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REFERENCE-DEPENDENT PREFERENCES IN THE PUBLIC AND PRIVATE SECTORS: A NONLINEAR PERSPECTIVE

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ABSTRACT

Although existing studies in the strategic management literature examine the importance of reference points in the context of managerial decisions vis-à-vis organizational performance, there is surprisingly little evidence on how reference earnings affect employees' wellbeing and behavior. The present study closes this gap by investigating adaptation dynamics towards reference earnings in the context of employees' behavioral responses to social comparisons. We argue that a wedge between actual and aspiration-level earnings causes discontent that spurs employees into action to materialize their aspirations. The robustness of such action depends on the size of the wedge in a nonlinear fashion, a hypothesis supported by our findings. Nevertheless, heterogeneity in behavioral responses is evident across the public and private sectors and across gender and educational attainment. Such heterogeneity could be partially attributed to differences in public service motivation among public and private sector employees, to the different weights that employees place on pecuniary vs. non-pecuniary rewards, and whether reference earnings are likely to trigger behavioral responses through a 'jealousy' or through an 'ambition' channel. These findings have implications for the design of strategic human resource management policies to establish reward structures encouraging employees to adopt risk attitudes that are consistent with an overall business strategic plan.

Keywords: adaptation, reference earnings, comparison income, reference-dependent preferences, ESTAR models

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INTRODUCTION

Since their inception, Cyert and March's (1963) *behavioral theory of the firm* and Kahneman and Tversky's (1979) *prospect theory* had a profound impact on decision analysis and management science. Inspired by these theoretical contributions, numerous empirical studies have examined reference points, risk attitudes, and the behavioral process of adaptation as potentially important determinants of organizational performance. Mezias et al. (2002) finds, for example, that in the context of an American financial services organization, attainment discrepancy and previous aspiration levels had a positive effect on current aspirations whilst social comparisons – the difference between a firm's performance and that of comparable firms - had a negative effect. As Mezias et al. (2002) explain this negative effect is the result of organizations with performance below that of their 'peers' setting higher targets or aspiration levels in an effort to reduce such performance discrepancies. Evidence also suggests that a wedge between actual and aspiration performance levels affects the degree of risk that characterizes organizational strategy and behavior (Fiegenbaum and Thomas, 1988; Fiegenbaum, 1990; Greve, 1998). Fiegenbaum and Thomas (1988) summarize risk-return studies and use *prospect theory* to predict a nonlinear relationship between risk and return for companies. Numerous other empirical tests support this prediction, showing that decision makers in firms with returns below a certain reference point are risk seeking, implying a negative risk-return association (Fiegenbaum and Thomas, 1988; Fiegenbaum, 1990; Bromiley, 1991; and Grinyer and McKiernan, 1990). In contrast, when performance exceeds aspiration levels, decision makers are expected to adopt a more risk adverse attitude, consistent with a positive risk-return relationship (see also Singh, 1986; March and Shapira, 1992). The study by Fiegenbaum and Thomas (1995) is particularly notable in that it examines strategic group dynamics within a

partial adjustment model, assuming that a deviation between a firm's current strategic decision and its reference point results in a strategic behavior adjustment in the next and each subsequent period.

While the importance of aspirations and reference points has been explored extensively in the context of managerial decisions and organizational performance, there is little evidence in the strategic management literature on how reference points affect the behavior and risk attitudes of employees within the organization. As strategic human resource management academics and practitioners emphasize, employee behavior is an integral part of an overall business strategy, in recognition of the fact that long-term organizational performance is inextricably linked to how people in the organization, often the greatest asset, are managed, motivated, and deployed. In this respect, understanding employees' behavioral responses to aspirations, reference points, and social comparisons remains an important prerequisite for a successful business plan.

This paper focuses on one type of employees' behavioral response to social comparisons – adaptation towards reference earnings. Examining whether individuals adapt to changing circumstances has been a long-standing pursuit in psychological research. As advocates of set-point theory maintain, individuals may react to changing circumstances, but personality traits cause them to return to predetermined levels of wellbeing (Brickman, Coates, and Janoff-Bulman, 1978; Heady and Wearing, 1989; Lykken and Tellegen, 1996). More recently, empirical studies have exploited the potential of longitudinal data for testing adaptation and have provided similar support of the baseline hypothesis (Lucas, Clark, Georgellis, and Diener, 2003; Lucas, Clark, Georgellis, and Diener, 2004; Clark, Diener, Georgellis, and Lucas, 2008). However, heterogeneity in individuals' reaction and patterns of adaptation are evident. As Lucas (2007) points out, not only it is possible for long-run subjective wellbeing to change, but also

patterns of adaptation differ across events and across individuals. Therefore, whether adaptation is usually rapid and complete remains an open question that calls for additional empirical evidence. What is more, recent survey-based evidence in the social sciences literature tends to confirm the importance of comparison income as a determinant of employee welfare and behavior (Clark and Oswald, 1996; Ferrer-i-Carbonnel, 2005; Stutzer, 2004). In a similar vein, findings from behavioral and neurophysiological experiments on how social comparisons influence reward processing in the human brain, offer additional support for the above hypothesis. For example, Fliessbach et al. (2007), using MRI scans to monitor the brain activity of volunteers performing tasks for a monetary reward, find that although the reward center in the brain was activated by individual success, far more brain activity was recorded when volunteers received higher rewards relative to those of their partners.

Consistent with the predictions of *prospect theory*, recent studies also find that reference income not only influences individuals' attitude and disposition towards risk but it has important behavioral implications. As Rizzo and Zeckhauser (2003) confirm, for example, a wedge between physicians' actual earnings and the earnings of their professional peers encourages them to adopt a risk-seeking or risk-averse attitude depending on whether actual earnings are below or above reference earnings. Mas (2006) shows that, in the context of police wage negotiations, when the actual pay award does not match the expectations formed during the arbitration process, there is a negative impact on police performance. Using labor supply data for New York taxi drivers, Farber (2008) finds that although a reference level of income on a given day influences when a taxi driver ends his shift, reference income varies unpredictably day by day and most drivers end their shift before they reach their reference income. This is suggestive of the presence of nonlinearities and of more smoothness characterizing the relationship between

income and the probability of stopping the daily shift than that implied by reference-dependent preferences.

In this paper, we hypothesize that a wedge between employees' actual and aspiration-level earnings causes discontent, which spurs employees into action to materialize their aspiration-level of earnings. We further conjecture that the robustness of such action, and therefore the speed of adjustment towards reference earnings, depends on the size of the wedge in a nonlinear fashion in that employees whose current welfare or economic situation is far below (above) that of their peers (i.e. the reference group) have a stronger (weaker) incentive to improve their status. The implication of the presence of nonlinearities characterizing the adaptation process is that earnings do matter, but much more so when the deviation of actual from reference earnings is large. In contrast, evidence of reference-dependent preferences in a small enough neighborhood around reference earnings is weak, if non-existent. This is consistent with the adaptation-level theorists' suggestion that only stimuli that are significantly different from a predetermined frame of reference can produce a positive or negative response (Helson, 1964). We further hypothesize that heterogeneity in responses to reference earnings is also evident. A source of such heterogeneity in responses could be traced back to individuals' dispositions, which influence their perceptions of their current jobs and consequently their adaptation or attitudinal equilibrium level (Bowling, Beehr, Wagner, and Libkuman, 2005).

DATA AND METHODS

Our empirical investigation is based on data from the British Household Panel Survey (BHPS), a large-scale longitudinal survey that allows us to capture and model the dynamics of evolution of current earnings towards reference earnings. The BHPS is a representative survey of 10,000

individuals in approximately 5,000 households, interviewed annually, covering the period 1991-2005. It contains detailed information on standard demographic and labor market characteristics, including education, earnings and whether working in the public or the private sectors. Focusing on individuals 19-65 years of age results in a sample of 27048 and 27003 person-year observations for men and women respectively. Of those observations, 21577 refer to men in the private sector and 5471 in the public sector. The corresponding split for women is 17705 to 9298.

To quantify and model the dynamic trajectory of the gap between actual and reference earnings, we assume that e_t represents the gap between the actual earnings $\left(W_S^E\right)$ of an employee with educational attainment E employed in sector S and her reference earnings $\left(W_S^E\right)^*$

$$e_t = \left[W_S^E - \left(W_S^E\right)^*\right]. \tag{1}$$

Contrary to the relatively straightforward identification of the dynamic evolution of actual earnings, the time trajectory of reference earnings is more difficult to ascertain, mostly because of the multitude of alternative definitions of the reference group. Among others, Ferrer-i-Carbonell (2005) uses an operational definition of the reference group that includes all people with similar education, in the same age bracket and living in the same region. McBride (2001) uses the average values of all those in the same age group within five years younger or older than the individual concerned. If reference earnings are defined as earnings of 'people like you' with similar age, education, occupation and other demographic and labor market characteristics, then the time trajectory of reference earnings will be influenced greatly by trends and patterns in the composition and characteristics of the peer group. Alternatively, if reference earnings refer

to those of the highest paid member in the organization, then trends in the compensation of the highest earners (e.g. executive pay) will be the main driving force behind the evolution of reference earnings. Brown, Gardner, Oswald, and Qian (2008) find evidence of the rank within an organization being an important determinant of employees' wellbeing.

Our proxy for reference earnings is based on Clark and Oswald's (1996) definition, using the fitted values from estimated multivariate earnings regressions. We estimate earnings regressions and derive fitted values separately for men and women. We further disaggregate by whether working in the public or the private sector and by educational attainment. More specifically, we estimate nine regressions for men, based on separate samples for: (1) All men; (2) All men in the public sector; (3) Men in the public sector with university education; (4) Men in the public sector with teaching, nursing or other higher qualification; (5) Men in the public sector with other education; (6) All men in the private sector; (7) Men in the private sector with university education; (8) Men in the private sector with teaching, nursing or other higher qualification; (9) Men in the private sector with other education. Based on the same groupings, we estimate nine equivalent regressions for women. In all earnings regressions, we control for the standard demographic and labor market characteristics, including age, marital status, number of children, health, whether working full-time, firm size, region and time dummies.[1]

Then, we explore separately for each of the above sub-samples the dynamics of adjustment towards reference earnings adopting the Smooth Transition Autoregressive (STAR) model (Granger and Terasvirta, 1993; Terasvirta, 1994). The main attraction of such a model is that it allows for the speed of adjustment to vary in a nonlinear fashion with the distance between actual and reference earnings. Essentially, the STAR model implies that the costs of

earning below a reference level of earnings increase with the distance from reference earnings. In comparison, the partial adjustment model implies that such costs remain constant.

Naturally, whether the STAR model is superior to linear models in capturing the dynamics of adjustment towards reference earnings is a testable hypothesis, which entails a three-stage testing procedure for the presence of nonlinearities. The first stage specifies the appropriate lag length for the linear autoregressive model and the second stage involves tests for the presence of nonlinearities. If nonlinearities are present, the choice between the Logistic STAR (LSTAR) and the Exponential STAR (ESTAR) model as potential candidates for best describing the dynamic adjustment process is made in the third stage.

Formally, consider two possible regimes comprising a pure 'small' and a pure 'large' adjustment of individuals' current earnings with respect to changes in their reference earnings. Following Granger and Terasvirta (1993), we write a STAR model of order k, for e_t as:

$$e_t = \theta_0 + \theta_1' x_t + (\delta_0 + \delta_1' x_t) F(e_{t-d}) + w_t, \tag{2}$$

where $x_t = (e_{t-1}, e_{t-2}, ...e_{t-k})$, $\theta_1 = (\theta_1, \theta_2, ...\theta_k)'$, $\delta_1 = (\delta_1, \delta_2, ...\delta_k)'$, $w_t \sim iid(0, \sigma^2)$, $F(.)$ is a continuous transition function, e_{t-d} is the switching variable, and d is the delay parameter. $F(.)$ is a monotonically increasing function with $F(-) = 0$ and $F(+) = 1$ which yields a nonlinear asymmetric adjustment.

Terasvirta and Anderson (1992) define the ESTAR function as:

$$F(e_{t-d}) = 1 - \exp\left[-a(e_{t-d} - c)^2\right], \tag{3}$$

[1] These results are available upon request.

where a measures the speed of transition from one regime to another and c is a threshold value for e which indicates the halfway point between the two regimes. The ESTAR function in (3) defines a transition function about c where $F(.)$ is still bounded between 0 and 1. As in the case of the LSTAR model above, the main property of the ESTAR model, described in equation (3), that makes it an attractive model in the present context is the fact that it captures the nonlinear, smooth adjustment process towards reference values.

The initial testing for the presence of nonlinearities in e_t involves three stages. First, a linear autoregressive model for e_t is specified in order to determine the lag length k. The lag length selection is based on the Schwarz information criteria and the Ljung-Box statistic for serial correlation. The residuals are saved from the chosen autoregressive model and denoted as v. Second, having determined k, the next stage is to test for the presence of nonlinearities. This is done through the estimation of

$$v_t = \beta_0 + \beta_1' x_t + \beta_2' x_t e_{t-d} + \beta_3' x_t e^2_{t-d} + \beta_4' x_t e^3_{t-d} + w_t, \qquad (4)$$

where the linearity test is on the null hypothesis $H_0 : \beta_2' = \beta_3' = \beta_4' = 0.$ Equation (4) is estimated across a range of values for d where the smallest *p-value* attached to the linearity test determines d in the estimation of (2). The final stage of the nonlinearity test is to determine which smooth transition model, LSTAR or ESTAR, is appropriate for the data. This is done by running the following sequence of nested tests:

$$H_{04} : \beta_4 ' = 0 \tag{5}$$

$$H_{03} : \beta_3 ' = 0 / \beta_4 ' = 0 \tag{6}$$

$$H_{02} : \beta_2 ' = 0 / \beta_4 ' = \beta_3 ' = 0 . \tag{7}$$

The ESTAR model does not contain a cubic term (see equation 3.16 in Terasvirta). Therefore, if we reject (5) there is a cubic term in the nonlinear model suggesting that we have an LSTAR specification. If we accept (5) and reject (6), then the nonlinear model possess a squared term but not a cubic term. Since a squared term is required for an ESTAR specification and we have no cubic term, then we can conclude that accepting (5) and rejecting (6) implies acceptance of the ESTAR model (see equation 3.16 in Terasvirta). Accepting (5) and (6) and rejecting (7) leads to an LSTAR model because although $H_{02} : \beta_2 ' \neq 0$ is important for an LSTAR specification, it is insignificant for an ESTAR model (see page 209, equation 3.10 in Terasvirta). However, Granger and Terasvirta 1993) and Terasvirta 1994) show that application of this sequence of tests may lead to incorrect conclusions because the higher order terms of the Taylor expansion used in deriving these tests are disregarded. Thus, they recommend that the choice of STAR model should be made based on the lowest *p-value* among the values computed for all the F tests of (5)-(7).

To account for potential asymmetries in the adjustment process, we implement the STAR methodology separately for when actual values are below reference values and for when actual values are above reference values. When actual values are above reference values, the model

does not reject the null hypothesis of absence of nonlinear adjustment. In this case, a further test of the null hypothesis H_o: $\beta_1 = 0$ for the presence of linear adjustment shows no adjustment at all. Therefore, all subsequent results reported in the empirical section focus on nonlinear adaptation of earnings, job satisfaction and work hours when actual values are below reference values.[2]

RESULTS

Table 1 presents the results of nonlinear estimation of equation (2) for men, estimated separately for men in the public and private sector and by educational qualifications.[3] The main parameter of interest is α, which captures the speed of adjustment of actual towards reference earnings. Small (large) values of α are indicative of a slow (fast) speed of adjustment. In all cases a is correctly signed and significantly different from zero at the 5 per cent level, implying the presence of significant nonlinearities in the speed of adjustment towards reference earnings. We argue that such nonlinearities reflect the presence of nonlinearities in employees' reference-dependent preferences and their incentives to take stronger remedial action to improve their earnings when the distance between current and reference earnings is larger.

[TABLE 1 here]

[2] The results of linear and nonlinear tests for the case of actual values above the reference values are available upon request.

[3] The model was estimated using the Gauss Newton method. The Ljung-Box Q statistic for serial correlation among the residuals suggests white noise residuals for all autoregressive models. Using 0.05 as a threshold *p-value*, the test rejects linearity, classifying the series as nonlinear. The standard errors of the nonlinear models are smaller then the standard errors of the linear models for all the series suggesting, that the nonlinear models provide a better fit of the data. The Jacque Bera normality test indicates that the residuals are normally distributed for all the series examined, confirming that nonlinearities in individuals' reported well-being are not the outcome of any outliers in the data. We further test the residuals for first order serial correlation and ARCH effects. The *p-values* using 0.05 as the threshold) reject the presence of serial correlation and the presence of ARCH nonlinearity in the residuals for all series.

A comparison of the estimated coefficients a, based on separate samples for all men in the private sector and for all men in public sector, points to a faster adjustment speed towards reference earnings in the private sector than that in the public sector. A faster speed of adjustment in the private sector is consistent with steeper earnings profiles in the private sector as well as higher aspiration-level of earnings. This argument is further supported by evidence showing that differences in adjustment speeds between the two sectors are more pronounced for employees with a university degree or a higher educational qualification. As reflected by the corresponding estimated coefficients a of -3.73 and -2.90 in the private and public sector respectively, university graduates are closing the gap between actual and reference earnings much faster in the private sector than in the public sector. The opposite is true, however, for men with lower educational qualifications who tend to close the gap between their actual and reference earnings at a much lower rate in the private rather than the public sector with corresponding estimated a coefficients of -2.72 and -3.14. Largely, such differences in adjustment speeds could be attributed to the differential returns to education across the two sectors. Well-documented evidence of wage compression in the public sector, often portrayed as a reason for the difficulty of the sector to attract highly skilled employees, implies lower returns to education with flatter age-earnings profiles than those in the private sector.[4] However, the speed of adjustment depends not only on the level but also on the evolution of reference values over time as well as how such reference values are perceived by employees. It is possible, for example, that reference earnings operate via a 'jealousy' channel whereby peers' higher earnings have a negative impact on individuals' well-being, thus mitigating the positive

[4] For analyses of wage structures in the public and private sectors, see Katz and Krueger (1991), Hundley (1991), Bender and Elliott (2002), Kahn (2008), among others.

effect of own earnings. Alternatively, it is likely that reference earnings induce a positive well-being effect, which operates via an 'ambition' channel. In this case, peers' higher earnings raise expectations of higher own earnings in the future, a conjecture consistent with Hirschman's (1973) 'tunnel effect' phenomenon referring to the possibility that in uncertain and adverse situations individuals often interpret any positive signals that they observe around them to predict an improvement in their own situation to occur sooner or later (Senik, 2008). In a similar fashion, it is likely that university graduates aspire to higher reference earnings in the private sector because of the presence of skewed distributions of graduate earnings with long upper tails. In contrast, as earnings for less qualified employees are generally lower whilst earnings distributions are generally less dispersed, reference or aspiration earnings for those employees will tend to be lower. Higher reference earnings will, *ceteris paribus*, imply a larger wedge between actual and reference earnings implying a stronger incentive to take action to eliminate such a wedge. Differences between public and private sector employees' perceptions about the earnings of their peers could determine the strength of the influence of reference earnings on employees' well-being, which consequently influences their incentives to undertake robust action to match the potentially higher earnings of their employees. Such perceptions are generally shaped by employees' evaluation of intrinsic vis-à-vis extrinsic job rewards. Assuming that public sector employees value, and they are motivated by, intrinsic rather than extrinsic rewards, higher earnings of co-employees in the public sector will cause little disutility, thus providing only a weak incentive to take action to achieve higher earnings. As arguments advanced in the public administration literature suggest, employees in the public sector are indeed more likely to exhibit characteristics and work attitudes that are consistent with Public Service Motivation (PSM), a concept associated with "an individual's predisposition to respond

to motives grounded primarily or uniquely in public institutions" (Perry, 1996). An implication of PSM in the context of the present study is that, in comparison to employees in the private sector, public sector employees are less likely to be motivated by pecuniary rewards, so that higher co-worker earnings (reference earnings) induce little disutility and a weak incentive for taking action to close the gap between actual and reference earnings. Therefore, stronger evidence of Public Service Motivation (PSM) among public sector than among private sector employees could offer an additional explanation of potential differences in the speed of adjustment towards reference earnings between the two sectors.

[TABLE 2 here]

As shown in Table 2, similar patterns of adaptation are evident for women. Although adjustment speeds tend to be generally lower for women compared to those of men, adjustment speeds for female university graduates are higher in the private sector than in the public sector. As in the case of men, women with lower educational qualification tend to reach their reference earnings faster in the public sector instead. It is worth noting, however, that such differences in adjustment speeds across sectors and educational attainment are less pronounced in the case of women. This is consistent with previous findings on the existence of significant gender differences in age-earnings profiles as well as gender differences in the returns to education, implying generally flatter age-earnings profiles of women in comparison to earnings profiles of men. Interestingly, women with teaching, nursing or other higher qualifications are closing the gap between actual and reference earnings faster in the private than in the public sector. This could be attributed partially to rigid public sector pay arrangements that compress the structure

of wages. Given anecdotal evidence or common wisdom that teaching and nursing are occupations characterized by high public service motivation, higher earnings of co-employees in these professions are likely to exert little influence on employees' perceptions of their relative position and on the incentive to take robust action to reach their aspiration earnings.

CONCLUDING COMMENTS

Against the backdrop of a resurgent interest in the process of adaptation as a behavioral response to social comparisons in the decision analysis and social science literature, examining whether aspiration-level earnings affect employees' wellbeing has attracted surprisingly little attention in the strategic management literature. Most of the existing studies examine the importance of reference points and adaptation in the context of managerial decisions and organizational performance. The present study closes this gap in the literature by investigating patterns of adaptation of employees' actual earnings towards reference earnings, using large-scale longitudinal data. Employing nonlinear methods, our findings uncover a consistent pattern whereby the speed of adjustment towards reference earnings increases with the distance of actual from reference earnings. From a Strategic Human Resource Management perspective, the main implication of such a nonlinear pattern is that a greater wedge between actual and target earnings spurs a stronger response and possibly more risk taking on the part of employees. Noticeably, this is not the case when actual earnings are above target. To the extent that encouraging a more risk taking attitude among employees is a desirable outcome, integral to a business strategic plan, then personnel policies should aim at creating a rewards structure that increases the dispersion of earnings within the organization. However, if risk taking is not a

desirable outcome in the context of an overall business plan, then reward structures resulting in more equitable, less dispersed earnings distributions should be adopted instead. Nevertheless, heterogeneity in behavioral responses to reference earnings cannot be ignored. As our results confirm, stark differences in the speed of adaptation towards reference earnings exist across the public and private sectors and across gender and educational attainment. Such differences could be partially attributed to differences in public service motivation among public and private sector employees and, more generally, to the different weights that employees with different characteristics place on pecuniary vs. non-pecuniary rewards. The possibility that reference earnings could triger behavioral responses either through a 'jealousy' or through an 'ambition' channel adds an additional dimension to the way employee reward structures could operate within an organization. In this context, it becomes essential for human resource management policies to incorporate and emphasize the need for an effective system for managing earnings aspirations to meet organizational objectives.

This study makes also a methodological contribution to the existing literature by introducing a novel approach for modeling adaptation dynamics. The ESTAR model captures the inherent dynamics of the path of adjustment towards reference earnings better, in a statistical sense, than alternative models. Certainly, the ESTAR model outperforms linear models in accurately capturing the dynamics of adaptation of actual to reference earnings. What's more, it offers an extension and a potentially viable alternative to the partial adjustment model, which was used by Fiegenbaum and Thomas (1995) to model dynamic adjustment of strategic reference groups. The main advantage of the ESTAR model over the partial adjustment model is that it allows for the costs of disequilibrium to increase with the distance from the target or reference points. Finally, the study contributes to a small but growing empirical literature

exploiting the benefits of longitudinal data for testing the predictions of adaptation-level theories. The use of the BHPS data, a large-scale longitudinal survey of more than 10,000 individuals who were followed for a considerable number of years is a 'quantum leap' from the early evidence on adaptation-level theories, based on small cross-sectional samples.

The analysis presented here can be extended in several ways for future research. First, as our analysis is based on a single measure of reference earnings, derived from predicted earnings of 'people like you', there is ample scope for exploring alternative operational definitions of reference points. Guided by a large literature on reference groups and a growing number of empirical studies testing the importance of reference points, future work could compare dynamic paths of adjustment towards different or competing reference points. In such a context, the issue of heterogeneity in responses to reference values could be revisited by disaggregating the sample into more refined categories. Second, in future work we aim to disentangle the influence of behavioral responses from other factors that may affect the dynamic trajectory towards reference earnings. Such factors include employees' observed productive characteristics, the differential returns to education in the public and private sectors, the prevalence of wage compression in the public sector, and the possible existence of public service motivation, which dampens the negative well-being effect of peers' higher earnings. A closer investigation of such factors could also inform our understanding of how reference points evolve over time, which could allow for explicitly modeling shifts of individual reference points overtime. This approach was adopted by Lehner (2000) who relaxed the assumption of a common reference level and allowed for the possibility of shifts of individual reference levels in the context of organizational behavior.

REFERENCES

Bender K, Elliott R. 2002. The role of job attributes in understanding the public-private wage differential. *Industrial Relations*, 41 (3): 407-421.

Bowling N, Beehr T, Wagner S, Libkuman T. 2005. Adaptation-level theory, opponent process theory, and dispositions: An integrated approach to the stability of job satisfaction. *Journal of Applied Psychology*, 90: 1044-1053.

Brickman P, Coates D, Janoff-Bulman, R. 1978. Lottery winners and accident victims: Is happiness relative? *Journal of Personality and Social Psychology*, 36: 917-927.

Bromiley P. 1991. Testing a causal model of corporate risk taking and performance'. *Academy of Management Journal*, 34: 37-59.

Brown G, Gardner J, Oswald A, Qian, J. 2008. Does wage rank affect employees' wellbeing? *Industrial Relations*, 47: 355-389.

Clark A, Diener E, Georgellis Y, Lucas R. 2008. Lags and leads in life satisfaction: A test of the baseline hypothesis. *Economic Journal*, 118: F222-F243.

Clark A, Oswald A. 1996. Satisfaction and comparison income. *Journal of Public Economics,* 61: 359-381.

Cyert R.M, March J.G. 1963. *A behavioral theory of the firm*. Prentice-hall, Englewood Cliffs, NJ.

Easterlin R. 2005. A puzzle for adaptive theory. *Journal of Economic Behavior and Organization*, 56: 513-521.

Farber H. 2008. Reference-dependent preferences and labor supply: The case of New York City taxi drivers. *American Economic Review*, 98: 1069-1082.

Ferrer-I-Carbonell A. 2005. Income and well-being: an empirical analysis of the comparison income effect. *Journal of Public Economics*, 89, 5-6: 997-1019.

Fiegenbaum A. 1990. Prospect theory and the risk-return association. *Journal of Economic Behavior and Organization*, 14: 187-203.

Fiegenbaum A, Thomas T. 1988. Attitudes towards risk and the risk-return paradox: prospect theory explanations. *Academy of Management Journal*, 31: 85-106.

Fiegenbaum A, Thomas H. 1995. Strategic groups as reference groups: theory, modeling and empirical examination of industry and competitive strategy. *Strategic Management Journal*, 16: 461-476.

Fiegenbaum A, Hart S, Schendel D. 1996. Strategic reference point theory. *Strategic Management Journal*, 17: 219-235.

Fliessbach K, Weber B, Trautner P, Dohmen T, Sunde U, Elger C.E, Falk A. 2007. Social comparison affects reward-related brain activity in the human ventral striatum. *Science*, 318, 5854: 1305-1308.

Granger C, Terasvirta T. 1993. *Modelling nonlinear economic relationships*, Oxford University Press.

Greve H.R. 1998. Performance, aspirations, and risky organizational change. *Administrative Science Quarterly*, 43: 58-86.

Grinyer P.H, McKiernan P. 1990. Generating major change in stagnating companies. *Strategic Management Journal*, 11: 131-146.

Headey B, Wearing A. 1989. Personality, life events, and subjective well-being: toward a dynamic equilibrium model. *Journal of Personality and Social Psychology*, 57: 731-39.

Helson H. 1964. Current trends and issues in adaptation-level theory. *American Psychologist*, 19: 26-38.

Hirschman A. 1973. The changing tolerance for income inequality in the course of economic development. *Quarterly Journal of Economics,* 87: 544–566.

Hundley G. 1991. Public and private sector occupational pay structures. *Industrial Relations*, 30: 417-434.

Kahneman D, Tversky A. 1979. Prospect theory: An analysis of decisions under risk. *Econometrica*, 47: 263-291.

Kahn L. 2008. The impact of wage-setting institutions on the incidence of public employment in the OECD: 1960-1998. *Industrial Relations*, 47: 329-354.

Katz L, Krueger A. 1991. Changes in the structure of wages in the public and private sectors. *Research in Labor Economics*, 12: 137-172.

Lehner J. 2000. Shifts of reference points for framing of strategic decisions and changing risk-return associations. *Management Science*, 46 1): 63-76.

Lucas R. 2007. Adaptation and the set-point model of subjective well-being: Does happiness change after major life events? *Current Directions in Psychological Science*, 16: 75-79.

Lucas R, Clark A, Georgellis Y, Diener E. 2003. Reexamining adaptation and the set point model of happiness: Reactions to changes in marital status. *Journal of Personality and Social Psychology*, 84: 527-539.

Lucas R, Clark A, Georgellis Y, Diener E. 2004. Unemployment alters the set point of life satisfaction. *Psychological Science*, 15: 8-13.

Lykken D, Tellegen A. 1996. Happiness is a stochastic phenomenon. *Psychological Science*, 7: 186-189.

Mas A. 2006. Pay, reference points, and police performance. *Quarterly Journal of Economics.* 121: 783-821.

McBride M. 2001. Relative-income effects on subjective well-being in the cross-section. *Journal of Economic Behavior and Organization*, 45: 251-278.

Mezias S, Chen Y-R, Murphy P. 2002. Aspiration-level adaptation in an American financial services organization: A field study. *Management Science*, 48 10): 1285-1298.

Perry J.L. 1996. Measuring public service motivation: An assessment of construct reliability and validity. *Journal of Public Administration Research and Theory*, 6: 5-22.

Rizzo J, Zeckhauser R. 2003. Reference incomes, loss aversion, and physician behavior. *Review of Economics and Statistics*, 85: 909-922.

Senik C. 2008. Ambition and jealousy: Income interactions in the 'old' Europe versus the 'new' Europe and the United States. *Economica*, 75: 495-513.

Singh J. V. 1986. Performance, slack, and risk taking in organizational decision making. *Academy of Management Journal*, 29: 562-585.

Stutzer A. 2004. The role of income aspirations in individual happiness. *Journal of Economic Behavior and Organization*, 54: 89-109.

Terasvirta T, Anderson H. 1992. Characterizing nonlinearities in business cycles using smooth transition autoregressive models. *Journal of Applied Econometrics*, 7: S119-S139.

Terasvirta T. 1994. Specification, estimation, and evaluation of smooth transition autoregressive models. *Journal of the American Statistical Association*, 89: 208-218.

van Praag B, Ferrer-I-Carbonell A. 2004. *Happiness quantified: A satisfaction calculus approach*, Oxford: Oxford University Press.

Table 1 – Estimates of the Estar Models (Men)

	θ_o	θ_1	δ_o	δ_1	α	C	S	Q (1)	ARCH (1)	NORM (2)	S/SL
ALL											
	0.42 (0.11)	0.80 (0.26)	0.90 (0.30)	0.92 (0.28)	-1.91 (0.74)	0.41 (0.18)	0.36	0.42	0.175	0.27	0.84
PRIVATE SECTOR											
All	0.46 (0.14)	0.86 (0.25)	0.84 (0.24)	0.87 (0.25)	-3.52 (1.04)	0.48 (0.20)	0.37	0.39	0.177	0.29	0.85
University degree	0.41 (0.14)	0.84 (0.26)	0.89 (0.25)	0.93 (0.24)	-3.73 (1.07)	0.51 (0.24)	0.28	0.43	0.182	0.35	0.87
Teaching, Nursing or other higher QF	0.52 (0.12)	0.67 (0.20)	0.85 (0.27)	0.90 (0.28)	-2.61 (1.10)	0.46 (0.21)	0.31	0.32	0.187	0.12	0.87
Education: Other	0.42 (0.16)	0.65 (0.23)	0.80 (0.26)	0.85 (0.27)	-2.72 (1.01)	0.50 (0.21)	0.30	0.33	0.182	0.23	0.76
PUBLIC SECTOR											
All	0.36 (0.13)	0.82 (0.23)	0.76 (0.23)	0.80 (0.25)	-3.21 (1.04)	0.56 (0.22)	0.28	0.34	0.195	0.17	0.78
University degree	0.44 (0.12)	0.75 (0.21)	0.81 (0.28)	0.83 (0.30)	-2.90 (1.00)	0.51 (0.19)	0.32	0.37	0.192	0.25	0.77
Teaching, Nursing or other higher QF	0.56 (0.14)	0.65 (0.22)	0.83 (0.25)	0.87 (0.24)	-2.65 (1.12)	0.51 (0.20)	0.34	0.34	0.192	0.21	0.91
Education: other	0.34 (0.14)	0.84 (0.26)	0.70 (0.21)	0.73 (0.22)	-3.14 (1.02)	0.47 (0.23)	0.29	0.37	0.194	0.28	0.77

Notes: Standard errors in parentheses. *Q (1)* is the *p-value* for first order serial correlation Ljung-Box *Q statistic*). *ARCH (1)* is the *p-value* for the first order autoregressive conditional heteroscedasticity (Engle F-test). *NORM (2)* is the *p-value* for the Jacque-Bera normality test. *S/SL* is the ratio of the standard errors for the nonlinear and linear models.

Table 2 – Estimates of the Estar Models (Women)

	θ_o	θ_1	δ_o	δ_1	α	C	S	Q (1)	ARCH (1)	NORM(2)	S/SL
ALL											
	0.50 (0.15)	0.77 (0.23)	0.84 (0.27)	0.87 (0.25)	-1.44 (0.31)	0.52 (0.20)	0.31	0.39	0.195	0.28	0.75
PRIVATE SECTOR											
All	0.38 (0.13)	0.73 (0.25)	0.82 (0.24)	0.84 (0.25)	-1.30 (0.61)	0.44 (0.18)	0.29	0.31	0.18	0.16	0.92
University degree	0.40 (0.12)	0.87 (0.24)	0.87 (0.26)	0.91 (0.28)	-2.02 (1.00)	0.50 (0.23)	0.27	0.40	0.179	0.31	0.86
Teaching, Nursing or other higher QF	0.43 (0.14)	0.81 (0.25)	0.72 (0.28)	0.75 (0.27)	-1.72 (0.80)	0.45 (0.22)	0.31	0.35	0.183	0.26	0.75
Education: other	0.45 (0.10)	0.71 (0.24)	0.87 (0.23)	0.93 (0.24)	-1.10 (0.34)	0.52 (0.22)	0.36	0.29	0.183	0.13	0.84
PUBLIC SECTOR											
All	0.39 (0.14)	0.80 (0.24)	0.75 (0.31)	0.77 (0.30)	-1.6 (0.74)	0.54 (0.20)	0.37	0.42	0.178	0.31	0.93
University degree	0.40 (0.11)	0.79 (0.27)	0.86 (0.25)	0.91 (0.26)	-1.80 (0.87)	0.51 (0.21)	0.33	0.37	0.197	0.19	0.72
Teaching, Nursing or other higher QF	0.46 (0.12)	0.76 (0.22)	0.77 (0.30)	0.81 (0.29)	-1.52 (0.70)	0.48 (0.21)	0.35	0.41	0.176	0.30	0.89
Education: other	0.37 (0.13)	0.67 (0.23)	0.88 (0.26)	0.91 (0.30)	-1.84 (0.80)	0.45 (0.20)	0.34	0.41	0.198	0.24	0.81

Notes: Standard errors in parentheses. *Q (1)* is the *p-value* for first order serial correlation Ljung-Box (*Q statistic*). *ARCH (1)* is the *p-value* for the first order autoregressive conditional heteroscedasticity (Engle F-test). *NORM (2)* is the *p-value* for the Jacque-Bera normality test. *S/SL* is the ratio of the standard errors for the nonlinear and linear models.