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A THEORETICAL NOTE ON ASYMMETRIES IN INTENSITY AND
PERSISTENCE OF RECIPROCITY IN LABOUR MARKETS

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A Theoretical Note on:
Asymmetries in Intensity and Persistence of Reciprocity in Labour Markets[*]

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Abstract

This paper presents a model that can account for, and explain, two well documented empirical asymmetries characterising a worker's reciprocity: negative reciprocity is both stronger, and more persistent, than positive reciprocity. The stronger intensity of negative reciprocity is driven by the worker being loss averse; the longer persistence is driven by the slower adaptation of the worker to wage changes that are perceived as unfair.

KEYWORDS: reciprocity; loss aversion; adaptation; asymmetries.

JEL classification: D91, J30, J41.

> *"Pleasure is always contingent upon change and disappears with continuous satisfaction. Pain may persist under persisting adverse conditions"*
>
> Frijda (1988, p.353)

1 Introduction

Employment relationships are based on a mutual understanding of fairness and reciprocity. The seminal papers of Akerlof (1982) and Akerlof and Yellen (1990) respectively predated what have become known in the behavioural economics literature as positive and negative reciprocity: wage increases that are perceived as gifts are positively reciprocated by increases in effort, while wage decreases that are perceived as unfair are negatively reciprocated by decreases in effort.

Starting with Fehr et al. (1993), several experiments have been developed to investigate the existence of such positive wage-effort relationship (see Fehr et al. (2009) and Esteves-Sorenson (2017) for surveys). These studies have also been supported, and motivated by, a large body of anthropological evidence (see Bewley (2007) for a survey).

The resulting evidence on worker's reciprocity can be divided in two main findings. First, the negative reciprocity response to unfair wage cuts is stronger than the positive reciprocity response to wages that are perceived as gifts. Second, in the context of long-term employment relationships, the effort boost induced by a wage increase is only transitory,[1] while the drop in effort following a wage cut is much more persistent.[2] Drawing from the theoretical framework developed by Dickson and Fongoni (2016), this paper presents a simple model of workers' reciprocity that can account for, and explain, both these asymmetries.

If workers are loss averse and use their most recent wage as their reference for fairness, the loss generated by a wage cut looms larger than the gain induced by an equivalent-sized wage increase, implying that their reciprocity response to wage cuts is stronger (Dickson and Fongoni, 2016).[3] Moreover, in subsequent periods, as workers 'get used' to their new wage, any positive or negative reciprocity will eventually disappear.

That reference wage adaptation to past wages can explain the temporary nature of worker's reciprocity has been recently established by the models of Dickson and Fongoni (2016) and Sliwka and Werner (2017). In particular, Sliwka and Werner (2017) also provide direct evidence of this hypothesis, which is consistent with other evidence on reference point formation (e.g. Koch (2017) and Herz and Taubinsky (2018)), and with the notion of adaptation, or habituation, popular in social psychology (see Kahneman and Thaler (1991) and Baucells and Sarin (2010)). However, these models cannot explain the longer persistence of negative reciprocity.

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[1] See for instance Gneezy and List (2006) and Sliwka and Werner (2017).

[2] See Kube et al. (2013) and Chemin and Kurmann (2014).

[3] See also Sliwka and Werner (2017) and Macera and te Velde (2018).

Inspired by the "law of hedonic asymmetry" conjectured by Frijda (1988) and the experimental findings of Arkes et al. (2008, 2010) and Baucells et al. (2011), this paper contributes to this literature by formally establishing that, if workers adapt more rapidly to gains than to losses over time, negative reciprocity is not only stronger, but also more persistent than positive reciprocity.

2 Model

2.1 Worker's Reciprocity

Consider a worker in a long-term employment relationship with a firm. The worker is reference dependent and loss averse: at the beginning of each employment period t the worker evaluates the wage received w_t in relation to a reference 'fair' wage r_t, and subsequently decides on the utility-maximising level of effort e_t that will generate output for the firm. A wage below the reference wage is perceived as unfair, while a wage above is perceived as a gift.

Following the derivation of a worker's 'asymmetric reference-dependent reciprocity' by Dickson and Fongoni (2016, Theorem 1), the worker's optimal effort function can be expressed as

$$\tilde{e}_t = \tilde{e}(w_t, r_t, \lambda) = \tilde{e}^n + \begin{cases} \eta[w_t - r_t] & \text{if } w_t \geq r_t \\ \lambda \eta[w_t - r_t] & \text{if } w_t < r_t; \end{cases} \tag{1}$$

where $\tilde{e}^n$ captures 'normal effort', that is, the level of effort that a worker would exert when they are paid their 'fair' wage (note that $\tilde{e}^n$ is independent of w_t); η is a scaling parameter; and λ is the worker's degree of loss aversion.[4] The effort function in (1) captures the essential features of a worker's reciprocity. For a given r_t, if the worker is paid a wage above their reference wage, they will positively reciprocate this gift with supra-normal effort $\tilde{e}(w_t, r_t)^+ \equiv \tilde{e}_t > \tilde{e}^n$; while if the wage is set below their reference wage, they will negatively reciprocate this unfair wage by exerting sub-normal effort $\tilde{e}(w_t, r_t, \lambda)^- \equiv \tilde{e}_t < \tilde{e}^n$.

2.2 Asymmetric Adaptation

Experimental evidence on the dynamics of reference points suggests that individuals adapt more rapidly to gains than to losses over time (see Arkes et al. (2008, 2010) and Baucells et al. (2011)). Inspired by this literature, this paper assumes that the worker adapts their reference wage to the past wage as follows:

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[4]An effort function with similar properties can be derived from the conceptual model developed by Sliwka and Werner (2017) for the case in which the worker considers only the most recent wage change relative to the reference wage (i.e. the worker has 'short memory' with respect to their emotional states in the past).

A1. (Asymmetric Adaptation). The reference wage r_t evolves according to:

$$r_t = \begin{cases} \alpha^+ w_{t-1} + (1-\alpha^+)r_{t-1} & \text{if } w_{t-1} > r_{t-1} \\ \alpha^- w_{t-1} + (1-\alpha^-)r_{t-1} & \text{if } w_{t-1} \leq r_{t-1}, \end{cases} \tag{2}$$

where r_0 is given, and $\boldsymbol{\alpha} = (\alpha^-, \alpha^+) \in [0,1]^2$ with $\alpha^+ \geq \alpha^-$.

The parameter α denotes the worker's subjective *speed of adaptation*. The higher α the more weight is given on the past wage w_{t-1} relative to the last reference wage r_{t-1}; that is, a higher α implies a faster adaptation of the reference wage to the most recent wage received. If $\alpha = 0$ there is *no adaptation* while if $\alpha = 1$ adaptation is *immediate*. If $\alpha^- = \alpha^+ = \alpha \in (0,1)$, then it will take more than one employment period for the worker to adapt their reference wage completely to the past wage: i.e. adaptation will be *partial*, but still symmetric. Finally, if $\alpha^+ > \alpha^-$ adaptation will be *asymmetric*, and the worker will adapt more rapidly to wage gifts (gains) than to unfair wages (losses) over time.

3   Asymmetric Intensity and Persistence of Reciprocity

Consider now an initial situation in which the employed worker is paid their reference wage $w_t = r_t$ and exerts normal effort $\tilde{e}_t = \tilde{e}^n$. The analysis that follows characterise the asymmetries in *intensity* and *persistence* of the worker's reciprocity responses to equivalent-sized wage rises and cuts. In particular, consider an unanticipated and permanent wage change of $\pm X\%$ in period $\tau \equiv t+1$, so that the worker will be paid the wage $w_\tau = w_t(1 \pm X\%)$ for all $t \geq \tau$. The following proposition establishes the dynamics of the worker's reciprocity response.

Proposition 1. *Given a wage change in period $\tau = t+1$:*

a) *if $w_\tau > w_t$ and $\alpha^+ \in (0,1]$, then $\tilde{e}_\tau = \tilde{e}(w_\tau, r_\tau)^+ > \tilde{e}^n$ and for all $t > \tau$, $r_t \nearrow w_\tau$ and $\tilde{e}_t \searrow \tilde{e}^n$;*

b) *if $w_\tau < w_t$ and $\alpha^- \in (0,1]$, then $\tilde{e}_\tau = \tilde{e}(w_\tau, r_\tau, \lambda)^- < \tilde{e}^n$ and for all $t > \tau$, $r_t \searrow w_\tau$ and $\tilde{e}_t \nearrow \tilde{e}^n$.*

Consider first the effort response in the period of the wage change: the worker positively reciprocates a wage gift with supra-normal effort $\tilde{e}(w_\tau, r_\tau)^+ > \tilde{e}^n$; and negatively reciprocates a wage cut with sub-normal effort $\tilde{e}(w_\tau, r_\tau, \lambda)^- < \tilde{e}^n$. However, if the worker is loss averse this effort response is asymmetric: the negative reciprocity response to unfair wage cuts is stronger than the positive reciprocity response to wage increases perceived as gifts. This property of the worker's effort function (1) is recalled in the following corollary:

Corollary 1. *(Asymmetric Intensity, Dickson and Fongoni (2016, Theorem 1)). If the worker is loss averse: $\lambda > 1$, then*

$$\frac{\lim_{w \nearrow r} \tilde{e}_w(w_\tau, r_\tau, \lambda)^-}{\lim_{w \searrow r} \tilde{e}_w(w_\tau, r_\tau)^+} = \lambda > 1.$$

Next consider the dynamics of the worker's reciprocity as established in Proposition 1 for all $t > \tau$. First notice that due to reference wage adaptation, in both cases $a)$ and $b)$, the worker will eventually adapt their wage entitlement to the new wage w_τ, implying that effort will eventually converge back to the normal level $\tilde{e}^n$ that preceded the wage change. This result formally demonstrates that, if workers are characterised by adaptation as in (2), reciprocity is essentially temporary. However if adaptation is asymmetric because the worker adapts more rapidly to wage increases as opposed to wage cuts, then negative reciprocity will be also more persistent than positive reciprocity.

Corollary 2. *(Asymmetric Persistence). If adaptation is asymmetric: $\alpha^+ > \alpha^-$, then the convergence of $\tilde{e}(w_t, r_t)^+ \searrow \tilde{e}^n$ is faster than the convergence of $\tilde{e}(w_t, r_t, \lambda)^- \nearrow \tilde{e}^n$.*

These theoretical predictions are illustrated in Figure 1, which plots the dynamics of the worker's effort function (1) in response to a wage change of $\pm 10\%$ in period $\tau = 1$, subject to reference wage adaptation (2) for a set of (α^+, α^-).[5] As established in Corollary
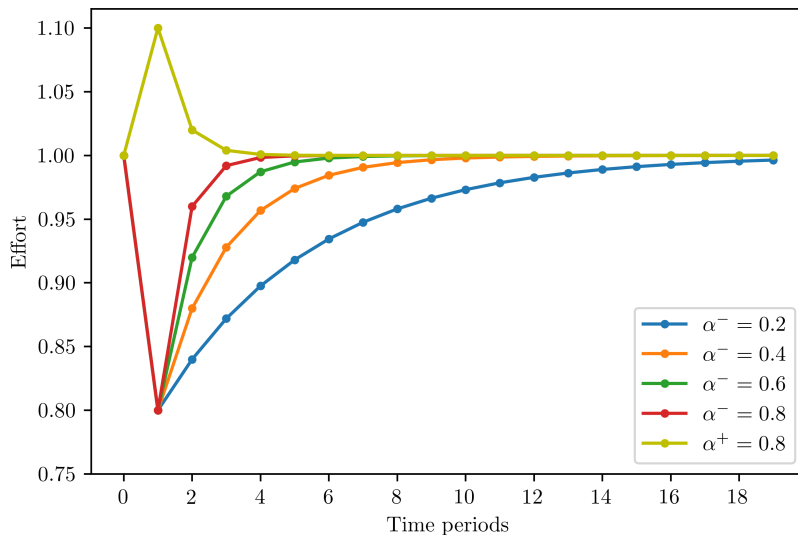

Figure 1:
Reciprocity Dynamics

1, due to the worker being loss averse $\lambda > 1$, the negative reciprocity response to a wage cut of 10% is two times stronger than the positive reciprocity response to an equivalent-sized wage increase. Moreover, as established in Corollary 2, the slower the worker's adaptation to wage cuts, the longer the persistence of sub-normal effort. In fact, lower values of α^- mean that, even if the worker will eventually adapt to the lower wage, they will perceive the loss induced by a 10% wage cut for longer, which implies that their negative reciprocity response will be more persistent. The related dynamics of the reference wage is illustrated in Figure 2.

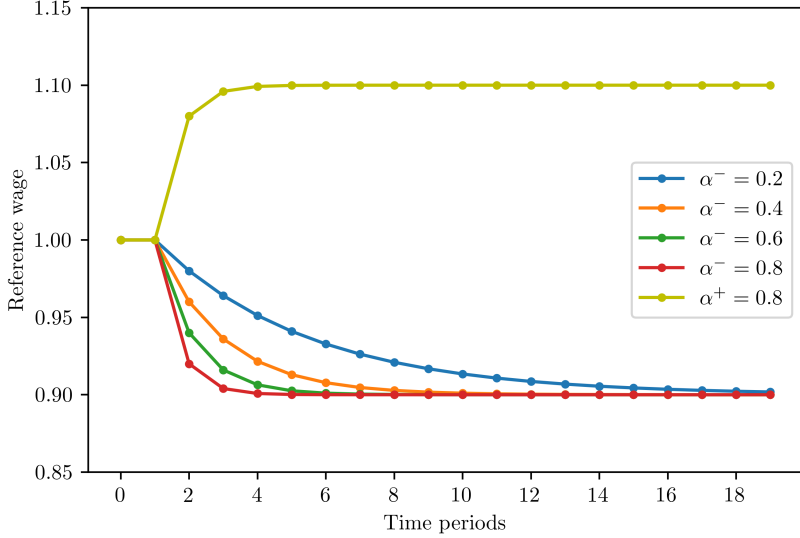[5]In this simulation: $\tilde{e}^n$ and η are set to 1; $\lambda = 2$; and $w_0 = r_0 = 1$.

Figure 2:
Reference Wage Dynamics

4 Conclusions

This paper presented a simple model of workers' reciprocity in which the negative reciprocity response to wage cuts is not only stronger, but also more persistent, than their positive reciprocity response to equivalent-sized wage rises. Moreover the analysis formally established that the stronger intensity of negative reciprocity is driven by the worker being loss averse (Dickson and Fongoni, 2016), while the longer persistence is driven by the slower adaptation of the worker to wage changes that are perceived as unfair.

The analysis of this paper highlights two additional avenues for future research. First, in the spirit of Sliwka and Werner (2017), it will be interesting to design and conduct a laboratory experiment to test for the predictions of Corollary 1 and 2, investigating the dynamics of both positive and negative reciprocity subject to a variety of increasing and decreasing wage profiles. Second, in the spirit of Dickson and Fongoni (2016) and Macera and te Velde (2018), it will also be relevant to study the optimal wage policy of a firm in response to these asymmetries, from both a positive and normative perspective. The author has already started investigating in both directions.

Appendix

Proof of Proposition 1. To prove this statement it is sufficient to show that for all $t \in [\tau, \infty)$ the linear dynamical system for r_t has a unique, and globally stable, steady state. Express (2) as: $r_{t+1} = (1 - \alpha^s)r_t + \alpha^s w_\tau = g(r_t)$, r_τ, w_τ given, where $s \in \{-, +\}$. The steady state is the value of r^* such that $r^* = g(r^*)$, that is, $r^* = w_\tau$. Global asymptotic stability is readily established by noticing that $(1 - \alpha^s) < 1$. Hence: $\lim_{t \to \infty} \tilde{e}(w_t, r_t, \lambda) = \tilde{e}(w_\tau, r^*, \lambda) = \tilde{e}^n$. ∎

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