

Schnytzer, Adi; Westreich, Sara

**Working Paper**

## False consciousness in financial markets: Or is it in ivory towers?

Working Paper, No. 2011-07

**Provided in Cooperation with:**

Department of Economics, Bar-Ilan University

*Suggested Citation:* Schnytzer, Adi; Westreich, Sara (2009) : False consciousness in financial markets: Or is it in ivory towers?, Working Paper, No. 2011-07, Bar-Ilan University, Department of Economics, Ramat-Gan

This Version is available at:

<https://hdl.handle.net/10419/96006>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# False Consciousness in Financial Markets: Or is it in Ivory Towers?

By

Adi Schnytzer and Sara Westreich<sup>1</sup>

December, 2009

## Abstract

In general, models in finance assume that investors are risk averse. An example of such a recent model is the pioneering work of Aumann and Serrano, which presents an economic index of riskiness of gambles which is independent of wealth and holds (as might be understood from the adjective “economic”) for exclusively risk averse investors. In their paper, they discuss gambles with positive expected returns which will be accepted or rejected by agents with different levels of risk aversion. The question never asked by the authors (and in most of the finance literature) is: Who is offering these attractive gambles? To arrive at an answer, we extend the Aumann-Serrano risk index in such a way that it accommodates gambles with either positive or negative expectations and is thus suitable for both the risk averse and risk lovers. Once we allow for the existence of risk lovers, it may be shown that in financial markets, many gambles with negative expectations are taken either knowingly or unknowingly so that there are always people that act as if they are risk lovers. The paper concludes with a brief discussion of the implications of our result, in particular that gambling is by no means restricted to the casino or the track.

(*The Journal of Gambling Business and Economics*, Volume 4, no. 1, 2010, pp. 19-30.)

## 1 Introduction

The current financial crisis has raised many questions surrounding the arguably excessive risks taken by various agents in financial markets in recent years. After all, it is not often that banks the size of Bear Stearns and Lehmann Brothers go under in the absence of even a rush on banks. And part of the problem is surely the cognitive dissonance that has accompanied the crash. This reaction is largely due to the fact that gambling is supposed to be carried out in casinos and at the track, while investment goes on in the stock, commodity,

---

<sup>1</sup> Departments of Economics and Logistics, respectively, Bar Ilan University, Israel.

currency, real estate and other "genuine" financial markets, where "investment" implies that the agents are risk averse. An agent is generally defined as risk averse if she would not accept any gamble with zero or negative expected return. And gambles are generally defined as sums or distributions of the products of possible outcomes and the probabilities of their occurrence at a given time. And presumably, were investors provided with accurate expected returns of all gambles offered them in any given market, the vast majority may well demonstrate risk averse behavior, although this turns out to be an empirically un-testable hypothesis. The purpose of this paper is to demonstrate that, as soon as the existence of risk loving agents is permitted in theory, most of the financial markets we know today must contain them in practice.

We do so by showing that for well-defined gambles which are independent of other gambles, if one of the agents (either the one taking or the one offering the gamble) is risk averse, the other must be risk loving. Either that, or both are risk neutral. We call this the **Theorem of Risk Balance**. But if this is so, why do these markets exist and flourish? We begin with one obvious answer which need not be dealt with further in this paper: In many organizations which provide agents for financial markets, the incentive structure may not be consistent with risk averse transactions. Thus, the employee receives a large bonus if his risky bet wins while the risk averse owner of the firm foots the bill if it does not. The rogue traders who have made front page news during the past decade are merely extreme examples, *inter alia*, of this phenomenon at work. Less dramatically, in most cases of managed funds known to the authors, the manager shares in profits from investment (if not also the principle) and does not share in losses.

More important for our purposes is the fact that objective probabilities of outcomes are almost never known in any financial markets (casinos and perhaps lotteries being the ironic exceptions) and the outcomes themselves are rarely known. Thus, if Mary buys a stock today she has no idea what it might be worth next Monday let alone what probabilities to attach to various possible outcomes. And if John sells an option today, he knows that he can gain at most the premium from the sale but has no way to calculate expected losses. This, of course, follows directly from the assumed absence of free lunches in economics. In this case, market agents suffer from false consciousness because, believe as they may that they are risk averse they have no way to accept or reject this hypothesis.

But there is an alternative story that must be considered. Perhaps many participants in financial markets are knowingly risk lovers! In other words, in preference to casinos and the track, they prefer the higher risk gambles offered by, for example, selling naked options. This is an alternative ruled out by academics in economics and finance, perhaps because they truly believe that no one could possibly be risk loving, or could it be that they simply prefer the

calculus of “well-behaved” concave utility functions in their modeling? Either way, in this case, false consciousness would reside in the ivory tower.

A modern text demonstrates the problem well:<sup>2</sup> To determine whether students understand the difference between speculation (which is presumed compatible with risk aversion, since speculation, unlike gambling, is a socially acceptable feature of financial markets) and gambling (risk loving behavior and a “bad” thing), they are asked whether a US investor who faces exchange rate risk when buying UK T-bills is engaged in speculation or gambling. The last two sentences of their answer – after explaining what is involved in the mechanics of the trade – are: *Therefore, if the investor expects favorable exchange rate movements, the UK bill is a speculative investment. Otherwise, it is a gamble.* But, of course, nowhere in the remaining nine hundred-plus pages of the book, where gambling is never mentioned again, are students informed how to calculate expected returns from investments involving exchange rate risk and thus there is no way of applying this tautology in the real world. And they are not informed because the authors know well that according to financial theory there is no knowable way to predict movements in foreign exchange with any accuracy.

We proceed as follows. In the next section, we take the economic model of riskiness developed by Aumann and Serrano, 2007 (hereafter AS) and extend it to permit the existence of risk lovers. Our purpose is to discover whether there is a connection between risk averse and risk loving traders in financial markets once such a connection is no longer *a priori* ruled out as by AS and most other authors. We shall show that once the index is generalized it does indeed suggest a compelling connection between risk averse and risk loving traders. We call this result the *Theorem of Risk Balance* and conclude the paper with a brief discussion of its meaning and application to real financial markets.

## 2 Generalization of the Aumann and Serrano Index of Riskiness

Following [AS]<sup>3</sup>, we introduce and discuss the notion of a *generalized index of economic riskiness*, with no *a priori* assumptions about attitudes toward risk. A *utility function* is

---

<sup>2</sup> See Brodie, Kane and Marcus (2009), pp. 158, 186.

<sup>3</sup> For an alternative approach to the derivation of the [AS] index, see Hart (2008).

a strictly monotonic twice continuously differentiable function  $u$  defined over the entire line. We normalize  $u$  so that

$$u(0) = 0 \quad \text{and} \quad u'(0) = 1 \quad (1)$$

If  $u$  is concave then an agent with a utility function  $u$  is risk averse, while if  $u$  is convex, then an agent with a utility function  $u$  is risk lover.

The following definition is due to Arrow (1965 and 1971) and Pratt (1964):

**Definition 1.1** *The coefficient of absolute risk of an agent  $i$  with utility function  $u_i$  and wealth  $w$  is given by:*

$$\rho_i(w) = \rho_i(w, u_i) = -u_i''(w)/u_i'(w)$$

Note  $u_i(x)$  is concave in a neighborhood of  $w$  if and only if  $\rho_i(w) > 0$ , while if it is convex if and only if  $\rho_i(w) < 0$ .

Along the lines of [AS, Lemma 2,3] we show :

**Lemma 1.2** *Let agents  $i$  and  $j$  have normalized utility functions  $u_i$  and  $u_j$  and Arrow-Pratt coefficients  $\rho_i$  and  $\rho_j$  of absolute risk aversion. Then*

1. *For each  $\delta > 0$ , suppose that  $\rho_i(w) > \rho_j(w)$  at each  $w$  with  $|w| < \delta$ . Then  $u_i(w) < u_j(w)$  whenever  $0 \neq |w| < \delta$ .*
2. *If  $\rho_i(w) \leq \rho_j(w)$  for all  $w$ , then  $u_i(w) \geq u_j(w)$  for all  $w$ .*

**Proof.** 1. Let  $|y| < \delta$ . If  $y > 0$ . Then by (1),

$$\begin{aligned} \ln u_i'(y) &= \ln u_i'(y) - \ln u_i'(0) = \int_0^y (\ln u_i'(z))' dz = \int_0^y u_i''(z)/u_i'(z) dz \\ &= \int_0^y -\rho_i(z) dz < \int_0^y -\rho_j(z) dz = \ln u_j'(y) \end{aligned}$$

If  $y < 0$  then the inequality is reversed by the same arguments. Thus,  $\ln u_i'(y) \geq \ln u_j'(y)$  whenever  $y \geq 0$ , so also  $u_i'(y) \geq u_j'(y)$  whenever  $y \geq 0$ . So if  $w > 0$  then by (1)

$$u_i(w) = \int_0^w u_i'(y) dy < \int_0^w u_j'(y) dy = u_j(w)$$

and similarly by using the reverse signs, when  $w < 0$ .

2. In parallel to the first part, with  $i$  and  $j$  interchanged, strict inequalities are replaced by weak inequalities and the restriction to  $|w| < \delta$  is eliminated. QED

Let agent  $i$  have utility function  $u_i$ , and let  $w$  be a real number. We say that  $i$  *accepts*  $g$  at  $w$  if  $Eu_i(w+g) > u_i(w)$ , where  $E$  stands for "expectation", otherwise,  $i$  *rejects*  $g$  at  $w$ . We show:

**Proposition 1.3** *Let agents  $i$  and  $j$  have normalized utility functions  $u_i$  and  $u_j$  and Arrow-Pratt coefficients  $\rho_i$  and  $\rho_j$  of absolute risk aversion. If  $\rho_i(w_i) > \rho_j(w_j)$  then there is a gamble  $g$  that  $j$  accepts at  $w_j$  and  $i$  rejects at  $w_i$ .*

**Proof.** Without loss of generality assume  $w_i = w_j = 0$ , so  $\rho_i(0) > \rho_j(0)$ . Since  $u_i$  and  $u_j$  are twice continuously differentiable it follows that there is a  $\delta > 0$  so that  $\rho_i(w) > \rho_j(w)$  for all  $|w| < \delta$ . Moreover, for  $\delta$  small enough  $u_i$  and  $u_j$  are each either concave or convex in the interval  $(-\delta, \delta)$ . It follows from Def.1.1 that if  $u_j$  is concave then  $\rho_i(w) > \rho_j(w) > 0$  and so  $u_i$  is concave as well, and if  $u_i$  is convex so is  $u_j$ . Now, by Lemma 1.2.1,

$$u_i(w) < u_j(w) \quad \text{whenever } 0 \neq |w| < \delta \quad (2)$$

(I) Assume first that  $u_j$  is concave. Choose  $\varepsilon$  with  $0 \leq \varepsilon \leq \delta/2$ . For  $0 \leq x \leq \varepsilon$  and  $k = i, j$ , set

$$f_k(x) := \frac{1}{2}u_k(x-\varepsilon) + \frac{1}{2}u_k(x+\varepsilon)$$

By (2),

$$f_i(x) < f_j(x) \text{ for all } x \quad (3)$$

By (3), concavity of  $u_j$ , and (1),

$$f_i(0) < f_j(0) < u_j(0) = 0.$$

On the other hand, by monotonicity of the utilities,

$$f_i(\varepsilon) = \frac{1}{2}u_i(2\varepsilon) > \frac{1}{2}u_i(0) = 0$$

Since  $f_i$  is continuous, it follows that  $f_i(y) = 0$  for some  $0 < y < \varepsilon$  and so by (3),  $f_j(y) > 0$ .

So if  $\eta > 0$  is sufficiently small then  $y - \eta > 0$  and

$$f_i(y - \eta) < 0 < f_j(y - \eta)$$

Let  $g$  be the half-half gamble yielding  $-\varepsilon + y - \eta$  or  $\varepsilon + y - \eta$ . Then

$$Eu_i(g) = f_i(y - \eta) < 0 < f_j(y - \eta) = Eu_j(g)$$

Hence  $j$  accepts  $g$  at 0 while  $i$  rejects it.

(II) Now assume that  $u_i$  is convex. For  $k = i, j$ , define  $\tilde{u}_k$  by

$$\tilde{u}_k(x) = -u_k(-x)$$

Then

$$\tilde{u}_k(0) = 0, \tilde{u}_k'(x) = u_k'(-x) > 0, \tilde{u}_k'(0) = 1 \text{ and } \tilde{u}_k''(x) = -u_k''(-x).$$

Moreover, by (2),

$$\tilde{u}_j(w) < \tilde{u}_i(w) \quad \text{whenever } 0 \neq |w| < \delta$$

Since  $\tilde{u}_i$  is concave in the interval  $(-\delta, \delta)$ , we are in the same situation as in (I), with  $i$  and  $j$  interchanged, thus there is a gamble  $g$  so that

$$E\tilde{u}_j(g) < 0 < E\tilde{u}_i(g)$$

Take the gamble  $-g$ , then

$$Eu_i(-g) = -E\tilde{u}_i(g) < 0 < -E\tilde{u}_j(g) = Eu_j(-g)$$

Hence  $j$  accepts  $-g$  at 0 while  $i$  rejects it.

(III) Finally assume  $u_i$  is concave and  $u_j$  is convex. This case is the simplest. Let  $g$  be the half-half gamble yielding  $-\varepsilon$  or  $\varepsilon$ . Then

$$Eu_i(g) < 0 < Eu_j(g)$$

Thus  $i$  rejects  $g$  and  $j$  accepts it.

For arbitrary  $w_i$  and  $w_j$ , define  $u_i(x)$  by  $u_i^*(x + w_i)$  and  $u_j(x) = u_j^*(x + w_j)$  and apply

the following to  $u_i^*$  and  $u_j^*$ . QED

**Definition 1.4** Call  $i$  at least risk averse or no more risk loving than  $j$  (written  $i \succeq j$ ) if for all levels  $w_i$  and  $w_j$  of wealth,  $j$  accepts at  $w_j$  any gamble that  $i$  accepts at  $w_i$ . Call  $i$  more risk averse or less risk loving than  $j$  (written  $i \succ j$ ) if  $i \succeq j$  and  $j \not\succeq i$ .<sup>4</sup>

As a corollary of Prop.1.3 we have:

**Corollary 1.5** Given agents  $i$  and  $j$ , then

$$i \succeq j \iff r_i(w_i) \geq r_j(w_j)$$

for all  $w_i$  and  $w_j$ .

**Proof.** Assume  $i \succeq j$  and assume there are  $w_i$  and  $w_j$  with  $\rho_i(w_i) < \rho_j(w_j)$ . By Prop.1.3, there is a gamble  $g$  that  $i$  accepts and  $j$  rejects, a contradiction. So  $\rho_i(w_i) \geq \rho_j(w_j)$  for all  $w_i, w_j$ .

Assume now  $\rho_i(w_i) \geq \rho_j(w_j)$  for all  $w_i, w_j$ . We wish to show that for all  $w_i$  and  $w_j$  and any gamble  $g$ , if  $i$  accepts  $g$  at  $w_i$  then  $j$  accepts  $g$  at  $w_j$ . Without loss of generality assume  $w_i = w_j = 0$ . Then Lemma 1.2.2 with  $i$  and  $j$  interchanged implies  $u_j(w) \geq u_i(w)$  for all  $w$ . Hence  $Eu_j(g) \geq Eu_i(g)$  for all  $g$  implying the desired result. QED

**Definition 1.6** An agent is said to have Constant Absolute Risk (CAR) utility function if his normalized utility function  $u(x)$  is given by

$$u_\alpha(x) = \begin{cases} \alpha^{-1}(1 - e^{-\alpha x}), & \alpha \neq 0 \\ x & \alpha = 0 \end{cases}$$

If  $\alpha > 0$  then the agent is risk-averse with a CARA utility function, while if  $\alpha < 0$  then the agent is risk-loving with a CARL - Constant Absolute Risk-Loving - utility function. If  $\alpha = 0$  then the agent is risk neutral. The notion of "CAR" is justified since for any  $\alpha$ , the coefficient of absolute risk  $\rho$  defined in Def.1.1, satisfies  $\rho(w) = \alpha$  for all  $w$ , that is, the

---

<sup>4</sup> Note that in [AS] the above is defined for risk averse agents only, and is denoted by " $i$  is at least as risk averse as  $j$ ".



Arrow-Pratt coefficient is a constant that does not depend on  $w$ . We have thus a sheaf of functions  $u_\alpha$  satisfying for all  $x$ :

$$u_\alpha(x) \text{ is continuous at } \alpha = 0.$$

To see this, we need to show that for all  $x$ ,  $\lim_{\alpha \rightarrow 0} u_\alpha(x) = x$ , where we consider the two sided limit. Now, if  $x = 0$  then for all  $\alpha$ ,  $u_\alpha(x) = x$  and if  $x \neq 0$  then

$$\lim_{\alpha \rightarrow 0} \alpha^{-1}(1 - e^{-\alpha x}) = \lim_{\alpha \rightarrow 0} x e^{-\alpha x} = x$$

Given any  $\beta$ , observe that

$$Eu_{-\beta}(g) = -Eu_\beta(-g) \quad (4)$$

Indeed, assume  $g$  results in  $\{x_1, \dots, x_n\}$  with respective probabilities  $p_1, \dots, p_n$ . Then

$$Eu_{-\beta}(g) = \sum p_i u_{-\beta}(x_i) = \sum p_i (-\beta)^{-1} (1 - e^{\beta x_i}) = -Eu_\beta(-g)$$

The CARA version of following proposition is proved in [AS, Prop.4.1]. We state here the general case.

**Proposition 1.7** *An agent  $i$  has CAR utility function if and only if for any gamble  $g$  and any two wealth levels,  $i$  either accepts  $g$  at both wealth levels, or rejects  $g$  at both wealth levels.*

**Proof.** Any CAR utility function  $u_\alpha$  accepts  $g$  if and only if  $-Ee^{\alpha(g+w)} > -e^{-\alpha w}$ , that is if and only if  $Ee^{-\alpha g} > 1$  which is independent of  $w$ . Conversely, assume an agent  $i$  so that  $\rho_i(w_*) < \rho_i(w_*)$  for wealth levels  $w, w_*$ . If  $\rho_i(w) > \rho_i(w_*) > 0$  then we can follow the proof at [AS]. The proof there is based on the formula  $\rho(w) = \lim_{\delta \rightarrow 0} (p_\delta(w) - 1/2) / \delta$  where  $p_\delta(w)$  is that  $p$  for which  $i$  is indifferent at  $w$  between taking and not taking the gamble yielding  $\pm \delta$  with probabilities  $p$  and  $1-p$  respectively. (This formula can be found in e.g. Aumann and Kurz (1977), Section 6). It is then used to construct another gamble which is rejected by  $i$  at  $w$  but accepted at  $w_*$ .

If  $\rho_i(w) < 0$ , then as in 1.3, define  $\tilde{u}_i(x) = -u_i(-x)$ . Then  $\rho_i(\tilde{u}_i, w)$  is positive and we have a gamble  $g$  accepted at one level and rejected at the other for  $\tilde{u}_i$ . Replacing  $g$  by  $-g$  concludes the proof for this case.

If  $\rho_i(w_*) < 0 < \rho_i(w)$  then for  $\delta$  small enough a half-half gamble resulting  $\pm \delta$  will be accepted at  $w_*$  and rejected at  $w$ . QED

The next theorem verifies the existence of the general index for the following class of gambles. A gamble  $g$  is *gameable* if it results in possible losses and possible gains. If  $g$  has a continuous distribution function, then it is gameable if it is bounded from above and below, that is, its distribution function is truncated.

**Theorem 1.8** *Let  $g$  be a gameable gamble. Then there exists a unique number  $\alpha$ , so that, for any wealth, a person with utility function  $u_\alpha$  is indifferent between taking and not taking  $g$ . In other words, the CAR utility function  $u_\alpha$  satisfies for all  $x$ ,*

$$Eu_\alpha(g+x) = u_\alpha(x).$$

Moreover,  $\alpha$  is positive (negative) if and only if  $Eg$  is positive (resp. negative),

**Proof.** Define a map  $f(\alpha)$  by

$$f(\alpha) = 1 - Ee^{-\alpha g} \tag{5}$$

Since  $g$  is gameable it follows first that  $f(\alpha)$  is defined for all  $\alpha$ , and then, since it results positive and negative values, we have  $\lim_{\alpha \rightarrow -\infty} f(\alpha) = -\infty$  and  $\lim_{\alpha \rightarrow \infty} f(\alpha) = -\infty$ .

Now,

$$(i) f(0) = 0 \quad (ii) f'(0) = Eg \quad (iii) f''(\alpha) < 0 \quad \forall \alpha$$

By (iii)  $f$  is concave, hence has at most two roots, one of which is zero. If  $Eg > 0$  then  $f$  increases at 0, hence the second root  $\alpha$  is positive. If  $Eg < 0$  then  $f$  decreases at 0, hence the second root is negative. If  $Eg = 0$  then  $\alpha = 0$  is the only root.

To show the last part note that if  $\alpha \neq 0$  we have by definition

$$Eu_\alpha(g) = \alpha^{-1}(1 - Ee^{-\alpha g}) = 0$$

It follows that for all  $x$ ,

$$Eu_\alpha(x+g) = \alpha^{-1}(1 - Ee^{-\alpha(x+g)}) = \alpha^{-1}(1 - e^{-\alpha x} Ee^{-\alpha g}) = u_\alpha(x)$$

Also if  $\alpha = 0$ , then by the proof above necessarily  $Eg = 0$  and so  $Eu_0(g) = Eg = 0$  and

$Eu_0(g+x) = x = u_0(x)$ . QED

**Remark** As pointed out by Schulze (2008), [hereafter Sc], for an unbounded distribution function  $u(x)$ , the map  $f(\alpha)$  is not necessarily defined for all  $\alpha$ . (In [Sc, Ex 3] it is defined for  $\alpha = 0$  only). In this case we cannot apply the proof of Th. 1.8. In [Sc] it is shown that  $Ee^{-\alpha g}$  is the Laplace transform of  $u(x)$ . Since we consider both positive and negative values of  $\alpha$ , we use the two-sided Laplace transform. Thus  $f(\alpha)$  is defined for all real  $\alpha$  in the region of convergence of  $u(x)$ . If this region of convergence is wide enough, then the proof is still applicable. The question, which distributions admit the appropriate range of convergence, is beyond the scope of this paper.

**Definition 1.9** *Given a gamble  $g$ , denote the number  $\alpha$  obtained in Th.1.8 by the upper limit of taking  $g$ .*

Note that if we replace  $g$  by  $Ng$  then the upper limit of  $Ng$  is the corresponding root of (5) where  $g$  is replaced by  $Ng$ , and thus equals  $N^{-1}\alpha$ .

**Remark 1.10** *Given a gamble  $g$  where  $Eg > 0$ , let its upper limit  $\alpha$  be as in Def.1.9. Then  $\alpha^{-1}$  is the index of riskiness of  $g$  as defined in [AS].*

The notation upper limit is justified by the following corollary.

**Corollary 1.11** *Let  $\alpha$  be the upper limit of taking a gamble  $g$ . Then:*

1. *If  $Eg > 0$  then all CARL accept  $g$  and a CARA person with a utility function  $u_\beta$  accepts  $g$  if and only if*

$$0 < \beta < \alpha$$

2. *If  $Eg < 0$  then all CARA reject  $g$  and a CARL person with a utility function  $u_\beta$  accepts  $g$  if and only if*

$$\beta < \alpha < 0$$

3. *If  $E(g) = 0$  the all CARA people reject  $g$  while all CARL people accept  $g$ .*

**Proof.** 1. Assume  $Eg > 0$  and let  $0 < \beta < \alpha$ . Note that for all  $w$ ,  $a = r(w, u_a)$  and  $\beta = \rho(w, u_\beta)$  as defined in Def.1.1. By Lemma 1.2.2,  $\beta < \alpha$  implies  $u_\beta(x) > u_\alpha(x)$  for all  $x > 0$ . Hence by definition of the upper limit  $\alpha$ ,

$$Eu_\beta(g) > Eu_\alpha(g) = u_\alpha(0) = 0$$

This implies that a CARA person with a utility function  $u_\beta$  accepts  $g$ . Similarly, if  $\beta > \alpha$  then a  $\beta$ -CARA person will not accept  $g$ .

2. If  $Eg < 0$  then by Th.1.8,  $\alpha < 0$ , and for  $\beta < \alpha < 0$  we have  $0 < -\alpha < -\beta$ . Since  $E(-g) > 0$  this implies by (4) and part 1:

$$-Eu_\beta(g) = Eu_{-\beta}(-g) < Eu_{-\alpha}(-g) = -Eu_\alpha(g) = 0$$

Hence  $Eu_\beta(g) > 0$  and a CARL person with a utility function  $u_\beta$  accepts  $g$ . QED

We propose here a general index of economic riskiness. Given a gamble  $g$  and its upper limit  $\alpha$ , define  $Q(g)$  by

$$Q(g) = e^{-\alpha} \tag{6}$$

It is straightforward to check the following properties:

**Theorem 1.12** *The generalized index  $Q(g)$  given in (6) satisfies:*

1.  $Q(g) > 0$  for all  $g$ .
2. If  $Eg > 0$  then  $Q(g) < 1$  and if  $Eg < 0$  then  $Q(g) > 1$ . When  $Eg = 0$  then  $Q(g) = 1$ .
3.  $Q(Ng) = Q(g)^{1/N}$ . In particular

$$Q(-g) = Q(g)^{-1}$$

**Proof.** 1. is clear. 2. follows directly from Th.1.8.

3. By Remark 1.9, the upper limit of taking  $Ng$  is  $N^{-1}\alpha$ , where  $\alpha$  is the upper limit of taking  $g$ . Hence by (7),

$$Q(Ng) = e^{-N^{-1}\alpha} = Q(g)^{1/N}$$

QED

### 3 Discussion and Conclusions

Property 3 of Theorem 1.12 may be termed the *Risk Balance Theorem*<sup>5</sup> and its implications are simply put: One can think of any financial transaction as someone buying a gamble, which at the same time must be sold by someone else. Thus, while one party in the transaction faces  $g$ , the other faces  $-g$ . In any transaction, if buying is very risky, selling must have little risk, and vice versa. So long as  $g$  is not dependent upon other gambles (as, for instance, selling a naked call to an agent who does not hold the underlying), one of the agents must accept a gamble with negative expected return. The case of transacting an asset of zero expected return is also interesting, albeit perhaps less so, as one could argue that buying such an asset is not particularly riskier or less risky than selling it.

At first glance, one might even be tempted to argue that, risk neutral agents aside, half of all traders in financial markets must be risk lovers, but this would be to assume that one gamble is independent of all others and this is clearly false. Thus, suppose that John sells Mary 1000 out-of-the-money put options on IBM stock for the end of next year. Suppose further, that John somehow knows that his gamble has a positive expected return for the entire period until expiry. He is hence accepting a gamble with expected positive return with respect to this trade. But what of Mary? Her trade has a negative expected return, but does that make Mary a risk lover? Not necessarily. If she owns 1000 IBM shares she has simply bought insurance against a sharp fall in the market and her overall investment (purchase of stock *and* puts) may well have a positive expected return, making her risk averse *on average*. Accordingly, our result *vis a vis* trades will not be as dramatic as it may seem. But to the extent that most traders in commodity markets never take deliver or produce the commodity in which they trade and to the extent that most traders in options markets do not hold or sell the underlying asset, our argument carries some weight. In other words, throughout the derivation of the risk balance result the implicit assumption was made that we are dealing either with a risk lover or a risk averse agent whereas

---

<sup>5</sup> The authors wish to thank an anonymous referee for this suggestion and its elaboration.

in reality many investors put together a portfolio whose separate elements may have variously positive and negative expectations.<sup>6</sup>

Yet this is to assume – as we have done so far – that the parameters of each gamble, the payouts and their concomitant probabilities, are known. And while this is true, agents are aware of the expectations of different gambles and, if rational<sup>7</sup>, will only ever knowingly behave as risk lovers. But, in truth, probabilities are almost never known in traditional financial markets and payouts only occasionally, so that traders may be victims of false consciousness, believing themselves to be investors (and thus, by definition, risk averse) while in reality accepting gambles with negative returns.

We are unable to distinguish between these cases since we require well-defined and gameable gambles for the derivation of risk balance and thus the question of how many genuine risk lovers are to be found in financial markets is ultimately an empirical one. It may, however, be safely concluded that the number is far from that assumed in the ivory tower, namely zero.

## 4 Bibliography

- Arrow, K. J. (1965), "Aspects of the Theory of Risk-Bearing", Helsinki: Yrjö Jahnssonin Säätiö  
--- (1971), "Essays in the Theory of Risk Bearing", Chicago: Markham Publishing Company.  
Aumann, R. J. and R. Serrano (2007), "An Economic Index of Riskiness", Discussion Paper #446, Centre for the Study of Rationality, Jerusalem.  
Brodie, Z., Kane, A. and A. J. Marcus (2009), *Investments* (8<sup>th</sup> edition), Mc. Graw Hill, New York.  
Friedman, M. and L. Savage (1948), "Utility Analysis of Choices Involving Risk," *Journal of Political Economy*, 56, No. 4 , 279-304.  
Pratt, J. (1964), "Risk Aversion in the Small and in the Large," *Econometrica*, 32, 122-136.  
Schulze, K. (2008), "How to Compute the Aumann-Serrano Index of Riskiness",  
<http://ssrn.com/abstract=1156933>.

---

<sup>6</sup> The classic paper dealing risk loving and risk averse behavior by the same agent, albeit in a very different context, is Friedman and Savage (1948).

<sup>7</sup> A consideration of the connection between the arguments presented here and those underlying behavioral finance is beyond the scope of this paper.

**Bar-Ilan University**  
**Department of Economics**  
**WORKING PAPERS**

---

- 1-01 **The Optimal Size for a Minority**  
Hillel Rapoport and Avi Weiss, January 2001.
- 2-01 **An Application of a Switching Regimes Regression to the Study of Urban Structure**  
Gershon Alperovich and Joseph Deutsch, January 2001.
- 3-01 **The Kuznets Curve and the Impact of Various Income Sources on the Link Between Inequality and Development**  
Joseph Deutsch and Jacques Silber, February 2001.
- 4-01 **International Asset Allocation: A New Perspective**  
Abraham Lioui and Patrice Poncet, February 2001.
- 5-01 **מודל המועדון והקהילה החרדית**  
יעקב רוזנברג, פברואר 2001.
- 6-01 **Multi-Generation Model of Immigrant Earnings: Theory and Application**  
Gil S. Epstein and Tikva Lecker, February 2001.
- 7-01 **Shattered Rails, Ruined Credit: Financial Fragility and Railroad Operations in the Great Depression**  
Daniel A. Schiffman, February 2001.
- 8-01 **Cooperation and Competition in a Duopoly R&D Market**  
Damiano Bruno Silipo and Avi Weiss, March 2001.
- 9-01 **A Theory of Immigration Amnesties**  
Gil S. Epstein and Avi Weiss, April 2001.
- 10-01 **Dynamic Asset Pricing With Non-Redundant Forwards**  
Abraham Lioui and Patrice Poncet, May 2001.
- 11-01 **Macroeconomic and Labor Market Impact of Russian Immigration in Israel**  
Sarit Cohen and Chang-Tai Hsieh, May 2001.

Electronic versions of the papers are available at  
[http://www.biu.ac.il/soc/ec/wp/working\\_papers.html](http://www.biu.ac.il/soc/ec/wp/working_papers.html)

- 12-01 **Network Topology and the Efficiency of Equilibrium**  
Igal Milchtaich, June 2001.
- 13-01 **General Equilibrium Pricing of Trading Strategy Risk**  
Abraham Lioui and Patrice Poncet, July 2001.
- 14-01 **Social Conformity and Child Labor**  
Shirit Katav-Herz, July 2001.
- 15-01 **Determinants of Railroad Capital Structure, 1830–1885**  
Daniel A. Schiffman, July 2001.
- 16-01 **Political-Legal Institutions and the Railroad Financing Mix, 1885–1929**  
Daniel A. Schiffman, September 2001.
- 17-01 **Macroeconomic Instability, Migration, and the Option Value of Education**  
Eliakim Katz and Hillel Rapoport, October 2001.
- 18-01 **Property Rights, Theft, and Efficiency: The Biblical Waiver of Fines in the Case of Confessed Theft**  
Eliakim Katz and Jacob Rosenberg, November 2001.
- 19-01 **Ethnic Discrimination and the Migration of Skilled Labor**  
Frédéric Docquier and Hillel Rapoport, December 2001.
- 1-02 **Can Vocational Education Improve the Wages of Minorities and Disadvantaged Groups? The Case of Israel**  
Shoshana Neuman and Adrian Ziderman, February 2002.
- 2-02 **What Can the Price Gap between Branded and Private Label Products Tell Us about Markups?**  
Robert Barsky, Mark Bergen, Shantanu Dutta, and Daniel Levy, March 2002.
- 3-02 **Holiday Price Rigidity and Cost of Price Adjustment**  
Daniel Levy, Georg Müller, Shantanu Dutta, and Mark Bergen, March 2002.
- 4-02 **Computation of Completely Mixed Equilibrium Payoffs**  
Igal Milchtaich, March 2002.
- 5-02 **Coordination and Critical Mass in a Network Market – An Experimental Evaluation**  
Amir Etziony and Avi Weiss, March 2002.



- 6-02 **Inviting Competition to Achieve Critical Mass**  
Amir Etziony and Avi Weiss, April 2002.
- 7-02 **Credibility, Pre-Production and Inviting Competition in a Network Market**  
Amir Etziony and Avi Weiss, April 2002.
- 8-02 **Brain Drain and LDCs' Growth: Winners and Losers**  
Michel Beine, Frédéric Docquier, and Hillel Rapoport, April 2002.
- 9-02 **Heterogeneity in Price Rigidity: Evidence from a Case Study Using Micro-Level Data**  
Daniel Levy, Shantanu Dutta, and Mark Bergen, April 2002.
- 10-02 **Price Flexibility in Channels of Distribution: Evidence from Scanner Data**  
Shantanu Dutta, Mark Bergen, and Daniel Levy, April 2002.
- 11-02 **Acquired Cooperation in Finite-Horizon Dynamic Games**  
Igal Milchtaich and Avi Weiss, April 2002.
- 12-02 **Cointegration in Frequency Domain**  
Daniel Levy, May 2002.
- 13-02 **Which Voting Rules Elicit Informative Voting?**  
Ruth Ben-Yashar and Igal Milchtaich, May 2002.
- 14-02 **Fertility, Non-Altruism and Economic Growth: Industrialization in the Nineteenth Century**  
Elise S. Brezis, October 2002.
- 15-02 **Changes in the Recruitment and Education of the Power Elites in Twentieth Century Western Democracies**  
Elise S. Brezis and François Crouzet, November 2002.
- 16-02 **On the Typical Spectral Shape of an Economic Variable**  
Daniel Levy and Hashem Dezhbakhsh, December 2002.
- 17-02 **International Evidence on Output Fluctuation and Shock Persistence**  
Daniel Levy and Hashem Dezhbakhsh, December 2002.
- 1-03 **Topological Conditions for Uniqueness of Equilibrium in Networks**  
Igal Milchtaich, March 2003.
- 2-03 **Is the Feldstein-Horioka Puzzle Really a Puzzle?**  
Daniel Levy, June 2003.

- 3-03 **Growth and Convergence across the US: Evidence from County-Level Data**  
Matthew Higgins, Daniel Levy, and Andrew Young, June 2003.
- 4-03 **Economic Growth and Endogenous Intergenerational Altruism**  
Hillel Rapoport and Jean-Pierre Vidal, June 2003.
- 5-03 **Remittances and Inequality: A Dynamic Migration Model**  
Frédéric Docquier and Hillel Rapoport, June 2003.
- 6-03 **Sigma Convergence Versus Beta Convergence: Evidence from U.S. County-Level Data**  
Andrew T. Young, Matthew J. Higgins, and Daniel Levy, September 2003.
- 7-03 **Managerial and Customer Costs of Price Adjustment: Direct Evidence from Industrial Markets**  
Mark J. Zbaracki, Mark Ritson, Daniel Levy, Shantanu Dutta, and Mark Bergen, September 2003.
- 8-03 **First and Second Best Voting Rules in Committees**  
Ruth Ben-Yashar and Igal Milchtaich, October 2003.
- 9-03 **Shattering the Myth of Costless Price Changes: Emerging Perspectives on Dynamic Pricing**  
Mark Bergen, Shantanu Dutta, Daniel Levy, Mark Ritson, and Mark J. Zbaracki, November 2003.
- 1-04 **Heterogeneity in Convergence Rates and Income Determination across U.S. States: Evidence from County-Level Data**  
Andrew T. Young, Matthew J. Higgins, and Daniel Levy, January 2004.
- 2-04 **"The Real Thing:" Nominal Price Rigidity of the Nickel Coke, 1886-1959**  
Daniel Levy and Andrew T. Young, February 2004.
- 3-04 **Network Effects and the Dynamics of Migration and Inequality: Theory and Evidence from Mexico**  
David McKenzie and Hillel Rapoport, March 2004.
- 4-04 **Migration Selectivity and the Evolution of Spatial Inequality**  
Ravi Kanbur and Hillel Rapoport, March 2004.
- 5-04 **Many Types of Human Capital and Many Roles in U.S. Growth: Evidence from County-Level Educational Attainment Data**  
Andrew T. Young, Daniel Levy and Matthew J. Higgins, March 2004.

- 6-04 **When Little Things Mean a Lot: On the Inefficiency of Item Pricing Laws**  
Mark Bergen, Daniel Levy, Sourav Ray, Paul H. Rubin and Benjamin Zeligler,  
May 2004.
- 7-04 **Comparative Statics of Altruism and Spite**  
Igal Milchtaich, June 2004.
- 8-04 **Asymmetric Price Adjustment in the Small: An Implication of Rational Inattention**  
Daniel Levy, Haipeng (Allan) Chen, Sourav Ray and Mark Bergen, July 2004.
- 1-05 **Private Label Price Rigidity during Holiday Periods**  
Georg Müller, Mark Bergen, Shantanu Dutta and Daniel Levy, March 2005.
- 2-05 **Asymmetric Wholesale Pricing: Theory and Evidence**  
Sourav Ray, Haipeng (Allan) Chen, Mark Bergen and Daniel Levy,  
March 2005.
- 3-05 **Beyond the Cost of Price Adjustment: Investments in Pricing Capital**  
Mark Zbaracki, Mark Bergen, Shantanu Dutta, Daniel Levy and Mark Ritson,  
May 2005.
- 4-05 **Explicit Evidence on an Implicit Contract**  
Andrew T. Young and Daniel Levy, June 2005.
- 5-05 **Popular Perceptions and Political Economy in the Contrived World of Harry Potter**  
Avichai Snir and Daniel Levy, September 2005.
- 6-05 **Growth and Convergence across the US: Evidence from County-Level Data (revised version)**  
Matthew J. Higgins, Daniel Levy, and Andrew T. Young , September 2005.
- 1-06 **Sigma Convergence Versus Beta Convergence: Evidence from U.S. County-Level Data (revised version)**  
Andrew T. Young, Matthew J. Higgins, and Daniel Levy, June 2006.
- 2-06 **Price Rigidity and Flexibility: Recent Theoretical Developments**  
Daniel Levy, September 2006.
- 3-06 **The Anatomy of a Price Cut: Discovering Organizational Sources of the Costs of Price Adjustment**  
Mark J. Zbaracki, Mark Bergen, and Daniel Levy, September 2006.

- 4-06     **Holiday Non-Price Rigidity and Cost of Adjustment**  
Georg Müller, Mark Bergen, Shantanu Dutta, and Daniel Levy.  
September 2006.
- 2008-01     **Weighted Congestion Games With Separable Preferences**  
Igal Milchtaich, October 2008.
- 2008-02     **Federal, State, and Local Governments: Evaluating their Separate Roles in US Growth**  
Andrew T. Young, Daniel Levy, and Matthew J. Higgins, December 2008.
- 2008-03     **Political Profit and the Invention of Modern Currency**  
Dror Goldberg, December 2008.
- 2008-04     **Static Stability in Games**  
Igal Milchtaich, December 2008.
- 2008-05     **Comparative Statics of Altruism and Spite**  
Igal Milchtaich, December 2008.
- 2008-06     **Abortion and Human Capital Accumulation: A Contribution to the Understanding of the Gender Gap in Education**  
Leonid V. Azarnert, December 2008.
- 2008-07     **Involuntary Integration in Public Education, Fertility and Human Capital**  
Leonid V. Azarnert, December 2008.
- 2009-01     **Inter-Ethnic Redistribution and Human Capital Investments**  
Leonid V. Azarnert, January 2009.
- 2009-02     **Group Specific Public Goods, Orchestration of Interest Groups and Free Riding**  
Gil S. Epstein and Yosef Mealem, January 2009.
- 2009-03     **Holiday Price Rigidity and Cost of Price Adjustment**  
Daniel Levy, Haipeng Chen, Georg Müller, Shantanu Dutta, and Mark Bergen,  
February 2009.
- 2009-04     **Legal Tender**  
Dror Goldberg, April 2009.
- 2009-05     **The Tax-Foundation Theory of Fiat Money**  
Dror Goldberg, April 2009.

- 2009-06      **The Inventions and Diffusion of Hyperinflatable Currency**  
Dror Goldberg, April 2009.
- 2009-07      **The Rise and Fall of America's First Bank**  
Dror Goldberg, April 2009.
- 2009-08      **Judicial Independence and the Validity of Controverted Elections**  
Raphaël Franck, April 2009.
- 2009-09      **A General Index of Inherent Risk**  
Adi Schnytzer and Sara Westreich, April 2009.
- 2009-10      **Measuring the Extent of Inside Trading in Horse Betting Markets**  
Adi Schnytzer, Martien Lamers and Vasiliki Makropoulou, April 2009.
- 2009-11      **The Impact of Insider Trading on Forecasting in a Bookmakers' Horse Betting Market**  
Adi Schnytzer, Martien Lamers and Vasiliki Makropoulou, April 2009.
- 2009-12      **Foreign Aid, Fertility and Population Growth: Evidence from Africa**  
Leonid V. Azarnert, April 2009.
- 2009-13      **A Reevaluation of the Role of Family in Immigrants' Labor Market Activity: Evidence from a Comparison of Single and Married Immigrants**  
Sarit Cohen-Goldner, Chemi Gotlibovski and Nava Kahana, May 2009.
- 2009-14      **The Efficient and Fair Approval of "Multiple-Cost-Single-Benefit" Projects Under Unilateral Information**  
Nava Kahanaa, Yosef Mealem and Shmuel Nitzan, May 2009.
- 2009-15      **Après nous le Déluge: Fertility and the Intensity of Struggle against Immigration**  
Leonid V. Azarnert, June 2009.
- 2009-16      **Is Specialization Desirable in Committee Decision Making?**  
Ruth Ben-Yashar, Winston T.H. Koh and Shmuel Nitzan, June 2009.
- 2009-17      **Framing-Based Choice: A Model of Decision-Making Under Risk**  
Kobi Kriesler and Shmuel Nitzan, June 2009.
- 2009-18      **Demystifying the 'Metric Approach to Social Compromise with the Unanimity Criterion'**  
Shmuel Nitzan, June 2009.

- 2009-19      **On the Robustness of Brain Gain Estimates**  
Michel Beine, Frédéric Docquier and Hillel Rapoport, July 2009.
- 2009-20      **Wage Mobility in Israel: The Effect of Sectoral Concentration**  
Ana Rute Cardoso, Shoshana Neuman and Adrian Ziderman, July 2009.
- 2009-21      **Intermittent Employment: Work Histories of Israeli Men and Women, 1983–1995**  
Shoshana Neuman and Adrian Ziderman, July 2009.
- 2009-22      **National Aggregates and Individual Disaffiliation: An International Study**  
Pablo Brañas-Garza, Teresa García-Muñoz and Shoshana Neuman, July 2009.
- 2009-23      **The Big Carrot: High-Stakes Incentives Revisited**  
Pablo Brañas-Garza, Teresa García-Muñoz and Shoshana Neuman, July 2009.
- 2009-24      **The Why, When and How of Immigration Amnesties**  
Gil S. Epstein and Avi Weiss, September 2009.
- 2009-25      **Documenting the Brain Drain of «la Crème de la Crème»: Three Case-Studies on International Migration at the Upper Tail of the Education Distribution**  
Frédéric Docquier and Hillel Rapoport, October 2009.
- 2009-26      **Remittances and the Brain Drain Revisited: The Microdata Show That More Educated Migrants Remit More**  
Albert Bollard, David McKenzie, Melanie Morten and Hillel Rapoport, October 2009.
- 2009-27      **Implementability of Correlated and Communication Equilibrium Outcomes in Incomplete Information Games**  
Igal Milchtaich, November 2009.
- 2010-01      **The Ultimatum Game and Expected Utility Maximization – In View of Attachment Theory**  
Shaul Almakias and Avi Weiss, January 2010.
- 2010-02      **A Model of Fault Allocation in Contract Law – Moving From Dividing Liability to Dividing Costs**  
Osnat Jacobi and Avi Weiss, January 2010.

- 2010-03        **Coordination and Critical Mass in a Network Market: An Experimental Investigation**  
Bradley J. Ruffle, Avi Weiss and Amir Etziony, February 2010.
- 2010-04        **Immigration, fertility and human capital: A model of economic decline of the West**  
Leonid V. Azarnert, April 2010.
- 2010-05        **Is Skilled Immigration Always Good for Growth in the Receiving Economy?**  
Leonid V. Azarnert, April 2010.
- 2010-06        **The Effect of Limited Search Ability on the Quality of Competitive Rent-Seeking Clubs**  
Shmuel Nitzan and Kobi Kriesler, April 2010.
- 2010-07        **Condorcet vs. Borda in Light of a Dual Majoritarian Approach**  
Eyal Baharad and Shmuel Nitzan, April 2010.
- 2010-08        **Prize Sharing in Collective Contests**  
Shmuel Nitzan and Kaoru Ueda, April 2010.
- 2010-09        **Network Topology and Equilibrium Existence in Weighted Network Congestion Games**  
Igal Milchtaich, May 2010.
- 2010-10        **The Evolution of Secularization: Cultural Transmission, Religion and Fertility Theory, Simulations and Evidence**  
Ronen Bar-El, Teresa García-Muñoz, Shoshana Neuman and Yossef Tobol, June 2010.
- 2010-11        **The Economics of Collective Brands**  
Arthur Fishman, Israel Finkelstein, Avi Simhon and Nira Yacouel, July 2010.
- 2010-12        **Interactions Between Local and Migrant Workers at the Workplace**  
Gil S. Epstein and Yosef Mealem, August 2010.
- 2010-13        **A Political Economy of the Immigrant Assimilation: Internal Dynamics**  
Gil S. Epstein and Ira N. Gang, August 2010.
- 2010-14        **Attitudes to Risk and Roulette**  
Adi Schnytzer and Sara Westreich, August 2010.

- 2010-15      **Life Satisfaction and Income Inequality**  
Paolo Verme, August 2010.
- 2010-16      **The Poverty Reduction Capacity of Private and Public Transfers in Transition**  
Paolo Verme, August 2010.
- 2010-17      **Migration and Culture**  
Gil S. Epstein and Ira N. Gang, August 2010.
- 2010-18      **Political Culture and Discrimination in Contests**  
Gil S. Epstein, Yosef Mealem and Shmuel Nitzan, October 2010.
- 2010-19      **Governing Interest Groups and Rent Dissipation**  
Gil S. Epstein and Yosef Mealem, November 2010.
- 2010-20      **Beyond Condorcet: Optimal Aggregation Rules Using Voting Records**  
Eyal Baharad, Jacob Goldberger, Moshe Koppel and Shmuel Nitzan, December 2010.
- 2010-21      **Price Points and Price Rigidity**  
Daniel Levy, Dongwon Lee, Haipeng (Allan) Chen, Robert J. Kauffman and Mark Bergen, December 2010.
- 2010-22      **Price Setting and Price Adjustment in Some European Union Countries: Introduction to the Special Issue**  
Daniel Levy and Frank Smets, December 2010.
- 2011-01      **Business as Usual: A Consumer Search Theory of Sticky Prices and Asymmetric Price Adjustment**  
Luís Cabral and Arthur Fishman, January 2011.
- 2011-02      **Emigration and democracy**  
Frédéric Docquier, Elisabetta Lodigiani, Hillel Rapoport and Maurice Schiff, January 2011.
- 2011-03      **Shrinking Goods and Sticky Prices: Theory and Evidence**  
Avichai Snir and Daniel Levy, March 2011.
- 2011-04      **Search Costs and Risky Investment in Quality**  
Arthur Fishman and Nadav Levy, March 2011.



- 2011-05      **To What Extent do Investors in a Financial Market Anchor Their Judgments? Evidence from the Hong Kong Horserace Betting Market**
- Johnnie E.V. Johnson, Shuang Liu and Adi Schnytzer, March 2011.
- 2011-06      **Attitudes to Risk and Roulette**
- Adi Schnytzer and Sara Westreich, March 2011.
- 2011-07      **False Consciousness in Financial Markets: Or is it in Ivory Towers?**
- Adi Schnytzer and Sara Westreich, March 2011.
- 2011-08      **Herding in Imperfect Betting Markets with Inside Traders**
- Adi Schnytzer and Avichai Snir, March 2011.
- 2011-09      **Painful Regret and Elation at the Track**
- Adi Schnytzer and Barbara Luppi, March 2011.
- 2011-10      **The Regression Tournament: A Novel Approach to Prediction Model Assessment**
- Adi Schnytzer and Janez Šušteršič, March 2011.
- 2011-11      **Shorting the Bear: A test of anecdotal evidence of insider trading in early stages of the sub-prime market crisis**
- Les Coleman and Adi Schnytzer, March 2011.
- 2011-12      **SP Betting as a Self-Enforcing Implicit Cartel**
- Adi Schnytzer and Avichai Snir, March 2011.
- 2011-13      **Testing for Home Team and Favorite Biases in the Australian Rules Football Fixed Odds and Point Spread Betting Markets**
- Adi Schnytzer and Guy Weinberg, March 2011.
- 2011-14      **The Impact of Insider Trading on Forecasting in a Bookmakers' Horse Betting Market**
- Adi Schnytzer, Martien Lamers and Vasiliki Makropoulou, March 2011.
- 2011-15      **The Prediction Market for the Australian Football League**
- Adi Schnytzer, March 2011.

2011-16      **Information and Attitudes to Risk at the Track**

Adi Schnytzer and Sara Westreich, March 2011.

2011-17      **Explicit Evidence on an Implicit Contract**

Andrew T. Young and Daniel Levy, March 2011.

2011-18      **Globalization, Brain Drain and Development**

Frédéric Docquier and Hillel Rapoport, March 2011.