responding about their aspirations.

[16] In equation 3.16we use two variables to measure the dimensions of LOC proposed by Levenson (1981). In section 3.4.2 we explain that decision.

Locus of control and ES. Evidence that $\hat{\lambda}_i < 0$ supports the idea of aspiration failure. Individuals who perceive that they have low capacity or chance to change their destiny, under equal conditions declare themselves to be more satisfied with their economic situation. On other hand, individuals that perceive they have a higher chance of success, they set higher aspiration for themselves and are less satisfied.

Finally, we use LOC_C information to distinguish fatalistic individuals, who consider that their future depends entirely on external circumstances and luck (In section 3.4.2 we describe how fatalistic dummy is defined). Following Ray (2006)'s ideas, it could be argued that individuals with a fatalistic view report greater economic satisfaction. It would be the case when they have a strong belief that their destiny is pre-ordained and beyond their control, this leads them to reduce their aspirations in order to avoid frustration, or because they believe that their chances of achieving better results are low. In order to advance in this direction, we consider an interaction term between the relative income gap and a variable which identifies fatalistic individuals.

$$\begin{aligned} ES = \alpha + (\beta')ln(Y) + \gamma_- G(Y^R) + \gamma_+ G(Y^R) + \theta_+ \left(Y - Y^{rg}\right)^2 (\mathrm{I}) + \theta_-(Y - Y^{rg})^2(1 - \mathrm{I}) \\ + \gamma_{F-} G(Y^R) * F + \gamma_{F+} G(Y^R) * F + \lambda_F F + \lambda_{IP} LOC_{IP} + \delta X + e \end{aligned} \tag{3.17}$$

where F is an indicator function which identifies fatalistic individuals, and LOC_{IP} measures *internality* and *powerful others*. Equation 3.17 incorporates an interaction term between income gap and F, where γ_{F+} and γ_{F-} measure if the relative situation affects fatalistic individuals differently. Note that $\widehat{\gamma}_{F+} > 0$, supports the idea that, for fatalistic individuals with relative deprivation, high relative deprivation leads to higher economic satisfaction**.** In this case, the hypothesis is that, under equal conditions, fatalistic individuals with higher relative deprivation declare themselves to be more satisfied with their

economic situation. Evidence that $\widehat{\gamma}_{F+} < 0$, also agrees with a reduction in economic aspirations, because fatalistic individuals, *ceteris paribus,* demand a lower relative income to declare themselves to be more satisfied. However, given their relative situation, it is difficult to interpret this evidence as aspiration failure in the sense of Ray (2006).

As a result, the analysis of the sign and significance of these parameters allow us, on one hand, to assess the relationship between LOC domains and economic satisfaction and, on the other hand, to identify the association between fatalistic individuals and relative deprivation with the level of economic satisfaction.

3.3.3 Specification test for our hypothesis

Equation 3.9 allows the relative income to differentially affect those individuals with relative deprivation and those with positive relative income. Performing standard statistical tests on the parameters γ_+ and γ_- (standard t-test) we can assess reference dependence and the hypothesis of asymmetry in the comparisons. The parameter γ_+ and γ_- are expected to have a significant and positive effect, which confirm that reference group income play a role as a benchmark and that individuals whose household income is below that level face relative deprivation. Previous literature suggests that the intensity of the valuation is greater among individuals facing relative deprivation, so it is expected that $(\gamma_+ < \gamma_-)$ and even that the relative position is not relevant for those with a relative advantage $(\gamma_+ = 0)$. Furthermore, we carry out a statistical test based on the null hypothesis $H_0 : \gamma_+ = \gamma_-$.

The comparison of the incidence of $\tilde{\beta}$, β, γ_+ and γ_- will allow us to test a secondary hypothesis on the greater importance of their relative income with respect to their income. The main hypothesis of this chapter is tested from specification 3.12, which allows asymmetry in the comparisons, by considering different sensitivity between those who are above and below the reference level. First, unlike equation 3.9, the asymmetry in the income comparison requires testing the linear and quadratic terms. Second, if the relative con-

cern in relation to the reference group income follows the basics of prospect theory, among individuals without relative deprivation, $\theta_+ \leq 0$ must be met, while for those facing relative deprivation ($\theta_- \geqslant 0$). This would be consistent with the model of Genicot and Ray (2014) on aspiration formation. An alternative hypothesis has been proposed by Vendrik and Woltjer (2007), who find that the function is concave on both sides of the reference income ($\theta_- < 0$).

Moreover, what this hypothesis establishes is that at points close to the reference point the slope is very steep on both sides of the reference point. As they move away from it, it would be steeper among those facing relative deprivation in relation to those with a positive relative income. In order to test this proposition the joint significance tests $\gamma_+\Delta Y^R + 2\theta_+\Delta Y^R = \gamma_-\Delta Y^R + 2\theta_-\Delta Y^R$ is used. These parameters can be used to evaluate the degree of concavity / convexity that exists on both sides of the reference income. An indicator used to carry out such an evaluation is to compare $\frac{2\theta_+}{\gamma_+ + 2\theta_+(Y^R)}$ with $\frac{2\theta_-}{\gamma_- + 2\theta_-(Y^R)}$.

The estimates which arise from equations 3.14 and 3.15, provide evidence of robustness of the above hypotheses. They provide evidence on the use of alternatives thresholds as a benchmark.

3.4 Data, operationalization of variables and estimation procedure

3.4.1 Source of data

This research uses the "Multidimensional Well-being Trajectories in Childhood" (MWTC) survey as an information source. This panel is representative of households which had children attending first year at public primary school in 2004. In Uruguay public school coverage is close to 90% among children in the first year. In that year 3266 households were

surveyed, of which 1800 resided in the metropolitan area (Montevideo and Canelones). In 2006 a second wave was carried out, where only households located in the metropolitan area were surveyed, a total of 1327 respondents, which represents an attrition of 26% of the panel.[17] The third wave of this panel began to be carried out in 2011 and was extended until the first few months of 2012. This sample is representative of the entire country, where information on 2500 households was obtained. This source of information provides some advantages in addressing the proposed hypotheses, with some questions being specifically designed to work on these issues. In particular, the second wave contains original information to analyze the hypothesis of adaptive preferences, while the third wave includes specific information on the perception of status, mobility, reference groups and economic aspirations. In addition, there are very few panels containing this type of information for developing countries.

In this chapter we only work with the information for the metropolitan area, a region which provides the possibility of working with a panel with two waves (information about self-reported satisfaction are only available for the second and third waves). The use of self-reported satisfaction leads to the unit of analysis being the individual and not the household, which creates an additional attrition problem. This reduces the panel to a total of 738 individuals surveyed both in 2006 and in 2011-2012. The samples are balanced in the sense that the difference in means test between the individuals in the cross-section data and individuals in the panel survey do not reject the null hypothesis of equal means at conventional significance levels (see Table 3.A.2 of the section 3.A). The only exception are two variables, sex and hours worked only in the first wave. In addition, all the available information for each wave is also used in the estimates by OLS (1283 for the second set and 1084 observations for the third).

[17] Burstin et al. (2010) carry out a detailed analysis of this survey data.

3.4.2 Variables and measures for reference income

In this research, the dependent variable used in the estimates is the economic satisfaction ES which, as argued, seems more appropriate when testing the assumptions of prospect theory. Economic satisfaction is reported on a scale of 1 to 5, which represents a difference from previous papers, which generally have a scale of 1 to 10 (e.g.Vendrik and Woltjer (2007). Alternatively, life satisfaction is used as the dependent variables, which allows us to obtain results which are comparable to previous papers.

Table 3.A.1 of the section 3.A, summarizes the variables used in the empirical analysis, presenting its definition, source of data and main statistics. Following previous papers, the logarithm of total household income at July 2012 prices is used as a regressor. The income gap is expressed in thousands of pesos and arises from the difference between household income and the reference point. Alternative definitions of the reference income are used.

In a first alternative, reference groups are defined following Vendrik and Woltjer (2007) and Ferrer-i-Carbonell (2005), considering 4 age groups, 6 educational levels and sex.[18] In Clark (2008) and Clark et al. (2008) the treatment of the reference groups is discussed. In general the literature estimates the income averages for each group, and each person belonging to that group is assigned this statistic as a reference income. Considering that the size of the panel sample of the MWTC and its representativeness could cause problems in estimating the average income of the reference group of each individual, we use the Continuous Household Survey (CHS) to estimate the average income for the corresponding years. As such, income at July 2012 prices was used, using all households in

[18]The first category groups individuals between 20 and 34 years old; the second groups individuals between 35 and 44 years old; the third groups between 46 and 65; the fourth group over 65. As for the educational levels a version was used which allowed us to combine the different data sources and years used. The categories were: (i) without formal education, (ii) primary, (iii) secondary, (iv) technical, police or military; (v) teaching or IPA; (vi) tertiary education and university. In Uruguay is a very homogeneous country and regional dimension is less necessary to define the reference group income. In particular, this is true for our sample, whose individuals reside in the metropolitan area.

the Metropolitan area. This alternative allows us to define more homogeneous reference groups and estimate their mean income with greater precision (we use a large enough number of individuals in each reference group). Moreover, using the MWTC income information would involve assuming that individuals only consider individuals who, at some point, sent their children to the first year of a public school in their reference groups. However, this decision could lead to some problems, as there may be measurement errors in the income reported in the MWTC that were not present in the CHS. This problem deserves more attention. The strategy used to mitigate this problem was to use the median income of the groups as a reference, an indicator which is less sensitive to the outliers.

We use information about individual perceptions of income distribution to define a "corrected reference income" Y_i^{rgcorr}. In the MWTC survey there is information on the self-perception of the rank in the income distribution of each individual. Moreover, it allowed us to build the variable $e^p{}_i = P_i{}^P - P_i{}^R$, which reflects the biases in individuals' evaluations of their own relative position in the income distribution (difference between their perceived rank in the income distribution, $P_i{}^P$, and their real rank, $P_i{}^R$). In order to identify the real position, the income deciles of the metropolitan area were built based on the CHS. This data allows us to make a more accurate estimate of income deciles. This variable and the function $\psi(e_i)$ is presented in section 3.B. It allows us to generate the corrected reference income as $Y_i^{rgcorr} = \frac{Y_i^{rg}}{\psi_i}$.

It should be noted that this solution incorporates the problem of using a subjective variable among the regressors. However, this problem is expected to be mitigated, because the perception variable in the income distribution is not used directly. Furthermore, this information was used as a control.

A third alternative uses information about the subjective poverty line to define reference income. In the estimate of the specification of equation 3.15, the minimum income re-

quired for a hypothetical household, which consists of 2 adults and 2 children, to avoid poverty is used as a reference income. This alternative could generate potential endogeneity problems (Stutzer, 2004), because reference points incorporate a subjective component. This represents a limitation of this strategy and suggests that estimates could generate biases. Nonetheless, an advantage in relation to Stutzer (2004) is that in this case the responses do not refer to the well-being of the respondent's household, but that they have an imaginary household as a benchmark. In addition, the specification does not incorporate the subjective variable directly, but considers a transformation of it.[19] Moreover, in order to mitigate the effects of this endogeneity problem, an auxiliary model to explain the MIA reported by each individual is estimated. Therefore two alternatives are used as a reference point, one is based on the reported MIA and another on the predicted MIA. It is expected that this second alternative partly corrects the unobservables that could affect the formation of the subjective threshold. The auxiliary model used follows Stutzer (2004), and the estimated coefficients are presented in the Table 3.C.1 in the section 3.C..[20] In order to make the estimation results comparable, we use the same controls used by Vendrik and Woltjer (2007), and as a test of robustness, we include some additional controls. On the one hand, we include an indicator of wealth. It is built using Principal Component Analysis based on the presence of certain household assets. On the other hand, we include an indicators of both objective income mobility (deciles change in the income distribution), subjective intergenerational income mobility (difference between the actual household's rank in the income distribution and the self-perception of the rank of their household during childhood) and educational mobility (difference between individual's

[19] Two alternatives are used, one which directly takes the response and another which it is adjusted for the number of members in each household.

[20] The predicted MIA explains that part of the subjective poverty that is independent of personal unobservables as ability or personality traits. A linear model is specified to explain the subjective poverty line based on the following regressors: 2004 income, number of people in the household in 2011, dichotomous variables identifying the years of education, the education of the best friend and a dichotomous variable which identifies the semester in which the survey was carried out. The later variable is exogenous and is associated with the MIA through the prices evolution.

educational achievement and their parent's educational achievement) are included.[21] Furthermore, we use a proxy of locus of control (LOC) as a variable control, which considers one important aspect of personality and is used as a control in various previous papers (Budria and Ferrer-i-Carbonell, 2013; Blázquez and Budria, 2014, Proto and Rustichini, 2015). In more recent years there has been increasing attention to consider explicit personality measures in empirical research in economics (Almlund et al. 2011; Borghans et al., 2008; Cobb-Clark and Schurer, 2013). For example, locus measures have been used as non-cognitive abilities measures (Heckman et al., 2006; Heckman and Kautz, 2012).

The LOC is defined as the individual's perception of their control of their life, which is explained as the degree to which an individual believe that his life is under his control or depends on external factors (actions of others, luck, etc). There is extensive research which has proposed alternative methodologies to measure LOC, whose findings are convergent. Levenson (1981) proposes three dimensions to measure the LOC, *internality*, *powerful others* and *chance*, which are more statistically independent of one another than previous dimensions used in Rotter's scales.[22] *Internality* indicates the extent to which individuals perceive that they have control over their own lives, meanwhile *powerful others* indicates the perception that other people control the events in one's life. Finally, *chance* indicates the degree to which an individual perceives that their experiences and outcomes are contingent upon their actions. In order to measure LOC, we explore these three components separately, which allows for more flexibility.

We use information available in the MWTC panel to measure these three dimensions of LOC. Table 3.A.4 in the section 3.A summarizes the main statistics for each LOC domain,

[21] There are some previous studies that suggest that the level of mobility in Uruguay is relatively low (Perera, 2006; Sanroman, 2010). Arim et al. (2013) found that the income dynamics are very different Depending on the characteristics of the head of the household, and while they do not statistically accept the presence of poverty traps for households whose head has a medium to high educational level, they do not reject it for the lower level.

[22] These three dimensions have been used in economics, for example by Heckman et al. 2006 and Heckman and Kautz (2012).

and also shows their domain range. Table 3.A.1 presents the questions used to build the index for each dimension. In a first step, the *LOC* control variable is defined as the individual average of standardized scores in each dimension and wave (LOC_{IPC}). Table 3.A.1, in the section 3.A, presents a detailed description of the LOC variable construction.

In order to advance in the relationship between economic satisfaction and the LOC dimensions, we explore its three components (internality, powerful others, and chance) separately as well as their correlation with economic satisfaction, happiness and minimum income aspiration. Table 3.A.3 of the section 3.A shows a negative correlation between the three LOC components and happiness. As expected, there are positive and significant correlations between higher life satisfaction, having an *internal locus of control* and having a higher relative *powerful others*. Second, LOC domain is correlated with income aspiration; individuals with *internal locus of control*, powerful other and longer *chance*, are correlated with higher income aspiration. Both results agree with the previous literature. Finally, while the LOC sub-components *internality* and *powerful others* have a negative correlation with economic satisfaction (internal and more powerful individuals are more satisfied), the component of *chance* has a positive correlation (low chance views are associated with higher economic satisfaction). Considering these results we aggregate the components *internality* and *powerful others* across individuals (LOC_{IP}), and we use our disaggregated LOC- chance index (LOC_C). The aggregated LOC_{IP} is the individual average of standardized LOC_I and LOC_P, and there is still a negative correlation with economic satisfaction and happiness. [23]

3.4.3 Estimation procedure

Our estimates are based on the random effect model extended to include a Mundlak term (Mu) and fixed effect model (Fe).[24] Following Vendrik and Woltjer (2007) the use of the

[23] Table 3.A.3 of the Appendix also presents correlation between LOC components and other satisfaction domains. Results show differences between LOC components.

[24] In the presented results, we use the average over the two waves. We also estimate the OLS for each

Logit or Probit models is discarded to simplify the contrasts linked to the convexity or concavity of the relative concern and provide a simpler interpretation of the results. We use the Probit-adapted OLS procedure (Van Praag and Ferrer-i-Carbonell, 2008), which assumes ordinality in the individual's responses. This method based on a transformation of the ordered satisfaction variable, allows us to carry out OLS estimates whose results are equivalent to the ordered Probit models. The main advantage is that it provides a simpler interpretation of the coefficients, analogous to the OLS.[25]

However, in order to make the results more robust, we assume cardinality in the individual's responses, and estimate Mu and Fe models. In this case, estimates demand interpersonal comparison and cardinality assumptions, which implies that, for all individuals, a one unit for fall in satisfaction from 5 to 4 is equivalent to a fall from 3 to 2. Ferrer-i-Carbonell and Frijters (2004) provide a more detailed explanation of the implications of this assumption. This paper also demonstrates that the estimates which assume that the subjective responses are ordinal produce the same results as the methods which assume cardinality which supports our strategy.[26]

Previous research on the field suggests the presence of omitted individual characteristics that could lead to endogeneity problems when using self-reported measures in econometric estimations (Clark et al., 2008; Ferrer-i-Carbonell, 2011, Van Praag and Ferrer-i-Carbonell, 2008). For example, the existence of some idiosyncratic variables such as personality traits might affect access to resources (income or wealth) and satisfaction levels.[27] Ferrer-i-Carbonell and Frijters (2004) conclude that unobservable time-invariant

wave separately and for pooling data from all observations of the two waves. The results of which are not included but are consistent with those we present in section 3.5. Due to the availability of information, the estimates of equation 3.15 are only made by OLS, and we use the lagged income as control variable.

[25] In chapter 2 of Van Praag and Ferrer-i-Carbonell (2008) this technique is developed.

[26] Ferrer-i-Carbonell and Frijters (2004) found that when fixed effects are used to explain self-reported satisfaction, the ordered Probit models show results which are very close to the findings of an OLS model. The main conclusion is that assuming cardinality or ordinality in the satisfaction responses has little effect on the results.

[27] Pischke (2011) instruments income using the industry wage differentials, to address the correlation

characteristics are highly relevant to explain the levels of self-reported satisfaction. This result is consistent with Diener and Lucas (1999) and Argyle (1999) literature surveys, which suggest that very persistent personality traits are the best predictors for life satisfaction answers. A second source of endogeniety arises from simultaneity problems between some of the regressors and the dependent variable. For example, if happier people are more successful in economic terms, then, higher income is an outcome rather than a casual factor (Stutzer and Frey, 2006; Graham et al. 2004).

According to Ferrer-i-Carbonell (2011) the literature on the field has not yet been successful in identifying appropriate methods to address these problems. Ferrer-i-Carbonell and Frijters (2004) suggest that the use of Fe can mitigate endogeneity problems that may arise due to the presence of unobservable invariants over time. The latter is applied in this research, although in the data-set used in this study only three waves are available. Furthermore, Fe estimates rely on within variations in the variables of interest, which poses a potential problem if an important fraction of individuals do not change their relative situation (Blázquez and Budria, 2014). To address this issue we use an extended random effects model, containing a Mundlak correction term. We include the individual mean across the two waves of those variables that be correlated with the individual time persistent unobservable term.[28] As a result this term controls the respondents' personality traits (and other unobservables) and corrects the potential correlation between the individual time persistent unobservable term and explanatory variables (Mundlak, 1978; Budria et al., 2012). [29]

between life satisfaction measures and income. In this case, instrumental variable estimates and OLS estimates yield to similar results, suggesting a causal relationship between income and life satisfaction.

[28]The variables considered are: household income, working hours, years of education, number of children, household members and unemployment. We tested with alternative groups of variables and provides the same results. For the individual average variable of the Mundlack term, we use alternatively the information from three and two waves. Both alternatives provide the same results.

[29]Mundlack (1978) argues that the choosing among random or fixed effect models, is arbitrary and unnecessary. His view unifies both approaches, by providing it provides a "desirable" estimator properties.

Furthermore, to address endogeneity problems, our data has a broad set of variables that allow us to use some proxies for unobservable characteristics (we incorporates alternative mobility measures, personality traits and an access to durable goods index as a wealth proxy). An alternative procedure to mitigate the potential simultaneity problem, is to exploit the possibilities offered by exploiting the longitudinal nature of the information, including lagged income instead of contemporary income. The robustness of the results is analyzed on this bases replacing income with one period lagged income, both in Re and Fe estimates. Under the same argument, lagged wealth is included as a control.

An additional source of bias, in regard to our parameters of interest, the relative concern coefficients, can arise from the interaction between some personality traits and social comparisons, which could affect self reported satisfaction (Proto and Rustichini, 2015 and Budria and Ferrer-i-Carbnoell, 2012). Specification 3.17, incorporates and interaction term between LOC and relative concern, which could help us to address this problem.

Furthermore, previous literature discusses potential endogeneity concern in the choice of the reference group: for example, people could choose a poorer reference group to feel better, or choose a richer reference group to improve their performance (Falk and Knell, 2004; Heffetz and Frank, 2011). If this is the case, the Mu and Re estimates could be facing a simultaneity problem. For example, the reference income could be relevant in deciding how much effort individuals exert in order to reach a certain income level and obtain a certain level of economic satisfaction. In addition, achieving a certain level of economic satisfaction could lead to redefining the reference group. Senik (2009) and Clark and Senik (2010) provide evidence for a better understanding of the endogenous determination of reference groups. However the solution is still in its early stages, and generally the reference group is assumed to be exogenous in empirical studies (Ferrer-i-Carbonell, 2011; Clark et al, 2008, Clark, 2008). Although instrumental variables estimations can contribute solving this problem, we have not in the previous literature studies treating rel-

ative income endogeneity problems using instrumental variables. As already mentioned, in this chapter this aspect will be considered by approximating reference income in alternative ways. Furthermore, we use some variables to controls for individuals' personality traits. Cobb-Clark and Schurer (2013) find that locus of control is relatively stable, but not time invariant. This means that the fixed effect model is not able to capture the entire effect of this variable.

With respect to the interpretation of the coefficients associated with relative concern, it is necessary to clarify some aspects. Given the objectives of the chapter, we focus on the sign of the marginal effect of relative income with respect economic satisfaction levels. We pay less attention to their magnitude in absolute terms (to some extent, this is conditioned by the range of the dependent variable, which in previous papers varies from 1 to 7 or from 1 to 10). Secondly, the hypotheses to be tested require the evaluation of the significance and sign of the coefficients of interest. Furthermore, in some cases, in order to test our hypotheses, we compare the magnitude of the parameters in relation to other parameters of the regression (For example, using joint significance test).

Another issue that deserves attention is the potential endogeneity problem of the variables reflecting the Locus of control. While some authors emphasize that LOC reflects some stable aspects of the individual personality which indicates attitudes regarding the causes of their present achievement. In this case, the endogeneity problem is limited. Other authors focus on the role of the individuals' environments in shaping their perceptions on response-outcome relationships (Almlund, 2011; Lefcourt, 1984). When environments are adverse in terms of opportunity, it is more difficult to ascribe such perceptions to personality, and it is likely that they would change if these constraints disappear.[30] When

[30]Cobb-Clark and Schurer (2013), using data from Australia, found that short- and medium-run changes in locus of control are modest on average, and are concentrated among young and very old people. Although they confirm its stability, they suggest that Locus of control is not time invariant. On the other hand, there is evidence about the effect of public programs or experimental treatments on locus of control (Gottschalk, 2004; Bernard, et al., 2014)

the environments are favorable it is easier to relate LOC scores with relatively stable differences in personality characteristics (Lefcourt, 1984).

Therefore, omitted variables correlated with LOC could lead to endogeneity problems. For example, the relationship between ES and LOC could be explained by the fact that individuals with internal locus of control are more likely to remember their economic success than those with external locus (Rotter, 1966; Argyle, 2001). An other source could arise from the correlation between internal LOC and cognitive ability, which is an omitted variable in our model. However, there is not a consensus in the empirical literature about this issue: while Coleman and DeLeire (2003) confirm this correlation, Stankov (2005) and Ackerman and Heggestad (1997) suggest that these personality traits are weakly correlated with IQ. Furthermore, Almlund, et al. (2011) highlight that LOC is empirically easily distinguished from general cognitive ability.

To address this issue in this chapter, we first include individual fixed effects, which control unobservable invariants over time. Secondly we interact LOC variables and relative deprivation. Finally, we use lagged LOC variables.[31]

3.5 Estimation results

We organize the results in two subsections. In subsection 3.5.1, the evidence regarding hypotheses HI and HII is presented using the standard definition of reference group income (Y^{rg}). Furthermore, we present a series of robustness checks, by including additional control variables and considering alternative reference income (Y^{rgcorr} and MIA). In subsection 3.5.2, we present preliminary evidence on income aspiration.

3.5.1 Testing assumption of prospect theory

Table 3.1 presents the results from the baseline specification of equation 3.3 and from equation 3.9. We present the results for the extended random effect model (Mu) and

[31] In the section 3.A Table 3.A.4 presents statistics about LOC domains distribution and Figure 3.Areports about the individual variation of LOC domains.

the fixed effect model (Fe), assuming ordinal approach. The baseline results confirm that household income presents a significant and positive correlation with ES. However, when we incorporate the relative concern term, the coefficient associated with the logarithm of the household income level is not significantly different from zero. This is partly consistent with previous results on a greater valuation of relative concern in relation to the level of income.

When we focus on equation 3.9 and the relative concern parameters, which provide a first test of hypothesis HI. First, the Mu estimate confirms the importance of relative concern and the reference-dependence model.[32] It shows that $\hat{\gamma}_+$ and $\hat{\gamma}_-$ are statistically significantly different from zero (student test) and that $\hat{\gamma}_+ < \hat{\gamma}_-$. As a result, this estimate provide evidence on the asymmetry in income comparison in the linear term. However, at the usual significance levels, the hypothesis $\hat{\gamma}_+ = \hat{\gamma}_-$ is not rejected (see last raw in Table 3.1), which suggests that deeper analysis about hypothesis HI will be necessary.

Fe estimate provides weak evidence on relative concern. Although $\hat{\gamma}_+ > 0$ and $\hat{\gamma}_- > 0$, they are not statistically significantly different from zero. Apparently, individual fixed effects explain the variation in ES. The differences in the results with respect Mu estimate could be attributed to two issues: specification problems in the relative concern term; the fixed effects estimator is less efficient (which leads to greater standard error).

On other hand, years of education, which are a proxy for permanent income, presents a positive correlation but is significantly different from zero in Mu estimates.[33] Finally, the sign of the controls is consistent with the previous paper, although its significance is weak and varies depending on the estimation method.

Table 3.2 presents the estimates of equation 3.12 using the ordinal approach, which allow

[32] Results produced by cardinal approach are in Table 3.D.2.

[33] Year of education is maintained as an explanatory variable in the fixed effects model because it identifies a group of individuals who improve their educational achievements in the period analyzed. Furthermore, the results of fixed effect model remain when we exclude this variable.

Table 3.1: Economic Satisfaction, specification based on equations 3.3 and 3.9

		Ordinal approach-POLS							
Estimation procedure		Mu		FE		Mu		FE	
Regressors.		Coefficient	T-Ratio	Coefficient	T-Ratio	Coefficient	T-Ratio	Coefficient	T-Ratio
Household income (ln y)	**β**	**0.0497***	**4.56**	**0.0492***	**3.81**	**-0.02320**	**-0.71**	**0.02750**	**0.74**
Income gap if RD<0 (y-y^{rg}<0)	**γ_-**					**0.0105*****	**3.82**	**0.0033**	**0.91**
Income gap if RD>0 (y-y^{rg}>0)	**γ_+**					**0.0051*****	**3.03**	**0.0012**	**0.63**
Years of education		0.0272	2.56	0.0268	-0.52	0.0462**	2.28	0.0327	1.59
Unemployment		-0.1545	-2.50	-0.1302	-3.13	-0.1453	-1.26	-0.127	-1.10
Ln(Active household members)		0.1056	0.83	-0.1808	1.14	0.1202	0.73	-0.1763	-0.82
Ln(Household members)		0.028	-1.74	0.0994	-1.83	0.0064	0.04	0.0876	0.49
Ln (age)		-0.1313	-0.66	-0.6047*	-1.89	-0.0237	-0.14	-0.5327	-1.41
Male		-0.1243	-1.18			-0.1207	-1.11		0.00
Ln (1+working hours)		0.0052	-0.64	0.016	-0.86	0.0048	0.21	0.0159	0.70
Marital status		-0.2935***	-4.53	-0.3324***	-3.38	-0.2565***	-3.87	-0.3251***	-3.32
Ln (number of children)		0.0577	0.91	-0.0188	-0.16	-0.0167	-0.26	-0.034	-0.41
Constant		-0.8105	-0.94	1.5547	-0.64	-0.1602	1.61	1.5134	1.06
Individual means Mundlack									
Mean Ln(Household income)		0.1102**	2.57			0.0848	1.61		
Mean Ln(1+working hours)		-0.04	-1.24			-0.0504	-1.47		
Mean Years of education		-0.0147	-0.73			-0.02	-0.95		
Mean Ln(number of children)		-0.0027	-0.02			0.104	0.86		
Mean Ln(household members)		-0.2665	-1.32			-0.3134	-1.44		
Mean Unemployment		-0.1994	-1.06			-0.2043	-1.17		
Observations		1,476		1,476		1,476		1,476	
Individuals		738		738		738		738	
R-squared		0.065		0.041		0.089		0.044	
Joint significance tests		89.360		3.475		130.300		2.598	
Hypotheses						**Relative concern test (P-value)**			
Tests: $\beta=\gamma_-=\gamma_+=0$						0.000		0.166	
Tests: $\gamma_-=\gamma_+$						0.118		0.633	

Reference group income is defined using mean reference group income (CHS). The reference group is defined by education, age, and sex. Income gap is in thousands of pesos. MU, Mundlack: Fe, Fixed effect). (*) The Joint sginificance test is a Chisquared test and F -test., in the MU estimates and FE estimates respectively.

*** p<0.01, ** p<0.05, * p<0.1

us to test hypotheses HI and HII. First of all, Mu and Fe estimates produce consistent results and coefficients with similar magnitudes. We analyze first the statistical significance of the additional variables, which allows us to assess the new specification and to test hypothesis HII. The hypothesis $\hat{\theta}_- \neq 0$ is rejected in both estimates (Table 3.2), being positive in both cases. Furthermore, the results arising from specification 3.12 are consistent with the assumptions of prospect theory and, unlike the findings of Vendrik and Woltjer (2007), relative concern would be convex among individuals facing relative deprivation. Both estimates show that $\hat{\theta}_- > 0$, while $\hat{\theta}_+ < 0$, but the null hypothesis $\hat{\theta}_+ \neq 0$ is not rejected. As such, the evidence is robust in relation to the convexity of the relative concern for individuals located below the reference point and is weak with respect to its concavity for individuals with a positive relative income.

Moreover, the results lead to a revision of the conclusions arising from specification 3.9 on the asymmetry in the income comparison, which in this case requires testing the joint significance of the linear and quadratic terms. First, the coefficients associated with relative deprivation (γ_-) are individually significantly different from zero in both estimates (Table 3.2). While the relative concern coefficients associated to the individuals with a positive relative income are positive, but in Fe estimates they are not significantly different from zero. The estimates again confirm that $\hat{\gamma}_+ < \hat{\gamma}_-$, which is consistent with the results of hypothesis HI on the greater aversion to relative deprivation.[34] Furthermore, the joint significance tests of the parameters associated with the relative deprivation reject the null hypothesis ($H_0 : \hat{\gamma}_- = \hat{\theta}_- = 0$), but do not reject the null hypothesis ($H_0 : \hat{\gamma}_+ = \hat{\theta}_+ = 0$). That result is fully consistent with the hypothesis of Duesenberry (1949), which suggests that agents are upward looking when making comparisons. Furthermore the test rejects the null hypothesis $\hat{\theta}_+ = \hat{\theta}_-$ in both cases (see bottom Table 3.2), with $\left|\hat{\theta}_+\right| < \left|\hat{\theta}_-\right|$.

The results arising from the alternative approaches (cardinal or ordinal), procedures and

[34] At the usual significance levels, the hypothesis $\hat{\gamma}_+ = \hat{\gamma}_-$ is not rejected under ordinal approach, while is rejected under cardinal approach Table 3.D.2 in section 3.D..

samples are consistent (see Table 3.D.2 in the section 3.D.). All these results hold when the median income of the reference group is used as a reference (see Table 3.D.3 in the section 3.D.).[35]

To test the asymmetric aversion among individuals with relative advantage and relative deprivation, we consider the quadratic term and we evaluate if there are statistically significant differences in the slope through the following hypothesis: $\hat{\gamma}_+ + 2\hat{\theta}_+ \mid Y^R \mid = \hat{\gamma}_- + 2\hat{\theta}_- \mid Y^R \mid$. In Table 3.3 we present the results for the estimates which use the mean and median income of the reference group as a reference under the ordinal approach for ES (Table 3.2 and Table 3.D.3 in the section 3.D.). Furthermore, we include the estimates based on the cardinal approach (Table 3.D.2 in section 3.D.). Unlike the linear specification, in this case the derivative of the relative concern depends on the level of relative income, so the test is evaluated at three points (Y^R=0 , Y^R=1 and $Y^R = \mid \bar{Y^R} \mid$). In the first case, it is rejected that the slopes are different, which would indicate that when an individual is very close to the reference income ($\Delta Y^R \to 0$), the sensitivity to the relative income is similar on both sides of the reference point (see Table 3.3). In the second case ($Y^R = 0.001$), the magnitude of the gap increases, the null hypothesis is not rejected, with the exception of the Mu estimates with the cardinal approach. Finally, in the third case, when ($Y^R = \mid \bar{Y^R} \mid$) the null hypothesis is rejected in all cases. That is, around the reference income, sensitivity to relative income is similar both for those facing relative deprivation and those with a relative advantage. Once we move away from the reference level, the slope of the valuation of the relative income is steeper among those facing relative deprivation in relation to those with an income above their reference (Hypothesis HII).

In short, the evidence confirms the hypothesis of "reference dependence" (assumption a)

[35]We also estimate the OLS for each wave separately and the pooled data, the results of which are not included in the chapter but are consistent with those we present in Table 3.2.

Table 3.2: Economic Satisfaction, specification based on equation 3.12

Estimation procedure		Ordinal approach-POLS Mu		FE	
		Coefficient	**T-Ratio**	**Coefficient**	**T-Ratio**
Income gap if ($y-y^{rg}$)<0	γ_-	**0.0178*** **	**3.96**	**0.0122****	**2.09**
Income gap if ($y-y^{rg}$)>0	γ_+	**0.0075***	**1.91**	**0.0015**	**0.30**
Squared income gap if (y-yrg)<0	θ_+	**0.0000**	**-1.18**	**0.0000**	**-0.47**
Squared income gap if (y-yrg)>0	θ_-	**0.0002****	**2.49**	**0.0002****	**2.01**
Household income (log y)	β	-0.0153	-0.46	0.0383	1.01
Years of education		0.0491**	2.42	0.0349*	1.69
Unemployment		-0.1338	-1.15	-0.1153	-1.00
Ln(Active household members)		0.1136	0.69	-0.1744	-0.81
Ln(Household members)		-0.0156	-0.09	0.0545	0.31
Ln (age)		-0.0301	-0.18	-0.4911	-1.30
Male		-0.1198	-1.10		
Ln (1+working hours)		0.0051	0.22	0.0155	0.68
Marital status		-0.2527***	-3.81	-0.3310***	-3.35
Ln (number of children)		-0.0167	-0.25	-0.0243	-0.29
Constant		-0.0721	-0.10	1.3228	0.92
Individual means Mundlack					
Mean Ln(Household income)		0.0775	1.50		
Mean Ln(1+working hours)		-0.0506	-1.48		
Mean Years of education		-0.0261	-1.22		
Mean Ln(number of children)		0.1107	0.92		
Mean Ln(household members)		-0.2971	-1.37		
Mean Unemployment		-0.2141	-1.23		
Observations		1,476		1,476	
Individuals		738		738	
R-squared		0.092		0.048	
Joint significance tests †		133.40		2.55	
Hypotheses		**Relative concern test (P-value)**			
Test: $\gamma+ = \gamma- =0$		0.132		0.223	
Test: $\theta+ = \theta-$		0.003		0.031	
Test: $\gamma+ = \theta+ = 0$		5.497		0.775	
Test: $(\gamma+) - (\gamma-) + 2*(\theta)+ 2(\theta-) =0$		0.119		0.207	
Test: $(\gamma+) + 2*(\theta)Y^{Rmed} = (\gamma-)- 2(\theta-)Y^{Rmed}$ ††		0.024		0.078	

Reference group income is defined using mean reference group income (CHS). The reference group is defined by education, age, and sex. Income gap is in thousands of pesos..Re, Randome effect; MU, Mundlack: Fe, Fixed effect. (†) The Joint sginificance test is a Chisquared test and F -test., in the MU estimates and FE estimates respectively. (††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

Table 3.3: Test of asymmetrical relative concerns.

Based on estimates of economic satisfaction (ordinal approach), using mean reference group income (Table 3.2)		
Test | Specification	Mu	Fe
$Y^R =\mid 0.001 \mid$ (P-value)	0.209	0.301
$Y^R =\mid 1 \mid$ (P-value)	0.187	0.279
$Y^R = \mid \bar{Y^R} \mid$(P-value)	0.033	0.096

Based on estimates of economic satisfaction (ordinal approach), using mean reference group income (Table 3.2)		
$Y^R =\mid 0.001 \mid$ (P-value)	0.209	0.301
$Y^R =\mid 1 \mid$ (P-value)	0.187	0.279
$Y^R = \mid \bar{Y^R} \mid$(P-value)	0.033	0.096
Based on estimates of economic satisfaction (cardinal approach), using median reference group income (Table 3.D.1 in the section 3.D.)		
$Y^R =\mid 0.001 \mid$ (P-value)	0.091	0.140
$Y^R =\mid 1 \mid$ (P-value)	0.082	0.128
$Y^R = \mid \bar{Y^R} \mid$(P-value)	0.015	0.040
Tested hypothesis $H_0 : \hat{\gamma}_+ + 2\hat{\theta}_+ \left\|Y^R\right\| = \hat{\gamma}_- + 2\hat{\theta}_- \left\|Y^R\right\|;$ $H_1 : \hat{\gamma}_+ + 2\hat{\theta}_+ \left\|Y^R\right\| \neq \hat{\gamma}_- + 2\hat{\theta}_- \left\|Y^R\right\|$		

and is ambiguous with respect to the greater valuation of relative income in relation to absolute income. The asymmetry of comparisons are confirmed, which is consistent with previous findings that suggest loss aversion, in this case, referring to a greater marginal sensitivity to relative deprivation (assumption b and Hypothesis HI). Moreover, the evidence is robust in relation to the convexity of the curve for those in a position of relative deprivation (assumption c and Hypothesis HII).

Robustness check

As a test of robustness some alternative specifications are included. First, explicit controls for the individuals' personality traits are included, using the MWTC survey, which includes some questions to measure the respondents' Locus of control (LOC_{IPC}). In a second step, considering a potential problem of endogeneity between income and the level of economic satisfaction, contemporary household income is substituted for lagged income in the estimates of random and fixed effects models.[36] Moreover, considering that the evaluations of satisfaction could incorporate longer-term issues (which shows the incidence of education) and that in general the current income presents volatility, a lagged wealth indicator is included as an additional control. The inclusion of a wealth indicator is a contribution to the previous literature, since it is a variable which is rarely used in this type of specification.

The results are presented in Table 3.4. With respect to the additional controls, we found a positive correlation between individuals with internal locus and economic satisfaction, which is consistent with previous papers (Budria and Ferrer-i-Carbonell, 2013; Blázquez and Budria, 2014). However, this coefficient is significantly different from zero in the Mu estimates but it is not in the case of Fe. If LOC_{IPC} represents personality characteristic

[36] Because we incorporate lagged variables, we do not presents the results of extended Re model. The results between Re and Mu are consistent when we incorporate these additional controls.

Table 3.4: Economic Satisfaction, specification based on equation 3.12 including additional controls

		Ordinal approach-POLS							
Estimation procedure		Mu		FE		Mu		FE	
Variables		Coeff.	T-Ratio	Coeff.	T-Ratio	Coeff.	T-Ratio	Coeff.	T-Ratio
Income gap if ($y-y^{rg}$)<0	γ_-	**0.0174*** **	**3.86**	**0.0122** **	**2.06**	**0.0175*** **	**3.75**	**0.0131** **	**2.02**
Income gap if ($y-y^{rg}$)>0	γ_+	**0.0078** **	**2.01**	**0.0016**	**0.31**	**0.0068***	**1.67**	**-0.0010**	**-0.18**
Squared income gap if (y-yrg)<0	θ_+	**0.0000**	**-1.29**	**0.0000**	**-0.47**	**0.0000**	**-1.02**	**0.0000**	**0.07**
Squared income gap if (y-yrg)>0	θ_-	**0.0002** **	**2.50**	**0.0002** **	**2.00**	**0.0002** **	**2.03**	**0.0002***	**1.68**
Household income (log y)	β	**-0.0159**	**-0.47**	**0.0376**	**0.9927**				
Years of education		0.0491**	2.44	0.0344	1.65	0.0264***	3.18	0.0280	1.33
Unemployment		-0.1384	-1.19	-0.1148	-0.98	-0.2133**	-2.13	-0.1331	-1.09
Ln(Active household members)		0.1067	0.66	-0.1747	-0.81	0.0991	0.59	-0.1055	-0.47
Ln(Household members)		-0.0085	-0.05	0.0548	0.31	-0.1613	-1.63	0.1499	0.77
Ln (age)		-0.0444	-0.27	-0.4900	-1.29	0.0426	0.25	-0.4231	-0.85
Male		-0.1284	0.19	-0.0461	0.67	-0.2262	-1.63	-0.1658	-0.65
Ln (1+working hours)		0.0044	-1.18	0.0154	-0.25	-0.0111	-0.64	0.0141	0.59
Marital status		-0.2585***	-3.92	-0.3323***	-3.35	-0.3014***	-4.41	-0.3312***	-3.13
Ln (number of children)		-0.0200	-0.31	-0.0246	-0.30	0.0369	0.61	-0.0080	-0.08
Locus of control (LOC_{IPC})		0.1122**	0.08	0.0197	0.00	**0.1163** **	**2.25**	**0.0477**	**0.60**
Lagged household income						**0.0077**	**0.43**	**-0.0116**	**0.43**
Lagged wealth index						**0.0004*** **	**3.95**	**0.0006*** **	**5.96**
Individual means Mundlack									
Mean Ln(Household income)		0.0764	1.46						
Mean Ln(1+working hours)		-0.0508	-1.49						
Mean Years of education		-0.0304	-1.43						
Mean Ln(number of children)		0.1106	0.92						
Mean Ln(household members)		-0.3045	-1.41						
Mean Unemployment		-0.2170	-1.25						
Constant		0.0446	0.06	0.0000	0.00	-0.0761	-0.12	1.4396	0.78
Observations		1,476		1,476		1,348		1,348	
Individuals		738		738		674		674	
R-squared		0.091		0.052		0.096		0.048	
Joint significance tests (†)		131.700		2.229		149.100		26.290	
Hypotheses				**Relative concern test (P-value)**					
Test: $\gamma+ = \gamma- =0$ (P-value)		0.138		0.232		0.151		0.144	
Test: $\theta+ = \theta-$(P-value)		0.002		0.031		0.013		0.105	
Test: $\gamma+ = \theta+ = 0$ (P-value)		0.057		0.789		0.103		0.895	
Test: $(\gamma+) - (\gamma-) + 2*(\theta)+ 2(\theta-) =0$ (P-value)		0.125		0.216		0.140		0.137	
Test: $(\gamma+) + 2*(\theta)Y^{Rmed} =(\gamma-)- 2(\theta-)Y^{Rmed}$ (P-value) (††)		0.024		0.082		0.046		0.082	

Reference group income is defined using mean reference group income (CHS). The reference group is defined by education, age, and sex. Re, Randome effect: Fe (Fixed effect). (†) .The Joint sginificance test is a Chisquared test and F -test., in the RE estimates and FE estimates respectively. (††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

which are stable over time its effects are captured by individuals' fixed effect term (Ferrer-i-Carbonell and Frijters, 2004). Another explanation could be associated with problems in the measurement of LOC_{IPC}, and how we consider its different domains. We advance in this issue in the section 3.5.2.

With respect to lagged wealth, both estimates present a significant and positive correlation. While the coefficient of the lagged income is not significantly different from zero. The inclusion of these controls does not affect other coefficient estimates.

When we focus on the relative concern parameters, the results confirm the conclusions already presented. The hypothesis $\hat{\gamma}_- = 0$ is rejected in all cases, with $\hat{\gamma}_- > 0$ and with a magnitude comparable. Furthermore, the hypothesis $\hat{\gamma}_+ = 0$ is rejected only in the case of Mu estimates, with the coefficients always being positive. All estimates confirm $\hat{\gamma}_+ < \hat{\gamma}_-$ (between 2 and 7 times). Meanwhile, the hypothesis $\hat{\theta}_- = 0$ is rejected in both estimates. Furthermore, $\hat{\theta}_+$ does not have a significant incidence. The hypothesis $\hat{\theta}_+ = \hat{\theta}_-$ is rejected, confirming $\left|\hat{\theta}_+\right| < \left|\hat{\theta}_-\right|$ and the joint significance tests reject the null hypothesis $H_0 : \hat{\gamma}_- = \hat{\theta}_- = 0$, but do not reject the null hypothesis $H_0 : \hat{\gamma}_+ = \hat{\theta}_+ = 0$.[37] Finally, the contrasts indicate that for the income levels nearer to the reference point, there is a steeper slope for function $G(.)$ among those facing relative deprivation in relation to those with a positive relative income (see two last raw of Table 3.4).

In summary, these results confirm the asymmetry in the income comparison, with higher marginal sensitivity among those with relative deprivation. Moreover, the evidence is robust regarding the convexity of the curve in the zone of relative deprivation. The similarity of these results with respect to that previous section suggests that the biases due to the simultaneity (endogeneity) problem are small.

Considering the role that experienced mobility in the formation of the reference group

[37] Although multicollinearity problem (so long as it is not perfect) does not violate OLS classic assumptions, it leads to greater standard error. As a result, the t-statistics for the coefficients not reject null hypothesis when is false. An alternative to address this issue is use joint hypothesis tests for a group of coefficients associated with correlated variables, instead t-tests for individual coefficients.

could play, variables aiming to capture the incidence of the objective and subjective mobility of individuals are included as a control. Firstly, an objective intragenerational income mobility variable is incorporated (estimates a in Table 3.5). It identifies the movements in the position of the income distribution between waves. Secondly, an objective indicator of intergenerational educational mobility, which measures the difference between the level of education obtained by the respondent and the highest level of education obtained by their parents, is incorporated (estimates b in the Table 3.5). Finally, a subjective intragenerational income mobility is included as a final additional control, which considers how the individuals perceive their current position in the income distribution, relative to that of their parents (estimates c in the Table 3.5). Furthermore, LOC_{IPC} remains as a control variable.

The main conclusion of these estimates is that the inclusion of these controls does not change the results in relation to any conclusions about the main hypotheses of our this chapter (see Table 3.5). We find $\hat{\gamma}_- > 0$ in all cases, with $\hat{\gamma}_+ < \hat{\gamma}_-$. The hypothesis $\hat{\gamma}_- = 0$ is rejected in all cases, with the only exception of estimates Fe-c. Furthermore, in general $\hat{\gamma}_+ > 0$ but the test $\hat{\gamma}_+ \neq 0$ indicates that it is not significantly different from zero in any case with the exception of estimate Mu-a. Furthermore $\hat{\theta}_+$ is negative but does not have a significant incidence. The hypothesis $\hat{\theta}_+ = \hat{\theta}_-$ is rejected in all cases, confirming $\left|\hat{\theta}_+\right| < \left|\hat{\theta}_-\right|$. Finally, the results confirm asymmetry in the income comparison, and they are robust regarding the hypothesis of diminishing sensitivity.

Furthermore, we found a positive correlation between individuals with internal locus and economic satisfaction, but its coefficient is significant only in Mu estimates. Moreover, variables associated with mobility are generally not significant, although generally their sign is consistent with what is expected.[38] On the one hand, the objective indicator of

[38] Alternative specifications of equation 3.12 are estimated by OLS using each wave separately and pool data, which provide similar result that Mu estimates. We carry out the Hausman specification test

Table 3.5: Specification based on equation 3.12, including mobility variables as additional controls

		Ordinal approach-POLS											
Estimation procedure		Mu - a		FE -a		Mu -b		FE -b		Mu -c		FE -c	
Variables		Coefficient	T-Ratio	Coefficient	T-Ratio	Coefficient	T-Ratio	Coefficient	T-Ratio	Coefficient	T-Ratio	Coefficient	T-Ratio
Income gap if RD<0 (y-y^{rg}<0)	**γ-**	**0.0164*** **	**3.26**	**0.0139** **	**2.09**	**0.0174*** **	**3.71**	**0.0151** **	**2.57**	**0.0130*** **	**2.59**	**0.0095**	**1.33**
Income gap if RD>0 (y-y^{rg}>0)	**γ+**	**0.0081***	**1.93**	**0.0041**	**0.67**	**0.005**	**1.29**	**0**	**0.00**	**0.0048**	**1.18**	**-0.0007**	**-0.11**
Squared income gap if RD<0 (y-y^{rg}<0)	**θ+**	**0**	**-1.06**	**0**	**-0.54**	**0**	**-0.39**	**0**	**-0.04**	**0**	**-0.66**	**0**	**-0.20**
Squared income gap if RD>0 (y-y^{rg}>0)	**θ-**	**0.0002** **	**2.14**	**0.0002***	**1.92**	**0.0002*** **	**2.71**	**0.0002** **	**2.23**	**0.0002** **	**2.02**	**0.0002** **	**2.10**
Household income (log y)	β	-0.004	-0.10	0.0254	0.52	0.024	0.77	0.0434	1.03	0.0328	1.30	0.0786**	2.20
Years of education		0.0176	1.35	0.0369*	1.70	0.0167	1.21	0.0410*	1.83	0.0105	0.83	0.0282	1.30
Unemployment		-0.2116**	-2.03	-0.108	-0.89	-0.1798	-1.63	-0.0855	-0.68	-0.2250**	-2.23	-0.1371	-1.19
Ln(Active household members)		0.0721	0.43	-0.1597	-0.71	0.1172	0.72	-0.1456	-0.62	0.0834	0.51	-0.1926	-0.89
Ln(Household members)		-0.1019	-0.65	0.0437	0.23	-0.251	-1.63	-0.0978	-0.53	-0.0484	-0.32	0.1141	0.62
Ln (age)		-0.0269	-0.16	-0.4545	-1.19	-0.0342	-0.19	-0.4038	-1.03	-0.0735	-0.43	-0.5307	-1.40
Male		-0.1527	-1.36		0.00	-0.1713	-1.51	0	0.00	-0.1766*	-1.65	0	0.00
Ln (1+working hours)		-0.0332*	-1.84	0.0079	0.34	-0.0295	-1.56	0.0186	0.77	-0.0283	-1.58	0.0175	0.77
Marital status		-0.2474***	-3.55	-0.3306***	-3.20	-0.2633***	-3.74	-0.2835***	-2.77	-0.2556***	-3.81	-0.3414***	-3.45
Ln (number of children)		-0.0127	-0.19	-0.0278	-0.33	-0.0535	-0.79	-0.0483	-0.56	-0.0099	-0.16	-0.0058	-0.07
Locus of Control (LOC_{IPC})		**0.1179** **	**2.33**	**0.0343**	**0.44**	**0.1675*** **	**3.26**	**0.0653**	**0.84**	**0.1004** **	**1.99**	**0.0155**	**0.20**
Objetive intragenerational mobility		**-0.0171**	**-1.27**	**-0.0134**	**-0.83**								
Intergenerational educational						**0.0182**	**1.02**	**0.0041**	**0.14**				
Subjetive intergenerational mobility										**0.0114**	**0.98**	**0.0198**	**0.68**
Constant		-0.443	-0.56	1.3266	**0.90**	-0.17	-0.23	1.115	0.75	-0.3406	-0.48	1.0305	0.72
Individual means - Mundlack													
Mean (ln(Household income))		0.0696	1.02			0.0111	0.27			0.0194	0.51		
Mean (ln(1+working hours))		0.1155	1.31			0.1168	1.33			0.131	1.59		
Mean (ln(1+Years of education)		0.0034	0.12			0.0035	0.12			0.021	0.74		
Mean (ln(number of children))		0.1766	0.99			0.1649	0.91			0.1781	1.03		
Mean (ln(household members))		-0.1249	-0.61			0.0512	0.25			-0.1134	-0.58		
Mean (Unemployment)		-0.196	-0.33			-0.6439	-1.05			-0.382	-0.66		
Observations		1418		1418		1334		1334		1472		1472	
Individuals		709		709		667		667		736		736	
R-Cuadrado		0.0996		0.0457		0.109		0.0458		0.0996		0.0557	
Joint significance tests (*)		151.4		2.29		151.3		2.252		158.1		3.021	
Hypotheses		**Relative concern test (P-value)**											
Test: γ+ = γ- =0		0.241		0.276		0.078		0.0913		0.245		0.251	
Test: θ+ = θ-		0.0123		0.0443		0.00453		0.0277		0.0247		0.0397	
Test: γ+ = θ+ = 0		6.906		0.713		5.157		0.99		2.528		0.571	
Test: (γ+) - (γ-) + 2*(θ)+ 2(θ-) =0		0.222		0.257		0.0705		0.084		0.23		0.234	
Test: (γ+)+ 2*(θ)Y^{Rmed} =(γ-)- 2(θ-		0.0658		0.0959		0.0168		0.0296		0.0873		0.0923	

Reference group income is defined using mean reference group income (CHS). The reference group is defined by education, age, and sex. Income gap is in thousands of pesos.; MU, Mundlack: Fe, Fixed effect).
(†) The Joint sginificance test is a Chisquared test and F -test., in the Re (Mu) estimates and Fe estimates respectively. (††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

intragenerational mobility does not present a statistically significant relationship with economic satisfaction, and its sign is negative. A priori, a positive sign is expected. However, in that period (2006 -2011) there was a significant growth in household income, which could explain the greater satisfaction in spite of the more disadvantageous relative position. Furthermore, changes in the position in the income distribution are concentrated in the left tail of the income distribution (because the income gaps between the first income deciles are much lower than the gap of those deciles at the top of the income distribution). On the other hand, the objective educational mobility proxy is positively correlated with economic satisfaction, which is consistent with what is expected, but it is not statistically significant. The same results arise with respect to the subjective intergenerational mobility.

Life satisfaction

Unlike the findings of Vendrik and Woltjer (2007), our results are fully consistent with the assumptions of prospect theory. That difference could be explained by the differences in the specification and particularly in the dependent variable used in their paper. While our estimates used economic satisfaction as a dependent variable, which seems more appropriate when evaluating the validity of the assumptions of prospect theory, Vendrik and Woltjer (2007) used life satisfaction. Economic satisfaction refers to the allocation of resources, while life satisfaction is more complex as it includes other life domains (Ferrer-

(Hausman, 1978) to compare the fixed effect model and random effect model. The null hypothesis establishes that individual effects are uncorrelated with any of the regressors in the model and both models will be consistent estimator (Hausman, 1978). If the null hypothesis is not rejected, the test concludes that correlation is important and Re model is inconsistent, while Fe is consistent. Finally, Re model is more efficient than Fe model. The Hausman test does not reject the null hypothesis in the estimates presented in Table 3.5, which suggest that individual effects are uncorrelated with any of the regressors in the model. However, when we carry out this test in a specification without these additional controls, the null hypothesis is rejected. This provides favorable evidence for the use of these additional variables and supports the robustness of the Re estimates. The Hauman test produce the same result, and reject endogenity, when we use the additional controls of Table 3.4.

i-Carbonell, 2011). We carried out the same exercise using life satisfaction as a dependent variable, which provides a benchmark for comparing results while allowing us to analyze the existence of differences between both domains.

In Table 3.6 we present the results with respect to life satisfaction using the baseline controls of 3.12 (in a second step we also include LOC_{IPC}). The results of the Mu estimates agree with our previous results with respect ES. At the individual level, the significance of relative concern among those below the reference point, in its linear expression, is confirmed in the Mu estimates. Moreover, in this model $\hat{\theta}_{-}$ is significant and positive. The coefficients associated with a positive relative income are not significant at the individual level or in the joint test (this is consistent with Ferrer-i-Carbonell, 2005). Finally, the test confirms the steeper slope among those facing relative deprivation in the case of the Mu estimate.

On the other hand, the results of Fe estimates are somewhat different. Relative concern parameters are not statistically significantly different from zero. Furthermore, household income has a positive and significant incidence.

In summarize, when life satisfaction is used as a dependent variable, the results are less robust with respect our hypotheses. The Mu estimates are consistent with the findings of the previous section, but the Fe estimates are not.

A proposal for correcting reference group income

Individuals with the same observable characteristics may have heterogeneity in their reference income, depending on both the intensity and direction of income comparisons. The potential heterogeneity of the reference point between individuals with similar observable characteristics will be considered in this section by applying an alternative way of approximating the reference income.

Table 3.6: Life satisfaction, specification based on equation 3.12

Estimation procedure		Ordinal approach-POLS							
		Mu		FE		Mu		FE	
		Coefficient	T-Ratio	Coefficient	T-Ratio	Coefficient	T-Ratio	Coefficient	T-Ratio
Income gap if ($y-y^{rg}$)<0	γ_-	**0.0130*** **	**2.62**	**0.0063**	**0.92**	**0.0122** **	**2.49**	**0.0060**	**0.87**
Income gap if ($y-y^{rg}$)>0	γ_+	**0.0040**	**0.93**	**0.0055**	**0.96**	**0.0045**	**1.05**	**0.0057**	**1.00**
Squared income gap if (y-yrg)<0	θ_+	**0.0000**	**-0.37**	**-0.0001**	**-1.15**	**0.0000**	**-0.47**	**-0.0001**	**-1.17**
Squared income gap if (y-yrg)>0	θ_-	**0.0002***	**1.68**	**0.0002**	**1.28**	**0.0002***	**1.70**	**0.0002**	**1.31**
Household income (log y)	β	0.0534	1.52	0.1028***	2.62	0.0523	1.48	0.1032***	2.61
Years of education		0.0113	0.58	0.0009	0.05	0.0113	0.59	0.0007	0.04
Unemployment		-0.0590	-0.43	-0.0516	-0.38	-0.0668	-0.49	-0.0572	-0.42
Ln(Active household members)		0.4226**	2.47	0.2657	1.32	0.4070**	2.40	0.2711	1.35
Ln(Household members)		-0.0911	-0.49	-0.0445	-0.23	-0.0789	-0.43	-0.0358	-0.19
Ln (age)		-0.0482	-0.32	-0.0055	-0.02	-0.0732	-0.48	-0.0439	-0.12
Male		0.0489	0.48			0.0338	0.33		
Ln (1+working hours)		-0.0205	-0.88	-0.0171	-0.73	-0.0216	-0.91	-0.0181	-0.77
Marital status		-0.3013***	-4.15	-0.2120**	-1.97	-0.3139***	-4.39	-0.2138**	-1.99
Ln (number of children)		-0.0362	-0.55	0.0260	0.31	-0.0422	-0.65	0.0195	0.23
Locus of Control (LOC_{IPC})						0.1976***	4.03	0.0973	1.28
Constant		-0.2920	-0.46	-1.1196	-0.86	-0.1784	-0.93	0.0000	0.00
Individual means Mundlack									
Mean Ln(Household income)		-0.0291	-0.77			0.1976***	4.03		
Mean Ln(1+working hours)		-0.0445	-1.36			-0.0311	-0.81		
Mean Years of education		0.0155	0.75			-0.0449	-1.38		
Mean Ln(number of children)		-0.0013	-0.01			0.0079	0.39		
Mean Ln(household members)		0.0398	0.18			-0.0013	-0.01		
Mean Unemployment		-0.1736	-0.91			0.0266	0.12		
Observations		1,476		1,476		1,476		1,476	
Individuals		738		738		738		738	
R-squared		0.000		0.037		0.000		0.039	
Joint significance tests †		88.02		1.73		107.90		0.07	
Hypotheses		**Relative concern test (P-value)**							
Test: $\gamma+ = \gamma- = 0$		0.245		0.940		0.316		0.982	
Test: $\theta+ = \theta-$		0.059		0.077		0.052		0.071	
Test: $\gamma+ = \theta+ = 0$		1.748		0.514		1.972		0.505	
Test: $(\gamma+) - (\gamma-) + 2*(\theta)+ 2(\theta-) = 0$		0.231		0.903		0.299		0.944	
Test: $(\gamma+) + 2*(\theta)Y^{Rmed} = (\gamma-)- 2(\theta-)Y^{Rmed}$ ††		0.111		0.471		0.136		0.488	

Reference group income is defined using mean reference group income (CHS). The reference group is defined by education, age, and sex. Income gap is in thousands of pesos. MU, Mundlack: Fe, Fixed effect) (†) .The Joint sginificance test is a Chisquared test and F -test., in the MU estimates and FE estimates respectively. (††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

Table 3.7: Economic satisfaction, specification based on equation 3.14

		Ordinal approach-POLS							
Estimation procedure		**Mu**		**Fe**		**RE (**)**		**Fe (**)**	
Variables		**Coeff.**	**T-Ratio**	**Coeff.**	**T-Ratio**	**Coeff.**	**T-Ratio**	**Coeff.**	**T-Ratio**
Income gap if (y-y^{rgcorr}<0)	**γ-**	**0.0172*****	**5.25**	**0.0083****	**2.03**	**0.0184*****	**4.93**	**0.0094****	**2.17**
Income gap if (y-y^{rgcorr}>0)	**γ+**	**0.0064***	**1.76**	**0.0017**	**0.36**	**0.0086****	**2.01**	**0.0016**	**0.33**
Squared income gap if (y-y^{rgcorr}<0)	**θ+**	**0.0000**	**-1.11**	**0.0000**	**-0.73**	**-0.0001**	**-1.18**	**0.0000**	**-0.59**
Squared income gap if (y-y^{rgcorr}>0)	**θ-**	**0.0001*****	**6.02**	**0.0001****	**2.51**	**0.0001*****	**2.67**	**0.0000**	**1.40**
Household income (log y)	β	0.0308	1.04	0.0689**	2.07				
Years of education		0.0478**	2.39	0.0357*	1.77	0.0348***	4.05	0.0308	1.48
Unemployment		-0.1555	-1.36	-0.1389	-1.22	-0.2247**	-2.37	-0.1578	-1.31
log(Active household members)		0.0944	0.58	-0.1946	-0.90	0.0964	0.64	-0.1190	-0.53
log(Household members)		-0.0223	-0.13	0.0795	0.45	-0.2089**	-2.24	0.1754	0.90
Log (age)		0.0098	0.06	-0.5012	-1.34	0.1292	0.81	-0.3928	-0.79
Male		-0.0944	-0.85			-0.2123	-1.41		
log (1+working hours)		0.0019	0.08	0.0154	0.67	-0.0083	-0.48	0.0143	0.60
Marital status		-0.2639***	-4.03	-0.3388***	-3.47	-0.3063***	-4.36	-0.3387***	-3.24
Log (number of children)		0.0131	0.20	-0.0133	-0.16	0.0515	0.83	-0.0028	-0.03
Locus of control (LOC_{IPC})						0.0993**	2.07	0.0367	0.46
Lagged household income †††						0.0085	0.53	-0.0110	-0.55
Lagged wealth index †††						0.0004	1.01	0.0006***	6.54
Constant		-0.5518	-0.77	1.0000	0.70	-0.4375	-0.70	1.2448	0.68
Individual means Mundlack									
Mean Ln(Household income)		0.0661	1.24						
Mean Ln(1+working hours)		-0.0405	-1.19						
Mean Years of education		-0.0219	-1.03						
Mean Ln(number of children)		0.0805	0.67						
Mean Ln(household members)		-0.3322	-1.54						
Mean Unemployment		-0.1777	-1.01						
Observaciones		1472		1472		1344		1344	
Individuals		736		736		672		672	
R-square		0.104		0.055		0.127		0.053	
Joint significance tests †		158.200		3.187		130.800		27.310	
Hypothesis				**Relative concern test (P-value)**					
Test: γ+ = γ- =0		0.049		0.356		0.141		0.303	
Test: θ+ = θ-		0.000		0.019		0.003		0.164	
Test: γ+ = γ-= θ+ = θ- =0		0.000		0.078		0.000		0.196	
Test: γ+ = θ+ = 0		4.147		0.478		0.075		0.629	
Test: (γ+) - (γ-) + 2*(θ)+ 2(θ-) =0		0.041		0.337		0.127		0.292	
Test: (γ+) + 2*(θ)Y^{Rmed} =(γ-)- 2(θ-)Y^{Rmed} ††		0.001		0.111		0.019		0.155	

The corrected reference income (y^{rgcorr}) is defined based on the average income of all individuals in the same reference group, where the perceptions about relative position in the whole income distribution is used to correct the average income of the reference group. The reference group is defined by education, age, and sex. Re, Randome effect; MU, Mundlack: Fe, Fixed effect) (†) .The Joint sginificance test is a Chisquared test and F -test, in the MU estimates and FE estimates respectively. (††) Y^{Rmed} is defined as the average income gap. (†††) Estimates are based on the 3 waves sample. For this reason we miss 64 individuals.

*** p<0.01, ** p<0.05, * p<0.1

In this section results from specification 3.14 are presented, which consider a corrected reference group income (Y^{RGcorr}). Table 3.7 present the results using the baseline control variables for the extended Re model (Mu) and the fixed effects model. The joint significance of the parameters associated with relative concern is confirmed, which, to some extent, validates the use of this corrected reference point (bottom of the Table 3.7). Additionally, the magnitude of the relative concern parameter is similar to that presented in Table 3.2. Also, there is evidence that $\hat{\gamma}_+ < \hat{\gamma}_-$. Moreover, the individual tests reject $\hat{\gamma}_- = 0$ and $\hat{\theta}_- = 0$, in both estimates. The Mu estimates confirm the relevance of relative income for those who are above the reference level, a hypothesis that is rejected (both at the individual and joint level) in the case of the estimates arising from the Fe model. The tests confirm that the quadratic term is positive and greater among those with relative deprivation than those with positive relative income (see Table 3.7).

Following the procedure already mentioned, contemporary income is replaced by its lags and a wealth lag is included as a control. In Table 3.7 we present Re and Fe estimates.[39] All the results associated with the relative concern parameters are confirmed. In the case of Fe estimates $\hat{\theta}_-$ is positive but not significant. The additional control does not effect those results and the significance of their coefficients is not robust. The conclusions about LOC_{IPC} coefficient remain. Further, the coefficient associated with lagged wealth is significant and positive only in the Fe estimate.

Considering the role that experienced mobility may play in the perception of the place in the income distribution, variables that capture the real and perceived levels of mobility of individuals are included as a control, replicating the same specifications as those used in Table 3.5 in the previous section for equation 3.14. The coefficients associated with our hypotheses are not altered, $\hat{\gamma}_-$ and $\hat{\theta}_-$ are positive and significant. In relation to the

[39] In this case we do not include Mundlak's specification, because lagged variables are used as a control. However we carry out these estimates and the results are the same. Furthermore, we carry out the Hausman Test, and result does not reject the null hypothesis of consistency of Re estimates.

additional controls, the pattern mentioned in the previous section is repeated (Table 3.8). These results provide a test of robustness to those obtained in estimates when we use y^{rg}. The results confirm the hypothesis of asymmetric valuation relative to the corrected reference income and the convexity of relative concern among those below the reference level. The use of corrected reference income allows us to deal with the problem suggested by the literature, on the limitations that approximating the reference income with ex-ante criteria, in situations of high social mobility or lack of information, could generate. Moreover, they provide preliminary evidence about heterogeneity in the reference groups. The gap is significant with this corrected reference income, which suggests that individuals with similar observable characteristics have different benchmarks. Therefore, when the income of peers with equal characteristics is imputed directly, in some cases we may be underestimating or overestimating the reference point. This situation can be interpreted in the light of the basics of the aspirations window defined by Genicot and Ray (2014). In this case, differences in the reference income would be determined by differences in the bandwidth of the aspirations window, which explain the sharing contextual experience of the peers and the pooling information.

Relative concern in relation to a minimum income aspiration threshold.

In this section the individual subjective poverty line is used as a reference level of the minimum income aspiration (MIA). As mentioned, this strategy has three main advantages, the first being that it allows heterogeneity in the reference level among individuals with similar observable characteristics. Secondly, to some extent it would mitigate the problems associated with social mobility as (Clark and D'Ambrosio, 2014), by definition, MIA incorporates adjustments for changes in the way in which people choose their reference group.[40] Finally, as Stutzer (2004) argues, this threshold is expected to have a direct

[40]There is abundant evidence which shows that the minimum income threshold identified by each indi-

link with the level of aspirations.

Due to the availability of information, in this case the estimates are only made by OLS for the last wave. We incorporate the OLS estimates of the baseline specification as benchmark, which considers y^{rg} as reference income (Columns A and B in Table 3.9). The real MIA responses are used (Columns a and b in Table 3.9), and to consider the potential problems that could arise from the use of this self-reported variable, a prediction is made based on individual and household characteristics (Columns a' and b' in Table 3.9).[41] In both cases, the poverty line is adjusted in real terms and considering the number of individuals in the household.[42] Furthermore we use as additional control, LOC_{IPC} one on hand (estimates A, a, and a' Table 3.9), and lagged household income and a lagged wealth index on the other hand (estimates B, b, and b' Table 3.9).

First of all, in terms of magnitude and significance, the parameters of relative concern with respect to y^{rg} estimated by OLS are fully consistent with the results of the Mu and Fe estimates previously presented (see columns Columns A and B in Table 3.9 and results presented in Table 3.2). Although there are some differences between the estimates presented in Table 3.9, depending on what reference level is used, they are consistent. The magnitude of the coefficients associated with relative concern is higher when reference group income is used than when we use the other alternatives. However, the results regarding the significance and sign are fully consistent between the three estimates, regardless of what reference point is used.

When we focus on estimates based on real MIA and projected MIA, both cases provide evidence in favor of reference dependence, that is that the relative income gap has the

vidual depends on their social context and their income (Stutzer, 2004).

[41] The results of the estimates of this first stage are in Table 3.C.1 in the section 3.C..

[42] The results do not change when they are not adjusted by the number of household members.

Table 3.8: Economic satisfaction , specification based on equation, using additional control variables 3.14

		Ordinal approach-POLS											
Estimation procedure		**Mu - a**		**FE -a**		**Mu -b**		**FE -b**		**Mu -c**		**FE -c**	
Variables		**Coeff.**	**T-Ratio**	**Coeff.**	**T-Ratio**	**Coeff.**	**T-Ratio**	**Coeff.**	**T-Ratio**	**Coeff.**	**T-Ratio**	**Coeff.**	**T-Ratio**
Income gap if (y-y^{rgcorr}<0)	**γ-**	**0.0164*** **	**4.93**	**0.0100** **	**2.23**	**0.0174*** **	**5.38**	**0.0099** **	**2.32**	**0.0165*** **	**5.13**	**0.0075**	**1.60**
Income gap if (y-y^{rgcorr}>0)	**γ+**	**0.0071***	**1.80**	**0.0049**	**0.85**	**0.0058**	**1.59**	**0.0017**	**0.36**	**0.0038**	**1.00**	**0.0008**	**0.14**
Squared income gap if (y-y^{rgcorr}<0)	**θ+**	**0**	**-0.96**	**0**	**-0.85**	**0**	**-0.93**	**0**	**-0.63**	**0**	**-0.63**	**0**	**-0.58**
Squared income gap if (y-y^{rgcorr}>0)	**θ-**	**0.0001*** **	**5.40**	**0.0001** **	**2.22**	**0.0001*** **	**5.53**	**0.0001*** **	**2.73**	**0.0001*** **	**4.70**	**0.0001** **	**2.36**
Household income (log y)	β	0.0536	1.56	0.0656	1.38	0.0602**	2.01	0.0842**	2.19	0.0245	0.90	0.0729**	2.07
Years of education		0.0165	1.32	0.0374*	1.79	0.0172	1.26	0.0393*	1.78	0.0162	1.33	0.0346*	1.70
Unemployment		-0.2117**	-2.04	-0.1239	-1.03	-0.1856*	-1.70	-0.1067	-0.86	-0.2204**	-2.19	-0.1407	-1.23
Ln(Active household members)		0.0415	0.25	-0.1839	-0.82	0.095	0.58	-0.1575	-0.67	0.0809	0.50	-0.1942	-0.90
Ln(Household members)		-0.1162	-0.75	0.0559	0.29	-0.2564*	-1.69	-0.0763	-0.42	-0.072	-0.48	0.0911	0.50
Ln (age)		0.01	0.06	-0.4702	-1.24	0.0163	0.09	-0.4232	-1.08	0.0051	0.03	-0.5032	-1.34
Male		-0.1255	-1.10		0.00	-0.148	-1.28	0	0.00	-0.1632	-1.50	0	0.00
Ln (1+working hours)		-0.0329*	-1.84	0.0079	0.35	-0.0293	-1.55	0.0183	0.76	-0.0302*	-1.71	0.0154	0.67
Marital status		-0.2500***	-3.61	-0.3398***	-3.33	-0.2644***	-3.80	-0.2953***	-2.93	-0.2401***	-3.59	-0.3364***	-3.44
Ln (number of children)		0.0127	0.20	-0.0133	-0.16	-0.0372	-0.55	-0.0365	-0.42	-0.0143	-0.22	-0.0122	-0.15
Locus of Control (LOC_{IPC})		**0.0958***	**1.88**	**0.0227**	**0.29**	**0.1483*** **	**2.89**	**0.0566**	**0.72**	**0.0852***	**1.69**	**0.0068**	**0.09**
Objetive intragenerational mobility		**-0.0181**	**-1.42**	**-0.0183**	**-1.20**								
Intergenerational educational mobility						**0.0231**	**1.32**	**0.011**	**0.37**				
Subjetive intergenerational mobility										**0.0193***	**1.90**	**0.0086**	**0.34**
Constant		-0.8361	-1.08	0.9449	**0.64**	-0.5459	-0.73	0.7232	0.49	-0.5097	-0.73	0.9646	0.67
Includes Mundlack term (individual means)		Yes		No		Yes		No		Yes		No	
Observations		1,414		1,414		1,330		1,330		1472		1472	
Individuals		707		707		665		665		736		736	
R-Cuadrado		0.112		0.0531		0.125		0.053		0.115		0.0552	
Joint significance tests (†)		178.1		2.508		185.6		2.661		191.2		2.77	
Hypotheses		**Relative concern test (P-value)**											
Test: γ+ = γ- =0		0.096		0.493		0.0342		0.266		0.0205		0.354	
Test: θ+ = θ-		1.30E-05		0.0258		3.08E-06		0.0103		0.000461		0.0449	
Test: γ+ = θ+ = 0		6.223		0.692		3.993		0.599		1.38		0.45	
Test: (γ+) - (γ-) + 2*(θ)+ 2(θ-) =0		0.0839		0.469		0.0292		0.25		0.0177		0.336	
Test: (γ+)+ 2*(θ)Y^{Rmed} =(γ-)- 2(θ-)Y^{Rmed}††		0.00521		0.167		0.00128		0.0732		0.00109		0.12	

Reference group income is defined using mean reference group income (CHS). The reference group is defined by education, age, and sex. Income gap is in thousands of pesos.; MU, Mundlack: Fe, Fixed effect). (†) The Joint sginificance test is a Chisquared test and F -test., in the Re (Mu) estimates and Fe estimates respectively. (††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

Table 3.9: Economic satisfaction, specification based on equation 3.15

		Ordinal Approach - POLS											
		Reference group income				Reference income: Reported minimum Income Aspiration responses (MIA)				Reference Income: proyected MIA			
Variables		(A)		(B)		(a)		(b)		(a')		(b')	
Income gap if (y-MIA)<0	**γ-**	**0.02561*** **	**4.90**	**0.02243*** **	**4.24**	**0.01390*** **	**6.16**	**0.01349*** **	**6.26**	**0.03099*** **	**6.16**	**0.02676*** **	**6.26**
Income gap if (y-MIA)>0	**γ+**	**0.00861**	**1.64**	**0.00834**	**1.60**	**0.01656*** **	**4.28**	**0.01509*** **	**3.95**	**0.00856** **	**4.28**	**0.00748** **	**3.95**
Squared income gap if (y-MIA)<0	**θ+**	**-0.00003**	**-0.80**	**-0.00003**	**-0.78**	**-0.00007** **	**-2.07**	**-0.00006* **	**-1.95**	**-2.00E-05**	**-2.07**	**-1.00E-05**	**-1.95**
Squared income gap if (y-MIA)>0	**θ-**	**0.00024*** **	**2.66**	**0.00022*** **	**2.65**	**0.00004*** **	**5.01**	**0.00004*** **	**5.04**	**0.00032** **	**5.01**	**0.00031** **	**5.04**
Household income (log y)	β	-0.03642	-1.25	0.02599	0.70	-0.01625	-0.66			-0.04624	-0.66		
Years of education		0.03789***	3.76	0.03048***	3.10	0.00843	0.98	0.00386	0.43	0.0098	0.98	0.00521	0.43
Unemployment		-0.48450***	-3.65	-0.50302***	-3.67	-0.49114***	-3.80	-0.49974***	-3.82	-0.51212***	-3.80	-0.51145***	-3.82
Ln(Active household members)		0.34482*	1.65	0.30321	1.42	0.35480*	1.68	0.34559	1.64	0.36316*	1.68	0.34645	1.64
Ln(Household members)		-0.15356	-1.43	-0.16385	-1.51	0.15795	1.44	0.14525	1.33	0.27272**	1.44	0.17869	1.33
Ln (age)		0.01036	0.06	-0.00468	-0.03	-0.08817	-0.53	-0.09453	-0.57	-0.18152	-0.53	-0.17955	-0.57
Male		0.05311	0.63	0.05957	0.70	0.02854	0.35	0.02753	0.34	0.01361	0.35	0.02314	0.34
Ln (1+working hours)		-0.05940***	-2.60	-0.05963***	-2.58	-0.04301*	-1.91	-0.04418*	-1.96	-0.06307***	-1.91	-0.06143***	-1.96
Marital status		-0.24757***	-3.27	-0.23923***	-3.15	-0.30076***	-4.03	-0.29051***	-3.87	-0.23442***	-4.03	-0.23505***	-3.87
Ln (number of children)		0.04344	0.52	0.05793	0.69	0.03789	0.46	0.0533	0.65	0.0642	0.46	0.07056	0.65
Locus of control (LOC_{IPC})		-0.20599***	-3.62	-0.19111***	-3.32	-0.20166***	-3.54	-0.19291***	-3.37	-0.20658***	-3.54	-0.20026***	-3.37
Lagged household income †††				0.02599	0.70			0.05012	1.44			0.0377	1.44
Lagged wealth index †††				0.00089***	0.00089			0.00089***	3.71			0.00093***	3.71
Constant		0.3530	0.4766	0.0543	0.0740	0.1168	0.1618	-0.0847	-0.08	0.7797	0.1618	3.55E-01	-0.12
Observations		1,033		1,030		1,033		1,030		1,033		1,030	
R-square		0.1205		0.1178		0.1500		0.1510		0.1211		0.1193	
Joint significance tests †		12.0000		10.8600		12.3400		14.0100		11.6200		11.2300	
Hypothesis						**Relative concern test (P-value)**							
Test: γ+ = γ- =0		0.0575		0.1120		0.5890		0.7450		0.0097		0.0262	
Test: θ+ = θ-		0.0021		0.0025		0.0009		0.0013		0.0227		0.0326	
Test: γ+ = γ-= θ+ = θ- =0		0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	
Test: γ+ = θ+ = 0		0.1110		0.1230		0.0000		0.0000		0.0003		0.0010	
Test: (γ+) - (γ-) + 2*(θ)+ 2(θ-) =0		0.0517		0.1020		0.6180		0.7750		0.0092		0.0251	
Test: (γ+) + 2*(θ)Y^{Rmed} =(γ-)- 2(θ-)Y^{Rmed} ††		0.0112		0.0260		0.7550		0.6260		0.0076		0.0187	

The reference group is defined by education, age, and sex MIA real: is constructed based on the subjetive poverty line declared by each respondent, expressed in real terms at July 2012, The subjetive poverty line is multiplied by 4 and divided by the number of each household members.Proyected MIA : Is the individual prediction based on estimates of a model of real MIA presented in Appendix C

(†) The Joint sginificance test is a Chisquared test and F -test., in the Re (Mu) estimates and Fe estimates respectively. (††) Y^{Rmed} is defined as the average income gap. (†††) Variables refers to 2004 household income and 2004 wealth index. Wealth index is not defined for 3 observations. *** p<0.01, ** p<0.05, * p<0.1

significant impact and the sign that are expected. The joint significance tests of all parameters associated with relative concern reject the null hypothesis ($H_0 : \gamma_+ = \theta_+ = \gamma_- = \theta_- = 0$, see bottom of the Table 3.9). These results seem to validate the use of this threshold as a benchmark. The evidence rejects the significance of the household income level and its lag, which would indicate the greater importance of relative income with respect to absolute income. While the lagged wealth index coefficient remains positive and significant, which indicates a relationship between economic satisfaction and a proxy of permanent income (Columns b and b').

Individual tests reject the null hypothesis $\hat{\gamma}_+ = 0$ in estimates with both real and projected MIA. Only in the second case, the tests reject the hypothesis $\hat{\gamma}_+ = \hat{\gamma}_-$, with $\hat{\gamma}_+ < \hat{\gamma}_-$. Furthermore, the convexity of the relative concern is confirmed for those who are below the reference point. One point to highlight arises regarding $\hat{\theta}_+$, which is significant and negative in real MIA estimates (Columns a and b in Table 3.9). In this case, the hypothesis of increasing sensitivity is confirmed on both sides of the reference income. But, when the projected MIA is used as a reference, $\hat{\theta}_+$ is not statistically significantly different from zero (Columns a' and b' in Table 3.9). When we consider the quadratic term, the asymmetry hypothesis is confirmed in both groups of estimates. Finally, in the case of projected MIA, the valuations in the area of relative deprivation are higher than those of relative advantage. Once we move away from the reference level, the slope of the valuation of relative income is steeper among those facing relative deprivation in relation to those with an income above their reference. This later result is less robust in the case of real MIA, where slopes are similar on both sides of reference level.

These results are totally consistent with those of the previous sections with respect to HI and HII. Furthermore, there is weak evidence on the concavity of relative concern function for individuals with a positive relative income. However, these results should be interpreted with caution, as they are based on the OLS estimates for the 2011-2012 wave.

3.5.2 Preliminary evidence on income aspirations

This section contributes new preliminary evidence about economic aspiration formation, exploring the role of reference groups and Locus of Control (LOC) on economic satisfaction. Furthermore it provides evidence on the validity of the assumptions and predictions about aspiration failure in the models developed in Genicot and Ray (2014) and Dalton et al. (2015).

Previous literature on the conformation of individual aspiration shares several common features. First, aspirations are associated with a reference point, which in turn establishes goals or desired future end-states, which guide decisions and actions (Bernard, et al., 2014; Dalton et al., 2015, Appadurai, 2004).[43] Second, the previous literature agrees that aspirations are always formed in social life. Individuals observe the achievements and experiences of others in their immediate environment to shape their desires and goals (Bandura, 1977; Genicot and Ray, 2014). Genicot and Ray (2014) emphasize the central role of the "aspiration window" in the aspiration formation. It establishes "the group of peers" which defines the individual's cognitive world (Ray, 2006; Mookherjee et al., 2010).[44] Third, aspirations affect people's incentives and motivations and, therefore, shape the intention to make an effort or invest in order to obtain certain goals. As suggested by Appadurai (2004), this issue could lead to a constraining preference framework, which interacts with exogenous constraints to affect human behavior. This is discussed by Dalton et al. (2015), who emphasize the role of internal and external constraints (and their interaction), as well as behavioral biases, in explaining aspiration formation. In the same sense, Ray (2006) identifies two types of aspiration failures. Type I occurs when agents with low social origins do not include agents with high social origins in their aspiration

[43] Literature suggests that people set goals in many domains that are relevant for their well-being (Appadurai, 2004; Bernard, et al., 2014).

[44] These groups limits are based on biological or evolutionary factors, and may be highly society-specific (Ray, 2006).

window. As a result, the aspiration gap is low, as will be individual investment for the future. In aspiration failure type II, agents with low social origins include individuals from higher origins in their aspiration window, but they perceive the goal to be unattainable and they are discouraged. In this case, the chances of success are internalized and then transformed into individual aspiration. As a result they reduce their aspirations in order to avoid frustration (Ray, 2006; Dalton et al., 2015)

To explore these issues, first the relative deprivation component defined as the gap between income and a reference income level is interpreted as the aspiration gap defined by Genicot and Ray (2014). Our previous results validate this decision. Second, we explore how each dimension of *LOC* is related with economic satisfaction and aspirations. Both issues could provide some evidence on how relative deprivations and the individual perception about the causal connection between their actions and experienced outcomes, affect economic aspiration.

Table 3.10 presents the results. When we focus on the relative concern parameters, the evidence confirms the "reference dependence", and a greater sensitivity to relative deprivation. The coefficients associated with the income gap among individuals with relative deprivation are always significantly different from zero and positive ($\hat{\gamma}_- > 0$), while the coefficients associated to the individuals with a positive income gap are not individually significantly different from zero.[45] In all cases $\hat{\gamma}_+ < \hat{\gamma}_-$, and in the case of the Fe estimates rejects the hypothesis $\hat{\gamma}_+ = \hat{\gamma}_-$.

Moreover, both estimates provide robust evidence in relation to the convexity of the curve for those in a position of relative deprivation, while the evidence is weak with respect to the concavity for those with a positive relative income gap. To test the asymmetric aversion among individuals with relative advantage and relative deprivation, we evaluate if there are statistically significant differences in the slope through the following hypothesis:

[45]Furthermore, the standard tests reject the null hypothesis $\hat{\gamma}_+ = \hat{\theta}_+ = 0$ in all estimates.

Table 3.10: Economic satisfaction, specification based on equation 3.16

Ordinal approach-POLS					
Estimation procedure		Mu		FE	
Variables		Coefficient	T-Ratio	Coefficient	T-Ratio
Income gap if RD<0 (y-yrg<0)	γ_-	**0.01844*** **	**3.47**	**0.01730** **	**2.56**
Income gap if RD>0 (y-yrg>0)	γ_+	**0.01**	**1.31**	**0.00**	**-0.13**
Squared income gap if RD<0 (y-yrg<0)	θ_+	**0.00**	**-0.75**	**0.00**	**-0.30**
Squared income gap if RD>0 (y-yrg>0)	θ_-	**0.00018** **	**2.02**	**0.00031** **	**2.44**
Household income (log y)	β	**0.00**	**0.08**	**0.04**	**0.98**
Years of education		0.02419*	1.70	0.04377*	1.86
Unemployment		-0.21374*	-1.76	-0.09	-0.63
log(Active household members)		0.07	0.39	-0.25	-0.99
log(Active household members)		0.08	0.47	0.20	0.97
Log (age)		-0.06	-0.34	-0.06	-0.15
Male		-0.21970*	-1.85	0.00	0.00
log (1+working hours)		-0.06577***	-3.08	0.01	0.45
Marital status		-0.26123***	-3.27	-0.36113***	-3.03
Log (number of children)		-0.27284***	-3.66	-0.17400*	-1.82
LOC $_C$	λ_C	**-0.11511*** **	**-3.77**	**-0.10538*** **	**-2.64**
LOC $_{IP}$	λ_{IP}	**0.29153*** **	**5.97**	**0.13845** **	**2.19**
Constant		2.70627***	2.70627***	2.55	2.55
Individual means (Mundlack)					
Mean (ln(Household income))		0.04	0.91		
Mean (ln(1+working hours))		0.17496*	1.88		
Mean (ln(1+Years of education)		0.02	0.50		
Mean (ln(number of children))		0.50246***	2.58		
Mean (ln(household members))		-0.35	-1.56		
Mean (Unemployment)		-0.31	-0.47		
Observations		1,482		1,482	
Individuals		758		758	
R-squared		0.000		0.060	
Joint sigjificance tests †		224.600		2.775	
Hypotheses		**Relative concern test (Pvalue)**			
Test: $\gamma+ = \gamma-$		0.112		0.083	
Test: $\theta+ = \theta-$		0.019		0.011	
Test: $\gamma+ = \gamma-= \theta+ = \theta- =0$		0.000		0.079	
Test: $\gamma+ = \theta+ = 0$		3.040		0.273	
Test: $(\gamma+) - (\gamma-) + 2*(\theta)+ 2(\theta-) =0$		0.104		0.075	
Test: $(\gamma+) + 2*(\theta)YRmed- (\gamma-)- 2(\theta-) YRmed=0$ ††		0.036		0.020	

The reference income is defined as the average income of all individuals in the same reference group. The reference group is defined by education, age and sex. (†) The Joint sginificance test is a Chisquared test and F -test., in the MU estimates and FE estimates respectively. (††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

$\hat{\gamma}_+ + 2\hat{\theta}_+ \mid Y^R \mid = \hat{\gamma}_- + 2\hat{\theta}_- \mid Y^R \mid$(See bottom of Table 3.10).The null hypothesis is rejected and it is found that the slope is greater among those facing relative deprivation. That is, around the reference income, sensitivity to relative income is similar both for those facing relative deprivation and those with a relative advantage. Once we move away from the reference level, the slope of the valuation of the relative income is steeper among those facing relative deprivation in relation to those with an income above their reference.

These findings are fully consistent with the assumptions used by Genicot and Ray to model aspirations, and with the value function proposed in prospect theory (Kahneman and Tversky, 1979). Furthermore, in the first chapters we showed that for those with relative deprivation, the response in the effort decisions to changes in the income of the reference group depend, fundamentally, on the concavity or convexity of the relative concern curve. The model predicts that when the relative concern is convex, with a more demanding reference income, individuals respond by reducing their effort.

We focus now on the significance of the LOC components. Both Mu and Fe results confirm that the LOC_C and LOC_{IP} are significant, but their incidence is asymmetric. Higher internal locus of control and lower powerful others are associated with higher economic satisfaction ($\lambda_{IP} > 0$). This is consistent with the previous evidence, and with the idea that individuals with internal locus of control are more active in setting and achieving valued goals (Levenson, 1974; Lefcourt, 1991; Caliendo et al.,2015; Cobb-Clark et al., 2014;). On the other hand, LOC_C has a negative incidence on economic satisfaction ($\lambda_C < 0$), which shows that more fatalistic (external) individuals are more satisfied. When social environments are adverse in terms of opportunity, individuals are less likely to perceive a connection between their actions and their experienced outcomes. Because those individuals believe that their outcome is not contingent upon the effort made, they adapt and reduce their economic aspiration. That is, individuals who perceive that they have no possibility of influencing their future, under equal conditions, declare themselves

to be more satisfied with their economic situation. This could indicate a reduction in aspirations in order to avoid frustration.

Table 3.11 and Table 3.12 provides evidence on how some aspects of the personality or the beliefs of individuals may affect the relationship between relative concern and economic aspiration. In order to analyze how the relationship between fatalistic beliefs and relative deprivation affects economic satisfaction, we substitute LOC_C by a indicator function which identifies fatalistic individuals as "1" (we identify fatalistic individuals when LOC_C takes values 4 or 5).[46] In a second step, in Table 3.12 estimates include an interaction term between the indicator function (fatalistic individuals) and their income gap .

First of all, the significance and magnitude of the coefficients of relative concern remain unchanged. These results agree with the aspiration model assumptions. Second, the LOC_{IP} coefficient is still significant in all estimates and is associated with higher economic satisfaction ($\hat{\lambda}_{IP} > 0$). Third, estimates of fatalistic indicator function coefficients are always positive and significant. Namely, more fatalistic individuals, *ceteris paribus*, have higher economic satisfaction.

When an interaction term is included, the LOC_{IP} coefficient is still significant and positive. The coefficient of the indicator function is still positive ($\hat{\lambda}_F > 0$) but is not significant, while, the coefficients of the interaction term between income gap and fatalistic individuals are asymmetric. It is only significant in one case and its sign is negative among those facing relative deprivation ($\hat{\gamma}_{F-} < 0$). Furthermore, in all cases joint tests reject the hypotheses $\hat{\lambda}_{IP} = \hat{\lambda}_F = 0$ and $\hat{\lambda}_F = \widehat{\gamma}_{F-} = \widehat{\gamma}_{F+} = 0$, which provides favorable evidence about the incidence of fatalistic belief on relative concern (See Table 3.12). The coefficient $\widehat{\gamma}_{F-}$ must be interpreted in conjunction with what arises from the term of relative depri-

[46] This definition should be interpreted with caution. Lefcourt (1991) remarks about the problem of the use of LOC scales to develop typologies.

Table 3.11: Economic satisfaction, specification based on equation 3.16

		Ordinal approach-POLS			
Estimation procedure		Mu		FE	
Variables		Coefficient	T-Ratio	Coefficient	T-Ratio
Income gap if RD<0 (y-yrg<0)	γ_-	**0.01935*** **	**3.64**	**0.01864*** **	**2.77**
Income gap if RD>0 (y-yrg>0)	γ_+	**0.0062**	**1.43**	**-0.00014**	**-0.02**
Squared income gap if RD<0 (y-yrg<0)	θ_+	**0.0000**	**-0.91**	**-0.00002**	**-0.39**
Squared income gap if RD>0 (y-yrg>0)	θ_-	**0.00020****	**2.22**	**0.00034*** **	**2.67**
Household income (log y)	β	**0.0044**	**0.13**	**0.04538**	**1.03**
Years of education		0.02418*	1.71	0.04217*	1.79
Unemployment		-0.21779*	-1.79	-0.09208	-0.65
log(Active household members)		0.0849	0.47	-0.25997	-1.01
log(Active household members)		0.0697	0.41	0.20066	0.99
Log (age)		-0.0848	-0.45	-0.11067	-0.27
Male		-0.22045*	-1.87	0.00000	0.00
log (1+working hours)		-0.06582***	-3.09	0.01400	0.51
Marital status		-0.26036***	-3.24	-0.35446***	-2.94
Log (number of children)		-0.25571***	-3.44	-0.16220*	-1.70
LOC-$_{IP}$	λ_{IP}	0.28742***	5.94	0.12920**	2.07
"Fatalistic" (1 if LOC-C- >1)	λ_F	0.48060***	4.93	0.43989***	4.93
Constant		2.72100***	3.39	2.66741*	1.65
Individual means (Mundlack)					
Mean (ln(Household income))		0.0359	0.82		
Mean (ln(1+working hours))		0.17014*	1.86		
Mean (ln(1+Years of education)		0.0224	0.68		
Mean (ln(number of children))		0.47263**	2.43		
Mean (ln(household members))		-0.3439	-1.53		
Mean (Unemployment)		-0.3430	-0.53		
Observations		1,482		1,482	
Individuals		758		758	
R-squared		0.0000		0.0695	
Joint significance tests (F-statistic) †		245.7000		3.1340	
Hypotheses		**Relative concern test (Pvalue)**			
Test: $\gamma+ = \gamma- =0$		0.100		0.068	
Test: $\theta+ = \theta-$		0.008		0.005	
Test: $\gamma+ = \gamma- = \theta+ = \theta- =0$		0.000		0.046	
Test: $\gamma+ = \theta+ = 0$		0.008		0.300	
Test: $(\gamma+) - (\gamma-) + 2*(\theta)+ 2(\theta-) =0$		0.091		0.061	
Test: $(\gamma+) + 2*(\theta)YRmed- (\gamma-)- 2(\theta-) YRmed=0$ ††		0.026		0.013	
Hypotheses		**LOC domains test (Pvalue)**			
Test $\lambda_{IP}=\lambda_F=0$		0.000		0.000	

The reference income is defined as the average income of all individuals in the same reference group. The reference group is defined by education, age and sex. (†) The Joint sginificance test is a Chisquared test and F -test., in the MU estimates and FE estimates respectively. (††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

Table 3.12: Economic satisfaction, specification based on equation 3.17

Ordinal approach-POLS					
Estimation procedure		Mu		FE	
Variables		Coefficient	T-Ratio	Coefficient	T-Ratio
Income gap if RD<0 (y-yrg<0)	γ_-	**0.02189*** **	**4.0298**	**0.01917*** **	**2.7728**
Income gap if RD>0 (y-yrg>0)	γ_+	**0.0055**	**1.2562**	**-0.0008**	**-0.1435**
Squared income gap if RD<0 (y-yrg<0)	θ_+	**0.0000**	**-0.8791**	**0.0000**	**-0.4924**
Squared income gap if RD>0 (y-yrg>0)	θ_-	**0.00023****	**2.5508**	**0.00035*** **	**2.6367**
Household income (log y)	β	**0.0071**	**0.2155**	**0.0429**	**0.9694**
Years of education		0.02432*	1.7202	0.04193*	1.7820
Unemployment		-0.21184*	-1.7476	-0.0961	-0.6769
log(Active household members)		0.0887	0.4904	-0.2632	-1.0285
log(Active household members)		0.0654	0.3797	0.1900	0.9409
Log (age)		-0.0933	-0.4991	-0.0991	-0.2378
Male		-0.22062*	-1.8636		
log (1+working hours)		-0.06645***	-3.1226	0.0149	0.5393
Marital status		-0.25567***	-3.1705	-0.35479***	-2.9400
Log (number of children)		-0.25251***	-3.3860	-0.1504	-1.5736
LOC_{IP}	λ_{IP}	0.29028***	5.9975	0.13535**	2.1754
"Fatalistic" (1 if LOC-C- >1)	λ_F	0.2502	4.9329	0.3340	4.9329
Interaction "Fatalistic" *income gap					
Income gap if RD<0 & Fatalistic	γ_{-F}	-0.01672*	-1.8886	-0.0050	-0.4125
Income gap if RD>0 & Fatalistic	γ_{+F}	0.0073	0.7795	0.0173	1.4485
Constant		2.77026***	3.4611	2.67075*	1.6553
Individual means (Mundlack)					
Mean (ln(Household income))		0.0329	0.7589		
Mean (ln(1+working hours))		0.16862*	1.8464		
Mean (ln(1+Years of education)		0.0229	0.6948		
Mean (ln(number of children))		0.46411**	2.3862		
Mean (ln(household members))		-0.3340	-1.4790		
Mean (Unemployment)		-0.3576	-0.5580		
Observations		1,482		1,482	
Individuals		758		758	
R-squared		0.0000		0.0722	
Joint significance tests (†)		256.2000		2.9710	
Hypotheses		**Relative concern test (Pvalue)**			
Test: $\gamma+ = \gamma- =0$		0.043		0.056	
Test: $\theta+ = \theta-$		0.003		0.005	
Test: $\gamma+ = \gamma-= \theta+ = \theta- =0$		0.000		0.039	
Test: $\gamma+ = \theta+ = 0$		0.003		0.155	
Test: $(\gamma+) - (\gamma-) + 2*(\theta)+ 2(\theta-) =0$		0.038		0.050	
Test: $(\gamma+) + 2*(\theta)Y^{Rmed} - (\gamma-) - 2(\theta-) Y^{Rmed}=0$ ††		0.008		0.011	
Hypotheses		**LOC domains test (Pvalue)**			
Test $\lambda_{IP}=\lambda_F=0$		0.000		0.029	
Test $\lambda_F=\gamma_{+F} =\gamma_{+F}=0$		0.000		0.002	

The reference income is defined as the average income of all individuals in the same reference group. The reference group is defined by education, age and sex.(†) The Joint sginificance test is a Chisquared test and F -test., in the MU estimates and FE estimates respectively. (††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

vation $\widehat{\gamma}_{-}$. Results show that higher relative income with respect to the reference group leads to higher economic satisfaction, a relationship that is strongest among individuals who face relative deprivation. However, among fatalistic individuals, *ceteris paribus*, a higher relative deprivation increases economic satisfaction. This would be consistent with a reduction in their aspirations due to the unfavorable situation in their reference group and fatalistic beliefs.

Results confirm the relevance of LOC in explaining economic aspiration. Furthermore, they suggest that the sign and magnitude of the correlation between economic satisfaction (and aspiration) and LOC are not the same for all LOC_{IPC} components. While higher internality and relative power lead to higher economic aspiration, LOC_C presents a negative relationship. When individuals think chance, luck or fate affects their outcomes, "fatalistic belief" leads to a reduction of economic aspirations. These findings are in line with the results of Proto and Rustichini (2015) and Budria and Ferrer-i-Carbonell (2015), which suggest that the role of income comparison on life satisfaction is mediated by individual personality characteristics. Furthermore, these results are consistent with the predictions of Ray and Genicot (2014) and the possibilities of low economic aspiration among relative poorer individuals.

Robustness

To address potential endogeneity problems of LOC variables, we substitute LOC variables for their lags. Because this information is only available for two waves, we estimate an OLS model in cross section data. We use the same variable controls as the previous section, and we also consider a specification with Mundlak's controls (exploiting the time dimension of the panel).

The signs of lagged LOC_{IP} and lagged LOC_C remain unchanged, although their magnitudes show a small decrease. The coefficient of lagged LOC_{IP} is significant and similar to the

current LOC_{IP}. While the incidence of lagged LOC_C is not significant (their P-values are 0.107 and 0.131 respectively). However, in all cases the joint tests carried out reject the hypothesis that both coefficients are zero (See Table 3.13).

A second specification includes a lag of the indicator function, which identifies fatalistic individuals who were identified as fatalistic in the previous wave as "1" (we exclude lagged LOC_C). The results are consistent with the comments of the previous paragraph, although in this case the coefficient of the lag of the indicator function is not significant and its magnitude declines 70% with respect to the coefficient of the current indicator function. However, the joint test carried out rejects the hypothesis that the "fatalistic" indicator function and LOC_{IP} are zero, and also confirms the relevance of fatalism in explaining relative concern (See Table 3.13).

Finally we consider, following the previous section, an interaction term between the lagged "fatalistic" indicator function and current income gap. The coefficients of lagged LOC_{IP} and the "fatalistic" indicator function do not change. The results of the interaction term coefficient are consistent with previous results, significant and negative, which confirm the asymmetric incidence. It shows that for those fatalistic individuals, higher relative deprivation with respect to their reference group increases economic satisfaction. Results show that under equal conditions fatalistic individuals with relative deprivation declare themselves to be more satisfied, which is consistent with a reduction of economic aspiration.

Table 3.13: Economic satisfaction, specification based on equation 3.17, includes additional control variables

		OLS estimates based on Economic satisfaction reported in 2011 wave (Two waves subsample)											
		(†)		(††)		(†)		(††)		(†)		(††)	
		Coeff.	T-Ratio	Coeff.	T-Ratio	Coeff.	T-Ratio	Coeff.	T-Ratio	Coeff.	T-Ratio	Coeff.	T-Ratio
Income gap if RD<0 (y-yrg<0)	γ_-	0.01960***	3.26	0.01885***	2.95	0.01917***	3.16	0.01827***	2.85	0.02281***	3.68	0.02215***	3.37
Income gap if RD>0 (y-yrg>0)	γ_+	0.01569**	2.06	0.01504**	1.97	0.01599**	2.08	0.01545**	2.00	0.01845**	2.16	0.01788**	2.08
Squared income gap if RD<0 (y-yrg<0)	θ_+	-0.00025**	-2.43	-0.00024**	-2.31	-0.00026**	-2.43	-0.00025**	-2.33	-0.00035**	-2.40	-0.00034**	-2.32
Squared income gap if RD>0 (y-yrg>0)	θ_-	0.00019**	2.11	0.00018**	2.02	0.00018**	2.00	0.00017*	1.89	0.00021**	2.40	0.00021**	2.28
Household income (log y)	β	0.03635	0.78	0.02332	0.44	0.04011	0.84	0.02561	0.47	0.03164	0.68	0.02290	0.43
Years of education		0.03913***	3.39	0.03849**	2.13	0.03778***	3.26	0.03795**	2.10	0.04472***	3.82	0.04343**	2.38
Unemployment		-0.14885	-0.95	-0.18171	-1.06	-0.15191	-0.96	-0.17546	-1.02	-0.13694	-0.89	-0.15367	-0.92
log(Active household members)		0.44650**	1.98	0.44782*	1.88	0.43042*	1.89	0.43339*	1.80	0.41038*	1.83	0.40905*	1.72
log(household members)		-0.28543**	-2.23	-0.37411*	-1.67	-0.28743**	-2.25	-0.38314*	-1.71	-0.26183**	-2.07	-0.34108	-1.55
Log (age)		0.15784	0.78	0.12824	0.62	0.13045	0.64	0.10465	0.50	0.07549	0.37	0.04928	0.24
Male		-0.13694	-1.04	-0.12976	-0.97	-0.14683	-1.11	-0.13866	-1.04	-0.14971	-1.14	-0.14496	-1.09
log (1+working hours)		-0.03894	-1.47	-0.04161	-1.45	-0.04004	-1.50	-0.04366	-1.51	-0.04228	-1.62	-0.04546	-1.61
Marital status		-0.36562***	-4.16	-0.36435***	-4.05	-0.36000***	-4.10	-0.35730***	-3.98	-0.34392***	-3.92	-0.34141***	-3.81
Log (number of children)		0.10144	1.02	0.17075	1.04	0.09629	0.97	0.16649	1.01	0.06509	0.66	0.11925	0.73
Lagged LOC_C	λ'_C	0.05792	1.64	0.05488	1.55								
Lagged LOC_{IP}	$\lambda'_{I'P}$	-0.26172***	-3.99	-0.26187***	-3.95	-0.25612***	-3.91	-0.25661***	-3.88	-0.26859***	-4.11	-0.26881***	-4.08
Lagged "Fatalistic" (1 if LOC-C- >1)	λ'_C					0.09951	0.89	0.09369	0.83	0.08052	0.74	0.07707	0.71
Interaction "Fatalistic" *income gap (*)													
Income gap if RD<0 & Lagged Fatalistic	γ_{-F}									-0.02205***	-4.21	-0.02182***	-4.15
Income gap if RD>0 & Lagged Fatalistic	γ_{+F}									0.01412	1.59	0.01412	1.57
Constant		- 1.02	- 1.19	- 1.08	-1.17	- 0.92	- 1.07	- 0.99	- 1.07	- 0.70	- 0.82	- 0.71	-0.78
Includes individual means		No		Yes		No		Yes		No		Yes	
Observations		734		734		734		735		735		734	
R-squared		0.1360		0.1373		0.1324		0.1338		0.1525		0.1534	
Joint significance tests (†††)		8.5780		6.4370		8.5020		6.4390		8.5260		6.6450	
Hypotheses						**Relative concern test**							
Test: $\gamma+ = \gamma- = 0$		0.734		0.743		0.785		0.810		0.729		0.736	
Test: $\theta+ = \theta-$		0.000		0.001		0.000		0.001		0.000		0.000	
Test: $\gamma+ = \gamma- = \theta+ = \theta- = 0$		0.000		0.000		0.000		0.000		0.000		0.000	
Test: $\gamma+ = \theta+ = 0$ ç		0.052		0.069		0.052		0.067		0.057		0.068	
Test: $(\gamma+) - (\gamma-) + 2*(\theta)+ 2(\theta-) = 0$ ç		0.677		0.688		0.727		0.754		0.660		0.670	
Test: $(\gamma+) + 2*(\theta)$YRmed- $(\gamma-)$- $2(\theta-)$ YRmed=0 ††††		0.092		0.111		0.111		0.138		0.040		0.051	
Hypotheses						**LOC domains test (Pvalue)**							
Joint significance tests $\lambda'_C=\lambda'_{IP}=0$		0.000		0.000		0.000		0.000		0.000		0.000	
Joint significance tests $\lambda'_C=\gamma_{-F}=\gamma_{+F}=0$										0.000		0.000	

The reference income is defined as the average income of all individuals in the same reference group. The reference group is defined by education, age and sex.

(†) Basic OLS specification; (††) OLS estimates, individual mean consider 2 waves . Alternatively individual means were defined including 3 waves. The results are consistent. Y^{rmed} represents the sample average income of each reference group. (†††) The Joint sginificance test is a Chisquared test and F -test., in the MU estimates and FE estimates respectively. (†††††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

3.6 Conclusions

This chapter contributes new evidence to the economic literature on how individuals value their situation in relation to a reference group, evaluating the validity of the assumptions of prospect theory (Kahneman and Tversky, 2000; Vendrik and Woltjer, 2007). Relative concern is measured as the gap between the income of each individual and that of their reference group. Taking the "reference dependence" models as a starting point, a polynomial specification of relative concern is proposed which allows specific tests to be carried out to evaluate the validity of those assumptions, in particular that of asymmetry and diminishing marginal sensitivity. The results confirm the importance of relative income in the levels of economic satisfaction. When relative concern is considered as the gap between the income and that of their reference group, there is evidence of an asymmetric comparison. In contrast to what was found in Vendrik and Woltjer (2007) convexity is confirmed among individuals facing relative deprivation, which corresponds to a diminishing marginal sensitivity as they move away from the reference income. The results regarding relative concern for those above the reference income are less robust, but generally, a positive but not significant relationship is found. The returns, however, are asymmetric, and the valuations of the relative income would be higher among those located below the reference income. Moreover, in the region of positive relative income there is weak evidence on the presence of concavity. Finally, the evidence is robust with respect to the fact that below the reference group income, relative concern is steeper than it is above the reference income. These findings are consistent with the assumptions of prospect theory (Kahneman and Tversky, 2000).

These results are robust to alternative estimation procedures, as well as to alternative definitions of the reference group. To address potential problems of simultaneity, contemporary income is replaced by its lag and by a lagged wealth indicator. In addition, considering the suggestion of previous papers about the potential problems that economic

mobility could cause in identifying the reference group, variables that can capture these aspects are considered as a control. The results do not show significant changes in any of the cases.

As a robustness check, alternative reference points are considered to try to capture the potential heterogeneity that may exist among individuals with similar observable characteristics. To do this, the perception of individuals about their rank in the income distribution is taken into account. Moreover, an individual subjective poverty line is considered as a reference, a strategy that avoids defining a reference group exogenously, while introducing heterogeneity in the thresholds set by each individual. The results that arise from both strategies confirm the robustness of the validity of the assumptions of prospect theory. Furthermore, they provide preliminary evidence on the heterogeneity in the reference group income.

The model presented in the first chapters demonstrate the importance of the composition of reference groups and the functional form of relative concern. It shows that for those below the reference income, the response in the effort decisions to changes in the income of the reference group depends, fundamentally, on the concavity or convexity of the relative concern curve (assumptions b and c). The model predicts that when the relative concern is convex, with a more demanding reference income, individuals respond by reducing their effort, while they react in the opposite way if the form is concave. Furthermore, the heterogeneity in the reference group income could determine differences in the point of reference.

This chapter advances in this direction, it provides preliminary evidence on the role of relative deprivation in aspiration formation. In order to advance on this issue, we consider Rotter's Locus of Control (LOC), which allows us to explore how an individual's expectation about the connection between his personal characteristics and experienced outcomes affects economic satisfaction. That decision allows us to analyze how some as-

pects of the personality or beliefs of individuals may affect relative concern and economic satisfaction. First, it presents evidence that personality traits are relevant to explain differences in economic satisfaction. Furthermore, the magnitude of the correlation between economic satisfaction is not the same for all LOC dimensions. An increase in *the internality* and *powerful others* dimensions leads to higher economic satisfaction, which is consistent with the previous evidence. However, higher LOC-Chance has a negative incidence on economic satisfaction, which shows that more fatalistic individuals are more conformist. Furthermore, we confirm the incidence of fatalistic beliefs on relative concern. Our results show that among fatalistic individuals, *ceteris paribus*, higher relative deprivation increases economic satisfaction. This would be consistent with a reduction in their aspirations due to the unfavorable situation in their reference group and the perception of a low chance of economic improvement. These results represent preliminary evidence about the aspiration failures predicted in the model of Ray (2006), Dalton et al. (2015) and Ray and Genicot (2010).

There are several arguments that support the relevance of these results. Firstly, they confirm the relative importance in the levels of economic satisfaction, but the responses could be asymmetric. Inequality within reference groups (and between reference groups) could determine situations where the relative concern could generate incentives to achieve economic success or, conversely, discourage certain behaviors in order to avoid frustration. This has important consequences in the decisions of individuals and levels of social well-being and income inequality. Some previous papers suggest relative concern has very important implications in terms of the results of economic mobility (Piketty, 1998 and 2000, Austen-Smith and Fryer, 2005: Bourguignon et al., 2007; Ray, 2006; Genicot and Ray, 2010) and in terms of attitudes to income inequality (Piketty, 1995; Clark and D'Ambrosio, 2014).

Our findings validate the assumptions used in the aspiration model of (Ray, 2006; Genicot

and Ray, 2010). The functional form of the relative concern is robust when a proxy of the aspirations is considered as a threshold, and contributes to a better understanding of the aspirations formation process, so its link with mobility is immediate. (Appadurai, 2004; Ray, 2006; Genicot and Ray, 2010). Furthermore, the preliminary evidence found on heterogeneity in the reference income is consistent with the assumptions of Genicot and Ray (2010) on the importance of the aspirations window. The amplitude of the reference groups and the availability of information appear to be key aspects in determining the reference income. Moreover, it opens the question of the limitations that may be associated to fixing the income of a group of individuals with similar characteristics to each other as a benchmark, a strategy adopted by the majority of the research on the field in the absence of information about the reference groups.

Aspirations are relevant in explaining income distribution and social mobility but, in turn, the distribution of income and wealth and the income mobility possibilities are relevant to shape them. Genicot and Ray (2014) argue that aspiration and income (and its distribution) evolve jointly, and sometimes in a self-reinforcing pattern. Findings from psychological studies allow us to better understand the nature of this problem, and show that the causes and consequences of poverty and inequality are mediated by behavioral patterns, which could lead to poor individuals choosing lower-return options among the alternatives available. Haushofer and Fehr (2014) and Congdon et al. (2011) suggest that extreme poverty may have psychological consequences, which affect economic behavior and could lead to discourage people from making better mobility-enhancing investments, contributing to the poverty persistence. Our preliminary evidence about the role of relative deprivation on aspiration failures contributes to understand this issue. A first implication is that if this behavioral dimension reinforces the poverty persistence, program aiming to reduce the poverty and to promote income mobility, should go beyond that reducing material deprivation (Mullainathan and Shafir, 2009; Duflo et al., 2008;

Congdon et al, 2011, Dalton et al., 2015).

Finally, if the reference group and social interactions are primary determinants of individual aspirations, it may be necessary to understand how redistributive policies can affect group membership. For example, conditional cash transfer programs aiming to reduce poverty, which are an expanding intervention in the context of developing countries, could affect the composition of the reference group and the reference income level, which in turn could affect effort decisions and the long term income mobility. The cash transfer could increase the reference point (and aspirations), because families gain access to an expanded basket of goods or they gain access to new social interactions. However, there may be effects in the opposite direction, if the program reduces the amplitude of the composition of reference group of the beneficiaries. For example, if among individuals who do not participate in the transfer program, negative or discriminatory attitudes towards beneficiaries could emerge. This might increase the social distance (or social polarization), reduce the social rewards and negatively affect the composition of the reference group.

Finally, further research is required in order to understand how individuals form their reference groups and how cash transfer programs affect the composition of the reference group and the reference point level.

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Appendix

3.A Definition of variables and summary statistics

Table 3.A.1: Definitions of the variables

Status	Variable	Variable definitions	Source/years
Dependent variables	ES- Economic Satisfaction	Catogorical variable, 1 very dissatisfied, 5 very satisfied	MWTC 06/11 (2 waves)
	LS-Life satisfaction	Catogorical variable, 1 very dissatisfied, 5 very satisfied	
Controls	Household income	Log(1+real household income); July 2012 prices	MWTC 04/06/11 (3 waves)
	Age	Age of the respondent in year	
	Sex	(1) Male; (0) Female.	
	Unemployment	Identify unemployed individuals at the moment of the survey	
	Household members	log(number of members in the household)	
	Active household members	log(Number of labor active members in the household)	
	Marital status	Dichotomous variable. Identifies seperated and divorced individuals	
	Working hours	log (1+respondent's working hours)	
	Log (number of children)	log(1+number of children in the household). Children <13 year old	
	Education	Years of education of the respondent	
	Intergenerational perceived mobility	This variable is constructed as the perceived own actual income decile minus the perceived childhood household income decile.	MWTC 11 (1 waves)
	Objetive income mobility	This variable is constructed as the differences in the household income deciles between waves. Objetive Upward mobility: Identify positive objetive income mobility	MTC 06/11 (2 waves)
	Intergenerational educational mobility	Defined as the difference between educational achievement of the respondent and the maximum educational achievement of their parents.	
	Wealth index	This index is constructed using analysis of main components. Considers a wide set of household assets.	MWTC 04/06/11 (3 waves)

Definitions of the variables (cont)

Status	**Variable**	**Variable definitions**	**Source /years**
Controls	LOC_{IPC}	Is the individual average between LOC_I, LOC_P and LOC_C. A high score represents high internal Locus.	MWTC. 06/11 (2 waves)
	LOC - Internality (LOC_I)	Is the individual average between LOC_{Ia} and LOC_{Ib}. A high score represents high internality.	MWTC. 06/11 (2 waves)
	LOC_{Ia} (Internality)	We use three questions: (a) Do you feel that your views are considered in your work?. (b) Do you feel that your views are considered in your family, neighborhood or group of friends? (c) Recently do you feel that you play an important role in some family or community events?. The answers provide 3 dichotomous variables, identified by "1" yes and "0" no. We aggregate these responses, where 3 represents high internality, then we use a standardized index.	MWTC 06/11 (2 waves)
	LOC_{Ib} (Internality)	We use the question: "who will contribute more to a change in your life". Respondents have 8 categories. We define a categorical variable, which identifies "3" when "they are responsible for their changes"; and "2" when their family is responsible for their changes, and 1 otherwise (the State, God, local government, other groups of people or another person). Note that 3 represents high internality, then we use a standardized index.	MWTC. 06/11 (2 waves)
	LOC - Powerful LOC_P	We use the question: Please imagine a ladder with nine levels. In the first level are those with high power, and in the highest level (the ninth), are those with low power. Which level are you?. This categorical variables have 9 values, where 9 is greater power. Then we use a standardized index.	MWTC 06/11 (2 waves)
	LOC Chance LOC_C	The survey includes a categorical variable with a scale of 5 categories, where 1 is "We make our own destiny " and 5 "everything is determined by destiny or external forces". Then we use a standardized index.	MWTC 06/11 (2 waves)

Definitions of the variables (cont)

Status	Variable	Variables definitions	Source/years
Reference income	Y^{RG}- Reference group income level	Mean reference group income. Groups are defined considering 4 range ages (20 to 34 years old; 35 to 44 years old; 46 to 65 years old; over 65) , 6 educational levels (i without formal education, ii primary, iii secondary, iv technical, police or military; v teaching or IPA; vi tertiary education and university) and sex.	CHS 04/06/11
	Y^{RG}_{median}- Reference group median income level	Median reference group income. Groups are defined considering 4 range ages (20 to 34 years old; 35 to 44 years old; 46 to 65 years old; over 65), 6 educational levels (i without formal education, ii primary, iii secondary, iv technical, police or military; v teaching or IPA; vi tertiary education and university) and sex.	CHS 04/06/11
	Y^{RGcorr}- Corrected reference group income	It is defined as $Y_i^{rgcorr} = \frac{Y_i^{rg}}{\psi(e_i)}$	CHS/MWTC 04/06/11
	e - bias in individuals' evaluations of their own relative position	The bias is constructed as the perceived own income decile minus that the level of the objective income decile. It is positive for those who consider themselves to be in a higher position than they really are, and it is negative for those who consider themselves to be in a lower position than they really are. Objective income decile is constructed using CHS data.	MWTC 11 (1waves)
	MIA- Minimum income aspiration	We use the information from responses to the following question: A family composed of a husband, wife and two children: Aproximately how much do you think this family needs to earn per month in order to not be consdered poor? The responses are expressed in real terms at July 2012 prices. Two alternatives are applied, adjusted for numbers of household member, and not adjusted.	MWTC 11 (1 waves)

Table 3.A.2: Descriptive statistics of variables used in analysis and test for the difference between sample means (MWTC - metropolitan area)

Variables		Year 2006				Years 2011-2012			
		Media	D. S.	Int. Inf.	Int. Sup	Media	D. S.	Int. Inf.	Int. Sup
Economic satisfaction	*	2.762	0.043	2.678	2.846	3.032	0.067	2.901	3.162
	**	2.889	0.040	2.811	2.966	2.957	0.043	2.872	3.041
	Total	2.831	0.029	2.774	2.889	2.977	0.036	2.906	3.048
log(1+household income)	*	9.808	0.046	9.717	9.898	9.771	0.077	9.620	9.922
	**	9.832	0.039	9.755	9.909	9.848	0.049	9.751	9.945
	Total	9.818	0.030	9.760	9.877	9.822	0.042	9.740	9.904
Years of education	*	8.804	0.158	8.494	9.114	8.894	0.201	8.500	9.288
	**	9.290	0.145	9.006	9.574	9.497	0.134	9.235	9.759
	Total	9.081	0.107	8.871	9.291	9.312	0.112	9.093	9.531
Unemployment	*	0.110	0.013	0.084	0.136	0.077	0.014	0.049	0.105
	**	0.103	0.011	0.081	0.125	0.070	0.009	0.052	0.089
	Total	0.107	0.009	0.090	0.124	0.073	0.008	0.057	0.088
log(Active household members)	*	0.967	0.008	0.952	0.982	0.954	0.011	0.932	0.976
	**	0.967	0.007	0.955	0.980	0.978	0.005	0.968	0.989
	Total	0.967	0.005	0.957	0.977	0.970	0.005	0.960	0.981
log(Household members)	*	1.542	0.015	1.513	1.572	1.506	0.022	1.463	1.550
	**	1.532	0.013	1.508	1.557	1.509	0.013	1.483	1.535
	Total	1.536	0.010	1.517	1.555	1.507	0.011	1.485	1.530
log(age)	*	3.579	0.010	3.560	3.598	3.736	0.012	3.712	3.759
	**	3.582	0.008	3.567	3.597	3.708	0.007	3.695	3.721
	Total	3.584	0.006	3.572	3.595	3.720	0.006	3.709	3.731
Male	*	0.211	0.017	0.176	0.245	0.246	0.023	0.201	0.292
	**	0.056	0.008	0.039	0.072	0.045	0.008	0.030	0.060
	Total	0.121	0.009	0.103	0.139	0.108	0.009	0.089	0.126
log (1+working hours)	*	2.410	0.075	2.263	2.558	2.676	0.091	2.497	2.855
	**	2.074	0.065	1.946	2.203	2.640	0.059	2.524	2.757
	Total	2.211	0.050	2.114	2.309	2.656	0.050	2.558	2.753
Marital status	*	0.141	0.015	0.112	0.170	0.175	0.020	0.135	0.215
	**	0.152	0.013	0.126	0.178	0.188	0.014	0.160	0.217
	Total	0.148	0.010	0.129	0.168	0.185	0.012	0.162	0.209
Log (number of children)	*	1.091	0.015	1.062	1.120	0.495	0.029	0.438	0.552
	**	1.082	0.012	1.058	1.107	0.488	0.019	0.452	0.525
	Total	1.086	0.010	1.067	1.104	0.489	0.016	0.458	0.520
Number of observations	*	543				346			
	**	738				738			
	Total	1281				1084			

(*): Individual outside the Panel in each year; (**) Individuals in both panel waves;

Table 3.A.3: Correlation matrix between satisfaction domains, Minimum income aspirations and LOC domains, (MWTC - metropolitan area).

	Economic Satisfaction	Life Satisfaction	D-m housing satisfaction	Sicial life satisfaction	Minimum income aspirations	Subjetive poverty line	LOC-Ia	LOC-Ib	LOC-I	LOC-P	LOC -IP	LOC- C	Aggregated LOC (includes 3 domains)
Economic Satisfaction	1												
(P-value)													
Life Satisfaction	0.480	1											
(P-value)	*0.000*												
Decision-making housing satisfaction	0.234	0.298	1										
(P-value)	*0.000*	*0.000*											
Sicial life satisfaction	0.130	0.145	0.110	1									
(P-value)	*0.000*	*0.000*	*0.000*										
Consumption satisfaction	0.503	0.428	0.277	0.208	1								
(P-value)	*0.000*	*0.000*	*0.000*	*0.000*									
Minimum income aspirations	-0.051	0.024	0.002	-0.034	-0.065	1							
(P-value)	*0.096*	*0.427*	*0.949*	*0.307*	*0.035*								
LOC-Ia	-0.127	-0.128	-0.079	-0.049	-0.103	-0.082	1						
(P-value)	*0.000*	*0.000*	*0.000*	*0.023*	*0.001*	*0.008*							
LOC-Ib	-0.062	-0.024	0.043	0.029	-0.050	-0.012	0.049	1					
(P-value)	*0.003*	*0.248*	*0.037*	*0.181*	*0.099*	*0.704*	*0.019*						
LOC-I	-0.130	-0.108	-0.026	-0.017	-0.105	-0.065	0.733	0.721	1				
(P-value)	*0.000*	*0.000*	*0.209*	*0.427*	*0.001*	*0.033*	*0.000*	*0.000*					
LOC-P	-0.204	-0.190	-0.130	-0.115	-0.247	-0.048	0.108	0.000	0.079	1			
(P-value)	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.122*	*0.000*	*0.988*	*0.000*				
LOC -IP	-0.214	-0.187	-0.090	-0.076	-0.213	-0.080	0.637	0.579	0.834	0.620	1		
(P-value)	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.009*	*0.000*	*0.000*	*0.000*	*0.000*			
LOC- C	0.047	-0.003	-0.021	0.021	-0.023	-0.076	0.004	0.097	0.067	-0.042	0.033	1	
(P-value)	*0.023*	*0.884*	*0.312*	*0.336*	*0.451*	*0.013*	*0.863*	*0.000*	*0.001*	*0.043*	*0.104*		
Aggregated LOC (includes 3 domains)	0.126	0.139	0.077	0.039	0.195	0.092	-0.096	-0.521	-0.408	-0.534	-0.620	-0.537	1
(P-value)	*0.000*	*0.000*	*0.000*	*0.066*	*0.000*	*0.003*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	

Figure 3.A: Individuals temporal variation in the Locus of control ($\Delta LOC = LOC_t - LOC_{t-1}$)

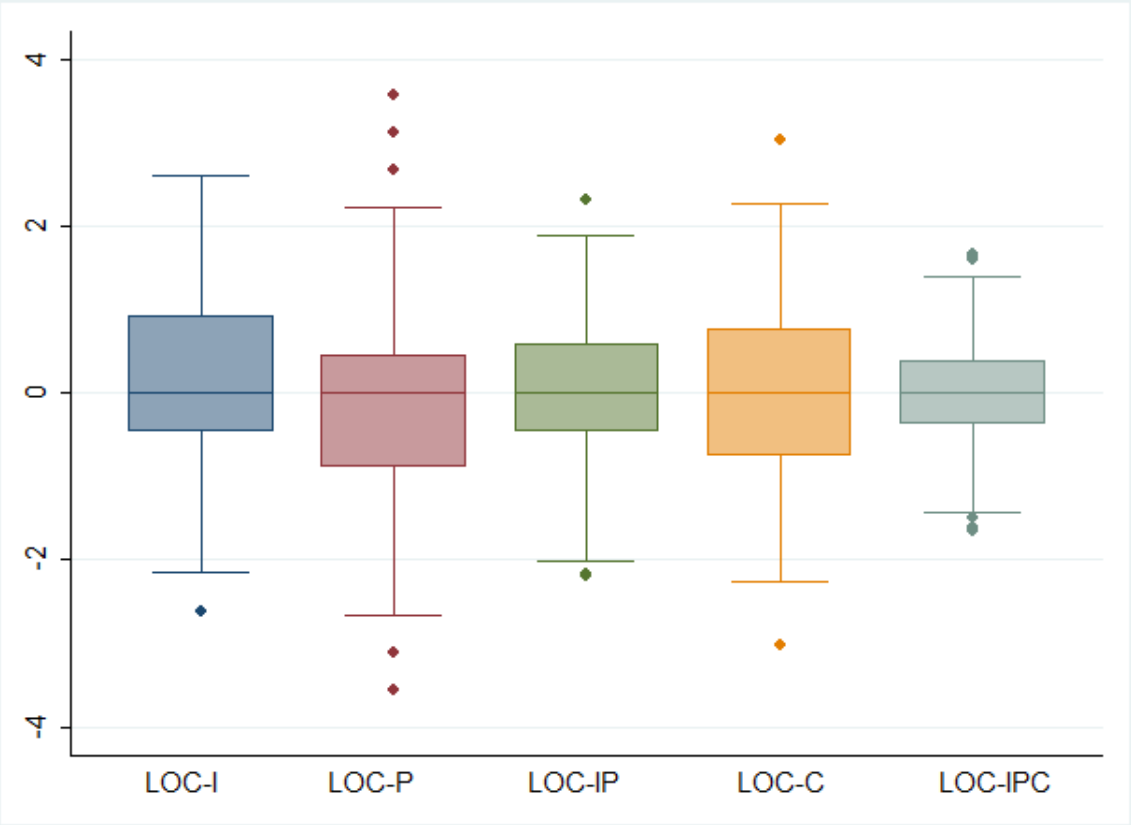

Table 3.A.4: Summary statistics of LOC domains variables, MWTC panel survey

	LOC-I		LOC-P		LOC -IP		LOC- C		Aggregated variables (LOC-IPC)	
	2006	2011	2006	2011	2006	2011	2006	2011	2006	2011
Mean	-0.06	0.08	0.09	0.02	-0.01	0.02	-0.13	0.14	0.00	0.00
Std. Dev.	0.73	0.73	0.99	0.61	0.59	0.61	1.00	0.96	0.55	0.54
Percentiles										
1%	-1.80	-1.80	-1.71	-1.71	-1.46	-1.46	-2.00	-2.00	-1.28	-1.41
5%	-1.33	-1.33	-1.71	-1.71	-1.05	-1.15	-2.00	-2.00	-0.97	-0.95
10%	-0.99	-0.87	-1.71	-1.71	-0.77	-0.84	-2.00	-2.00	-0.72	-0.67
25%	-0.72	-0.40	-0.38	-0.82	-0.46	-0.35	-0.48	-0.48	-0.34	-0.34
50%	-0.11	0.21	0.07	0.07	-0.03	0.07	-0.48	0.27	0.04	0.02
75%	0.82	0.82	0.51	0.51	0.54	0.57	1.03	1.03	0.35	0.40
90%	0.82	0.82	1.40	1.40	0.72	0.72	1.03	1.03	0.65	0.65
95%	0.82	0.82	1.85	1.85	0.86	0.86	1.03	1.03	0.85	0.85
99%	0.87	0.82	1.85	1.85	1.16	1.16	1.03	1.03	1.24	1.10

Source: MWTC 06/11

3.B Definition of the corrected reference income

Where function $\psi(e_i)$, holds that $0 < \psi(e_i)$, $1 = \psi(0)$, and $\psi'(e_i) > 0$, and it is defined as:

$$\psi(e_i) = \begin{cases} 1 & if\ P_i^P = P_i^R \\ > 1 & if\ P_i^P > P_i^R \\ < 1 & if\ P_i^P < P_i^R \end{cases} \tag{3.18}$$

The variables $P_i{}^P$ and $P_i{}^R$ are defined in a range from 0.1 to 1. In our paper, the function $\psi(e)$ used was the following:

$$\psi(e_i) = \begin{cases} 1 & if\ P_i^P = P_i^R \\ 1 + e_i^P & if\ P_i^P \neq P_i^R \end{cases} \quad (??.b)$$

For example, if the perception of the individual is located two deciles above the real position $e^p{}_i$ =0.2 and $\psi(e)$ =1.2. [47]. This allows us to generate the corrected reference income as $Y_i^{rgcorr} = \frac{Y_i^{rg}}{\psi_i}$.

Different functional forms of $\psi(e_i)$ were used. For example, the square root of the error was considered, so that greater perception errors receives less consideration. Alternatively, the errors were constructed as the ratio between real income and that of the decile where the individuals perceive themselves to be. With both alternatives the results coincided with those presented in this paper.

[47] As the variable of the perception of the place in the distribution is only available for the third wave, it is assumed that the error is constant between 2006 and 2011

3.C. Auxiliary model to explain the MIA

Table 3.C.1: Estimates of Minimum income aspirations by LSO, years 2011-12

Dependent variable Minimum Income Aspirations (Prices July 2011)		
Regressors	Coeficient	*t* - Ratio
Log (household income) Average 2004 - 2006	711.8092*	1.88
log(Household members)	-968.5698***	-3.22
(*) value of 1 if average household year of education is between 6 and 12	3691.573***	2.65
(*) value of 1 if average household year of education is higher than 12	12197.24***	5.64
(**) value of 1 if best friend has not formal education	-7017.042***	-3.03
(**) value of 1 if best friend has primary education	2270.17	1.35
(**) value of 1 if best friend has high school education	3608.925***	2.64
(**) value of 1 if best friend has college education	6201.188***	3.03
value of 1 if respondents do not know their best friend education	-206.7548	-0.08
value of 1 if respondent was surveyed in 2012	3938.591***	2.15
Constant	23208.14***	5.68
Observations	1048	
F(6, 1014) =	15.81	
Prob > F =	0.000	

(*) Average are based on household members between 20 and 64 years old.
(**) Omitted variable: Respondent who do not identify best friends

These coefficients are used to define proyected MIA

3.D. Additional Results

Table 3.D.1: Economic satisfaction, specification based on equation 3.9

		Ordinal approach-POLS			
Estimation procedure		Mu		FE	
Regressors.		Coefficient	T-Ratio	Coefficient	T-Ratio
Household income (ln y)	**β**	**-0.03110**	**-0.81**	**0.02970**	**0.49**
Income gap if RD<0 (y-y^{rg}<0)	**γ_-**	**0.0121*** **	**3.68**	**0.0039**	**3.50**
Income gap if RD>0 (y-y^{rg}>0)	**γ_+**	**0.0049*** **	**2.62**	**-0.0001**	**2.64**
Years of education		0.0554**	2.37	0.0415*	3.87
Unemployment		-0.1659	-1.22	-0.1467	-2.39
Ln(Active household members)		0.1390	0.73	-0.1959	0.82
Ln(Household members)		0.1068	0.52	0.1693	-0.86
Ln (age)		0.0227	0.12	-0.2159	-0.09
Male		-0.1726	-1.41		
Ln (1+working hours)		0.0077	0.28	0.0191	-0.88
Marital status		-0.3084***	-3.94	-0.3659***	-4.04
Ln (number of children)		-0.1918**	-2.51	-0.154	-1.86
Constant		2.4647***	1.82	3.1634*	3.82
Individual means Mundlack					
Mean Ln(Household income)		0.1114*	1.82		
Mean Ln(1+working hours)		-0.0614	-1.52		
Mean Years of education		-0.0245	-0.99		
Mean Ln(number of children)		0.2971**	2.13		
Mean Ln(household members)		-0.4750*	-1.86		
Mean Unemployment		-0.2356	-1.13		
Observations		1,476		1,476	
Individuals		738		738	
R-squared		0.089		0.049	
Joint significance tests (†)		134.000		2.441	
Hypotheses			**Relative concern test (P-value)**		
Tests: $\beta=\gamma_-=\gamma_+=0$		0.000		0.315	
Tests: $\gamma_-=\gamma_+$		0.076		0.438	

Reference group income is defined using mean reference group income (CHS). The reference group is defined by education, age, and sex. Income gap is in thousands of pesos. MU, Mundlack: Fe, Fixed effect. (†) The Joint sginificance test is a Chisquared test and F -test., in the MU estimates and FE estimates respectively.
*** p<0.01, ** p<0.05, * p<0.1

Table 3.D.2: Economic satisfaction, specification based on equation 3.9

Estimation procedure		Cardinal approach Mu		FE	
		Coefficient	**T-Ratio**	**Coefficient**	**T-Ratio**
Income gap if (y-y^{rg})<0	γ_-	**0.0209*** **	**3.96**	**0.0155** **	**2.26**
Income gap if (y-y^{rg})>0	γ_+	**0.0074**	**1.64**	**0.0001**	**0.02**
Squared income gap if (y-yrg)<0	θ_+	**0.0000**	**-1.11**	**0.0000**	**-0.46**
Squared income gap if (y-yrg)>0	θ_-	**0.0002** **	**2.52**	**0.0003** **	**2.23**
Household income (log y)	β	-0.0215	-0.55	0.0438	0.99
Years of education		0.0587**	2.51	0.0443*	1.85
Unemployment		-0.1523	-1.11	-0.1318	-0.97
Ln(Active household members)		0.1309	0.68	-0.1933	-0.76
Ln(Household members)		0.0809	0.40	0.1269	0.61
Ln (age)		0.0152	0.08	-0.1627	-0.38
Male		-0.1716	-1.39		
Ln (1+working hours)		0.0079	0.29	0.0186	0.69
Marital status		-0.3040***	-3.88	-0.3735***	-3.19
Ln (number of children)		-0.1916**	-2.50	-0.1414	-1.47
Constant		2.5680***	3.16	2.9196*	1.78
Individual means Mundlack					
Mean Ln(Household income)		0.1029*	1.71		
Mean Ln(1+working hours)		-0.0615	-1.53		
Mean Years of education		-0.0316	-1.27		
Mean Ln(number of children)		0.3049**	2.19		
Mean Ln(household members)		-0.4554*	-1.79		
Mean Unemployment		-0.2467	-1.18		
Observations		1,476		1,476	
Individuals		738		738	
R-squared		0.092		0.045	
Joint significance tests †		136.60		2.44	
Hypotheses		**Relative concern test (P-value)**			
Test: $\gamma+ = \gamma- =0$		0.091		0.140	
Test: $\theta+ = \theta-$		0.003		0.017	
Test: $\gamma+ = \theta+ = 0$		3.668		0.247	
Test: $(\gamma+) - (\gamma-) + 2*(\theta)+ 2(\theta-) =0$		0.082		0.128	
Test: $(\gamma+) + 2*(\theta)Y^{Rmed} =(\gamma-)- 2(\theta-)Y^{rmed}$ ††		0.015		0.040	

Reference group income is defined using mean reference group income (CHS). The reference group is defined by education, age, and sex. Income gap is in thousands of pesos..Re, Randome effect; MU, Mundlack: Fe, Fixed effect). (†) The Joint sginificance test is a Chisquared test and F -test., in the MU estimates and FE estimates respectively. (††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

Table 3.D.3: Economic satisfaction, specification based on equation 3.9 and median reference group income

Estimation procedure		Ordinal approach-POLS Mu		FE	
		Coefficient	**T-Ratio**	**Coefficient**	**T-Ratio**
Income gap if (y-$y^{rgmedian}$)<0	γ_-	**0.0174*** **	**3.74**	**0.0116***	**1.95**
Income gap if (y-$y^{rgmedian}$)>0	γ_+	**0.0088** **	**2.32**	**0.0027**	**0.55**
Squared income gap if (y-$y^{rgmedian}$)<0	θ_+	**-0.0001**	**-1.44**	**0.0000**	**-0.70**
Squared income gap if (y-$y^{rgmedian}$)>0	θ_-	**0.0002*** **	**2.62**	**0.0002** **	**2.04**
Household income (log y)	β	-0.0119	-0.36	0.0397	1.07
Years of education		0.0480**	2.37	0.0343*	1.67
Unemployment		-0.1307	-1.13	-0.1134	-0.98
Ln(Active household members)		0.1103	0.67	-0.1775	-0.82
Ln(Household members)		-0.0152	-0.09	0.0539	0.30
Ln (age)		-0.0366	-0.22	-0.4895	-1.30
Male		-0.1199	-1.09		0.00
Ln (1+working hours)		0.0054	0.23	0.0155	0.68
Marital status		-0.2538***	-3.83	-0.3311***	-3.35
Ln (number of children)		-0.0168	-0.26	-0.0248	-0.30
Constant		-0.1248	-0.18	1.2855	0.90
Individual means Mundlack					
Mean Ln(Household income)		0.0772	1.49		
Mean Ln(1+working hours)		-0.0504	-1.47		
Mean Years of education		-0.0255	-1.20		
Mean Ln(number of children)		0.1102	0.91		
Mean Ln(household members)		-0.2941	-1.36		
Mean Unemployment		-0.2161	-1.24		
Observations		1,476		1,476	
Individuals		738		738	
R-squared		0.091		0.048	
Joint significance tests †		131.50		2.56	
Hypotheses		**Relative concern test (P-value)**			
Test: $\gamma+ = \gamma-$ =0		0.209		0.301	
Test: $\theta+ = \theta-$		0.001		0.023	
Test: $\gamma+ = \theta+ = 0$		8.070		0.732	
Test: $(\gamma+) - (\gamma-) + 2*(\theta)+ 2(\theta-) =0$		0.187		0.279	
Test: $(\gamma+) + 2*(\theta)Y^{Rmed} = (\gamma-)- 2(\theta-)Y^{Rmed}$ **		0.033		0.096	

Reference group income is defined using median reference group income (CHS). The reference group is defined by education, age, and sex. Income gap is in thousands of pesos. MU, Mundlack: Fe, Fixed effect) (†) The Joint sginificance test is a Chisquared test and F -test., in the MU estimates and FE estimates respectively. (††) Y^{Rmed} is defined as the average income gap.

*** p<0.01, ** p<0.05, * p<0.1

4 Conclusion

These essays contribute both theoretically and empirically to a better understanding of the role of social status on intergenerational income mobility.

Our theoretical work extends previous economic models in several directions. First, there are many interpretations of status in economics and status models overlap with other economic models. In order to avoid any ambiguity we use a precise interpretation of status, following Weiss and Fershtman (1998), who define status as a relative concern and distinguish two perspectives. In our first Chapter we consider ones of the perspectives of individuals status, defined as *the self-perceived valuation of the relative position of individuals in their reference group.* In the second chapter, we add *social rewards based on how others value their observable actions* in the agent's objective function. This approach allows us to discuss the role of each status motive separately, and their interaction with each other. Second, we use recent empirical findings about relative concern to formalize how comparisons with respect to the reference group income affect an agent's utility. Third, based on these assumptions, we incorporate a leader-follower dynamic between agents with high social origins and low social origins. Fourth, we discuss how informational assumptions about peer behavior affect inequality persistence through social status. Finally, we explore how past peer experiences in terms of income mobility could affect effort decisions and intergenerational income mobility.

We demonstrate that, even when all agents are identical in their abilities, their effort levels differ in the long term due to status motives, which in turn affect long term income mobility. Relative position with respect to the reference group on the one hand, and social rewards, on the other, could generate incentives to achieve

economic success or, conversely, discourage certain behaviors. They may reduce intergenerational mobility through three mechanisms: i) mobility could be low because the poor are not sufficiently motivated to move up due to the reference group composition; ii) individuals are being discouraged by society as a whole because of low status rewards; iii) individuals are discouraged by expected peer effort, because their peer group failed in past attempts to move up. However, reference groups and social status rewards could generate an "encouragement effect" which could reduce economic success inequalities.

We show that the size and the direction of the effect of status on intergenerational mobility depend on several key factors:

The direction of income comparisons (to whom individuals compare?). In this sense, the composition of the reference group is relevant in explaining income mobility, regardless of inheritance patterns. A poorer reference group establishes lower incentives to increase individual effort level.

The functional form of income comparisons (how intensity?). First, the role of these mechanisms will be more important when individual well-being depends more on relative income than on its level in absolute terms. Second, if relative concern is additive in the utility function, standard assumptions and prospect theory assumptions, yield different predictions about the influence of reference groups on income mobility. Third, when relative concern is non additive in the utility function, the effect of the reference group will depend on whether leisure and relative income are complements or not. If relative income and leisure are complements, a more demanding reference group always promotes higher effort levels. However, when they are substitutes, the reference group has an ambiguous effect on effort. In this case, the expected income gap may encourage or discourage an agent with relative deprivation. The final result depends on the relevance of ex-ante inequality and the expected peer effort.

"*The relevance of the social rewards*". If income mobility is perceived as a positive "signal" of individual attributes, then social rewards provide additional incentives for effort. In this sense, a higher expected peer effort and past income mobility,

encourage higher effort. But the quality of the "signal" is also important, as it provides true information about the effort rewards in terms of income mobility. An intergenerational backward-looking learning process may thus reinforce (or mitigate) the effect of status on intergenerational mobility.

"When both perspectives of status matter". When both status perspectives are considered the trade-offs between them are crucial. The effects of social rewards and reference groups on effort decisions, could reinforce each other (when complementaries) or compensate. For example, the effect of a poor reference group could be compensated by a high social reward payoff, because society rewards economic success of low-background individuals.

Our theoretical model allows us to review the implication of status on social welfare. We demonstrate that the reference group effect leads to individual decisions on welfare that are suboptimal. This inefficiency is explained by a "between" social origin effect and a "within" social origin effect, and it is higher the higher is the inequality between agents with different social backgrounds. We show the relevance of informational assumptions to explain the implications of both status motives on social optimal decisions. An intergenerational peer learning process could mitigate the sub-optimal rat-race effect.

Finally this thesis contributes to the empirical economic literature with new evidence on how individuals value their economic situation in relation to a reference group, which is consistent with the assumptions of prospect theory (Kahneman and Tversky, 1979; 2000; Vendrik and Woltjer, 2007). The results confirm the importance of relative income in the levels of economic satisfaction, and provide favorable evidence about the assumptions of asymmetry and diminishing marginal sensitivity. The hypothesis of convexity of relative concern among those below the reference level is confirmed, which indicates diminishing marginal sensitivity as they move away from the reference income. The results regarding relative concern for those above the reference income are ambiguous, but in general we do not find a significant relationship. These results confirm that relative concern is more important among those who are close to the reference income level, and its sensitivity is greater for

those in the area of relative deprivation.

These results are robust to alternative estimation procedures, alternative definitions of the reference group, and alternative sets of control variables. Unlike the findings of Vendrik and Woltjer (2007), our results are fully consistent with the assumptions of prospect theory. This could be explained by the differences in the specification and due to their use of life satisfaction as dependent variable. When life satisfaction is used as dependent variable, the results with respect to our hypotheses are less robust.

Our findings confirm the convexity of relative concern between people facing relative deprivation and provide preliminary evidence for heterogeneity in the income level that each person takes as a reference, which were identified as key factors to explain low mobility traps. When the relative deprivation is convex, with a more demanding reference income, individuals respond by reducing their effort. Furthermore, the heterogeneity in the reference group income could determine differences in the point of reference. In addition, if the subjective poverty line is considered as an approximation of economic aspirations, it provides complementary evidence on the assumptions made by Genicot and Ray (2014) to model aspirations.

This paper provides preliminary evidence on the role of relative deprivation on aspiration formation. In order to advance on this issue, we consider Rotter's Locus of Control (LOC), which allows us to explore how an individual's expectation about the connection between his personal characteristics and experienced outcomes affects economic satisfaction. This measure could provide valuable information to better understand aspiration failure hypothesis suggested in Ray (2006), which suggests that people reduce their aspiration, because the aspiration gap is too large and the relative reward too low, that upward mobility is thought to be unattainable (Ray, 2006).

We confirm that that personality traits are relevant to explain differences on economic satisfaction. Furthermore, the sign of the correlation between economic satisfaction and LOC domains, depends on which of them we are considering. An increase in *internality* and *powerful* dimensions lead to higher economic satisfac-

tion, which is consistent with the previous evidence. However, higher LOC-Chance has a negative incidence on economic satisfaction, which shows that more fatalistic individuals are more satisfied. Furthermore, we confirm the incidence of fatalistic belief on relative concern. Our results show that among fatalistic individuals, *ceteris paribus*, a higher relative deprivation increases economic satisfaction. This would be consistent with a reduction in their aspirations due to the unfavorable situation in their reference group and the perception of a low chance of economic improvement. These results represent preliminary evidence about aspiration failures predicted in the model of Ray (2006), Dalton et al., (2015) and Ray and Genicot (2010). However, further research is required in order to better understand these issues. Our empirical research is based on a short panel survey for a developing country, which provides some advantages to address theses issues. But new waves of the survey used in this study could be useful to better address these issues.

Aspirations are relevant in explaining income distribution and social mobility but, in turn, the distribution of income and wealth and the income mobility possibilities are relevant to shape them. Genicot and Ray (2014) argue that aspiration and income (and its distribution) evolve jointly, and sometimes in a self-reinforcing pattern. Findings from psychological studies allow us to better understand the nature of this problem, and show that the causes and consequences of poverty and inequality are mediated by behavioral patterns, which could lead to poor individuals choosing lower-return options among the alternatives available. Haushofer and Fehr (2014) and Congdon et al. (2011) suggest that extreme poverty may have psychological consequences, which affect economic behavior and could lead to discourage people from making better mobility-enhancing investments, contributing to the poverty persistence.

Our theoretical contribution helps to better understand these issues, discussing how some decisions that would increase the levels of mobility may be discouraged (or encouraged) by the status that each individual occupies in society. A first implication is that this behavioral dimension is a key issue in designing better policies and suggests that redistributive policies should go beyond that reducing material

deprivation (Mullainathan and Shafir, 2009; Duflo et al., 2008; Congdon et al, 2011, Dalton et al., 2015).

The results of our model emphasize that, it is not only the condition of lower-class backgrounds which determine the low mobility and aspirations failure. It is the unequal initial status condition, together the social polarization, the lack of connectedness and the unequal distribution of opportunities to pursue upward mobility, which are responsible for an aspiration failure. Therefore, a more integrated society, one in which there is greater economic diversity in the reference groups and income inequality is relatively low, might open the possibility that the effects of reference group and status rewards increase intergenerational mobility. In the same sense, a lower social polarization could mitigate the existence of these aspiration failures.

Ray (2006) suggests some policies for reducing low mobility due to the presence of aspiration failure in an unequal society. He argues that affirmative action or public education could be policy tools to help create local, attainable incentives at the lower end of the wealth or income distribution. The predictions of our model on the role of social status on intergenerational income mobility support this policy recommendation. For example, anti-discriminatory and affirmative action could increase income mobility, through higher connectedness of reference groups and non distorsive social rewards. Another example, refers to urban and housing related public interventions: if the residential or public space segregation affects reference group composition, public policy could mitigate this effect.

Finally, if the reference group and social interactions are primary determinants of individual aspirations, it may be necessary to understand how redistributive policies can affect group membership. For example, conditional cash transfer programs aiming to reduce poverty, which are an expanding intervention in the context of developing countries, could affect the composition of the reference group and the reference income level, which in turn could affect effort decisions and the long term income mobility. The cash transfer could increase the reference point (and aspirations), because families gain access to an expanded basket of goods or they gain access to new social interactions. However, there may be effects in the opposite di-

rection, if the program reduces the amplitude of the composition of reference group of the beneficiaries. For example, if among individuals who do not participate in the transfer program, negative or discriminatory attitudes towards beneficiaries could emerge. This might increase the social distance (or social polarization), reduce the social rewards and negatively affect the composition of the reference group.

A number of important issues remain to be addressed. First, our theoretical models assume only two social origins, but this can be extended to a model in which society has multiple-social origins. Second, following the results of Bilancini and Boncinelli (2008), it would be relevant discuss the implication in terms of income mobility whether status is modelled as an ordinal or cardinal concern. Finally, in our model the possibility of strategic behavior on the part of agents with different social origins or reference groups is ignored or limited. For example, this might affect the reference group selection.

Moreover, further research is required in order to understand how individuals form their reference groups and what extent this is an endogenous process is not yet understood. Clark and Senik (2009) analyze information about how much and with whom individuals were comparing themselves. This provides some insight to understand this issue, but also opens new questions. To which extent people's responses are consistent with the comparison group that affects their self-reported satisfaction?. How cash transfer programs affect the composition of the reference group and the reference point level?. Furthermore, it seems relevant to advance in the causal relationship between relative deprivation and different personality traits. Finally, further empirical economic research in developing countries seems to be necessary to understand the role of inequality and social status on aspiration failure and intergenerational mobility.