

**VARIANCE SWAPS AND GAMMA SWAPS. THE THEORY AND
REALITY OF MODEL-FREE REPLICATION**

JACINTO MARABEL-ROMO

FUNDACIÓN DE LAS CAJAS DE AHORROS
DOCUMENTO DE TRABAJO
N° 703/2012

De conformidad con la base quinta de la convocatoria del Programa de Estímulo a la Investigación, este trabajo ha sido sometido a evaluación externa anónima de especialistas cualificados a fin de contrastar su nivel técnico.

ISSN: 1988-8767

La serie **DOCUMENTOS DE TRABAJO** incluye avances y resultados de investigaciones dentro de los programas de la Fundación de las Cajas de Ahorros.
Las opiniones son responsabilidad de los autores.

Variance Swaps and Gamma Swaps. The Theory and Reality of Model-Free Replication

Jacinto Marabel-Romo *

Resumen

En los últimos años están surgiendo nuevos activos derivados que tienen alguna medida de volatilidad como activo subyacente. Algunos de estos derivados, como los variance swaps y los gamma swaps, admiten una réplica independiente del modelo mediante una posición estática en opciones europeas y una gestión dinámica de posiciones en el activo subyacente. Este artículo estudia el marco de réplica asociado a los variance swaps y a los gamma swaps. A pesar de que la réplica independiente del modelo es un argumento prometedor, es importante considerar que para tener una réplica perfecta es necesario que se verifiquen ciertos supuestos. Este artículo se centra en las implicaciones prácticas para la gestión de los riesgos asociados a los variance swaps cuando no existe un continuo de opciones europeas disponible en el mercado y lo relaciona con las importantes pérdidas sufridas por diversas instituciones en 2008 durante la crisis financiera.

Abstract

In recent years new derivatives, that have some measure of volatility as underlying asset, are emerging. Some of these derivatives, such as the variance swaps and the gamma swaps, admit model-free replication by a static position in European options and dynamic trading of the underlying asset. This article studies the replication framework associated with variance swaps and gamma swaps. Although the model-free replication strategy is a promising argument, it is important to take into account that to have a perfect replication some assumptions must hold. This article focuses on the practical implications for the management of the risks arising from variance swaps when a continuum of European options is not available in the market and relates it with the large losses suffered by several trading desks corresponding to different financial institutions in 2008 with the international financial crisis.

Palabras clave: variance swap, gamma swap, estrategia réplica, volatilidad.

Keywords: variance swap, gamma swap, model free-replication, volatility.

JEL: G12, G13.

* BBVA e Instituto Universitario de Análisis Económico y Social, Universidad de Alcalá. Email: jacinto.marabel@bbva.com. The content of this paper represents the author's personal opinion and does not reflect the views of BBVA.

1. Introduction

As pointed out by Carr and Lee (2009), in recent years new derivatives, that have some measure of volatility as underlying asset, are emerging. Some of these derivatives, such as the variance swaps and the gamma swaps, admit model-free replication by a static position in European options and dynamic trading of the underlying asset. The variance swap is a forward contract on the annualized realized variance of a certain asset. As with all forward contracts or swaps, the fair value of variance at any time, called variance swap rate, is the delivery price that makes the swap currently have zero value. Hence, the absence of arbitrage opportunities implies that the variance swap rate equals the expected value of the realized variance under the risk-neutral probability measure. Neuberger (1994) and Dupire (1993) linked the variance swap rate with the log-contract, which is a derivative asset whose payoff at maturity is given by the logarithm of the underlying asset's price. Subsequently, Carr and Madan (1998) and Demeterfi et al. (1999), assuming continuity in the evolution of the underlying asset's price, showed that it is possible to replicate the variance swap rate from a static position on European options and a dynamic position on the underlying asset. The volatility exposure of a European option decreases as the spot price moves away from the strike price. Conversely, the variance swap allows us to take a volatility exposure independently of the spot price.

On the other hand, the gamma swap is a forward contract on the variance of a given asset, where this variance is weighted by the price of the underlying asset and it allows investors to acquire variance exposures proportional to the underlying level. In this sense, when the underlying asset decreases the sensitivity of the gamma swap with respect to variance is lower. Although the variance swap is actively traded in the volatility markets, the gamma swap is not so popular so far.

Although the model-free replication strategy is a promising argument, it is important to take into account that to have a perfect replication some assumptions must hold. In particular, the underlying asset must move continuously and we need a continuum of European calls and puts quoted in the market. But the reality shows that the underlying asset can exhibit jumps in its behavior and only a discrete number of strikes, relatively close to the at-the-money level, are quoted in the market. Moreover, as pointed out by Hörfelt and Torné (2010), if the interest rates are assumed to be stochastic, then the variance swap rate is also a function of the interest rate volatility. This effect may be relevant for long-term variance swaps.

This article studies the effect of the assumption corresponding to the existence of a continuum of European options quoted in the market on the correct valuation and hedging of the risks associated with this kind of structures. This fact is quite relevant since, as pointed out by Derman and Wilmott (2009), the most important questions about any model have to do with what the model ignores and how wrong it is like to be. In this sense, one of the reasons of the

financial crisis that started in August 2007 with the collapse in subprime mortgages was the use of inadequate models to value complex credit derivatives.

The rest of the article is structured as follows. Section 2 introduces the static replication framework associated with European payoffs and applies it to the valuation of variance swaps and gamma swaps. This section also considers the pricing problem under a stochastic volatility framework. Section 3 studies the features and sensitivities associated with these structures that motivate the use of variance swaps together with gamma swaps as a hedging and/or investment strategy. In this sense, I provide closed-form expressions corresponding to the vega of variance swaps and gamma swaps. Section 3 also focuses on the practical implications for the management of the risks arising from variance swaps when a continuum of European options is not available in the market and relates it with the large losses suffered by several trading desks corresponding to different financial institutions in 2008 with the international financial crisis. Finally, section 4 provides concluding remarks.

2. Model-free replication of European payoffs

Let S_t denote the spot price of the underlying asset at time $t \in [0, Y]$, where Y is some arbitrarily distant horizon. For simplicity, I assume that the continuously compounded risk-free rate r and dividend yield q are constant. Consider the time $t = 0$ price of a European call with strike K and maturity T , denoted as $C_{0T}(K)$. We can express this price as:

$$C_{0T}(K) = P(0, T) E_Q \left[(S_T - K)^+ \right], \quad T \in [0, Y]$$

where Q is the probability measure defined on a probability space (Ω, F, Q) such that asset prices expressed in terms of the current account are martingales. We denote this probability measure as the risk-neutral measure. $P(0, T)$ is the time $t = 0$ price of a zero coupon bond with maturity T . Differentiating once with respect to the strike price gives:

$$\frac{\partial C_{0T}(K)}{\partial K} = -P(0, T) E_Q \left[\mathbf{1}_{(S_T > K)} \right] = P(0, T) \left[\Psi_Q(S_0; K, T) - 1 \right] \quad (1)$$

where $\Psi_Q(S_0; K, T)$ denotes the cumulative distribution function of the asset price under the risk-neutral measure Q , evaluated at the future price level K and the future time T and conditional on the stock price starting at level S at time $t = 0$. $\mathbf{1}_{(S_T > K)}$ is the Heaviside step function or unit step function. Differentiating equation (1) with respect to the strike price, we obtain the following expression for the implied risk-neutral density:

$$\varphi_Q(S_0; K, T) = \frac{1}{P(0, T)} \frac{\partial^2 C_{0T}(K)}{\partial K^2}$$

where $\varphi_Q(S_0; K, T)$ denotes the density function of the asset price under the risk-neutral measure Q . This result was derived by Breeden and Litzenberger (1978). Let $P_{0T}(K)$ denote the time $t = 0$ price of an European put with strike K and maturity T and let $V(S_T)$ be a function of the terminal stock price. Then we can express its time $t = 0$ value as:

$$V_0 = P(0, T) \int_0^{\infty} V(K) \varphi_Q(S_0; K, T) dK = \int_0^{\infty} V(K) \frac{\partial^2 C_{0T}(K)}{\partial K^2} dK$$

From the put-call parity we know that $\frac{\partial^2 C_{0T}(K)}{\partial K^2} = \frac{\partial^2 P_{0T}(K)}{\partial K^2}$. Therefore, it is possible to rewrite the previous equation as:

$$V_0 = \int_0^{S_*} V(K) \frac{\partial^2 P_{0T}(K)}{\partial K^2} dK + \int_{S_*}^{\infty} V(K) \frac{\partial^2 C_{0T}(K)}{\partial K^2} dK \quad (2)$$

where S_* is a strike price that defines the boundary between liquid calls and puts. Let us assume that $V(\cdot)$ is twice continuously differentiable. Integrating by parts equation (2) gives:

$$\begin{aligned} V_0 &= V(K) \frac{\partial P_{0T}(K)}{\partial K} \Big|_0^{S_*} + V(K) \frac{\partial C_{0T}(K)}{\partial K} \Big|_{S_*}^{\infty} \\ &\quad - \int_0^{S_*} V'(K) \frac{\partial P_{0T}(K)}{\partial K} dK - \int_{S_*}^{\infty} V'(K) \frac{\partial C_{0T}(K)}{\partial K} dK \end{aligned} \quad (3)$$

Using the put-call parity and equation (1) yields:

$$\frac{\partial P_{0T}(K)}{\partial K} = P(0, T) \Psi_Q(S_0; K, T)$$

Therefore, $\frac{\partial P_{0T}(0)}{\partial K} = \frac{\partial C_{0T}(\infty)}{\partial K} = 0$. Integrating by parts equation (3) we have:

$$\begin{aligned}
V_0 &= V(S_*)P(0,T)\Psi_\rho(S_0;K,T) - V'(K)P_{0T}(K)|_0^{S_*} \\
&\quad - V(S_*)P(0,T)[\Psi_\rho(S_0;K,T) - 1] - V'(K)C_{0T}(K)|_{S_*}^{\infty} \\
&\quad + \int_0^{S_*} V''(K)P_{0T}(K)dK + \int_{S_*}^{\infty} V''(K)C_{0T}(K)dK
\end{aligned} \tag{4}$$

We know that $P_{0T}(0) = C_{0T}(\infty) = 0$. Hence, we can rewrite equation (4) as follows:

$$\begin{aligned}
V_0 &= V(S_*)P(0,T) - V'(S_*)P_{0T}(S_*) + V'(S_*)C_{0T}(S_*) \\
&\quad + \int_0^{S_*} V''(K)P_{0T}(K)dK + \int_{S_*}^{\infty} V''(K)C_{0T}(K)dK
\end{aligned} \tag{5}$$

From the put-call parity we know that:

$$C_{0T}(S_*) = P_{0T}(S_*) + S_0 e^{-qT} - P(0,T)S_*$$

Combining the previous expression with equation (5), we finally obtain the following expression for the time $t = 0$ value of the European payoff function $V(S_T)$:

$$\begin{aligned}
V_0 &= P(0,T)[V(S_*) - V'(S_*)(S_*)] + V'(S_*)S_0 e^{-qT} \\
&\quad + \int_0^{S_*} V''(K)P_{0T}(K)dK + \int_{S_*}^{\infty} V''(K)C_{0T}(K)dK
\end{aligned} \tag{6}$$

This result is equivalent to the one obtained by Carr and Madan (2001), in the absence of dividends, using the fundamental theorem of calculus. Importantly equation (6) has interesting implications. It establishes that it is possible to value any European payoff using the prices of products quoted in the market and it can be used to establish the replication strategy associated with variance swaps and with gamma swaps. The disadvantage is that it requires a continuum of European options but, usually, only a discrete number of strikes relatively close to the at-the-money level are quoted in the options market.

2.1 Model-free replication of a variance swap

Formally, a variance swap is a forward contract on the annualized historical variance. Its payoff at maturity is given by $N(\sigma_R^2 - VSR)$, where σ_R^2 represents the annualized realized variance during the lifetime of the contract, VSR is the variance swap rate and N is the notional amount expressed in currency units. Let us assume that the underlying asset follows a geometric Brownian motion where the drift μ_t , as well as the instantaneous volatility σ_t may depend on time and other stochastic variables:

$$\frac{dS_t}{S_t} = \mu_t dt + \sigma_t dW_t^P$$

where W_t^P is a Wiener process associated with the real probability measure P . A particular case is the Black-Scholes (1973) model, where μ_t and σ_t are assumed to be constant. The realized variance between the instant $t = 0$ and the instant $t = T$ is defined by the following expression:

$$\Lambda = \frac{1}{T} \int_0^T \sigma_t^2 dt$$

Let vs_0 denote the $t = 0$ value associated with the variance swap and let us assume that the notional amount equals one. It is possible to use the fundamental theorem of asset pricing to price this contract under the risk neutral probability measure Q as follows:

$$vs_0 = P(0, T) E_Q [\Lambda - VSR]$$

The variance swap rate VSR is chosen so that the net present value of the contract equals zero. Thus, the following condition must hold:

$$E_Q [\Lambda] = \frac{1}{T} E_Q \left[\int_0^T \sigma_t^2 dt \right] = VSR$$

Therefore, we have to set a replication strategy that allows us replicating the realized variance. Applying Ito's lemma to $\ln(S_t)$ and integrating it over the interval $(0, T)$ yields:

$$\Lambda = \frac{2}{T} \left[\int_0^T \frac{dS_t}{S_t} - \ln \left(\frac{S_T}{S_0} \right) \right]$$

From the Girsanov theorem¹, it is possible to obtain the following expression corresponding to the evolution of the underlying asset under the risk neutral probability measure Q :

$$\frac{dS_t}{S_t} = (r - q) dt + \sigma_t dW_t^Q$$

where W_t^Q is a Wiener process under Q . Hence, we have that:

¹ See for example Musiela and Rutkowski (1998).

$$VSR = \frac{2}{T} E_Q \left[\int_0^T \frac{dS_t}{S_t} - \ln \left(\frac{S_T}{S_0} \right) \right] = \frac{2}{T} \left((r-q)T - E_Q \left[\ln \left(\frac{S_T}{S_0} \right) \right] \right)$$

Using the result of equation (6) yields:

$$VSR = \frac{2}{T} \left[(r-q)T - \left(\frac{F_{0,T}}{S_*} - 1 \right) - \ln \left(\frac{S_*}{S_0} \right) \right] + \frac{1}{P(0,T)} \frac{2}{T} \left[\int_0^{S_*} \frac{P_{0T}(K)}{K^2} dK + \int_{S_*}^{\infty} \frac{C_{0T}(K)}{K^2} dK \right] \quad (7)$$

where $F_{0,T} = \frac{S_0 e^{-qT}}{P(0,T)}$ is the time $t = 0$ value of a forward contract on the underlying asset with

maturity $t = T$. Demeterfi et al. (1999) obtain an expression to characterize the VSR , which is equivalent to equation (7) in the absence of dividends. This equation shows a quite strong result: it is possible to replicate the variance swap, even in presence of volatility skew², setting a portfolio of forward contracts on the underlying asset and out-of-the-money calls and puts. Therefore, it is possible to replicate the variance swap using asset which are quoted in the market.

Variance swaps in a stochastic volatility framework

Note that the valuation method of variance swaps based on the replication strategy presented in equation (7) only relies on the assumption that the underlying asset evolves continuously through time and allows pricing the variance swap using the market information incorporated in listed options.

Nevertheless, since the stochastic volatility models impose dynamics for the instantaneous volatility corresponding to the underlying asset, it is possible to price a variance swap directly taking the risk-neutral expectation of the realized variance for a given maturity, without using any replication strategy. To illustrate this fact let us consider the Heston (1993) stochastic volatility model. This is one of the most popular models within the class of stochastic volatility models. The main reason is the existence of a fast quasi-closed form solution for European options. This fact becomes essential when calibrating the model to market option prices.

² The term volatility skew refers to the existence of a negative dependence of the implied volatility with respect to the strike price. This skew has characterized the equity options market since the stock market crash on October 1987.

The Heston (1993) model postulates the following processes for the price corresponding to the underlying asset S_t , as well as for its instantaneous variance v_t , under the risk-neutral probability measure Q :

$$\begin{aligned}\frac{dS_t}{S_t} &= (r - q)dt + \sqrt{v_t}dW_{S,t}^Q \\ dv_t &= \kappa(\theta - v_t)dt + \delta\sqrt{v_t}dW_{v,t}^Q\end{aligned}$$

where θ represents the long-run mean corresponding to the instantaneous variance, κ accounts for the speed of mean reversion and δ is the volatility of the instantaneous variance. $W_{S,t}^Q$ and $W_{v,t}^Q$ are two Wiener processes under the risk-neutral probability measure Q . Both processes are correlated so that:

$$dW_{S,t}^Q dW_{v,t}^Q = \rho dt$$

Under the specification for the instantaneous variance postulated in the Heston (1993) model, it is possible to obtain a closed-form expression for the variance swap rate as follows:

$$VSR = \frac{1}{T} E_Q \left[\int_0^T v_s ds \right] = \frac{1}{T} \int_0^T E_Q [v_s] ds \quad (8)$$

Let $\eta_t = E_Q [v_t]$ denote the mean instantaneous variance under the risk-neutral probability measure Q . This variable verifies the following linear differential equation:

$$\frac{d\eta_t}{dt} + \kappa\eta_t = \kappa\theta$$

The solution to the previous equation is given by:

$$\eta_s = \theta + (v_0 - \theta)e^{-\kappa s}$$

with $\eta_0 = v_0$. Combining the previous expression with equation (8) gives:

$$\begin{aligned}VSR &= \frac{1}{T} \int_0^T \theta ds + \frac{1}{T} (v_0 - \theta) \int_0^T e^{-\kappa s} ds \\ VSR &= \theta + \frac{\theta - v_0}{\kappa T} [e^{-\kappa T} - 1]\end{aligned} \quad (9)$$

Equation (9) shows that the dynamic of the variance swap rate in the Heston (1993) model is determined by the current instantaneous variance v_0 , as well as by the long-run mean variance

θ and the reversion factor κ . But this dynamic is unaffected by the volatility of the variance δ , as well as by the correlation between the process corresponding to the underlying asset price and its instantaneous variance ρ . The longer the maturity of the variance swap and the higher the speed of mean reversion, the closer will be the variance swap rate to the long-run mean variance. In this sense, Egloff, Leippold and Wu (2006) show that it is necessary to introduce a stochastic mean level in the specification of the instantaneous variance to capture the term structure variation of the variance swaps rates.

Finally, note that to price the variance swap consistently with the market information, it is necessary to calibrate the parameters of the model to the market implied volatilities and/or to the market prices of variance swaps. On the other hand, the replication strategy shows in a more transparent way the risks associated with the product, such as the vega risk, as well as the correct method to hedge those risks.

2.2 Model-free replication of a gamma swap

The gamma swap is a forward contract on the variance of a given asset, where this variance is weighted by the price of the underlying asset. Formally, in continuous time, the payoff at maturity of a gamma swap is given by:

$$\frac{1}{T} \int_0^T \sigma_t^2 S_t dt - GSR$$

where T is the maturity, σ_t^2 is the realized variance and is GSR the strike price of the swap or gamma swap rate. In this case, if there is a drop in the spot price, the exposure of the gamma swap with respect to volatility decreases. Therefore, the seller of this product is much more protected against an eventual increase in volatility than in the case of a variance swap. As with the variance swaps, the gamma swap rate GSR is chosen so that the net present value of the contract equals zero. Hence, we have that:

$$\frac{1}{T} E_Q \left[\int_0^T \sigma_t^2 S_t dt \right] = GSR$$

For simplicity, let us assume that the continuously compounded risk-free rate r and dividend yield q coincide, so that the process corresponding to the asset price under the risk neutral measure Q is given by:

$$\frac{dS_t}{S_t} = \sigma_t dW_{S,t}^Q$$

Let $V(S_T)$ denote a twice continuously differentiable function of the underlying asset price S_t .

From Ito's lemma we have that:

$$dV(S_t) = \frac{\partial V(S_t)}{\partial S_t} dS_t + \frac{1}{2} \frac{\partial^2 V(S_t)}{\partial S_t^2} \sigma_t^2 S_t^2 dt$$

Hence:

$$V(S_T) = V(S_0) + \int_0^T \frac{\partial V(S_t)}{\partial S_t} dS_t + \frac{1}{2} \int_0^T \frac{\partial^2 V(S_t)}{\partial S_t^2} S_t^2 \sigma_t^2 dt \quad (10)$$

The last element of the previous equation is related to the payoff of the gamma swap. In particular, we need that:

$$\frac{\partial^2 V(S_t)}{\partial S_t^2} = \frac{1}{S_t}$$

so that the function $V(S_T)$ is given by:

$$V(S_t) = S_t [\ln S_t - 1]$$

From equation (10) it is possible to express the gamma swap rate as:

$$GSR = \frac{1}{T} E_Q \left[\int_0^T \sigma_t^2 S_t dt \right] = \frac{2}{T} \left[E_Q [V(S_T)] - V(S_0) - \int_0^T E_Q [\ln S_t dS_t] \right]$$

From the law of iterated expectations, we have that:

$$E_Q [\ln S_t dS_t] = E_Q [\ln(S_t) \sigma_t S_t dW_t^Q] = E_Q [\ln(S_t) S_t E_Q (\sigma_t dW_t^Q | S_t)] = 0$$

Finally, considering the result of equation (6) with $S = S_0$, yields the following expression corresponding to the gamma swap rate:

$$GSR = \frac{1}{P(0,T) T} \left[\int_0^{S_0} \frac{P_{0T}(K)}{K} dK + \int_0^\infty \frac{C_{0T}(K)}{K} dK \right] \quad (11)$$

Therefore, there is a replication strategy for the gamma swap, similar to the one corresponding to the variance swap, based on a weighted sum of out-of-the-money calls and puts, where the weights are given by $1/K$.

3. Variance swaps and gamma swaps. Theory versus practice

3.1 Vega exposure

For simplicity, let us consider that the assumptions of the Black-Scholes (1973) model are satisfied, so that the implied volatility surface does not exhibit volatility skew. Under the assumptions of this model it is well known that it is possible to express the time $t = 0$ value of a European call with maturity $t = T$ and strike K as follows:

$$C_{0T}(K) = P(0, T) \left[F_{0,T} \Phi(d) - K \Phi(d - \Sigma \sqrt{T}) \right]$$

where $\Phi(\cdot)$ represents the standard normal cumulative distribution function and d is given by:

$$d = \frac{1}{\Sigma \sqrt{T}} \left[\ln \left(\frac{F_{0,T}}{K} \right) + \frac{1}{2} \Sigma^2 T \right] \quad (12)$$

with Σ being the implied volatility. In absence of arbitrage opportunities, the put-call parity implies that the vega corresponding to the call $C_{0T}(K)$, denoted by ν , equals the vega of the put:

$$\nu = P(0, T) \sqrt{T} \phi(d) F_{0,T} = P(0, T) \sqrt{T} K \phi(d - \Sigma \sqrt{T})$$

where $\phi(\cdot)$ represents the standard normal density function. From the previous results, it is possible to differentiate equation (7) with respect to the implied volatility to obtain the variance swap vega, denoted by V_{VS} :

$$V_{VS} = \frac{2}{P(0, T) T} \int_0^\infty \frac{\nu(K)}{K^2} dK = 2 \frac{F_{0,T}}{\sqrt{T}} \int_0^\infty \frac{\phi(d)}{K^2} dK \quad (13)$$

On the other hand, solving for the value of K in equation (12) we obtain:

$$K = F_{0,T} e^{\frac{\Sigma^2 T}{2} - \Sigma \sqrt{T} d} \quad (14)$$

Therefore, it is possible to change the variable to express equation (13) as follows:

$$V_{VS} = 2 \frac{F_{0,T}}{\sqrt{T}} \int_\infty^{-\infty} -\frac{\phi(d)}{K^2} \Sigma \sqrt{T} K dd = 2 \frac{F_{0,T}}{\sqrt{T}} \int_\infty^{-\infty} \frac{\phi(d)}{K} \Sigma \sqrt{T} dd$$

Substituting the value of K in the previous equation, we obtain:

$$V_{VS} = 2\Sigma \int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}} e^{-\frac{d^2 - \Sigma^2 T + \Sigma\sqrt{T}d}{2}} dd = 2\Sigma \int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}} e^{-\frac{(d-\Sigma\sqrt{T})^2}{2}} dd$$

Finally, using the following change of variable $x = d - \Sigma\sqrt{T}$, gives:

$$V_{VS} = 2\Sigma \int_{-\infty}^{\infty} \frac{1}{\sqrt{2\pi}} e^{-\frac{(x)^2}{2}} dx = 2\Sigma \int_{-\infty}^{\infty} \phi(x) dx = 2\Sigma$$

The previous equation shows that, when there is no volatility skew, the vega of the variance swap does not depend on stock the price. But, as we will see, for this conclusion to be true a continuous replication strategy should be possible.

On the other hand, differentiating equation (11) with respect to the implied volatility Σ , we have that the vega of the gamma swap, denoted as V_{GS} , is given by:

$$V_{GS} = \frac{2}{P(0,T)} \int_0^{\infty} \frac{v(K)}{K} dK = 2 \frac{F_{0,T}}{\sqrt{T}} \int_0^{\infty} \frac{\phi(d)}{K} dK$$

Taking into account equation (14) it is possible to express the vega associated with the gamma swap as follows³:

$$V_{GS} = 2F_{0,T} \int_{-\infty}^{\infty} \phi(d) dd = 2S_0 \quad (15)$$

Unlike in the case of variance swaps, equation (15) shows that the vega of the gamma swap is a function of the spot price. In particular, under the assumptions of the Black-Scholes (1973) model, the vega of the gamma swap is a linear function of the spot price. In this sense, it is possible to combine the variance swap together with the gamma swap to set vanna exposures⁴. In particular, let us consider a financial institution that would like to take a positive exposure to volatility when the asset price is low and a negative exposure when the spot price is high. This strategy is usually set buying out-of-the-money puts and selling out-of-the-money calls. But if there is a liquid market of variance swaps and gamma swaps, it can be more efficient to set the strategy buying the variance swap and selling the gamma swap.

³ I have used the fact that under the assumption that the continuously compounded risk-free rate r and dividend yield q coincide, the forward is equal to the spot price.

⁴ The vanna denotes the sensitivity of the vega with respect to the spot price. Alternatively, it represents the sensitivity of the delta with respect to changes in the implied volatility associated with the underlying asset.

3.2 Replication in absence of a continuum of European options

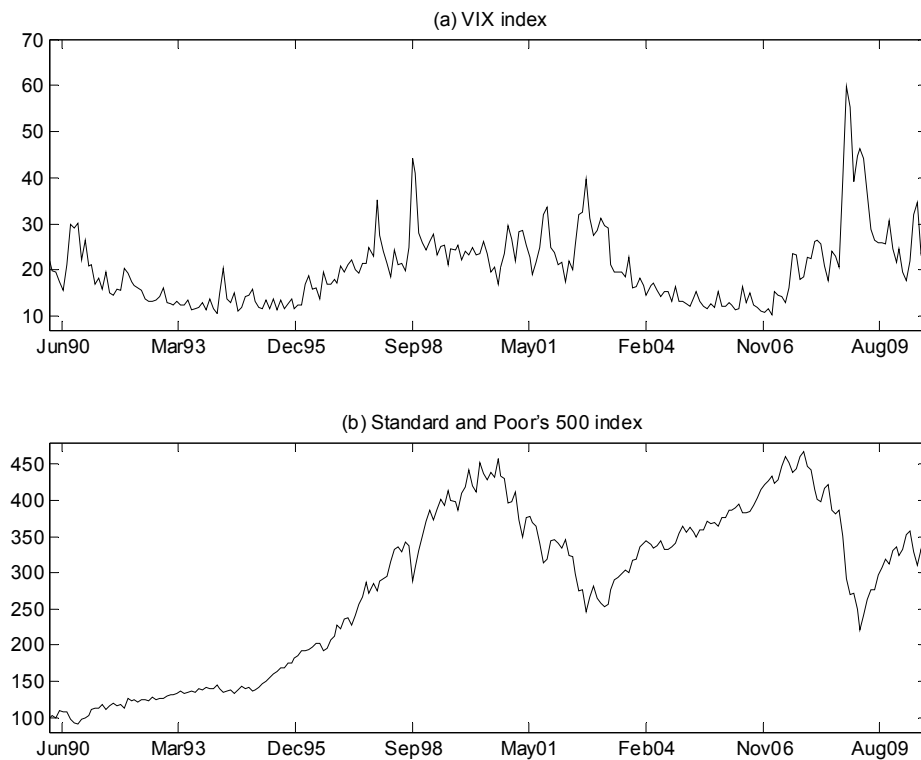
As said in the introductory section, in recent years new derivatives, that have some measure of volatility as underlying asset, are emerging. In particular, in 2004 the Chicago Board Options Exchange (CBOE) introduced futures traded on the CBOE Volatility Index (VIX) and in 2006 options on that index. The VIX index started to be calculated in 1993 and was originally designed to measure the market's expectation of 30-day at-the-money implied volatility associated with the Standard and Poor's 100 index. But with the new methodology⁵ implemented in 2003, the squared of the VIX index approximates the variance swap rate or delivery price of a variance swap. Carr and Wu (2006) find the existence of a negative strong correlation between the changes in the VIX volatility index and the performance corresponding to the Standard and Poor's s 500 index. This fact indicates that the volatility tends to be higher when the equity market falls.

Figure 1 shows the monthly evolution of the VIX index, during the period February 1990 to September 2010, as well as the performance of the Standard and Poor's 500 index. Panel a accounts for the values of the VIX index, whereas panel b captures the month-end values associated with the Standard and Poor's 500 index as a percentage of the month-end price corresponding to February 1990. As we can see from the figure, both indexes move in opposite directions.

Taking into account the previous stylized fact, note that to set a perfect replication strategy for the variance swap and for the gamma swap, the stock price should evolve continuously and a continuum of European calls and puts should be available in the market. But in real life stocks prices sometimes evolve discontinuously exhibiting jumps and only a discrete group of strike prices, relatively close to the at-the-money level, are quoted in the market. Therefore, in practice it may be difficult to set a perfect replication strategy. This section considers the effects of leaving the assumption corresponding to the existence of a continuum of European options on the vega exposure associated with the variance swaps and relates it with the large losses suffered by several trading desks corresponding to different financial institutions in 2008 with the international financial crisis, originated in the credit market and characterized by violent movements and epidemics of contagion from market to market.

⁵ For a definition of the methodology and the history of the VIX index, see CBOE (2009) and Carr and Wu (2006).

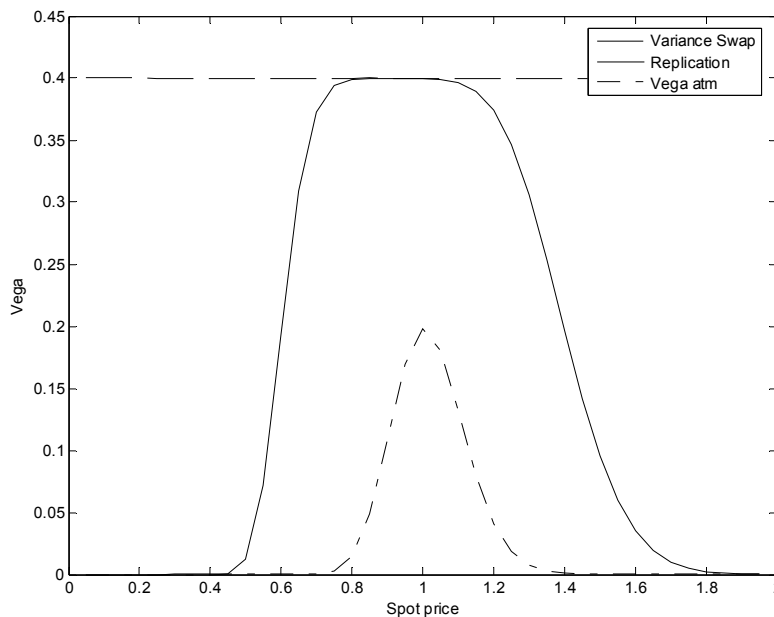
Figure 1: Monthly evolution of the VIX index (panel a) and the Standard and Poor's 500 index (panel b) during the period February 1990 to September 2010.



The panel b captures the month-end prices of the Standard and Poor's 500 index, obtained from Bloomberg, as a percentage of the month-end value corresponding to February 1990. The data corresponding to the VIX index are available at www.cboe.com/micro/vix/historical.aspx.

Let us consider a variance swap with maturity equal to three months. Figure 2 shows the vega corresponding to a replication strategy (denoted Replication) which consists of options with strikes ranging from 60% to 140% of the underlying asset price, with a step of 1%. The figure also reports the effective vega of the variance swap (denoted Variance Swap), as well as the vega corresponding to a European at-the-money option (denoted Vega atm). I assume an implied volatility of 20%, whereas the continuously compounded risk-free rate and the dividend yield are assumed to be equal to 2%.

Figure 2: Vega exposure corresponding to different strategies with maturity equal to three months.



The implied volatility is assumed to be constant and equal to 20%, whereas the continuously compounded risk-free rate and the dividend yield are equal to 2%. The spot price is expressed as a percentage of the current level.

Figure 2 shows that the vega corresponding to the replication strategy vanishes when the underlying asset price separates from the strikes of the options used to set this strategy. Furthermore, it is only possible to perfectly match the effective vega of the variance swap between the strikes 70% and 125% approximately. This simple example illustrates the risks associated with an imperfect replication strategy. In particular, consider a financial institution which sells a variance swap and hedges its vega risk with the replication strategy corresponding to the example of figure 2. If the underlying asset decreases more than 30%, the institution will have a short vega and short gamma position. In this situation the volatility of the underlying asset is expected to be much higher than the initial level. Therefore, the institution will suffer a negative impact on its results. This is precisely what happened in the months of October and November 2008. As it can be seen from figure 1, during these months there was a great increase in the level of volatility coinciding with the fall of equity markets and the financial problems of many banks. In particular, the largest historical closing price corresponding to the VIX index took place on November 20, 2008. These effects generated important losses for several trading desks that had short variance swap positions. Therefore, it is essential to

recognize that valuation models are tools to approximate reality. The goodness of the conclusions drawn from them crucially depends on the assumptions on which they are based.

4. Conclusion

Apart from the importance of asset volatilities for derivatives pricing, they are also a key element within portfolio theory. In this sense, there are a lot of hedge funds involved in volatility trading and it is usual to hear of analysts conceptualizing volatility as an asset class.

In recent years new classes of volatility derivatives are emerging. These derivatives have a measure of volatility as underlying asset. Examples of these derivatives are variance swaps and gamma swaps. Both of them admit model-free replication by a static position in European options and dynamic trading of the underlying asset, but variance swaps are traded in the market much more actively than gamma swaps. Unlike what happens with the variance swaps, in the case of a gamma swap the vega exposure decreases when the spot price drops. Therefore, the combination of variance swaps and gamma swaps can be a very useful tool for investors that would like to set a certain vanna strategy.

Sometimes market participants introduce caps in the variance swaps to limit the vega exposure of the product in case of a market fall. In this case, the variance swap is not anymore a forward on the realized variance and it becomes an option on the realized variance. This makes the product to be model dependent and we do not have a model-free replication of its payoff. As said previously, the vega exposure of the gamma swaps decreases when the underlying asset falls. In this sense, the gamma swap could be a good alternative to the variance swaps with cap with the advantage of a model-free replication.

Nevertheless, although the model-free replication strategy is a promising argument, it is important to take into account that to have a perfect replication some assumptions must hold. This article has focused on the effect of the assumption corresponding to the existence of a continuum of European options quoted in the market for the correct valuation and hedging of the risks associated with this kind of structures. If a financial institution sells a variance swap and sets a replication strategy based on a discrete number of options to hedge the risk associated with this product, the vega exposure is not perfectly hedge. In this sense, during the months of October and November 2008 there was a great increase in the level of volatility coinciding with the drop of equity markets. Many trading desk had short variance swaps positions and they hedged these positions setting replication strategies based on a discrete number of options. The drop of the equity market left these trading desks with a short vega exposure and the spike in volatilities generated large losses. Therefore, it is essential to recognize that valuation models are tools to approximate reality. The goodness of the conclusions drawn from them crucially depends on the assumptions on which they are based.

References

- [1] Black, F.; Scholes, M.S., 1973. The pricing of options and corporate liabilities. *Journal of Political Economy*, 81, 637-654.
- [2] Breeden, D. T; Litzenberger, R. H., 1978. Prices of state-contingent claims implicit in option prices. *Journal of Business*, 51, 621-651.
- [3] Carr, P.; Wu, L. 2006., A tale of two indices. *Journal of Derivatives*, 13, 13-29.
- [4] Carr, P.; Lee, R. 2009., Volatility derivatives. *Annual Review of Financial Economics*, 1, 1-21.
- [5] Carr P.; Madan, D. 1998., Towards a theory of volatility trading. In R. Jarrow (ed.), *Risk Book on Volatility*, New York.
- [6] Carr P.; Madan, D. 2001., Optimal positioning in derivative securities. *Quantitative Finance*, 1, 19-37.
- [7] CBOE. VIX white paper. 2009., Chicago Board Options Exchange.
- [8] Demeterfi, K., Derman, E., Kamal; M., Zou, J. 1999., More than you ever wanted to know about volatility swaps. Quantitative Strategies Research Notes, Goldman Sachs, New York.
- [9] Derman, E.; Wilmott. 2009., P. Perfect models, imperfect world. *Business Week*, 4115, 59.
- [10] Dupire, B. 1993., Model art. *Risk*, 9, 118-124.
- [11] Egloff, D., Leippold, M.; Wu, L. 2006., Variance risk dynamics, variance risk premia, and optimal variance swap investments. EFA 2006 Zurich Meetings Paper. Available at SSRN: <http://ssrn.com/abstract=903728>.
- [12] Heston, S. L. 1993., A closed-form solution for options with stochastic volatility with applications to bond and currency options. *Review of Financial Studies*, 6, 327-343.
- [13] Horfelt, P.; Torné, O., 2010. The value of a variance swap. A question of interest. *Risk*, 23, 82-85.
- [14] Musiela, M.; Rutkowski, M., 1998. *Martingale methods in financial modelling*. Springer-Verlag, Berlin.
- [15] Neuberger, A. 1994., The Log contract, a new instrument to hedge volatility. *Journal of Portfolio Management*, 20, 74-80.

FUNDACIÓN DE LAS CAJAS DE AHORROS

DOCUMENTOS DE TRABAJO

Últimos números publicados

- 159/2000 Participación privada en la construcción y explotación de carreteras de peaje
Ginés de Rus, Manuel Romero y Lourdes Trujillo
- 160/2000 Errores y posibles soluciones en la aplicación del *Value at Risk*
Mariano González Sánchez
- 161/2000 Tax neutrality on saving assets. The spanish case before and after the tax reform
Cristina Ruza y de Paz-Curbera
- 162/2000 Private rates of return to human capital in Spain: new evidence
F. Barceinas, J. Oliver-Alonso, J.L. Raymond y J.L. Roig-Sabaté
- 163/2000 El control interno del riesgo. Una propuesta de sistema de límites
riesgo neutral
Mariano González Sánchez
- 164/2001 La evolución de las políticas de gasto de las Administraciones Públicas en los años 90
Alfonso Utrilla de la Hoz y Carmen Pérez Esparrells
- 165/2001 Bank cost efficiency and output specification
Emili Tortosa-Ausina
- 166/2001 Recent trends in Spanish income distribution: A robust picture of falling income inequality
Josep Oliver-Alonso, Xavier Ramos y José Luis Raymond-Bara
- 167/2001 Efectos redistributivos y sobre el bienestar social del tratamiento de las cargas familiares en
el nuevo IRPF
Nuria Badenes Plá, Julio López Laborda, Jorge Onrubia Fernández
- 168/2001 The Effects of Bank Debt on Financial Structure of Small and Medium Firms in some Euro-
pean Countries
Mónica Melle-Hernández
- 169/2001 La política de cohesión de la UE ampliada: la perspectiva de España
Ismael Sanz Labrador
- 170/2002 Riesgo de liquidez de Mercado
Mariano González Sánchez
- 171/2002 Los costes de administración para el afiliado en los sistemas de pensiones basados en cuentas
de capitalización individual: medida y comparación internacional.
José Enrique Devesa Carpio, Rosa Rodríguez Barrera, Carlos Vidal Meliá
- 172/2002 La encuesta continua de presupuestos familiares (1985-1996): descripción, representatividad
y propuestas de metodología para la explotación de la información de los ingresos y el gasto.
Llorenç Pou, Joaquín Alegre
- 173/2002 Modelos paramétricos y no paramétricos en problemas de concesión de tarjetas de crédito.
Rosa Puertas, María Bonilla, Ignacio Olmeda

- 174/2002 Mercado único, comercio intra-industrial y costes de ajuste en las manufacturas españolas.
José Vicente Blanes Cristóbal
- 175/2003 La Administración tributaria en España. Un análisis de la gestión a través de los ingresos y de los gastos.
Juan de Dios Jiménez Aguilera, Pedro Enrique Barrilao González
- 176/2003 The Falling Share of Cash Payments in Spain.
Santiago Carbó Valverde, Rafael López del Paso, David B. Humphrey
Publicado en "Moneda y Crédito" nº 217, pags. 167-189.
- 177/2003 Effects of ATMs and Electronic Payments on Banking Costs: The Spanish Case.
Santiago Carbó Valverde, Rafael López del Paso, David B. Humphrey
- 178/2003 Factors explaining the interest margin in the banking sectors of the European Union.
Joaquín Maudos y Juan Fernández Guevara
- 179/2003 Los planes de stock options para directivos y consejeros y su valoración por el mercado de valores en España.
Mónica Melle Hernández
- 180/2003 Ownership and Performance in Europe and US Banking – A comparison of Commercial, Co-operative & Savings Banks.
Yener Altunbas, Santiago Carbó y Phil Molyneux
- 181/2003 The Euro effect on the integration of the European stock markets.
Mónica Melle Hernández
- 182/2004 In search of complementarity in the innovation strategy: international R&D and external knowledge acquisition.
Bruno Cassiman, Reinhilde Veugelers
- 183/2004 Fijación de precios en el sector público: una aplicación para el servicio municipal de suministro de agua.
M^a Ángeles García Valiñas
- 184/2004 Estimación de la economía sumergida en España: un modelo estructural de variables latentes.
Ángel Alañón Pardo, Miguel Gómez de Antonio
- 185/2004 Causas políticas y consecuencias sociales de la corrupción.
Joan Oriol Prats Cabrera
- 186/2004 Loan bankers' decisions and sensitivity to the audit report using the belief revision model.
Andrés Guiral Contreras and José A. Gonzalo Angulo
- 187/2004 El modelo de Black, Derman y Toy en la práctica. Aplicación al mercado español.
Marta Tolentino García-Abadillo y Antonio Díaz Pérez
- 188/2004 Does market competition make banks perform well?.
Mónica Melle
- 189/2004 Efficiency differences among banks: external, technical, internal, and managerial
Santiago Carbó Valverde, David B. Humphrey y Rafael López del Paso

- 190/2004 Una aproximación al análisis de los costes de la esquizofrenia en España: los modelos jerárquicos bayesianos
F. J. Vázquez-Polo, M. A. Negrín, J. M. Cavasés, E. Sánchez y grupo RIRAG
- 191/2004 Environmental proactivity and business performance: an empirical analysis
Javier González-Benito y Óscar González-Benito
- 192/2004 Economic risk to beneficiaries in notional defined contribution accounts (NDCs)
Carlos Vidal-Meliá, Inmaculada Domínguez-Fabian y José Enrique Devesa-Carpio
- 193/2004 Sources of efficiency gains in port reform: non parametric malmquist decomposition tfp index for Mexico
Antonio Estache, Beatriz Tovar de la Fé y Lourdes Trujillo
- 194/2004 Persistencia de resultados en los fondos de inversión españoles
Alfredo Ciriaco Fernández y Rafael Santamaría Aquilué
- 195/2005 El modelo de revisión de creencias como aproximación psicológica a la formación del juicio del auditor sobre la gestión continuada
Andrés Guiral Contreras y Francisco Esteso Sánchez
- 196/2005 La nueva financiación sanitaria en España: descentralización y prospectiva
David Cantarero Prieto
- 197/2005 A cointegration analysis of the Long-Run supply response of Spanish agriculture to the common agricultural policy
José A. Mendez, Ricardo Mora y Carlos San Juan
- 198/2005 ¿Refleja la estructura temporal de los tipos de interés del mercado español preferencia por la liquidez?
Magdalena Massot Perelló y Juan M. Nave
- 199/2005 Análisis de impacto de los Fondos Estructurales Europeos recibidos por una economía regional: Un enfoque a través de Matrices de Contabilidad Social
M. Carmen Lima y M. Alejandro Cardenete
- 200/2005 Does the development of non-cash payments affect monetary policy transmission?
Santiago Carbó Valverde y Rafael López del Paso
- 201/2005 Firm and time varying technical and allocative efficiency: an application for port cargo handling firms
Ana Rodríguez-Álvarez, Beatriz Tovar de la Fe y Lourdes Trujillo
- 202/2005 Contractual complexity in strategic alliances
Jeffrey J. Reuer y Africa Ariño
- 203/2005 Factores determinantes de la evolución del empleo en las empresas adquiridas por opa
Nuria Alcalde Fradejas y Inés Pérez-Soba Aguilar
- 204/2005 Nonlinear Forecasting in Economics: a comparison between Comprehension Approach versus Learning Approach. An Application to Spanish Time Series
Elena Olmedo, Juan M. Valderas, Ricardo Gimeno and Lorenzo Escot

- 205/2005 Precio de la tierra con presión urbana: un modelo para España
Esther Decimavilla, Carlos San Juan y Stefan Sperlich
- 206/2005 Interregional migration in Spain: a semiparametric analysis
Adolfo Maza y José Villaverde
- 207/2005 Productivity growth in European banking
Carmen Murillo-Melchor, José Manuel Pastor y Emili Tortosa-Ausina
- 208/2005 Explaining Bank Cost Efficiency in Europe: Environmental and Productivity Influences.
Santiago Carbó Valverde, David B. Humphrey y Rafael López del Paso
- 209/2005 La elasticidad de sustitución intertemporal con preferencias no separables intratemporalmente: los casos de Alemania, España y Francia.
Elena Márquez de la Cruz, Ana R. Martínez Cañete y Inés Pérez-Soba Aguilar
- 210/2005 Contribución de los efectos tamaño, book-to-market y momentum a la valoración de activos: el caso español.
Begoña Font-Belaire y Alfredo Juan Grau-Grau
- 211/2005 Permanent income, convergence and inequality among countries
José M. Pastor and Lorenzo Serrano
- 212/2005 The Latin Model of Welfare: Do 'Insertion Contracts' Reduce Long-Term Dependence?
Luis Ayala and Magdalena Rodríguez
- 213/2005 The effect of geographic expansion on the productivity of Spanish savings banks
Manuel Illueca, José M. Pastor and Emili Tortosa-Ausina
- 214/2005 Dynamic network interconnection under consumer switching costs
Ángel Luis López Rodríguez
- 215/2005 La influencia del entorno socioeconómico en la realización de estudios universitarios: una aproximación al caso español en la década de los noventa
Marta Rahona López
- 216/2005 The valuation of spanish ipos: efficiency analysis
Susana Álvarez Otero
- 217/2005 On the generation of a regular multi-input multi-output technology using parametric output distance functions
Sergio Perelman and Daniel Santin
- 218/2005 La gobernanza de los procesos parlamentarios: la organización industrial del congreso de los diputados en España
Gonzalo Caballero Miguez
- 219/2005 Determinants of bank market structure: Efficiency and political economy variables
Francisco González
- 220/2005 Agresividad de las órdenes introducidas en el mercado español: estrategias, determinantes y medidas de performance
David Abad Díaz

- 221/2005 Tendencia post-anuncio de resultados contables: evidencia para el mercado español
Carlos Forner Rodríguez, Joaquín Marhuenda Fructuoso y Sonia Sanabria García
- 222/2005 Human capital accumulation and geography: empirical evidence in the European Union
Jesús López-Rodríguez, J. Andrés Faiña y Jose Lopez Rodríguez
- 223/2005 Auditors' Forecasting in Going Concern Decisions: Framing, Confidence and Information Processing
Waymond Rodgers and Andrés Guiral
- 224/2005 The effect of Structural Fund spending on the Galician region: an assessment of the 1994-1999 and 2000-2006 Galician CSFs
José Ramón Cancelo de la Torre, J. Andrés Faiña and Jesús López-Rodríguez
- 225/2005 The effects of ownership structure and board composition on the audit committee activity: Spanish evidence
Carlos Fernández Méndez and Rubén Arrondo García
- 226/2005 Cross-country determinants of bank income smoothing by managing loan loss provisions
Ana Rosa Fonseca and Francisco González
- 227/2005 Incumplimiento fiscal en el irpf (1993-2000): un análisis de sus factores determinantes
Alejandro Estellér Moré
- 228/2005 Region versus Industry effects: volatility transmission
Pilar Soriano Felipe and Francisco J. Climent Diranzo
- 229/2005 Concurrent Engineering: The Moderating Effect Of Uncertainty On New Product Development Success
Daniel Vázquez-Bustelo and Sandra Valle
- 230/2005 On zero lower bound traps: a framework for the analysis of monetary policy in the 'age' of central banks
Alfonso Palacio-Vera
- 231/2005 Reconciling Sustainability and Discounting in Cost Benefit Analysis: a methodological proposal
M. Carmen Almansa Sáez and Javier Calatrava Requena
- 232/2005 Can The Excess Of Liquidity Affect The Effectiveness Of The European Monetary Policy?
Santiago Carbó Valverde and Rafael López del Paso
- 233/2005 Inheritance Taxes In The Eu Fiscal Systems: The Present Situation And Future Perspectives.
Miguel Angel Barberán Lahuerta
- 234/2006 Bank Ownership And Informativeness Of Earnings.
Víctor M. González
- 235/2006 Developing A Predictive Method: A Comparative Study Of The Partial Least Squares Vs Maximum Likelihood Techniques.
Waymond Rodgers, Paul Pavlou and Andres Guiral.
- 236/2006 Using Compromise Programming for Macroeconomic Policy Making in a General Equilibrium Framework: Theory and Application to the Spanish Economy.
Francisco J. André, M. Alejandro Cardenete y Carlos Romero.

- 237/2006 Bank Market Power And Sme Financing Constraints.
Santiago Carbó-Valverde, Francisco Rodríguez-Fernández y Gregory F. Udell.
- 238/2006 Trade Effects Of Monetary Agreements: Evidence For Oecd Countries.
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano.
- 239/2006 The Quality Of Institutions: A Genetic Programming Approach.
Marcos Álvarez-Díaz y Gonzalo Caballero Miguez.
- 240/2006 La interacción entre el éxito competitivo y las condiciones del mercado doméstico como determinantes de la decisión de exportación en las Pymes.
Francisco García Pérez.
- 241/2006 Una estimación de la depreciación del capital humano por sectores, por ocupación y en el tiempo.
Inés P. Murillo.
- 242/2006 Consumption And Leisure Externalities, Economic Growth And Equilibrium Efficiency.
Manuel A. Gómez.
- 243/2006 Measuring efficiency in education: an analysis of different approaches for incorporating non-discretionary inputs.
Jose Manuel Cordero-Ferrera, Francisco Pedraja-Chaparro y Javier Salinas-Jiménez
- 244/2006 Did The European Exchange-Rate Mechanism Contribute To The Integration Of Peripheral Countries?.
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano
- 245/2006 Intergenerational Health Mobility: An Empirical Approach Based On The Echp.
Marta Pascual and David Cantarero
- 246/2006 Measurement and analysis of the Spanish Stock Exchange using the Lyapunov exponent with digital technology.
Salvador Rojí Ferrari and Ana Gonzalez Marcos
- 247/2006 Testing For Structural Breaks In Variance With additive Outliers And Measurement Errors.
Paulo M.M. Rodrigues and Antonio Rubia
- 248/2006 The Cost Of Market Power In Banking: Social Welfare Loss Vs. Cost Inefficiency.
Joaquín Maudos and Juan Fernández de Guevara
- 249/2006 Elasticidades de largo plazo de la demanda de vivienda: evidencia para España (1885-2000).
Desiderio Romero Jordán, José Félix Sanz Sanz y César Pérez López
- 250/2006 Regional Income Disparities in Europe: What role for location?.
Jesús López-Rodríguez and J. Andrés Faña
- 251/2006 Funciones abreviadas de bienestar social: Una forma sencilla de simultaneizar la medición de la eficiencia y la equidad de las políticas de gasto público.
Nuria Badenes Plá y Daniel Santín González
- 252/2006 "The momentum effect in the Spanish stock market: Omitted risk factors or investor behaviour?".
Luis Muga and Rafael Santamaría
- 253/2006 Dinámica de precios en el mercado español de gasolina: un equilibrio de colusión tácita.
Jordi Perdiguero García

- 254/2006 Desigualdad regional en España: renta permanente versus renta corriente.
José M. Pastor, Empar Pons y Lorenzo Serrano
- 255/2006 Environmental implications of organic food preferences: an application of the impure public goods model.
Ana Maria Aldanondo-Ochoa y Carmen Almansa-Sáez
- 256/2006 Family tax credits versus family allowances when labour supply matters: Evidence for Spain.
José Felix Sanz-Sanz, Desiderio Romero-Jordán y Santiago Álvarez-García
- 257/2006 La internacionalización de la empresa manufacturera española: efectos del capital humano genérico y específico.
José López Rodríguez
- 258/2006 Evaluación de las migraciones interregionales en España, 1996-2004.
María Martínez Torres
- 259/2006 Efficiency and market power in Spanish banking.
Rolf Färe, Shawna Grosskopf y Emili Tortosa-Ausina.
- 260/2006 Asimetrías en volatilidad, beta y contagios entre las empresas grandes y pequeñas cotizadas en la bolsa española.
Helena Chuliá y Hipòlit Torró.
- 261/2006 Birth Replacement Ratios: New Measures of Period Population Replacement.
José Antonio Ortega.
- 262/2006 Accidentes de tráfico, víctimas mortales y consumo de alcohol.
José M^a Arranz y Ana I. Gil.
- 263/2006 Análisis de la Presencia de la Mujer en los Consejos de Administración de las Mil Mayores Empresas Españolas.
Ruth Mateos de Cabo, Lorenzo Escot Mangas y Ricardo Gimeno Nogués.
- 264/2006 Crisis y Reforma del Pacto de Estabilidad y Crecimiento. Las Limitaciones de la Política Económica en Europa.
Ignacio Álvarez Peralta.
- 265/2006 Have Child Tax Allowances Affected Family Size? A Microdata Study For Spain (1996-2000).
Jaime Vallés-Giménez y Anabel Zárate-Marco.
- 266/2006 Health Human Capital And The Shift From Foraging To Farming.
Paolo Rungo.
- 267/2006 Financiación Autonómica y Política de la Competencia: El Mercado de Gasolina en Canarias.
Juan Luis Jiménez y Jordi Perdiguero.
- 268/2006 El cumplimiento del Protocolo de Kyoto para los hogares españoles: el papel de la imposición sobre la energía.
Desiderio Romero-Jordán y José Félix Sanz-Sanz.
- 269/2006 Banking competition, financial dependence and economic growth
Joaquín Maudos y Juan Fernández de Guevara
- 270/2006 Efficiency, subsidies and environmental adaptation of animal farming under CAP
Werner Kleinhanß, Carmen Murillo, Carlos San Juan y Stefan Sperlich

- 271/2006 Interest Groups, Incentives to Cooperation and Decision-Making Process in the European Union
A. Garcia-Lorenzo y Jesús López-Rodríguez
- 272/2006 Riesgo asimétrico y estrategias de momentum en el mercado de valores español
Luis Muga y Rafael Santamaría
- 273/2006 Valoración de capital-riesgo en proyectos de base tecnológica e innovadora a través de la teoría de opciones reales
Gracia Rubio Martín
- 274/2006 Capital stock and unemployment: searching for the missing link
Ana Rosa Martínez-Cañete, Elena Márquez de la Cruz, Alfonso Palacio-Vera and Inés Pérez-Soba Aguilar
- 275/2006 Study of the influence of the voters' political culture on vote decision through the simulation of a political competition problem in Spain
Sagrario Lantarón, Isabel Lillo, M^a Dolores López and Javier Rodrigo
- 276/2006 Investment and growth in Europe during the Golden Age
Antonio Cubel and M^a Teresa Sanchis
- 277/2006 Efectos de vincular la pensión pública a la inversión en cantidad y calidad de hijos en un modelo de equilibrio general
Robert Meneu Gaya
- 278/2006 El consumo y la valoración de activos
Elena Márquez y Belén Nieto
- 279/2006 Economic growth and currency crisis: A real exchange rate entropic approach
David Matesanz Gómez y Guillermo J. Ortega
- 280/2006 Three measures of returns to education: An illustration for the case of Spain
María Arrazola y José de Hevia
- 281/2006 Composition of Firms versus Composition of Jobs
Antoni Cunyat
- 282/2006 La vocación internacional de un holding tranviario belga: la Compagnie Mutuelle de Tramways, 1895-1918
Alberte Martínez López
- 283/2006 Una visión panorámica de las entidades de crédito en España en la última década.
Constantino García Ramos
- 284/2006 Foreign Capital and Business Strategies: a comparative analysis of urban transport in Madrid and Barcelona, 1871-1925
Alberte Martínez López
- 285/2006 Los intereses belgas en la red ferroviaria catalana, 1890-1936
Alberte Martínez López
- 286/2006 The Governance of Quality: The Case of the Agrifood Brand Names
Marta Fernández Barcala, Manuel González-Díaz y Emmanuel Raynaud
- 287/2006 Modelling the role of health status in the transition out of malthusian equilibrium
Paolo Rungo, Luis Currais and Berta Rivera
- 288/2006 Industrial Effects of Climate Change Policies through the EU Emissions Trading Scheme
Xavier Labandeira and Miguel Rodríguez

- 289/2006 Globalisation and the Composition of Government Spending: An analysis for OECD countries
Norman Gemmell, Richard Kneller and Ismael Sanz
- 290/2006 La producción de energía eléctrica en España: Análisis económico de la actividad tras la liberalización del Sector Eléctrico
Fernando Hernández Martínez
- 291/2006 Further considerations on the link between adjustment costs and the productivity of R&D investment: evidence for Spain
Desiderio Romero-Jordán, José Félix Sanz-Sanz and Inmaculada Álvarez-Ayuso
- 292/2006 Una teoría sobre la contribución de la función de compras al rendimiento empresarial
Javier González Benito
- 293/2006 Agility drivers, enablers and outcomes: empirical test of an integrated agile manufacturing model
Daniel Vázquez-Bustelo, Lucía Avella and Esteban Fernández
- 294/2006 Testing the parametric vs the semiparametric generalized mixed effects models
María José Lombardía and Stefan Sperlich
- 295/2006 Nonlinear dynamics in energy futures
Mariano Matilla-García
- 296/2006 Estimating Spatial Models By Generalized Maximum Entropy Or How To Get Rid Of W
Esteban Fernández Vázquez, Matías Mayor Fernández and Jorge Rodríguez-Valez
- 297/2006 Optimización fiscal en las transmisiones lucrativas: análisis metodológico
Félix Domínguez Barrero
- 298/2006 La situación actual de la banca online en España
Francisco José Climent Diranzo y Alexandre Momparler Pechuán
- 299/2006 Estrategia competitiva y rendimiento del negocio: el papel mediador de la estrategia y las capacidades productivas
Javier González Benito y Isabel Suárez González
- 300/2006 A Parametric Model to Estimate Risk in a Fixed Income Portfolio
Pilar Abad and Sonia Benito
- 301/2007 Análisis Empírico de las Preferencias Sociales Respecto del Gasto en Obra Social de las Cajas de Ahorros
Alejandro Esteller-Moré, Jonathan Jorba Jiménez y Albert Solé-Ollé
- 302/2007 Assessing the enlargement and deepening of regional trading blocs: The European Union case
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano
- 303/2007 ¿Es la Franquicia un Medio de Financiación?: Evidencia para el Caso Español
Vanessa Solís Rodríguez y Manuel González Díaz
- 304/2007 On the Finite-Sample Biases in Nonparametric Testing for Variance Constancy
Paulo M.M. Rodrigues and Antonio Rubia
- 305/2007 Spain is Different: Relative Wages 1989-98
José Antonio Carrasco Gallego

- 306/2007 Poverty reduction and SAM multipliers: An evaluation of public policies in a regional framework
Francisco Javier De Miguel-Vélez y Jesús Pérez-Mayo
- 307/2007 La Eficiencia en la Gestión del Riesgo de Crédito en las Cajas de Ahorro
Marcelino Martínez Cabrera
- 308/2007 Optimal environmental policy in transport: unintended effects on consumers' generalized price
M. Pilar Socorro and Ofelia Betancor
- 309/2007 Agricultural Productivity in the European Regions: Trends and Explanatory Factors
Roberto Ezcurra, Belen Iraizoz, Pedro Pascual and Manuel Rapún
- 310/2007 Long-run Regional Population Divergence and Modern Economic Growth in Europe: a Case Study of Spain
María Isabel Ayuda, Fernando Collantes and Vicente Pinilla
- 311/2007 Financial Information effects on the measurement of Commercial Banks' Efficiency
Borja Amor, María T. Tascón and José L. Fanjul
- 312/2007 Neutralidad e incentivos de las inversiones financieras en el nuevo IRPF
Félix Domínguez Barrero
- 313/2007 The Effects of Corporate Social Responsibility Perceptions on The Valuation of Common Stock
Waymond Rodgers , Helen Choy and Andres Guiral-Contreras
- 314/2007 Country Creditor Rights, Information Sharing and Commercial Banks' Profitability Persistence across the world
Borja Amor, María T. Tascón and José L. Fanjul
- 315/2007 ¿Es Relevante el Déficit Corriente en una Unión Monetaria? El Caso Español
Javier Blanco González y Ignacio del Rosal Fernández
- 316/2007 The Impact of Credit Rating Announcements on Spanish Corporate Fixed Income Performance: Returns, Yields and Liquidity
Pilar Abad, Antonio Díaz and M. Dolores Robles
- 317/2007 Indicadores de Lealtad al Establecimiento y Formato Comercial Basados en la Distribución del Presupuesto
Cesar Augusto Bustos Reyes y Óscar González Benito
- 318/2007 Migrants and Market Potential in Spain over The XXth Century: A Test Of The New Economic Geography
Daniel A. Tirado, Jordi Pons, Elisenda Paluzie and Javier Silvestre
- 319/2007 El Impacto del Coste de Oportunidad de la Actividad Emprendedora en la Intención de los Ciudadanos Europeos de Crear Empresas
Luis Miguel Zapico Aldeano
- 320/2007 Los belgas y los ferrocarriles de vía estrecha en España, 1887-1936
Alberte Martínez López
- 321/2007 Competición política bipartidista. Estudio geométrico del equilibrio en un caso ponderado
Isabel Lillo, M^a Dolores López y Javier Rodrigo
- 322/2007 Human resource management and environment management systems: an empirical study
M^a Concepción López Fernández, Ana M^a Serrano Bedía and Gema García Piqueres

- 323/2007 Wood and industrialization. evidence and hypotheses from the case of Spain, 1860-1935.
Iñaki Iriarte-Goñi and María Isabel Ayuda Bosque
- 324/2007 New evidence on long-run monetary neutrality.
J. Cunado, L.A. Gil-Alana and F. Perez de Gracia
- 325/2007 Monetary policy and structural changes in the volatility of us interest rates.
Juncal Cuñado, Javier Gomez Biscarri and Fernando Perez de Gracia
- 326/2007 The productivity effects of intrafirm diffusion.
Lucio Fuentelsaz, Jaime Gómez and Sergio Palomas
- 327/2007 Unemployment duration, layoffs and competing risks.
J.M. Arranz, C. García-Serrano and L. Toharia
- 328/2007 El grado de cobertura del gasto público en España respecto a la UE-15
Nuria Rueda, Begoña Barruso, Carmen Calderón y M^a del Mar Herrador
- 329/2007 The Impact of Direct Subsidies in Spain before and after the CAP'92 Reform
Carmen Murillo, Carlos San Juan and Stefan Sperlich
- 330/2007 Determinants of post-privatisation performance of Spanish divested firms
Laura Cabeza García and Silvia Gómez Ansón
- 331/2007 ¿Por qué deciden diversificar las empresas españolas? Razones oportunistas versus razones económicas
Almudena Martínez Campillo
- 332/2007 Dynamical Hierarchical Tree in Currency Markets
Juan Gabriel Brida, David Matesanz Gómez and Wiston Adrián Risso
- 333/2007 Los determinantes sociodemográficos del gasto sanitario. Análisis con microdatos individuales
Ana María Angulo, Ramón Barberán, Pilar Egea y Jesús Mur
- 334/2007 Why do companies go private? The Spanish case
Inés Pérez-Soba Aguilar
- 335/2007 The use of gis to study transport for disabled people
Verónica Cañal Fernández
- 336/2007 The long run consequences of M&A: An empirical application
Cristina Bernad, Lucio Fuentelsaz and Jaime Gómez
- 337/2007 Las clasificaciones de materias en economía: principios para el desarrollo de una nueva clasificación
Valentín Edo Hernández
- 338/2007 Reforming Taxes and Improving Health: A Revenue-Neutral Tax Reform to Eliminate Medical and Pharmaceutical VAT
Santiago Álvarez-García, Carlos Pestana Barros y Juan Prieto-Rodríguez
- 339/2007 Impacts of an iron and steel plant on residential property values
Celia Bilbao-Terol
- 340/2007 Firm size and capital structure: Evidence using dynamic panel data
Victor M. González and Francisco González

- 341/2007 ¿Cómo organizar una cadena hotelera? La elección de la forma de gobierno
Marta Fernández Barcala y Manuel González Díaz
- 342/2007 Análisis de los efectos de la decisión de diversificar: un contraste del marco teórico “Agencia-
Stewardship”
Almudena Martínez Campillo y Roberto Fernández Gago
- 343/2007 Selecting portfolios given multiple eurostoxx-based uncertainty scenarios: a stochastic goal pro-
gramming approach from fuzzy betas
Enrique Ballester, Blanca Pérez-Gladish, Mar Arenas-Parra and Amelia Bilbao-Terol
- 344/2007 “El bienestar de los inmigrantes y los factores implicados en la decisión de emigrar”
Anastasia Hernández Alemán y Carmelo J. León
- 345/2007 Governance Decisions in the R&D Process: An Integrative Framework Based on TCT and
Knowledge View of The Firm.
Andrea Martínez-Noya and Esteban García-Canal
- 346/2007 Diferencias salariales entre empresas públicas y privadas. El caso español
Begoña Cueto y Nuria Sánchez- Sánchez
- 347/2007 Effects of Fiscal Treatments of Second Home Ownership on Renting Supply
Celia Bilbao Terol and Juan Prieto Rodríguez
- 348/2007 Auditors’ ethical dilemmas in the going concern evaluation
Andres Guiral, Waymond Rodgers, Emiliano Ruiz and Jose A. Gonzalo
- 349/2007 Convergencia en capital humano en España. Un análisis regional para el periodo 1970-2004
Susana Morales Sequera y Carmen Pérez Esparrells
- 350/2007 Socially responsible investment: mutual funds portfolio selection using fuzzy multiobjective pro-
gramming
Blanca M^a Pérez-Gladish, Mar Arenas-Parra , Amelia Bilbao-Terol and M^a Victoria Rodríguez-
Uría
- 351/2007 Persistencia del resultado contable y sus componentes: implicaciones de la medida de ajustes por
devengo
Raúl Iñiguez Sánchez y Francisco Poveda Fuentes
- 352/2007 Wage Inequality and Globalisation: What can we Learn from the Past? A General Equilibrium
Approach
Concha Betrán, Javier Ferri and Maria A. Pons
- 353/2007 Eficacia de los incentivos fiscales a la inversión en I+D en España en los años noventa
Desiderio Romero Jordán y José Félix Sanz Sanz
- 354/2007 Convergencia regional en renta y bienestar en España
Robert Meneu Gaya
- 355/2007 Tributación ambiental: Estado de la Cuestión y Experiencia en España
Ana Carrera Poncela
- 356/2007 Salient features of dependence in daily us stock market indices
Luis A. Gil-Alana, Juncal Cuñado and Fernando Pérez de Gracia
- 357/2007 La educación superior: ¿un gasto o una inversión rentable para el sector público?
Inés P. Murillo y Francisco Pedraja

- 358/2007 Effects of a reduction of working hours on a model with job creation and job destruction
Emilio Domínguez, Miren Ullibarri y Idoya Zabaleta
- 359/2007 Stock split size, signaling and earnings management: Evidence from the Spanish market
José Yagüe, J. Carlos Gómez-Sala and Francisco Poveda-Fuentes
- 360/2007 Modelización de las expectativas y estrategias de inversión en mercados de derivados
Begoña Font-Belaire
- 361/2008 Trade in capital goods during the golden age, 1953-1973
M^a Teresa Sanchis and Antonio Cubel
- 362/2008 El capital económico por riesgo operacional: una aplicación del modelo de distribución de pérdidas
Enrique José Jiménez Rodríguez y José Manuel Fera Domínguez
- 363/2008 The drivers of effectiveness in competition policy
Joan-Ramon Borrell and Juan-Luis Jiménez
- 364/2008 Corporate governance structure and board of directors remuneration policies: evidence from Spain
Carlos Fernández Méndez, Rubén Arrondo García and Enrique Fernández Rodríguez
- 365/2008 Beyond the disciplinary role of governance: how boards and donors add value to Spanish foundations
Pablo De Andrés Alonso, Valentín Azofra Palenzuela y M. Elena Romero Merino
- 366/2008 Complejidad y perfeccionamiento contractual para la contención del oportunismo en los acuerdos de franquicia
Vanessa Solís Rodríguez y Manuel González Díaz
- 367/2008 Inestabilidad y convergencia entre las regiones europeas
Jesús Mur, Fernando López y Ana Angulo
- 368/2008 Análisis espacial del cierre de explotaciones agrarias
Ana Aldanondo Ochoa, Carmen Almansa Sáez y Valero Casanovas Oliva
- 369/2008 Cross-Country Efficiency Comparison between Italian and Spanish Public Universities in the period 2000-2005
Tommaso Agasisti and Carmen Pérez Esparrells
- 370/2008 El desarrollo de la sociedad de la información en España: un análisis por comunidades autónomas
María Concepción García Jiménez y José Luis Gómez Barroso
- 371/2008 El medioambiente y los objetivos de fabricación: un análisis de los modelos estratégicos para su consecución
Lucía Avella Camarero, Esteban Fernández Sánchez y Daniel Vázquez-Bustelo
- 372/2008 Influence of bank concentration and institutions on capital structure: New international evidence
Víctor M. González and Francisco González
- 373/2008 Generalización del concepto de equilibrio en juegos de competición política
M^a Dolores López González y Javier Rodrigo Hitos
- 374/2008 Smooth Transition from Fixed Effects to Mixed Effects Models in Multi-level regression Models
María José Lombardía and Stefan Sperlich

- 375/2008 A Revenue-Neutral Tax Reform to Increase Demand for Public Transport Services
Carlos Pestana Barros and Juan Prieto-Rodríguez
- 376/2008 Measurement of intra-distribution dynamics: An application of different approaches to the European regions
Adolfo Maza, María Hierro and José Villaverde
- 377/2008 Migración interna de extranjeros y ¿nueva fase en la convergencia?
María Hierro y Adolfo Maza
- 378/2008 Efectos de la Reforma del Sector Eléctrico: Modelización Teórica y Experiencia Internacional
Ciro Eduardo Bazán Navarro
- 379/2008 A Non-Parametric Independence Test Using Permutation Entropy
Mariano Matilla-García and Manuel Ruiz Marín
- 380/2008 Testing for the General Fractional Unit Root Hypothesis in the Time Domain
Uwe Hassler, Paulo M.M. Rodrigues and Antonio Rubia
- 381/2008 Multivariate gram-charlier densities
Esther B. Del Brio, Trino-Manuel Níguez and Javier Perote
- 382/2008 Analyzing Semiparametrically the Trends in the Gender Pay Gap - The Example of Spain
Ignacio Moral-Arce, Stefan Sperlich, Ana I. Fernández-Saínz and Maria J. Roca
- 383/2008 A Cost-Benefit Analysis of a Two-Sided Card Market
Santiago Carbó Valverde, David B. Humphrey, José Manuel Liñares Zegarra and Francisco Rodríguez Fernandez
- 384/2008 A Fuzzy Bicriteria Approach for Journal Deselection in a Hospital Library
M. L. López-Avello, M. V. Rodríguez-Uría, B. Pérez-Gladish, A. Bilbao-Terol, M. Arenas-Parra
- 385/2008 Valoración de las grandes corporaciones farmacéuticas, a través del análisis de sus principales intangibles, con el método de opciones reales
Gracia Rubio Martín y Prosper Lamothe Fernández
- 386/2008 El marketing interno como impulsor de las habilidades comerciales de las pyme españolas: efectos en los resultados empresariales
M^a Leticia Santos Vijande, M^a José Sanzo Pérez, Nuria García Rodríguez y Juan A. Trespalacios Gutiérrez
- 387/2008 Understanding Warrants Pricing: A case study of the financial market in Spain
David Abad y Belén Nieto
- 388/2008 Aglomeración espacial, Potencial de Mercado y Geografía Económica: Una revisión de la literatura
Jesús López-Rodríguez y J. Andrés Faíña
- 389/2008 An empirical assessment of the impact of switching costs and first mover advantages on firm performance
Jaime Gómez, Juan Pablo Maícas
- 390/2008 Tender offers in Spain: testing the wave
Ana R. Martínez-Cañete y Inés Pérez-Soba Aguilar

- 391/2008 La integración del mercado español a finales del siglo XIX: los precios del trigo entre 1891 y 1905
Mariano Matilla García, Pedro Pérez Pascual y Basilio Sanz Carnero
- 392/2008 Cuando el tamaño importa: estudio sobre la influencia de los sujetos políticos en la balanza de bienes y servicios
Alfonso Echazarra de Gregorio
- 393/2008 Una visión cooperativa de las medidas ante el posible daño ambiental de la desalación
Borja Montaña Sanz
- 394/2008 Efectos externos del endeudamiento sobre la calificación crediticia de las Comunidades Autónomas
Andrés Leal Marcos y Julio López Laborda
- 395/2008 Technical efficiency and productivity changes in Spanish airports: A parametric distance functions approach
Beatriz Tovar & Roberto Rendeiro Martín-Cejas
- 396/2008 Network analysis of exchange data: Interdependence drives crisis contagion
David Matesanz Gómez & Guillermo J. Ortega
- 397/2008 Explaining the performance of Spanish privatised firms: a panel data approach
Laura Cabeza Garcia and Silvia Gomez Anson
- 398/2008 Technological capabilities and the decision to outsource R&D services
Andrea Martínez-Noya and Esteban García-Canal
- 399/2008 Hybrid Risk Adjustment for Pharmaceutical Benefits
Manuel García-Goñi, Pere Ibern & José María Inoriza
- 400/2008 The Team Consensus–Performance Relationship and the Moderating Role of Team Diversity
José Henrique Dieguez, Javier González-Benito and Jesús Galende
- 401/2008 The institutional determinants of CO₂ emissions: A computational modelling approach using Artificial Neural Networks and Genetic Programming
Marcos Álvarez-Díaz , Gonzalo Caballero Miguez and Mario Soliño
- 402/2008 Alternative Approaches to Include Exogenous Variables in DEA Measures: A Comparison Using Monte Carlo
José Manuel Cordero-Ferrera, Francisco Pedraja-Chaparro and Daniel Santín-González
- 403/2008 Efecto diferencial del capital humano en el crecimiento económico andaluz entre 1985 y 2004: comparación con el resto de España
M^a del Pópulo Pablo-Romero Gil-Delgado y M^a de la Palma Gómez-Calero Valdés
- 404/2008 Análisis de fusiones, variaciones conjeturales y la falacia del estimador en diferencias
Juan Luis Jiménez y Jordi Perdiguero
- 405/2008 Política fiscal en la ue: ¿basta con los estabilizadores automáticos?
Jorge Uxó González y M^a Jesús Arroyo Fernández
- 406/2008 Papel de la orientación emprendedora y la orientación al mercado en el éxito de las empresas
Óscar González-Benito, Javier González-Benito y Pablo A. Muñoz-Gallego
- 407/2008 La presión fiscal por impuesto sobre sociedades en la unión europea
Elena Fernández Rodríguez, Antonio Martínez Arias y Santiago Álvarez García

- 408/2008 The environment as a determinant factor of the purchasing and supply strategy: an empirical analysis
Dr. Javier González-Benito y MS Duilio Reis da Rocha
- 409/2008 Cooperation for innovation: the impact on innovatory effort
Gloria Sánchez González and Liliana Herrera
- 410/2008 Spanish post-earnings announcement drift and behavioral finance models
Carlos Forner and Sonia Sanabria
- 411/2008 Decision taking with external pressure: evidence on football manager dismissals in argentina and their consequences
Ramón Flores, David Forrest and Juan de Dios Tena
- 412/2008 Comercio agrario latinoamericano, 1963-2000: aplicación de la ecuación gravitacional para flujos desagregados de comercio
Raúl Serrano y Vicente Pinilla
- 413/2008 Voter heuristics in Spain: a descriptive approach elector decision
José Luís Sáez Lozano and Antonio M. Jaime Castillo
- 414/2008 Análisis del efecto área de salud de residencia sobre la utilización y acceso a los servicios sanitarios en la Comunidad Autónoma Canaria
Ignacio Abásolo Alessón, Lidia García Pérez, Raquel Aguiar Ibáñez y Asier Amador Robayna
- 415/2008 Impact on competitive balance from allowing foreign players in a sports league: an analytical model and an empirical test
Ramón Flores, David Forrest & Juan de Dios Tena
- 416/2008 Organizational innovation and productivity growth: Assessing the impact of outsourcing on firm performance
Alberto López
- 417/2008 Value Efficiency Analysis of Health Systems
Eduardo González, Ana Cárcaba & Juan Ventura
- 418/2008 Equidad en la utilización de servicios sanitarios públicos por comunidades autónomas en España: un análisis multinivel
Ignacio Abásolo, Jaime Pinilla, Miguel Negrín, Raquel Aguiar y Lidia García
- 419/2008 Piedras en el camino hacia Bolonia: efectos de la implantación del EEES sobre los resultados académicos
Carmen Florido, Juan Luis Jiménez e Isabel Santana
- 420/2008 The welfare effects of the allocation of airlines to different terminals
M. Pilar Socorro and Ofelia Betancor
- 421/2008 How bank capital buffers vary across countries. The influence of cost of deposits, market power and bank regulation
Ana Rosa Fonseca and Francisco González
- 422/2008 Analysing health limitations in spain: an empirical approach based on the european community household panel
Marta Pascual and David Cantarero

- 423/2008 Regional productivity variation and the impact of public capital stock: an analysis with spatial interaction, with reference to Spain
Miguel Gómez-Antonio and Bernard Fingleton
- 424/2008 Average effect of training programs on the time needed to find a job. The case of the training schools program in the south of Spain (Seville, 1997-1999).
José Manuel Cansino Muñoz-Repiso and Antonio Sánchez Braza
- 425/2008 Medición de la eficiencia y cambio en la productividad de las empresas distribuidoras de electricidad en Perú después de las reformas
Raúl Pérez-Reyes y Beatriz Tovar
- 426/2008 Acercando posturas sobre el descuento ambiental: sondeo Delphi a expertos en el ámbito internacional
Carmen Almansa Sáez y José Miguel Martínez Paz
- 427/2008 Determinants of abnormal liquidity after rating actions in the Corporate Debt Market
Pilar Abad, Antonio Díaz and M. Dolores Robles
- 428/2008 Export led-growth and balance of payments constrained. New formalization applied to Cuban commercial regimes since 1960
David Matesanz Gómez, Guadalupe Fugarolas Álvarez-Ude and Isis Mañalich Gálvez
- 429/2008 La deuda implícita y el desequilibrio financiero-actuarial de un sistema de pensiones. El caso del régimen general de la seguridad social en España
José Enrique Devesa Carpio y Mar Devesa Carpio
- 430/2008 Efectos de la descentralización fiscal sobre el precio de los carburantes en España
Desiderio Romero Jordán, Marta Jorge García-Inés y Santiago Álvarez García
- 431/2008 Euro, firm size and export behavior
Silviano Esteve-Pérez, Salvador Gil-Pareja, Rafael Llorca-Vivero and José Antonio Martínez-Serrano
- 432/2008 Does social spending increase support for free trade in advanced democracies?
Ismael Sanz, Ferran Martínez i Coma and Federico Steinberg
- 433/2008 Potencial de Mercado y Estructura Espacial de Salarios: El Caso de Colombia
Jesús López-Rodríguez y Maria Cecilia Acevedo
- 434/2008 Persistence in Some Energy Futures Markets
Juncal Cunado, Luis A. Gil-Alana and Fernando Pérez de Gracia
- 435/2008 La inserción financiera externa de la economía francesa: inversores institucionales y nueva gestión empresarial
Ignacio Álvarez Peralta
- 436/2008 ¿Flexibilidad o rigidez salarial en España?: un análisis a escala regional
Ignacio Moral Arce y Adolfo Maza Fernández
- 437/2009 Intangible relationship-specific investments and the performance of r&d outsourcing agreements
Andrea Martínez-Noya, Esteban García-Canal & Mauro F. Guillén
- 438/2009 Friendly or Controlling Boards?
Pablo de Andrés Alonso & Juan Antonio Rodríguez Sanz

- 439/2009 La sociedad Trenor y Cía. (1838-1926): un modelo de negocio industrial en la España del siglo XIX
Amparo Ruiz Llopis
- 440/2009 Continental bias in trade
Salvador Gil-Pareja, Rafael Llorca-Vivero & José Antonio Martínez Serrano
- 441/2009 Determining operational capital at risk: an empirical application to the retail banking
Enrique José Jiménez-Rodríguez, José Manuel Fera-Domínguez & José Luis Martín-Marín
- 442/2009 Costes de mitigación y escenarios post-kyoto en España: un análisis de equilibrio general para España
Mikel González Ruiz de Eguino
- 443/2009 Las revistas españolas de economía en las bibliotecas universitarias: ranking, valoración del indicador y del sistema
Valentín Edo Hernández
- 444/2009 Convergencia económica en España y coordinación de políticas económicas. un estudio basado en la estructura productiva de las CC.AA.
Ana Cristina Mingorance Arnáiz
- 445/2009 Instrumentos de mercado para reducir emisiones de co2: un análisis de equilibrio general para España
Mikel González Ruiz de Eguino
- 446/2009 El comercio intra e inter-regional del sector Turismo en España
Carlos Llano y Tamara de la Mata
- 447/2009 Efectos del incremento del precio del petróleo en la economía española: Análisis de cointegración y de la política monetaria mediante reglas de Taylor
Fernando Hernández Martínez
- 448/2009 Bologna Process and Expenditure on Higher Education: A Convergence Analysis of the EU-15
T. Agasisti, C. Pérez Esparrells, G. Catalano & S. Morales
- 449/2009 Global Economy Dynamics? Panel Data Approach to Spillover Effects
Gregory Daco, Fernando Hernández Martínez & Li-Wu Hsu
- 450/2009 Pricing levered warrants with dilution using observable variables
Isabel Abinzano & Javier F. Navas
- 451/2009 Information technologies and financial performance: The effect of technology diffusion among competitors
Lucio Fuentelsaz, Jaime Gómez & Sergio Palomas
- 452/2009 A Detailed Comparison of Value at Risk in International Stock Exchanges
Pilar Abad & Sonia Benito
- 453/2009 Understanding offshoring: has Spain been an offshoring location in the nineties?
Belén González-Díaz & Rosario Gandoy
- 454/2009 Outsourcing decision, product innovation and the spatial dimension: Evidence from the Spanish footwear industry
José Antonio Belso-Martínez

- 455/2009 Does playing several competitions influence a team's league performance? Evidence from Spanish professional football
Andrés J. Picazo-Tadeo & Francisco González-Gómez
- 456/2009 Does accessibility affect retail prices and competition? An empirical application
Juan Luis Jiménez and Jordi Perdiguero
- 457/2009 Cash conversion cycle in smes
Sonia Baños-Caballero, Pedro J. García-Teruel and Pedro Martínez-Solano
- 458/2009 Un estudio sobre el perfil de hogares endeudados y sobreendeudados: el caso de los hogares vascos
Alazne Mujika Alberdi, Iñaki García Arrizabalaga y Juan José Gibaja Martíns
- 459/2009 Imposing monotonicity on outputs in parametric distance function estimations: with an application to the spanish educational production
Sergio Perelman and Daniel Santin
- 460/2009 Key issues when using tax data for concentration analysis: an application to the Spanish wealth tax
José M^a Durán-Cabré and Alejandro Esteller-Moré
- 461/2009 ¿Se está rompiendo el mercado español? Una aplicación del enfoque de feldstein –horioka
Saúl De Vicente Queijeiro□, José Luis Pérez Rivero□ y María Rosalía Vicente Cuervo□
- 462/2009 Financial condition, cost efficiency and the quality of local public services
Manuel A. Muñiz□ & José L. Zafra□□
- 463/2009 Including non-cognitive outputs in a multidimensional evaluation of education production: an international comparison
Marián García Valiñas & Manuel Antonio Muñiz Pérez
- 464/2009 A political look into budget deficits. The role of minority governments and oppositions
Albert Falcó-Gimeno & Ignacio Jurado
- 465/2009 La simulación del cuadro de mando integral. Una herramienta de aprendizaje en la materia de contabilidad de gestión
Elena Urquía Grande, Clara Isabel Muñoz Colomina y Elisa Isabel Cano Montero
- 466/2009 Análisis histórico de la importancia de la industria de la desalinización en España
Borja Montaña Sanz
- 467/2009 The dynamics of trade and innovation: a joint approach
Silviano Esteve-Pérez & Diego Rodríguez
- 468/2009 Measuring international reference-cycles
Sonia de Lucas Santos, Inmaculada Álvarez Ayuso & M^a Jesús Delgado Rodríguez
- 469/2009 Measuring quality of life in Spanish municipalities
Eduardo González Fidalgo, Ana Cárcaba García, Juan Ventura Victoria & Jesús García García
- 470/2009 ¿Cómo se valoran las acciones españolas: en el mercado de capitales doméstico o en el europeo?
Begoña Font Belaire y Alfredo Juan Grau Grau
- 471/2009 Patterns of e-commerce adoption and intensity. evidence for the european union-27
María Rosalía Vicente & Ana Jesús López

- 472/2009 On measuring the effect of demand uncertainty on costs: an application to port terminals
Ana Rodríguez-Álvarez, Beatriz Tovar & Alan Wall
- 473/2009 Order of market entry, market and technological evolution and firm competitive performance
Jaime Gomez, Gianvito Lanzolla & Juan Pablo Maicas
- 474/2009 La Unión Económica y Monetaria Europea en el proceso exportador de Castilla y León (1993-2007): un análisis de datos de panel
Almudena Martínez Campillo y M^a del Pilar Sierra Fernández
- 475/2009 Do process innovations boost SMEs productivity growth?
Juan A. Mañez, María E. Rochina Barrachina, Amparo Sanchis Llopis & Juan A. Sanchis Llopis
- 476/2009 Incertidumbre externa y elección del modo de entrada en el marco de la inversión directa en el exterior
Cristina López Duarte y Marta M^a Vidal Suárez
- 477/2009 Testing for structural breaks in factor loadings: an application to international business cycle
José Luis Cendejas Bueno, Sonia de Lucas Santos, Inmaculada Álvarez Ayuso & M^a Jesús Delgado Rodríguez
- 478/2009 ¿Esconde la rigidez de precios la existencia de colusión? El caso del mercado de carburantes en las Islas Canarias
Juan Luis Jiménez y Jordi Perdiguero
- 479/2009 The poni test with structural breaks
Antonio Aznar & María-Isabel Ayuda
- 480/2009 Accuracy and reliability of Spanish regional accounts (CRE-95)
Verónica Cañal Fernández
- 481/2009 Estimating regional variations of R&D effects on productivity growth by entropy econometrics
Esteban Fernández-Vázquez y Fernando Rubiera-Morollón
- 482/2009 Why do local governments privatize the provision of water services? Empirical evidence from Spain
Francisco González-Gómez, Andrés J. Picazo-Tadeo & Jorge Guardiola
- 483/2009 Assessing the regional digital divide across the European Union-27
María Rosalía Vicente & Ana Jesús López
- 484/2009 Measuring educational efficiency and its determinants in Spain with parametric distance functions
José Manuel Cordero Ferrera, Eva Crespo Cebada & Daniel Santín González
- 485/2009 Spatial analysis of public employment services in the Spanish provinces
Patricia Suárez Cano & Matías Mayor Fernández
- 486/2009 Trade effects of continental and intercontinental preferential trade agreements
Salvador Gil-Pareja, Rafael Llorca-Vivero & José Antonio Martínez-Serrano
- 487/2009 Testing the accuracy of DEA for measuring efficiency in education under endogeneity
Salvador Gil-Pareja, Rafael Llorca-Vivero & José Antonio Martínez-Serrano
- 488/2009 Measuring efficiency in primary health care: the effect of exogenous variables on results
José Manuel Cordero Ferrera, Eva Crespo Cebada & Luis R. Murillo Zamorano

- 489/2009 Capital structure determinants in growth firms accessing venture funding
Marina Balboa, José Martí & Álvaro Tresierra
- 490/2009 Determinants of debt maturity structure across firm size
Victor M. González
- 491/2009 Análisis del efecto de la aplicación de las NIIF en la valoración de las salidas a bolsa
Susana Álvarez Otero y Eduardo Rodríguez Enríquez
- 492/2009 An analysis of urban size and territorial location effects on employment probabilities: the spanish case
Ana Viñuela-Jiménez, Fernando Rubiera-Morollón & Begoña Cueto
- 493/2010 Determinantes de la estructura de los consejos de administración en España
Isabel Acero Fraile□ y Nuria Alcalde Fradejas
- 494/2010 Performance and completeness in repeated inter-firm relationships: the case of franchising
Vanessa Solis-Rodriguez & Manuel Gonzalez-Diaz
- 495/2010 A Revenue-Based Frontier Measure of Banking Competition
Santiago Carbó, David Humphrey & Francisco Rodríguez
- 496/2010 Categorical segregation in social networks
Antoni Rubí-Barceló
- 497/2010 Beneficios ambientales no comerciales de la directiva marco del agua en condiciones de escasez: análisis económico para el Guadalquivir
Julia Martin-Ortega, Giacomo Giannoccaro y Julio Berbel Vecino
- 498/2010 Monetary integration and risk diversification in eu-15 sovereign debt markets
Juncal Cuñado & Marta Gómez-Puig
- 499/2010 The Marshall Plan and the Spanish autarky: A welfare loss analysis
José Antonio Carrasco Gallego
- 500/2010 The role of learning in firm R&D persistence
Juan A. Mañez, María E. Rochina-Barrachina, Amparo Sanchis-Llopis & Juan A. Sanchis-Llopis
- 501/2010 Is venture capital more than just money?
Marina Balboa, José Martí & Nina Zieling
- 502/2010 On the effects of supply strategy on business performance: do the relationships among generic competitive objectives matter?
Javier González-Benito
- 503/2010 Corporate cash holding and firm value
Cristina Martínez-Sola, Pedro J. García-Teruel & Pedro Martínez-Solano
- 504/2010 El impuesto de flujos de caja de sociedades: una propuesta de base imponible y su aproximación contable en España
Lourdes Jerez Barroso y Joaquín Texeira Quirós
- 505/2010 The effect of technological, commercial and human resources on the use of new technology
Jaime Gómez & Pilar Vargas

- 506/2010 ¿Cómo ha afectado la fiscalidad a la rentabilidad de la inversión en vivienda en España?
Un análisis para el periodo 1996 y 2007
Jorge Onrubia Fernández y María del Carmen Rodado Ruiz
- 507/2010 Modelización de flujos en el análisis input-output a partir de la teoría de redes
Ana Salomé García Muñiz
- 508/2010 Export-led-growth hypothesis revisited. a balance of payments approach for Argentina, Brazil,
Chile and Mexico
David Matesanz Gómez & Guadalupe Fugarolas Álvarez-Ude
- 509/2010 Realised hedge ratio properties, performance and implications for risk management: evidence
from the spanish ibex 35 spot and futures markets
David G McMillan & Raquel Quiroga García
- 510/2010 Do we sack the manager... or is it better not to? Evidence from Spanish professional football
Francisco González-Gómez, Andrés J. Picazo-Tadeo & Miguel Á. García-Rubio
- 511/2010 Have Spanish port sector reforms during the last two decades been successful? A cost frontier
approach
Ana Rodríguez-Álvarez & Beatriz Tovar
- 512/2010 Size & Regional Distribution of Financial Behavior Patterns in Spain
Juan Antonio Maroto Acín, Pablo García Estévez & Salvador Roji Ferrari
- 513/2010 The impact of public reforms on the productivity of the Spanish ports: a parametric distance
function approach
Ramón Núñez-Sánchez & Pablo Coto-Millán
- 514/2010 Trade policy versus institutional trade barriers: an application using “good old” ols
Laura Márquez-Ramos, Inmaculada Martínez-Zarzoso & Celestino Suárez-Burguet
- 515/2010 The “Double Market” approach in venture capital and private equity activity: the case of Europe
Marina Balboa & José Martí
- 516/2010 International accounting differences and earnings smoothing in the banking industry
Marina Balboa, Germán López-Espinosa & Antonio Rubia
- 517/2010 Convergence in car prices among European countries
Simón Sosvilla-Rivero & Salvador Gil-Pareja
- 518/2010 Effects of process and product-oriented innovations on employee downsizing
José David Vicente-Lorente & José Ángel Zúñiga-Vicente
- 519/2010 Inequality, the politics of redistribution and the tax-mix
Jenny De Freitas
- 520/2010 Efectos del desajuste educativo sobre el rendimiento privado de la educación: un análisis para el
caso español (1995-2006)
Inés P. Murillo, Marta Rahona y M^a del Mar Salinas
- 521/2010 Structural breaks and real convergence in opec countries
Juncal Cuñado
- 522/2010 Human Capital, Geographical location and Policy Implications: The case of Romania
Jesús López-Rodríguez□, Andres Faiña y Bolea Cosmin-Gabriel

- 523/2010 Organizational unlearning context fostering learning for customer capital through time: lessons from SMEs in the telecommunications industry
Anthony K. P. Wensley, Antonio Leal-Millán, Gabriel Cepeda-Carrión & Juan Gabriel Cegarra-Navarro
- 524/2010 The governance threshold in international trade flows
Marta Felis-Rota
- 525/2010 The intensive and extensive margins of trade decomposing exports growth differences across Spanish regions
Asier Minondo Uribe-Etxebarria & Francisco Requena Silvente
- 526/2010 Why do firms locate r&d outsourcing agreements offshore? the role of ownership, location, and externalization advantages
Andrea Martínez-Noya, Esteban García-Canal & Mauro f. Guillén
- 527/2010 Corporate Taxation and the Productivity and Investment Performance of Heterogeneous Firms: Evidence from OECD Firm-Level Data
Norman Gemmell, Richard Kneller, Ismael Sanz & José Félix Sanz-Sanz
- 528/2010 Modelling Personal Income Taxation in Spain: Revenue Elasticities and Regional Comparisons
John Creedy & José Félix Sanz-Sanz
- 529/2010 Mind the Remoteness!. Income disparities across Japanese Prefectures
Jesús López-Rodríguez□, Daisuke Nakamura
- 530/2010 El nuevo sistema de financiación autonómica: descripción, estimación empírica y evaluación
Antoni Zabalza y Julio López Laborda
- 531/2010 Markups, bargaining power and offshoring: an empirical assessment
Lourdes Moreno & Diego Rodríguez
- 532/2010 The snp-dcc model: a new methodology for risk management and forecasting
Esther B. Del Brio, Trino-Manuel Níguez & Javier Perote
- 533/2010 El uso del cuadro de mando integral y del presupuesto en la gestión estratégica de los hospitales públicos
David Naranjo Gil
- 534/2010 Análisis de la efectividad de las prácticas de trabajo de alta implicación en las fábricas españolas
Daniel Vázquez-Bustelo□□ y Lucía Avella Camarero
- 535/2010 Energía, innovación y transporte: la electrificación de los tranvías en España, 1896-1935
Alberte Martínez López
- 536/2010 La ciudad como negocio: gas y empresa en una región española, Galicia 1850-1936
Alberte Martínez López y Jesús Mirás Araujo
- 537/2010 To anticipate or not to anticipate? A comparative analysis of opportunistic early elections and incumbents' economic performance
Pedro Riera Sagrera
- 538/2010 The impact of oil shocks on the Spanish economy
Ana Gómez-Loscós, Antonio Montañés & María Dolores Gadea

- 539/2010 The efficiency of public and publicly-subsidized high schools in Spain. evidence from pisa-2006
María Jesús Mancebón, Jorge Calero, Álvaro Choi & Domingo P. Ximénez-de-Embún
- 540/2010 Regulation as a way to force innovation: the biodiesel case
Jordi Perdigueró & Juan Luis Jiménez
- 541/2010 Pricing strategies of Spanish network carrier
Xavier Fageda, Juan Luis Jiménez & Jordi Perdigueró
- 542/2010 Papel del posicionamiento del distribuidor en la relación entre la marca de distribuidor y lealtad al establecimiento comercial
Oscar González-Benito y Mercedes Martos-Partal
- 543/2010 How Bank Market Concentration, Regulation, and Institutions Shape the Real Effects of Banking Crises
Ana I. Fernández, Francisco González & Nuria Suárez
- 544/2010 Una estimación del comercio interregional trimestral de bienes en España mediante técnicas de interpolación temporal
Nuria Gallego López, Carlos Llano Verduras y Julián Pérez García
- 545/2010 Puerto, empresas y ciudad: una aproximación histórica al caso de Las Palmas de Gran Canaria
Miguel Suárez, Juan Luis Jiménez y Daniel Castillo
- 546/2010 Multinationals in the motor vehicles industry: a general equilibrium analysis for a transition economy
Concepción Latorre & Antonio G. Gómez-Plana
- 547/2010 Core/periphery scientific collaboration networks among very similar researchers
Antoni Rubí-Barceló
- 548/2010 Basic R&D in vertical markets
Miguel González-Maestre & Luis M. Granero
- 549/2010 Factores condicionantes de la presión fiscal de las entidades de crédito españolas, ¿existen diferencias entre bancos y cajas de ahorros?
Ana Rosa Fonseca Díaz, Elena Fernández Rodríguez y Antonio Martínez Arias
- 550/2010 Analyzing an absorptive capacity: Unlearning context and Information System Capabilities as catalysts for innovativeness
Gabriel Cepeda-Carrión, Juan Gabriel Cegarra-Navarro & Daniel Jimenez-Jimenez
- 551/2010 The resolution of banking crises and market discipline: international evidence
Elena Cubillas, Ana Rosa Fonseca & Francisco González
- 552/2010 A strategic approach to network value in information markets
Lucio Fuentelsaz, Elisabet Garrido & Juan Pablo Maicas
- 553/2010 Accounting for the time pattern of remittances in the Spanish context
Alfonso Echazarra
- 554/2010 How to design franchise contracts: the role of contractual hazards and experience
Vanesa Solis-Rodriguez & Manuel Gonzalez-Diaz

- 555/2010 Una teoría integradora de la función de producción al rendimiento empresarial
Javier González Benito
- 556/2010 Height and economic development in Spain, 1850-1958
Ramón María-Dolores & José Miguel Martínez-Carrión
- 557/2010 Why do entrepreneurs use franchising as a financial tool? An agency explanation
Manuel González-Díaz & Vanesa Solís-Rodríguez
- 558/2010 Explanatory Factors of Urban Water Leakage Rates in Southern Spain
Francisco González-Gómez, Roberto Martínez-Espiñeira, Maria A. García-Valiñas & Miguel Á. García Rubio
- 559/2010 Los rankings internacionales de las instituciones de educación superior y las clasificaciones universitarias en España: visión panorámica y prospectiva de futuro.
Carmen Pérez-Esparrells y José M^a Gómez-Sancho.
- 560/2010 Análisis de los determinantes de la transparencia fiscal: Evidencia empírica para los municipios catalanes
Alejandro Esteller Moré y José Polo Otero
- 561/2010 Diversidad lingüística e inversión exterior: el papel de las barreras lingüísticas en los procesos de adquisición internacional
Cristina López Duarte y Marta M^a Vidal Suárez
- 562/2010 Costes y beneficios de la competencia fiscal en la Unión Europea y en la España de las autonomías
José M^a Cantos, Agustín García Rico, M^a Gabriela Lagos Rodríguez y Raquel Álamo Cerrillo
- 563/2010 Customer base management and profitability in information technology industries
Juan Pablo Maicas y Francisco Javier Sese
- 564/2010 Expansión internacional y distancia cultural: distintas aproximaciones —hofstede, schwartz, globe
Cristina López Duarte y Marta M^a Vidal Suárez
- 565/2010 Economies of scale and scope in service firms with demand uncertainty: An application to a Spanish port
Beatriz Tovar & Alan Wall
- 566/2010 Fiscalidad y elección entre renta vitalicia y capital único por los inversores en planes de pensiones: el caso de España
Félix Domínguez Barrero y Julio López Laborda
- 567/2010 Did the cooperative start life as a joint-stock company? Business law and cooperatives in Spain, 1869–1931
Timothy W. Guinnan & Susana Martínez-Rodríguez
- 568/2010 Predicting bankruptcy using neural networks in the current financial crisis: a study for US commercial banks
Félix J. López-Iturriaga, Óscar López-de-Foronda & Iván Pastor Sanz
- 569/2010 Financiación de los cuidados de larga duración en España
Raúl del Pozo Rubio y Francisco Escribano Sotos

- 570/2010 Is the Border Effect an Artefact of Geographic Aggregation?
Carlos Llano-Verduras, Asier Minondo-Urbe & Francisco Requena-Silvente
- 571/2010 Notes on using the hidden asset or the contribution asset to compile the actuarial balance for pay-as-you-go pension systems
Carlos Vidal-Meliá & María del Carmen Boado-Penas
- 572/2010 The Real Effects of Banking Crises: Finance or Asset Allocation Effects? Some International Evidence
Ana I. Fernández, Francisco González & Nuria Suárez Carlos
- 573/2010 Endogenous mergers of complements with mixed bundling
Ricardo Flores-Fillol & Rafael Moner-Colonques
- 574/2010 Redistributive Conflicts and Preferences for Tax Schemes in Europe
Antonio M. Jaime-Castillo & Jose L. Saez-Lozano
- 575/2010 Spanish emigration and the setting-up of a great company in Mexico: bimbo, 1903-2008
Javier Moreno Lázaro
- 576/2010 Mantenimiento temporal de la equidad horizontal en el sistema de financiación autonómica
Julio López Laborda y Antoni Zabalza
- 577/2010 Sobreeducación, Educación no formal y Salarios: Evidencia para España
Sandra Nieto y Raúl Ramos
- 578/2010 Dependencia y empleo: un análisis empírico con la encuesta de discapacidades y atención a la dependencia (edad) 2008.
David Cantarero-Prieto y Patricia Moreno-Mencia
- 579/2011 Environment and happiness: new evidence for Spain
Juncal Cuñado & Fernando Pérez de Gracia
- 580/2011 Aanalysis of emerging barriers for e-learning models. a case of study
Nuria Calvo & Paolo Rungo
- 581/2011 Unemployment, cycle and gender
Amado Peiró, Jorge Belaire-Franch, & Maria Teresa Gonzalo
- 582/2011 An Analytical Regions Proposal for the Study of Labour Markets: An Evaluation for the Spanish Territory
Ana Viñuela Jiménez & Fernando Rubiera Morollón
- 583/2011 The Efficiency of Performance-based-fee Funds
Ana C. Díaz-Mendoza, Germán López-Espinosa & Miguel A. Martínez-Sedano
- 584/2011 Green and good?. The investment performance of US environmental mutual funds
Francisco J. Climent-Diranzo & Pilar Soriano-Felipe
- 585/2011 El fracaso de Copenhague desde la teoría de juegos.
Yolanda Fernández Fernández, M^a Ángeles Fernández López y Blanca Olmedillas Blanco
- 586/2011 Tie me up, tie me down! the interplay of the unemployment compensation system, fixed-term contracts and rehiring
José M. Arranz & Carlos García-Serrano

- 587/2011 Corporate social performance, innovation intensity and their impacts on financial performance: evidence from lending decisions
Andrés Guiral
- 588/2011 Assessment of the programme of measures for coastal lagoon environmental restoration using cost-benefit analysis.
José Miguel Martínez Paz & Ángel Perni Llorente
- 589/2011 Illicit drug use and labour force participation: a simultaneous equations approach
Berta Rivera, Bruno Casal, Luis Currais & Paolo Rungo
- 590/2011 Influencia de la propiedad y el control en la puesta en práctica de la rsc en las grandes empresas españolas
José-Luis Godos-Díez, Roberto Fernández-Gago y Laura Cabeza-García
- 591/2011 Ownership, incentives and hospitals
Xavier Fageda & Eva Fiz
- 592/2011 La liberalización del ferrocarril de mercancías en europa: ¿éxito o fracaso?
Daniel Albalade del Sol, Maria Lluïsa Sort García y Universitat de Barcelona
- 593/2011 Do nonreciprocal preference regimes increase exports?
Salvador Gil-Pareja, Rafael Llorca-Vivero & José Antonio Martínez-Serrano
- 594/2011 Towards a dynamic analysis of multiple-store shopping: evidence from Spanish panel data
Noemí Martínez-Caraballo, Manuel Salvador, Carmen Berné & Pilar Gargallo
- 595/2011 Base imponible y neutralidad del impuesto de sociedades: alternativas y experiencias
Lourdes Jerez Barroso
- 596/2011 Cambio técnico y modelo de negocio: las compañías de transporte urbano en España, 1871-1989
Alberte Martínez López
- 597/2011 A modified dickey-fuller procedure to test for stationarity
Antonio Aznar, María-Isabel Ayuda
- 598/2011 Entorno institucional, estructura de propiedad e inversión en I+D: Un análisis internacional
Félix J. López Iturriaga y Emilio J. López Millán
- 599/2011 Factores competitivos y oferta potencial del sector lechero en Navarra
Valero L. Casanovas Oliva y Ana M. Aldanondo Ochoa
- 600/2011 Política aeroportuaria y su impacto sobre la calidad percibida de los aeropuertos
Juan Luis Jiménez y Ancor Suárez
- 601/2011 Regímenes de tipo de cambio y crecimiento económico en países en desarrollo
Elena Lasarte Navamuel y José Luis Pérez Rivero
- 602/2011 La supervivencia en las empresas de alta tecnología españolas: análisis del sector investigación y desarrollo
Evangelina Baltar Salgado, Sara Fernández López, Isabel Neira Gómez y Milagros Vivel Búa
- 603/2011 Análisis económico y de rentabilidad del sistema financiero español, por tipo de entidades y tamaño, después de cuatro años de crisis y ante los retos de la reestructuración financiera
Salvador Climent Serrano

- 604/2011 Does competition affect the price of water services? Evidence from Spain
Germà Bel, Francisco González-Gómez & Andrés J Picazo-Tadeo
- 605/2011 The Effects of Remoteness in Japanese Educational Levels
Jesús López-Rodríguez & Daisuke Nakamura
- 606/2011 The money market under information asymmetries and imperfectly competitive loan and deposit markets
Aday Hernández
- 607/2011 The effects of airline and high speed train integration
M. Pilar Socorro & M. Fernanda Viéens
- 608/2011 Consecuencias de la imbricación de los clientes en la dirección medioambiental: un análisis empírico
Jesús Ángel del Brío González, Esteban Fernández Sánchez y Beatriz Junquera Cimadevilla
- 609/2011 Revenue autonomy and regional growth: an analysis for the 25 year-process of fiscal decentralisation in Spain
Ramiro Gil-Serrate, Julio López-Laborda & Jesús Mur
- 610/2011 The accessibility to employment offices in the Spanish labor market: Implications in terms of registered unemployment
Patricia Suárez, Matías Mayor & Begoña Cueto
- 611/2011 Time-varying integration in European government bond markets
Pilar Abad, Helena Chuliá & Marta Gómez-Puig
- 612/2011 Production networks and EU enlargement: is there room for everyone in the automotive industry?
Leticia Blázquez, Carmen Díaz-Mora & Rosario Gandoy
- 613/2011 Los factores pronóstico económico, estructura productiva y capacidad de innovar en la valoración de activos españoles
M^a Begoña Font Belaire y Alfredo Juan Grau Grau
- 614/2011 Capital structure adjustment process in firms accessing venture funding
Marina Balboa, José Martí & Álvaro Tresierra
- 615/2011 Flexibilidad Contable en la Valoración de Instrumentos Financieros Híbridos
Jacinto Marabel-Romo, Andrés Guiral-Contreras & José Luis Crespo-Espert
- 616/2011 Why are (or were) Spanish banks so profitable?
Antonio Trujillo-Ponce
- 617/2011 Extreme value theory versus traditional garch approaches applied to financial data: a comparative evaluation
Dolores Furió & Francisco J. Climent
- 618/2011 La restricción de balanza de pagos en la España del euro. Un enfoque comparativo.
David Matesanz Gómez, Guadalupe Fugarolas Álvarez-Ude y Roberto Bande Ramudo
- 619/2011 Is inefficiency under control in the justice administration?
Marta Espasa & Alejandro Esteller-Moré
- 620/2011 The evolving patterns of competition after deregulation
Jaime Gómez Villascuerna, Raquel Orcos Sánchez & Sergio Palomas Doña

- 621/2011 Análisis pre y post-fusiones del sector compuesto por las cajas de ahorros españolas: el tamaño importa
Antonio A. Golpe, Jesús Iglesias y Juan Manuel Martín
- 622/2011 Evaluating three proposals for testing independence in non linear spatial processes
Fernando A. López-Hernández, M. Luz Maté-Sánchez-Val & Andrés Artal-Tur
- 623/2011 Valoración del Mercado de los Activos Éticos en España: una Aplicación del Método de los Precios Hedónicos
Celia Bilbao-Terol y Verónica Cañal-Fernández
- 624/2011 Happiness beyond Material Needs: The Case of the Mayan People
Jorge Guardiola, Francisco González-Gómez & Miguel A. García-Rubio
- 625/2011 Stock characteristics, investor type and market myopia
Cristina Del Rio-Solano & Rafael Santamaria-Aquilué
- 626/2011 Is mistrust under control in the justice administration?
Alejandro Esteller-Moré
- 627/2011 Working capital management, corporate performance, and financial constraints
Sonia Baños-Caballero, Pedro J. García-Teruel & Pedro Martínez-Solano
- 628/2011 On the optimal distribution of traffic of network airlines
Xavier Fageda & Ricardo Flores-Fillol
- 629/2011 Environmental tax and productivity in a subcentral context: new findings on the porter hypothesis
Jaime Vallés- Giménez & Anabel Zárata-Marco
- 630/2011 The impact of scale effects on the prevailing internet-based banking model in the US
Alexandre Momparlera, Francisco J. Climentb & José M. Ballesterb
- 631/2011 Student achievement in a cross-country perspective: a multilevel analysis of pisa2006 data for Italy and Spain
Tommaso Agasisti & Jose Manuel Cordero-Ferrera
- 632/2011 Banking liberalization and firms' debt structure: International evidence
Víctor M. González & Francisco González
- 633/2011 Public sector contingent liabilities in Spanish toll roads
Carlos Contreras
- 634/2011 Fiscal Sustainability and Immigration in the Madrid Region
Luis Miguel Doncel, Pedro Durá, Pilar Grau-Carles & Jorge Sainz
- 635/2011 Las desviaciones presupuestarias del gasto del estado en el periodo 1990-2009: un análisis desde las perspectivas agregada y de programas.
Valentín Edo Hernández
- 636/2011 A network approach to services internationalization
Stefano Visintin
- 637/2011 Factors behind the presence of agricultural credit cooperatives in Spain, 1900-1935: an econometric model
Ángel Pascual Martínez-Soto, Ildefonso Méndez- Martínez & Susana Martínez-Rodríguez.

- 638/2011 La eficiencia técnica en la industria de agua latinoamericana medida a través de la función de distancia
Angel Higuerey Gómez , Lourdes Trujillo Castellano y María Manuela González Serrano
- 639/2011 Urban Patterns, Population Density and the Cost of Providing Basic Infrastructure: A Frontier Approach
Inmaculada C. Álvarez, Ángel M. Prieto & José L. Zofío
- 640/2011 A comparison of national vs. multinational firms' performance using a general equilibrium perspective
María C. Latorre
- 641/2011 A computable general equilibrium evaluation of market performance after the entry of multinationals
María C. Latorre
- 642/2011 Competition for procurement shares
José Alcalde & Matthias Dahm
- 643/2011 Air services on thin routes: regional versus low-cost airlines
Xavier Fageda & Ricardo Flores-Fillol
- 644/2011 Efficiency and Stability in a Strategic Model of Hedonic Coalitions
Antoni Rubí-Barceló
- 645/2011 An analysis of the cost of disability across Europe using the standard of living approach
José-Ignacio Antón, Francisco-Javier Braña & Rafael Muñoz de Bustillo
- 646/2011 Estimating the gravity equation with the actual number of exporting firms
Asier Minondo & Francisco Requena
- 647/2011 New public management-delivery forms, quality levels and political factors on solid management waste costs in Spanish local governments
José Luis Zafra-Gómez, Diego Prior Jiménez, Ana María Plata Díaz & Antonio M López Hernández
- 648/2011 El sector financiero como factor desestabilizador para la economía a partir del análisis de Hyman Minsky
Isabel Gimenez Zuriaga
- 649/2011 Determinantes de la prima de riesgo en las emisiones de bonos de titulización hipotecaria en España (1993-2011)
Miguel Ángel Peña Cerezo, Arturo Rodríguez Castellanos y Francisco Jaime Ibáñez Hernández
- 650/2011 Does complexity explain the structure of trade?
Asier Minondo & Francisco Requena
- 651/2011 Supplementary pensions and saving: evidence from Spain
José-Ignacio Antón, Rafael Muñoz de Bustillo & Enrique Fernández-Macías
- 652/2011 The role of destination spatial spillovers and technological intensity in the location of manufacturing and services firms
Andrés Artal-Tur, José Miguel Navarro-Azorín & María Luisa Alamá-Sabater

- 653/2011 El papel de los márgenes extensivo e intensivo en el crecimiento de las exportaciones manufactureras españolas por sectores tecnológico
Juan A. Máñez, Francisco Requena-Silvente, María E. Rochina-Barrachina y Juan A. Sanchis-Llopis
- 654/2011 Incumbents and institutions: how the value of resources varies across markets
Lucio Fuentelsaz, Elisabet Garrido & Juan Pablo Maicas
- 655/2011 Price differences between domestic and international air markets: an empirical application to routes from Gran Canaria
Xavier Fageda, Juan Luis Jiménez & Carlos Díaz Santamaría
- 656/2012 The role of accruals quality in the access to bank debt
Pedro J. García-Teruel, Pedro Martínez-Solano and Juan P. Sánchez-Ballesta
- 657/2012 Trade Under Uncertainty: Legal Institutions Matter
Lisa Kolovich & Isabel Rodríguez-Tejedo
- 658/2012 La relación bidireccional entre la rsc y el resultado empresarial: conclusiones de un estudio empírico el sector de las cajas de ahorros
Almudena Martínez Campillo, Laura Cabeza García y Federico Marbella Sánchez
- 659/2012 Consejos de administración y performance de la empresa: efecto de la pertenencia a múltiples consejos
Félix J. López Iturriaga y Ignacio Morrós Rodríguez
- 660/2012 Análisis comparado de los sistemas eléctricos en España y Argentina, 1890-1950. Estrategias globales y experiencias divergentes de la electrificación en dos países de industrialización tardía
Isabel Bartolomé y Norma Silvana Lanciotti
- 661/2012 Leverage and corporate performance: International evidence
Víctor M. González
- 662/2012 Procesos de prociclicidad crediticia e impacto de la provisión estadística en España
Francisco Jaime Ibáñez Hernández, Miguel Ángel Peña Cerezo y Andrés Araujo de la Mata
- 663/2012 Policy success or economic slowdown?. Effects of the 80 km•h-1 speed limit on air pollution in the Barcelona metropolitan area
Germà Bel i Queralt & Jordi Rosell i Segura
- 664/2012 Modelos regulatorios en las telecomunicaciones fijas de banda ancha: competencia en redes frente a competencia en servicios. la evidencia empírica en la OCDE y España
Juan Rubio Martín y César Sánchez Pérez
- 665/2012 Regional export promotion offices and trade margins
Salvador Gil-Pareja, Rafael Llorca-Vivero, José Antonio Martínez-Serrano & Francisco Requena-Silvente
- 666/2012 An Experimental Study of Gender Differences in Distributive Justice
Ismael Rodríguez-Lara
- 667/2012 Spanish savings banks in the credit crunch: could distress have been predicted before the crisis? A multivariate statistical analysis
Martí Sagarra, Cecilio Mar-Molinero & Miguel García-Cestona

- 668/2012 Cities to live or to work in: an input-output model of migration and commuting
Ana Viñuela & Esteban Fernández-Vázquez
- 669/2012 Non-linear Dynamics in Discretionary Accruals: An Analysis of Bank Loan-Loss Provisions
Marina Balboa, Germán López-Espinosa & Antonio Rubia
- 670/2012 Iniciación, persistencia e intensificación en la realización de actividades de I+D en España
Dolores Añón Higón, Juan A. Máñez and y Juan A. Sanchis-Llopis
- 671/2012 La neutralidad financiera en el impuesto sobre sociedades: microsimulación de las opciones de reforma para España
Lourdes Jerez Barroso y Fidel Picos Sánchez
- 672/2012 When trains go faster than planes: The strategic reaction of airlines in Spain
Juan Luis Jiménez and Ofelia Betancor
- 673/2012 Distribución del gasto sanitario público por edad y sexo en España: Análisis de la década 1998-2008
Ángela Blanco Moreno, Rosa Urbanos Garrido y Israel John Thuissard Vasallo
- 674/2012 Does school ownership matter? An unbiased efficiency comparison for Spain regions
Eva Crespo-Cebada, Francisco Pedraja-Chaparro and Daniel Santín
- 675/2012 Factores condicionantes de la desigualdad educativa: un análisis para el caso español
Crespo Cebada, Eva, Díaz Caro, Carlos y Jesús Pérez Mayo
- 676/2012 Integrating network analysis and interregional trade to study the spatial impact of transport infrastructure using production functions
Inmaculada C. Álvarez-Ayuso, Ana M. Condeço-Melhorado, Javier Gutiérrez y Jose L. Zofío
- 677/2012 An actuarial balance model for DB PAYG pension systems with disability and retirement contingencies
Manuel Ventura-Marco & Carlos Vidal-Meliá
- 678/2012 Will it last? An assessment of the 2011 Spanish pension reform using the Swedish system as benchmark
Carlos Vidal-Meliá
- 679/2012 Iniciativas educativas en las universidades mexicanas: un análisis estadístico multivariante
Martí Sagarra, Cecilio Mar-Molinero & Herberto Rodríguez-Regordosa
- 680/2012 Tributación y política de dividendos de las sociedades no financieras, 2000-2010
Félix Domínguez Barrero y Julio López Laborda
- 681/2012 Lending relationships and credit rationing: the impact of securitization
Santiago Carbó-Valverde, Hans Degryse & Francisco Rodriguez-Fernandez
- 682/2012 Percepciones de los ciudadanos sobre las haciendas regionales: quién es y quién debería ser responsable de los servicios e impuestos autonómicos
Julio López Laborda y Fernando Rodrigo
- 683/2012 Trade credit, the financial crisis, and firm access to finance
Santiago Carbó-Valverde, Francisco Rodríguez-Fernández & Gregory F. Udell
- 684/2012 Changing market potentials and regional growth in Poland
Jesús López-Rodríguez & Malgorzata Runiewicz-Wardyn

- 685/2012 Firm boundaries and investments in information technologies in Spanish manufacturing firms
Jaime Gómez, Idana Salazar & Pilar Vargas
- 686/2012 Movimientos de capital, inserción en el mercado mundial y fluctuaciones financieras de la economía cubana: la bolsa de la habana, 1910-1959
Javier Moreno Lázaro
- 687/2012 El impacto de la inmigración sobre el crecimiento económico español. un enfoque contable
Rodrigo Madrazo García de Lomana
- 688/2012 Structural equivalence in the input-output field
Ana Salomé García Muñiz
- 689/2012 Testing the expectations hypothesis in euro overnight interest swap rates
Lucía Hernandis & Hipòlit Torró
- 690/2012 Bank asset securitization before the crisis: Liquidity, bank type and risk transfer as determinants
Martí Sagarra, Miguel García-Cestona & Josep Rialp
- 691/2012 Análisis del riesgo soberano utilizando mapas auto-organizativos. el caso de europa, España y Alemania
Félix J. López Iturriaga e Iván Pastor Sanz
- 692/2012 Economic forecasting with multivariate models along the business cycle
Carlos Cuerpo & Pilar Poncela
- 693/2012 Testing opvar accuracy: an empirical back-testing on the loss distribution approach
José Manuel Feria-Domínguez, Enrique J. Jiménez-Rodríguez & M^a Paz Rivera-Pérez
- 694/2012 Is the boost in oil prices affecting the appreciation of real exchange rate?: Empirical evidence of “Dutch disease” in Colombia
Pilar Poncela, Eva Senra & Lya Paola Sierra
- 695/2012 Market efficiency and lead-lag relationships between spot, futures and forward prices: The case of the Iberian Electricity Market (MIBEL)
Jose María Ballester, Francisco Climent & Dolores Furió
- 696/2012 Complementarities in the innovation strategy: do intangibles play a role in enhancing the impact of r&d on firm performance?
Dolores Añón, Jaime Gómez & Pilar Vargas
- 697/2012 The real effects of bank branch deregulation at various stages of economic development: The European experience
José Manuel Pastor, Lorenzo Serrano & Emili Tortosa-Ausina
- 698/2012 Effects of the financial crisis on the european integration process: relevance of exchange rate, inflation and domestic risks
Alfredo J. Grau-Grau
- 699/2012 Las Preferencias por la Redistribución: Teoría y Evidencia para España
Julio López Laborda y Eduardo Sanz Arcega
- 700/2012 Firm boundaries and investments in information technologies in spanish manufacturing firms
Jaime Gómez, Idana Salazar and Pilar Vargas

- 701/2012 Oil Prices and Inflation in the Euro Area and its Main Countries: Germany, France, Italy and Spain
César Castro, Pilar Poncela and Eva Senra
- 702/2012 Oportunismo y sistemas de gestión medioambiental: las certificaciones como cortina de humo ante los grupos de interés
Gustavo Lannelongue Nieto y Javier González Benito
- 703/2012 Variance Swaps and Gamma Swaps. The Theory and Reality of Model-Free Replication
Jacinto Marabel-Romo