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

FUNDACIÓN DE LAS CAJAS DE AHORROS DOCUMENTO DE TRABAJO Nº 527/2010 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.

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

Abstract

This paper adds to the recent literature use micro-level data to examine the response of firms' productivity levels or growth rates to various policy settings. Our particular interest is to investigate how far corporate tax settings might affect firms' innovation and risk-taking activity. Previous investigations of this issue have examined the link between higher corporate taxes and firm-level total factor productivity (TFP) as mediated through higher profitability. That is, firms with higher corporate profits but in regimes involving higher corporate tax rates are expected to have lower TFP than equivalent firms in low corporate tax regimes. In this paper we re-examine this evidence – which has suggested apparently large and persistent impacts of corporate tax on firm-level TFP, as mediated through profits. We then consider how far alternative indicators of firm-level innovation/technology can provide better proxies for the impact of taxes on productivity via innovation effects than those based on firm profits.

Using an econometric model of innovation and productivity similar to that proposed by Griffith et al. (2006) and Schwellnus and Arnold (S&A, 2008), we show that:

- Using a similar sized sample to S&A (2008) but which does *not* exclude small (<20 employee) firms, the estimated impact of higher corporate tax rates on TFP *when interacted with firm profit levels* is no longer implausibly large and occurs relatively quickly (within 4-5 years rather than over decades).
- Using alternative measures of industries' innovative characteristics such as research intensity, the extent of intra-industry trade and firm entry-exit rates, we find stronger evidence that firms in those 'innovation intensive' industries are more adversely affected by high corporate tax rates than those in low 'innovation intensive' industries.
- Higher corporate tax rates, via their effect on the post-tax user cost of capital have significant adverse effects on firm's investment levels.

Keywords: corporate taxation, productivity, investment

JEL classification: D21, E22, H25, H32

1. Introduction

Macro-dynamic modelling in recent years has made great strides in analysing the potential impact of changes in tax policy on a variety of macro variables including output and productivity levels and the transitional/long-run rates of output or productivity growth (e.g. Barro et al., 1995; Turnovsky, 2004). While some of these models have been 'tested' by calibrating them to specific country (usually US) characteristics, in general empirical tests of such models have relied on aggregate level regressions for panels of different country samples, (see, for example, Kneller et al., 1999; Bleaney, et al 2001; Lee and Gordon, 2005; Angelopoulos et al., 2007; Myles, 2007; Romer and Romer, 2007; Arnold, 2008; Romero-Avila and Strauch, 2008). While these studies increasingly find evidence consistent with significant adverse impacts on long-run GDP growth rates from increases in various 'distortionary' taxes, the reliability of these high-level reduced form estimates has proved hard to pin down.

Micro-level evidence – at the firm, industry or sector levels – is comparatively scarce; what there is tends to focus on tax impacts on investment in particular or factors expected to contribute to overall investment or productivity performance – such as research and development expenditures, human capital formation or inter-industry and inter-country reallocations of investment or profit. [references to tax-investment & MNC investment/profit-shifting studies]. Much of this literature confirms that various types of investment activity or the location of corporate investments and profits are responsive to particular aspects of countries' tax regimes. Whether *factor productivity* is affected at the micro level by those same tax regimes is less clear with only one study, to our knowledge, addressing this aspect directly – Schwellnus and Arnold (2008).

Schwellnus and Arnold (2008) use a sample of firm-level data for OECD countries over 1996-2004 to investigate whether firms facing higher corporate tax rates on their profits exhibit lower total factor productivity (TFP) and investment levels compared to firms facing lower corporate tax rates. Based on the identifying assumption that "firm level TFP growth in very profitable sectors should be lower relative to sectors with low profitability in countries with high corporate taxes" they find that firm-level productivity appears to be lower in high tax country-year combinations. This may partly reflect companion evidence that investment is also lower in high tax contexts (in response to a higher user cost of capital) and if technological advances are at least partly embodied in this investment.

The Schwellnus and Arnold (S&A) analysis is an innovative and helpful advance in the methodologies applied to the study of the productivity effects of corporate tax changes but is limited by two aspects (methodological issues are discussed in more detail below). Firstly, because differences in corporate tax rates (across countries and/or time) affect firms differentially to the extent that their taxable profits differ, in the S&A estimation model a corporate profit-tax rate interaction term is the sole tax variable used to identify corporate tax effects. It might be expected that other corporate tax parameters (in addition to statutory rates) and variables other than profit could mediate corporate tax effects to TFP. More importantly, the key hypothesis is that corporate taxes reduce innovation and risk-taking and hence adversely affect TFP. However, while a measure of corporate profitability proxies the relevant tax base, it is unclear whether, or how far, this reflects the innovative or risk-taking characteristics of firms.

Secondly the estimated TFP impact of a corporate tax change is surprisingly large: TFP growth for a 'median firm' is around 0.4 percentage points higher when the statutory corporate rate is reduced from 35% to 30% and since "*trend TFP growth of OECD countries averaged 1.1% over the period 2000-2005 ... this is actually a large number*" (S&A, 2008, p.16). Arguably this estimate puts it in the 'implausibly large' category, in the same way that previous estimates based on aggregate level data have been described as implausibly large.

In this paper, we examine a firm-level dataset for OECD countries very similar to that used by S&A to re-test for the tax-profitability effects on TFP measured by S&A. We further argue that, to the extent that corporate tax can be expected to impact on firms' innovation or risk-taking characteristics that are hypothesised to generate different TFP growth across firms, this may be captured by a number of firm characteristics, not just firms' overall profit levels. In particular we argue that corporate tax may impact on productivity via interactions with inter-firm differences in 'research intensity', the degree of intra-industry trade, and firms' entry/exit/survival characteristics.

The remainder of the paper is structured as follows. In section 2 we discuss the relevant hypotheses linking corporate tax and firm productivity within an overall model of firm productivity. Section 3 then describes the data and methodology we use and section 4 discusses our econometric results. Section 5 draws some conclusions.

2. Corporate Tax, Technology and Total Factor Productivity

A model of the impact of tax on firm-level productivity requires a model of the various factors driving that productivity and the ways in which they are, or are not, likely to be susceptible to tax policy. Recent models of firm productivity, in turn, have focused on technological innovation as a key force driving firms' TFP levels. Successful innovations by firms, whether technological, managerial or whatever, can be expected to yield an economic return (profit) *inter alia* through their ability to raise the firm's TFP. Griffith *et al* (2006) for example, argue that the notion of an expanding 'frontier technology' and firms' heterogeneous abilities to catch-up on the frontier, can help explain simultaneous but counterveiling tendencies toward convergence and divergence in firms' productivity levels.¹ As they emphasise (p.4) for the UK case: the "*aggregate picture hides substantial heterogeneity across establishments and a Darwinian process of selection as poor performers exited and were replaced by new cohorts of establishments*". That is, understanding how technology affects firm-level productivity needs to recognise the heterogeneous circumstances, and turnover, of firms. We discuss this further below.

How might firm-level taxation affect innovation/productivity processes? As S&A (2008) note, if successful innovations are measured by the net-of-tax rate of return, then to the extent that tax parameters drive a wedge between a firm's gross and net returns, they can be expected to discourage that innovative activity, that in turn impacts negatively on a firm's ability to improve its productivity levels, other things equal. In principle this applies to both incorporated and unincorporated enterprises – such that the relevant tax parameters will differ in each case depending on these enterprises' liabilities under personal, corporate and other tax schedules. In our empirical work we focus on incorporated firms so that it is the impact of effective rates of corporate tax that are most relevant.

Standard features of corporate tax in OECD countries typically include (i) the use of one or more statutory rates (e.g. some countries set lower rates at low profit levels); (ii) limitations on the extent of tax rebates for negative profits (losses) generating asymmetric treatment of profits and losses (e.g. Auerbach, 1986; Altschuler and Auerbach, 1990; Cooper and Knittel, 2006; Creedy and Gemmell, 2009); (iii) various deductions offsetting tax liabilities on gross profits such as capital allowances, credits for R&D expenditures etc.

¹ Where technological improvements are embodied in new capital, and the measurement of this capital is unable to fully capture 'quality' improvements, some of this innovative improvement may appear to be attributable to firms' investment rather than TFP. This raises important issues for the measurement and interpretation of changes in capital stock and TFP.

These have the effect of generating firm-specific ETRs that can be quite different from statutory rates of tax and also contributing some progressivity to most corporate tax regimes.

This latter effect is especially associated with loss-making, and its tax treatment. As Auerbach (2007) has shown for the US for example, limitations on the use of losses for tax purposes is the major factor that has reduced effective average tax rates (EATRs) and changes in EATRs over time. In addition, as S&A (2008) and Gentry and Hubbard (2004a,b) point out, corporate taxes can be characterised as 'success taxes' since effective marginal rates are typically higher at higher profit levels, via the asymmetric treatment of losses, and because this feature also ensures the government taxes risky investments that are successful (yield higher profit) more than risky investments that fail (make a loss). To model the impact of corporate taxes on TFP we use the Griffiths *et al* (2006) model of firm technology (which ignores taxation), augmented by the insights of S&A (2008) to allow us to test for tax-specific impacts on firm TFP.

The model proposed by Griffith *et al* (2006) allows for a distribution of productivity across firms that changes over time and where each firm has the potential to catch-up on bestpractice technology in 'frontier' firms. Their formulation captures productivity convergence, but can also accommodate some persistence in firms' productivity levels over time. Their starting point is equation (1) below where lnA_{it} , is an index of technology or TFP (in firm *i*, at time, *t*). It is a function of previous TFP levels, lnA_{it-1} , allowing some persistence, a (heterogeneous) component reflecting the individual firms' abilities to generate TFP improvements, γ_i , and the frontier technology currently available in firm *j*, $lnA_{Fj t-1}$, capturing convergence or 'catch-up' possibilities. Hence, represented in ADL (1,1) form:

$$\ln A_{tt} = \gamma_t + a_1 \ln A_{tt-1} + \beta_0 A_{F_{tt}} + \beta_1 A_{F_{tt-1}} + u_{tt}$$
(1)

where u_{it} is a white noise error terms representing stochastic shocks to TFP²; or in error correction form as:

$$\Delta \ln A_{tt} = \gamma_t + \beta_0 \Delta A_{F_{jt}} + \phi \left\{ \ln A_{tt-1} + \beta^t A_{F_{jt-1}} \right\} + u_{tt}$$
(1')

 $^{^{2}}$ Note that (1) can be re-arranged to be expressed in terms of the *change* in TFP, and Griffith *et al* allow for it to be applied only to firms whose TFP remains high enough to remain in the industry, with implications for methods of testing (see below).

where $\beta^{*} = \frac{\beta_{1} + \beta_{1}}{1 - \alpha_{1}}$ is the long-run growth rate of frontier technology and $\phi = 1 - \alpha_{1}$ is the error correction parameter.

Equation (1') captures heterogeneity in firm productivity across industries (and countries). It allows for endogenous productivity catch-up but the presence of γ_i ensures that firms may converge towards their own equilibrium productivity path relative to that of the frontier firm(s). In the long-run, even if all firms' TFPs grow at the same rate, they are not necessarily converging to the same *level*. In addition, stochastic shocks to TFP together with the speed of correction to the steady-state mean that firms observed TFP may be 'transitional' for many periods. With the addition of a homogeneity assumption (that in the long-run all firms TFPs will grow at the rate of the frontier TFP), equation (1') can be rewritten in terms of firm's TFP *relative to* frontier levels, as:

$$\Delta \ln A_{te} = \gamma_t + \beta \Delta A_{F_{te}} + \phi \left(\frac{A_t}{A_{F_t}}\right)_{t=1} + u_{te}$$
⁽²⁾

Equation (2) forms the basis of our TFP model (with the addition of suitable industry, country and time fixed effects) prior to consideration of corporate tax impacts. Tax effects may be short-run and/or long-run (we focus on the latter in reporting our empirical estimates), and can be thought of as impacting on the firm-specific rates of TFP growth, γ_i .³ Conceptually this operates via the tax-wedge driven between the pre- and post-tax rates of return on innovations that drive each firm's productivity improvements (or declines - where tax affects declining firms or induces that decline). How we capture those tax impacts in our empirical model, we turn to next.

An interesting question concerns what country-, industry- of firm-specific characteristics might drive firm-level productivity and which are also susceptible to corporate tax settings? Information of firms' individual corporate tax liabilities would allow us to explore this question directly; for example, is a higher tax liability via effective marginal tax rate associated with lower TFP? Unfortunately *firm*-level corporate tax data is unavailable. Statutory corporate tax rate data by country and time period is however available, and we can

³ Griffith *et al* (2006) include a firm-specific fixed effect to pick up those firm-level sources of innovation. Doing so in our case would effectively remove the firm-specific sources of variation that may be due to corporate tax effects and that it is desired to identify here. We therefore include country, industry and time fixed effects but exclude firm fixed effects.

examine how far this affects industry-specific factors expected to be impacted by corporate tax – such as profitability.

The key insight of S&A (2008) is to recognise that firm-level corporate tax liability is a function of each firm's taxable profit levels in addition to the relevant tax rate. Though this profit data is also not available at the firm level, S&A (2008) construct *industry-level* information of firm profitability. However, this is based on *accounting* profit data rather than the *taxable* profit, net of relevant deductions, to which corporate tax rates are directly applicable, and hence at best proxies the relevant tax base. When combined with country-time-specific data on corporate tax rates, this allows S&A (2008) to apply to difference-in-difference estimation framework proposed by Rajan and Zingales (1998) to examine whether greater financial development assists firm growth.

The rationale is as follows. Ragan and Zingales (1998) argue that, if the level of financial development of an economy is important for its growth then, within a country, firms that have better access to sources of finance external to the firm should be less constrained, other things equal, than firms relying on internal finance. This suggests an empirical testing strategy that exploits the difference-in-difference approach recognising that firms within sectors that are inherently less dependent on internal finance should be observed to growth faster in countries that are more financially developed compared to firms in the same sectors in countries that are less financially developed. For present purposes, in effect S&A (2008) replace the country- and time-specific 'financial development' element of Rajan & Zingales with the 'statutory corporate tax rate', and replace the industry-specific element of 'external finance dependence' with industry-specific profitability. Since profit represents (at least in principle; more on this in section 3) the tax base to which the corporate tax rate is applied, then firms observed in inherently more profitable industries might be expected to have lower productivity in countries and/or years where corporate tax rates are higher, compared to firms in the same industries in low tax countries/years.

It is also worth noting that, since firm-level TFP might be expected to be positively, and endogenously, correlated with the firm's profitability (the tax base), the predicted negative impact on TFP of higher corporate tax rates arises despite this positive, endogenous relationship. That is, to the extent that profitability is thought to be determined simultaneously with TFP, this endogeneity should *reduce*, not increase, our likelihood of

finding a negative observed association between corporate tax liabilities and TFP. In addition, the use of *industry*-level profitability mitigates this possible endogeneity at firm level.

The values of a firm's profits as reflected in company accounts (the S&A data source, and the one used in this paper) are often very different from profits liable to corporate tax (at the host country rate). Nevertheless, as a 'tax base' proxy, accounting profit might be expected to broadly capture the potential for more profitable industries to face higher tax liabilities. With profit measured relative to value added, a measure of industry 'profitability' interacted with the corporate tax rate represents a form of industry-level effective average tax rate.

However, two important elements of the potential impact of corporate tax on TFP are the particular effects on innovation and risk-taking, with successful ventures (as evidenced, for example, in greater profitability) typically penalised disproportionately by corporate tax regimes. Various aspects of corporate tax regimes, other than the statutory rate, such as R&D tax credits or deductions for some or all types of investment, are aimed at reducing the adverse impact of corporation tax on firm's 'success'. These may not be observed through levels of firms' accounting profits, but rather through choices over types of investment or the extent of activities that give rise to reductions in *taxable* profits via increased deductions. To the extent that these aspects, stimulated by the corporate tax regime, generate productivity improvements (as opposed to corporate tax minimising strategies with no 'real' economic benefits) they should be evident in firm-level TFP.

Of course, even where *taxable* profits are available, these will allow tests of the influence of corporate tax on TFP via profitability which cannot specifically test the hypothesis that it is the impact of tax on firms' innovation and risk-taking activities that acts as the mechanism by which higher corporate tax rates reduce productivity. *Any* firm with a higher level of profitability but where these profits are taxed more highly could expect to experience lower TFP levels of growth. For example, the availability of internal sources of finance may be the binding constraint on firms' investment that would enhance productivity. In this case corporate tax will adversely affect productivity but it may be unrelated to firms' willingness or ability to innovate or make risky investment choices.

While measures of innovation or risk-taking are necessarily imprecise and difficult to pin down, we propose to test how far indictors that are more likely to be closely associated with innovation/risk-taking (than is profitability) are associated with lower TFP when combined with higher corporate tax rates. In particular, innovation is often argued to be associated with research-intensity, with Research & Development (R&D) argued to be a prerequisite for successful innovative products and processes (Griffith et al, 2004). Along similar lines, it has been argued that common characteristics of innovative industries include heightened levels of intra-industry trade (Melitz, 2003; Abraham and Van Hove, 2005; Balboni, 2005) and high rates of entry and exit of firms (Samaniego, 2009; Aghion, 2006; Aghion et al, 2006)

To examine these potential corporate tax impacts we construct industry-level measures of R&D intensity, intra-industry trade and firm entry-exit rates. A rational for these measures is that, like profitability, they are commonly argued to be positively correlated with TFP. Hence, if firms in similar industries (for example, in terms of R&D intensity) are located in different countries (x and z), and hence face different corporate tax rates, this should generate *lower* TFP in the higher-tax equivalent firms in country x compared to those in lower-tax country z. We discuss these issues further below.

3. Data and Methodology

Our firm-level data comes from the Amadeus database (Bureau van Dijk). In general we follow the approach of S&A (2008) in order to allow comparisons of their results with ours. In specific case we choose to define our firm sample differently in order to test parameter sensitivities etc. The database covers 16 European Union countries over the time period 1995-2008, though the sample for the first and final years of 1995 and 2008 is much smaller (S&A use 1996-2004). Following S&A (2008) we exclude Central and Eastern European Countries from the sample to preserve greater homogeneity across the EU sample. Unlike S&A (2008) we include in our sample all types of firms, including small firms with less than 20 employees. These small firms tend to have less satisfactory coverage leading to more missing values. However, since up to 95% of firms in our database have less than 20 employees, focusing only on large firms would risk drawing false conclusions for economy-wide firms based on an analysis of a particular and relatively minor set of firms with special characteristics.

3.1 Sampling Procedures

Our procedures for randomly selecting a sample of firms is described in detail in Appendix 1. We follow S&A (2008) in omitting certain outliers from our samples, where the

nature of the data suggests possible errors or difficulties of interpretation. For example, in calculating TFP (see below) we remove all variables with negative values from the dataset; in calculating firm investment, those reporting investment greater than their capital stock, or with extremely large decreases in capital stock (but not exiting the market) were also removed from the database. We further restrict the analysis to firms in manufacturing and services sectors (Nace 15-93).⁴

The Amadeus database covers 30 European OECD member countries over the time period 1995-2008. To ensure that the final sample is representative of the underlying population of firms we combine this with information on the distribution of firms by size class and industry from the OECD's much larger Structural and Demographic Business Statistics Database (yielding an overlapping set of 16 countries across the two databases). We use a random sampling procedure to select around 200,000 firms from the Amadeus dataset that match those in the OECD SDBS in terms of the employment size/industry/country composition (see Appendix 1). This yields a 'full sample' of 197,017 firms and a total of 1,034,933 observations. The sample we use for testing is further limited by available firm-level data on all relevant variables. This leads to final samples up to 242,000 observations for the various regression equations tested.

Important differences from our sample and that constructed by S&A (2008), in addition to our longer time span, are: (i) we begin by including all firms, not just those with more than 20 employees; and (ii) we select our stratified random sample before constructing firm TFP measures rather than after. (iii) S&A exclude multinational corporations (MNCs) from their sample, due to possible impacts of international tax rules on their effective tax rates. We prefer to retain MNCs in our sample since otherwise this seems likely to exclude many of the most tax-sensitive firms both in terms of international investment responses and profit-shifting. In addition, recent conceptual work and evidence at the aggregate level suggests that MNCs profit location choices are driven by statutory corporate tax rates (Devereux et al, 2008; Huizinga and Laeven, 2008).

For our R&D intensity variable, data come from the OECD's *Science, Technology and Industry Outlook.* We have computed average values for the period 1995-2007 by industrial

⁴ To assist comparability with S&A (2008) we also dropped the following sectors: recycling (Nace 37), refuse disposal (Nace 90), utilities (Nace 40, 41), financial services (Nace 65-67), real estate (Nace 70), holding companies (Nace 7415), public administration (Nace 75), education (Nace 80), health (Nace 85) and 'membership organisations' (Nace 91); see S&A (2008, p.10) for discussion.

sector. When using R&D intensity data we lose firms from service sector industries, focusing only on manufacturing industries.

3.2 Estimating Productivity Measures

To estimate total factor productivity, we take residuals from the estimated log-linear (Cobb-Douglas) production function in which value added (for firm i in year, t) is regressed on labour and capital stock inputs, where value added has been calculated as operating revenue minus material inputs. Labour inputs are measured by the firm's total wage bill, with capital stocks defined as tangible fixed assets. Sector-specific price indices from the EUKLEMS database have been used to transform nominal into real values, except for capital stocks for which we use a gross fixed capital formation deflator (from EUROSTAT National Accounts).

In line with S&A (2008) we estimate the production function at the country-industry level, such that firms' technologies can differ by country and industry. S&A propose two regression methods to estimate TFP: OLS and the semi-parametric method proposed by Levinsohn and Petrin (2003). We follow the latter method because this allows the production function input parameters to be estimated while allowing for the possibility of an endogenous response of productivity to unobserved shocks.⁵

3.3 Estimating Corporate Tax Effects

Following Griffith et al. (2006), Rajan and Zingales (1998) and S&A (2008) we add country (*c*), industry (*s*) and time (*t*) dummies to equation (2) together with interaction terms involving industry profitability (measured relative to mean profitability) and country-time specific tax rates, $\Pi_s \tau_{c t-1}$.

$[\Delta lnAU_{\downarrow}(it) = (\downarrow i + \beta_1 0 \Delta A_{\downarrow}(F_{\downarrow}(jt)) + ((A_1(F_{\downarrow}j))/A_1i)_{\downarrow}(t-1) \alpha(\downarrow s \tau_1(ct-1) + u_{\downarrow}c + u_1s + u_1t + s_{\downarrow})$ (3)

where terms are as defined in equation (2) and Π_s is profitability in industry *s*, $\tau_{c,t-1}$ is the statutory corporate tax rate in country *c* at time *t*-1⁶, u_s , u_c and u_t are industry, country and year fixed effects⁷ and ε_{it} is a random firm-specific error term.

⁵ The Levinsohn and Petrin (2003) estimator uses intermediate inputs as proxies, arguing that these may proxy for the unobservable productivity shock. However, the method requires additional information on firms' use of material inputs, thus reducing the sample.

⁶ Note that the long-run impact in this ADL (1, 1) specification is captured by the parameter on the lagged (t-1) tax term, α , modified by the convergence parameter ϕ .

Equation (3) allows for both a 'frontier effect' on firms' TFP levels as well as 'convergence or catch-up effect' and some persistence in TFP levels over time⁸. The interaction term $\Pi_s \tau_{c \ t-1}$ captures the differences-in-differences impact of corporate taxes whereby firms in the more profitable industries are expected to have lower TFP when they are also in countries and/or years with high corporate tax rates. Note that the interaction component terms Π_s and $\tau_{c,t-1}$ cannot be introduced separately while industry (*s*) and interactive country-year (*ct*) fixed effects are also included. However, as a robustness check we can investigate whether, omitting these fixed effects, the two interactive components display the expected signs (positive for profitability; negative for corporate tax rates).

To estimate the impact of corporate taxes on productivity therefore requires data on industry-level profitability and country-time specific statutory corporate tax rates, as described above. Data for statutory corporate tax rates are obtained from EUROSTAT, *Taxation Trends in the EU*. Information on the profitability of industries is calculated from the 2002 U.S. Benchmark Input-Output Data Table (*U.S. Bureau of Economic Analysis*, 2002).⁹ For each industry at the 2 digit ISIC level a profitability ratio is calculated from data on gross operating surplus divided by value added; this is applied to the whole period of our analysis, 1995-2008. We follow Rajan and Zingales (1998) in assuming that profitability differences observed across 2-digit industries in the United States apply similarly to the same industries in other sample countries. By making this assumption we reduce potential endogeneity between firm-level productivity and profitability across industries, and avoid simultaneity between the country- and time-specific corporate tax rate and the country-and time-*in*dependent industry profitability measure.

Furthermore, if we were to use an industry profitability measure differentiated by country there is increased risk that such a measure would reflect biases in reported profit. As S&A (2008) argue, in countries with high statutory corporate tax rates firms may under-

⁷ In addition we add interacted country-time or industry-time fixed effect (both cannot be added simultaneously). These allow for the possibility of common TFP shocks can affect all firms in the same industry in a given year (but different for firms in the same industry but a different country) or affecting all firms in the same country in a given year (but differing across firms in the same country but a different industry). Such shocks can arise, for example, where time fixed effects have an asynchronous component across countries such that in some years there can be a delayed country-specific time effect. Alternatively there may be TFP time shocks that, as well as having a common component across all industries, also affect some industries with different lags.

⁸ In contrast to Griffith et al. (2006), the present analysis does not account for firm heterogeneity in innovative capabilities by including firm-specific fixed effects, since corporate taxes may affect TFP levels through a reduction of a firm's innovative capabilities.

⁹ S&A (2008) use the 1997 version.

report their profits (and/or over-report their deductions). This can be compounded if high statutory corporate taxes are positively related to other conditions that adversely affect firm profitability (e.g. where corporate tax regimes with high rates occur simultaneously with government regulatory or similar interventions that harm profitability), this would further bias any country-specific profitability measures.

3.4 Taxes, the User Cost of Capital and Investment

Since Jorgenson (1963) introduced the concept of the *user cost of capital*, C, the relationship between this tax adjusted rental price and the dynamics of investment demand remains central in the empirical literature. Therefore, in the analysis of investment behaviour we have computed this concept as captured in equation (4).

$$C = \frac{(1-\hat{\mathbf{s}})}{(1-\tau)}(\rho + \delta - \pi) - \delta$$
(4)

where δ stands for the economic depreciation, τ denotes the statutory corporate tax rate, π indicates the existing inflation rate, ρ represents the investor's discount rate and S quantifies the present value of all the tax savings due to the existing fiscal incentives received by a given investment project in any specific form. In particular, in determining the specific value for S we have followed the proposal by King and Fullerton (1984), who identified three alternative ways for a new investment to become fiscally enhanced: standard depreciation allowances (Z), immediate expensing (including free depreciation) and up-front tax credits (k). As a consequence, if f_1 , f_2 and f_3 represent the proportion of the cost of a given asset which is entitled to each of these forms of tax incentives, then S is given by:

$$S = f_1 \tau Z + f_2 \tau + f_8 k \tag{5}$$

The value of the standard depreciation allowance is given by the legal method provided by the tax system, normally one of the following: straight-line depreciation, constant declining balance depreciation or the method of the 'sum-of-the-years'-digits – see Appendix 2. In determining the value of the firm's discount rate we also follow King and Fullerton (1984). However, since our interest is restricted to the impact of the corporate tax, in determining the magnitude of this discount rate we discard the tax treatment of savings under personal income taxation. Therefore, for the case of debt finance we assume $\rho = i(1-\tau)$ whereas if the investment is financed using own resources the nominal discount rate coincides with the market interest rate, i.e. $\rho = i$.¹⁰

In generating the user cost of capital as a *country-specific* regressor in our estimations, equation (4) has been computed for 6 different investment types in each of the 16 countries included in the study for the period 1996-2008. By an investment type we mean the combination of two forms of finance – debt and equity - and three alternative general asset types – buildings, machinery and technology. As a result, for each year every country has six basic measures of the user cost of capital (3 assets \times 2 financial instruments). These basic measures of the cost of capital are weighted to be included in our estimations.

The weighting procedure for the assets uses the shares of the real fixed capital stocks of buildings, machinery (the sum of transport equipment, other machinery and equipment, and other non-residential investment) and technology (Information and Communications Technologies, ICTs) based on the information provided in EU KLEMS growth and productivity accounts. The weighting procedure for forms of finance is based on the information from Morningstars on the market debt-to-capital ratio for more than 8.000 companies traded in US stock exchanges. This information has then been averaged by industry. Both the asset and form-of-financing weighting procedures are based on information for the US; that is, we assume again that industry-level technologies are similar across countries. In this way we also reduce the potential endogeneity between productivity and the user cost of capital, since more productive firms may have more access to loans and be more intensive in ICT use. By using US assets and form of financing shares, we also reduce the correlation between the user cost of capital and corporate tax rates if firms using more debt than equity tend to be found in countries with higher corporate tax rates.

¹⁰ In doing this we avoid our results being contaminated by the tax treatment of savings in the personal income tax. Originally, King and Fullerton (1984) determined the nominal discount rates for three alternative forms of finance: debt, retained earnings and equity. In quantifying these discount rates they took into account the tax treatment in personal income taxation. Specifically, $\rho = i(1-\tau)$ for debt finance, $\rho = i(1-m)/(1-z)$ for retained earnings and $\rho = i/\theta$ for new share issues, where *m* is marginal tax rates for interest income, *z* is the effective tax rate for capital gains and θ is the imputation rate in the case of dividend payments. The assumption of different discount rates depending on the form of finance has been subject to some criticisms however; see Scott (1987).

In computing equation (4), it is worth noting that since our concern is to isolate the impact of the corporate tax, it is preferable to use common values for non-tax variables regardless of the year under examination. The table below shows the assumed values for these non-tax variables which are consistent with other studies for the same time period (e.g. Lammersen and Schwager, 2005).

Summary of values for non-tax variables						
Economic depreciation rates (δ)	Buildings (3.80%); Machinery (18.04%); Technology (43.10%)					
Nominal interest rate (<i>i</i>)	10%					
Inflation rate (π)	2%					

The main advantage of this *cost-of-capital* approach stems from its transparency in taking into account otherwise complex tax provisions. However, it is important to bear in mind the following underlying assumptions. Firstly, the computation of equation (4) rests on the assumption that all the tax allowances and tax incentives can be claimed. In other words, companies' taxable incomes are large enough to absorb the full amount of potential fiscal incentives. Secondly, the modelling of incentives replicates the general setting for new investment; that is, special incentives schemes are not considered. Thirdly, due to the assumption of fixed equal values for common non-tax variables, the computed cost of capital cannot capture the impact of uncertainty.

Appendix 3 shows the user cost of capital for each of the six basic measures. We show the average for the period 1996-2007 in the nine countries included in the database (1995 and 2008 have very few observations in the Amadeus database). Scandinavian countries – Finland and Sweden – have the lowest corporate tax rates on average during these years, whereas Germany and Italy have the highest. The general trend has been a decrease in the corporate tax rate from a simple average of 39.6% to 31.3%. The user cost of capital corroborates that the best way to finance assets its debt. There is a different of more than 4 percentage points in each of the cases. As for the type of assets, the user cost of capital is on average highest for buildings, followed by technology and machinery. Nevertheless there are some countries for which the user cost of capital of buildings is lower than for technology: Finland, Spain and especially Sweden and France. In contrast, investing in technology in Italy is profitable even with very low rates of returns.

In addition to the use of the user cost of capital, in the investment analysis we have computed gross investment as the first difference between capital stocks. Following, S&A (2008) and Becker and Sivadasan (2006), we exclude from the analysis firms with investment higher than their capital stock and firms that are less than five years old. We also follow those authors in dropping firms with negative investment: such firms may be exiting the market or substantially down-sizing, therefore potentially biasing results. To test sensitivity to this restriction, in later robustness checks we include all firms in some estimations.

4. Results

4.1 Some Descriptive Statistics

Some descriptive statistics are shown in Appendix IV. The first one is on TFP growth by countries.

In Appendix IVa, average annual growth in TFP for the firms included in our sample during the period 1996-2007 is 0.9%. However this ranges from the -8.8% of the Czech Republic to 3.4% of Portugal. Some comments on these figures are worth making. Firstly they might be explained by country specific factors. The transition of the Czech Republic from a communist economic regime to a market economy in this period, for example, while Portugal, a relatively low productivity EU country, appears to be catching up. In contrast, Spain is perhaps benefitting less from frontier countries' technology, with TFP growth below the nine-country average. This in line with the OECD Productivity Database indicating multifactor productivity growth for Spain of 0.0% during the period 1995-2007. Secondly, for some countries there are a relatively small number of observations, such that these averages can be driven by extreme values. This is indicated by the large standard deviations in the table.

In Appendix IVb, we show the TFP growth by industry, along with the right-handside variables: profitability, R&D intensity (as a share of value added and production), intraindustry trade and entry-exit rates. Note that all these RHS variables are values for the US. Annual TFP growth for manufactures during the period 1996-2007 is estimated at 1.1%, close to the 0.8% estimated by EUKLEMS for the Euro Area for the period 1995-2004. Air transport and telecommunications appear to be the worst performing, with negative TFP growth rates. Again this would appear to be driven extreme values for a single firm in that industry.¹¹

Finally, Appendix IVc shows the structure of firms by employment and age. Only 5.5% of the firms have more than 20 employees, which is the sample used in S&A. Almost one third of the firms are relatively new, between 0 and 6 years, whereas a quarter are more than 18 years old.

4.2 Corporate Tax and Productivity

In this section we report results for firm-level TFP estimated by the Levinsohn and Petrin (2003) procedure discussed above. Table 1 shows results from estimating equation (3); the left-hand column headed "S&A (2008)" reports the equivalent S&A result for comparison; our results are in columns 1-7.

Column 1 reports the results for the two technology variables ('frontier TFP growth' and the gap between each firm and the frontier TFP), in addition to the relevant dummies and difference-in-difference effect associated with the impact of corporate tax rates and profit levels. We find a positive and significant impact on firms' TFP levels from the TFP growth of frontier firms in the same industry. In line with expectations, we also find a negative effect associated with a firm's distance from the frontier TFP level, indicating that *ceteris paribus* there is convergence among firm's efficiency levels.

Our sample includes almost 241,500 observations, similar in overall size to the S&A sample of 287,000 observations. However, since their sample is constructed to exclude firms of less than 20 employees, in column (2) we similarly restrict our sample to permit more direct comparisons. This radically reduces our sample size to around 11,000 firms and yields a smaller effect from frontier TFP growth (0.09 versus 0.17 for S&A) but a similar convergence effect (-0.21 versus -0.19). The 'frontier' effects on TFP growth are larger than either the S&A results or those in column 3 suggesting that small firms rely more on technology spillovers developed by others than internally developed R&D.

Our variable of interest, profitability interacted with the corporate tax rate, shows a negative and significant impact on growth in columns (1) and (2). This is similar to the S&A (2008) result. That is, firms in more profitable industries appear to have lower TFP when this

¹¹ It is also worth noting that this negative figure does not imply negative aggregate productivity growth, where that will be determined by additionally by the reallocation of market share across firms and the relative productivity of those firms that enter the industry versus those that exit.

occurs in high tax country-year combinations compared to low tax countries/years. Compared to the S&A parameter of -0.31 we find a larger direct effect (α in equation (3) above) for the larger sample including all firm sizes (-0.51) but a similar or smaller effect (-0.28) when <20 employee firms are omitted. These results would suggest that the adverse productivity impacts of corporate taxes are especially pronounced for small firms, perhaps because their limited size makes them more likely to be vulnerable when subject to profit failures. We note at this point however, that this result is sensitive to the exclusion of interactions between industry-and firm size in column (4). Once we control for the different in the rate of TFP growth between firms of different sizes within an industry we find that small firms are in fact less sensitive to higher corporate tax rates.

The parameters above do not measure the long-run impact of corporate taxes on TFP, which requires inclusion of the convergence parameter in the calculation. This is estimated at -0.662 in column (1) indicating that the impact decays relatively quickly: for example, changing the corporate tax rate by 5 percentage points (ppts) would have an impact on TFP growth over five years then largely disappear. The long-run impact on the TFP level would be to increase this by 3.8% in firms in the sector with median TFP. In contrast, S&A (2008) estimates (from Table 1) suggest much slower convergence with impacts lasting around 20 years, and increasing TFP level in the long-run by 8% (see Figure 1). So, in the short run the tax-related TFP impact we estimate is somewhat higher, but from 4 years onwards the S&A estimated impact is higher. Over 20 years, we estimate that a firm in a median profitability sector will increase its TFP by a 0.2% annually approximately half of the S&A estimate of 0.4%. Given trend TFP growth of OECD countries of around 1% per year in recent years (OECD, 2007), we consider our estimated impact to be more plausible, especially when recognising that our sample includes a wider range of both large and small firms. Figure 1 also highlights the potential for differences in taxation to help to explain differences in productivity levels, and therefore income levels, between countries.

Figure 1 Long-run impact of a 5 p.pts. cut in corporate tax rates on TFP levels



In column (3) of Table 1 we replace year-*country* interacted dummies with year*industry* dummies to allow for the possibility that time-dependent shocks are common across firms in an industry rather than in a country. By doing this the R^2 increases from 0.05 to 0.06. Otherwise, results are very similar to those of column (1), suggesting that parameter estimates are robust and not driven by the evolution of technology affecting different industries or countries.

Column (4) interacts profitability and corporate tax rates with firms' employment size.¹² As already noted, we also introduce size-industry interacted dummies to this regression. We find that the estimated corporate tax impact is both quantitatively smaller (less negative) and not significantly different from zero for very small firms – those with 5 employees or less. For the three categories of firm with more than 5 employees however (6-19, 20-30, 31+) the effect of corporate taxes on TFP is significantly negative and of similar orders of magnitude – the parameter estimate for 20-30 employee firms is slightly larger (less negative) but not significantly different from the others. It seems likely that especially small firms are less research-intensive, such that their productivity is less affected by a "success tax" such as the corporate tax rate. Such small firms, perhaps especially where they represent young firms, may also benefit more from tax exemptions than other firms, making them less sensitive to the corporate tax rate.

¹² Column (5) confirms the results in column (4) when introducing sector-year interacted dummies instead of country-year dummies.

Column 6 and 7 show, however, that a firm's age does not significantly affect the impact of the tax-profitability interaction on TFP. All firm age impacts are in the range -0.47 to -0.60 (-0.42 to -0.54) and are not significantly different. This is in contrast to S&A who found that older firms (6+ years) are more affected by taxes than younger firms. This may be due to the fact that our sample includes a much larger fraction of small- and medium-sized firms that are affected in a similar same way by corporate taxes, independently of their age.

Research Intensity

Table 2 tests research intensity variables interacted with corporate tax rates. By introducing R&D we are able to analyse if firms in sectors more intensive in technology are more affected by corporate tax rates than firms in the same country or year but in a industry that is less technology-intensive. Similarly a firm from a technology intensive industry in a country with a high corporate tax rate will be affected more than a firm from the same industry but in a country with a lower corporate tax rate. Furthermore, if our hypothesis that corporate tax rates reduce the incentive to take risks is correct, then a firm in a highly technology intensive industry *and* facing a high corporate tax rate will invest less in risky, TFP-enhancing activities. Of course, if some R&D activities are financed from profits, firms in countries with higher corporate profit taxes will be less able to finance this type of investment. In this case, firms that are also in more profitable industries (for given R&D intensity) will have lower TFP when corporate tax rates are higher due to this 'tax base' effect. It is also worth remembering that these regressions control for the general tendency for some industries and countries to have higher underlying rates of TFP growth.

To measure R&D intensity, we use US 23 2-digit industry-level R&D spending from OECD ANBERD Database as a ratio of either total production or value added (from the OECD STAN Database). We use the mean value of the ratio over the period 1995-2007. We choose to employ the US values for all countries to reduce the potential endogeneity arising from the possibility that, in a heterogeneous firm setting, within a given country, firms with higher productivity may be capable of investing more in R&D, thus biasing any estimated relationship from R&D to productivity.

To examine the role of R&D we are forced to focus on manufacturing sector firms since there is less information available on R&D spending in service sectors. We first reestimate the same equation as in column 1 of Table 1 but restricted to manufacturing firms. We find similar results, with a convergence parameter somewhat lower of -0.607 instead of - 0.662 and a higher associated impact to tax interacted with profitability (-0.600 instead of - 0.505). We also find some indication that manufacturing firms are more affected and for a longer period of time by taxes than combined industry-plus-service sector firms (a long-run impact of -1.0 instead of -0.8). The 'frontier effect' seems to be very similar in both estimations, and the R-squared increases to 0.08, suggesting that the model explains manufacturing firms' TFP better than for service sector firms.

Column 1 shows that introducing the interacted term of research intensity with the corporate tax rate does not affect the parameters associated with the 'frontier' effect and convergence. Research intensity (as a share of value added) interacted with corporate tax rate is however negative and highly significant, as predicted. Firms in high technology sectors in countries with high corporate tax rates tend to have reduced TFP growth compared with firms in the same sector but in lower corporate tax rate countries or firms in the same country but in low R&D-intensity industries. If we again simulate a reduction of the corporate tax rate by 5 percentage points (ppts), TFP would increase at a higher rate for four years before returning to its previous growth rate. The impact on the *level* of TFP would be a permanent rise of 3.9%.

To test the relevance of R&D versus profitability as transmission mechanisms from corporate taxes to TFP, column 2 introduces both R&D intensity interacted with the corporate tax rate *and* profitability interacted with the corporate tax rate. Results from nesting both hypotheses show that the research intensity interaction 'wins the race', indicating that the technology intensity of the sector is more relevant that sector profitability to account for the impact of corporate taxes on TFP growth. Put another way, recognising the role of R&D intensity to mediate corporate tax effects onto TFP, a firm's profitability adds no significant additional information.

This, analysis therefore suggests a more obviously *technology-related* channel by which corporate taxes impact on TFP growth. That is, higher corporate tax rates induce firms in technology sectors especially to reduce their engagement in TFP-enhancing facilities because the rate of return, if they succeed, will be lowered. By contrast, firms in low technology-intensive sectors are less affected by corporate tax rates, because their opportunities to benefit from R&D activities are commensurately lower. We find similar results when computing research intensity as a share of production rather than value added (columns 3 & 4). In this case the permanent impact on TFP of reducing the corporate tax rate

instead of country-year dummies (columns 5-8), we reach the same conclusion: research intensity is more relevant than profitability for determining the TFP impact of corporate tax rates. In fact we find somewhat larger TFP impacts of reducing the corporate tax rate by 5 ppts: 4.2% for the interaction with research intensity measured as a share of value added and 5.9% when computed as a share of production. Again, industry-year dummies capture a bit more of the variance than country-year dummies.

Table 3 analyses whether the impact of the corporate tax rate interacted with sector research intensity differs by the size and age of firms. Column 1 shows that parameters for the three 'fundamental variables' (the frontier effect, the convergence parameter and the interaction between corporate tax rate and research intensity) are highly stable across specifications. The estimated corporate tax rate impact on TFP growth by firm size is inconclusive, however, except that again, very small firms (up to 5 employees) appear to be least affected by corporate tax rates. Greater negative effects are found for all three larger categories (6-19, 20-30, 31+). To the extent that these categories differ, the 20-30 employee group appears to be less affected. These differences may reflect the typical sizes of the more research intensive, and less research intensive, firms but we are unable to confirm this from our data. Columns 2-4 show that this aspect of the results is consistently found for the alternative R&D intensity measure (as a share of production) and use of industry dummy variables.

Columns 5-8 shows the interacted effect of corporate tax rates and R&D intensity *by firm age*. These results suggest some tendency for especially young firms to be more responsive (more negative) to higher corporate tax rates, but otherwise different age groups display similar orders of magnitude – around -0.5 or -0.7 depending on specification. This evidence is in contrast to S&A (2008) who find a larger negative effect of corporate tax rates (when interacted with *profitability*) for older firms. Without further investigation it is hard to know the reasons behind this difference. It may be, for example, that by excluding firms of less than 20 employees, the 'young' firms in S&A's sample are more likely to be part of broader consolidated groups, making it easier to these firms to access group-related financial support and hence less vulnerable to corporate tax impacts. Our results would seem to be more in line with intuition that, other things equal, young innovating firms are especially vulnerable to higher corporate taxes compared to older innovating firms.

Intra-Industry Trade

We focus now on the role of intra-industry trade. As noted earlier, industries/sectors with more intra-industry trade are expected to be more competitive and are those in which creativeness, service and product innovations (or differentiation from other firms' goods) are more relevant to firm success and survival. In these sectors, arguably investments in these intangible assets, rather than inputs such as capital stock and employment, become critical for firms' performance. As in the case of interactions between profitability or R&D intensity and corporate tax rates, we test here whether firms in industries where intra-industry trade is greater are more affected by corporate tax rates than firms in the same country but in industries with less intra-industry trade. Of most relevance in this case are differences between firms in the same *industries* but in different *countries*. Intra-industry trade is often symptomatic of the presence of international firms producing similar, but differentiated, goods. Hence, for firms in the same industry with substantial pressure from international competition, international differences in corporate tax rates become more important.

Our data on intra-industry trade are again taken from the OECD STAN Database, and we use US values in order to reduce any potential endogeneity of those more productive sectors being also the sectors with more intra-industry trade. This reduces the number of observations to 26,128 because this information is available only for a limited number and range of industrial sectors (Nace 15-33).

Table 4 shows that the interaction of intra-industry trade with corporate tax rates impacts negatively and significantly on firms' TFP. Column 1 indicates that a 5 ppts reduction in the corporate tax rate would increase TFP levels by 6.3% over four years and then disappear (in a sector with a median intra-industry trade). Introducing year-*industry* dummies instead of year-*country* yields a similar result with a slightly higher impact of 6.8%. Of interest the effect of the corporate tax variable is better identified (the standard error is smaller) when we include industry-year rather than country-year effects. This would tend to reinforce the view that for the intra-industry trade measure it is the within industry-between country variation that is of greatest interest.

Columns 3 and 4 show that for small firms (<5 employees) the interaction between intra-industry trade and corporate tax rates is not significant. Tax exemptions to small firms may protect them from the impact of corporate tax rates or there may simply be limited numbers of such small firms engaged in intra-industry trade intensive industries. By contrast, larger firms may have to, or be more able to, differentiate their products more from those of other firms via innovations – and that are discouraged by corporate tax.

In contrast to the results from Table 2 for R&D, the interaction of corporate tax rates with intra-industry trade *and age* yields different results: now older firms (>10 years) appear to be associated with bigger impacts. This may reflect a tendency for younger innovating firms to be able to withstand short-term losses or low profitability (worsened by corporate tax rates) compared to older firms. That is, older high technology firms in loss or low profit situations are more likely to be vulnerable to failure since they have moved beyond their early gestation period when low returns might be expected. That is, if a high technology firms under more readily.

Industry Entry-Exit Rates

Another potential indicator of the effect of corporate tax rates to TFP growth may be the entry-exit rate of firms in an industry. Industries with relatively high turnover rates might generally be expected to have lower sunk costs (entry+exit rates are low in basic metals, chemicals, and retail and wholesale and high in textiles) but this is an industry characteristic also associated with innovative technologies (industry churn is also high in machinery and equipment, telecommunications and computer services). Whilst, perhaps a noisy measure of technology related aspects of an industry it has the advantage that it also covers the service sector. As with previous measures capturing technology-related aspects of an industry, so we might expect the negative impacts of higher corporate taxes in high entry-exit industries, ceteris paribus, to reduce TFP. Column 1 of Table 5 shows some evidence of a negative effect from the interaction term between the entry-exit rate of firms and corporate tax rates, though not to a statistically significant level when year-country dummies are included. When introducing year-industry dummies instead, the evidence of effects on TFP growth is stronger, with generally more precise estimates: column 2 shows a negative and significant effect of the interacted term. As discussed before, the introduction of these industry-year effects relies more on the cross time and country variation in the data to indentify the effects of corporate taxation.

We therefore find some evidence of corporate tax rates being associated with higher entry-exit rates perhaps inducing firms to die prematurely before realising their productivity potential such that those industries have lower TFP when corporate tax is higher. This evidence reinforces the conclusion of the Sapir Report (2004), who stresses that higher productivity levels and growth in the US compared to Europe, could be due to the fact that entry, as well as exit and turnover of firms, are more prominent in North American. In addition, as Aghion (2006) points out: 'Half of new pharmaceutical products are introduced by firms that are less than 10 years old in the United States, versus only 10% in Europe. Similarly, 12% of the largest US firms by market capitalisation at the end of the 1990s had been founded less than twenty years before, against only 4% in Europe.'

Columns 3-4 again suggest that particularly small firms, (<5 employees), are less affected by corporate tax rates even in the relatively high turnover industries, with a smaller, non-significant estimated impact. Larger firm size categories reveal similarly negative impacts from corporate taxes though the precision of these estimates is more variable. Columns 5 show insignificant effects from the interaction between corporate tax rates and turnover by industry and firm *age*. The introduction of year-*industry* dummies, however, improves the precision of the estimated effects yielding statistically significant negative effects, similar across firm ages. Year–industry dummies seem likely to capture technology differences better since these might be expected to differ more by sector than country.

The User Cost of Capital

Turning to estimates of the impact of corporate taxes on investment rather than TFP, Table 6 shows the results of estimating the impact of the user cost of capital on investment based on equation (4). We follow Becker and Sivadasan (2006), controlling for lagged investment, squared lagged investment, the output-to-capital ratio and cashflow-to-capital ratio. Using cashflow leads to a reduced sample of 138,318 firms. Becker and Sivadasan (2006) argue that quadratic adjustment costs means that we should expect a positive impact from lagged investment and a negative effect from squared lagged investment. Also firms with more access to internal funds will have more opportunity to finance new investment in the presence of financial market imperfections such as credit constraints. Thus, we follow these authors by introducing cashflow and output-to-capital ratios.

Column 1 shows that lagged investment and squared lagged investment have the expected significant signs. Cashflow and output-to-capital ratios also have the expected signs but are not significantly positive. Since our sample includes firms of all sizes (whereas S&A (2008) restrict their sample to firms with 20+ employees), it may be that for especially small firms output-to-capital ratios and cashflows are not decisive for marginal investment decisions. If so, it is unclear why this might be. The next column shows that, indeed, when restricting our sample to firms with 20+ employees we also find a significant positive impact from output-to-capital ratio (and the R-squared improves substantially suggesting that it is more difficult to explain small firms' investment). Cashflows seem to have a high correlation

with output-to-capital ratios. When we drop this latter variable in the restricted sample, we find a positive and significant impact for the cashflow-to-capital ratio (not shown).

Estimates of the impact of the user cost of capital on investment are negative and significant. (Our estimates appear to be even higher, in absolute terms, than those obtained by S&A, 2008). The estimated coefficient associated with the user cost of capital appears to *decrease* (in absolute value) when introducing year-*industry* dummies (column 2). Similarly, especially large firms (>30 employees) reveal smaller and less robust estimates of the impact of the user cost of capital on investment (columns 3-4). This may reflect a greater use of loan finance for investment which is less affected by corporate taxes (via debt deductibility) compared with financing with retained profits or equity. We also find no significantly different effects on firms' investment when disaggregated by *age* (columns 5-6).

Table 7 shows that industry-profitability or industry-research intensity (whether measured as a share of value added and production) do not appear to affect the impact of the user cost of capital on investment. That is, in contrast to TFP growth, profitability and R&D appear not to be relevant in this context. This evidence therefore suggests that firms in industries with high R&D intensity are more discouraged by corporate tax rates in their TFP-enhancing activities than firms in less R&D-intensive industries. However, firms in both types of industries are equally discouraged in their investment decisions. Similar evidence applies to profitability. This is in contrast to S&A (2008) who find that the user cost of capital reduces investment for firms in more profitable industries. Finally, regarding intra-industry trade (columns 7-8) we find that investment by firms in industries with more intra-industry trade are less affected by the user cost of capital than firms in industries with less intra-industry trade.

5. Conclusions

This paper has sought to add to the recent literature that has begun to use micro-level data to examine the response of firms to various conditions affecting their productivity levels or growth rates. Our particular interest has been to investigate how far corporate tax settings might affect firms' innovation and risk-taking activity: both of these activities can be linked to the known characteristics of corporate tax regimes in European countries via their treatment of corporate profits and losses.

Previous investigation of this issue, by Schwellnus and Arnold (2008), examined the link between higher corporate taxes and firm-level TFP as mediated through higher

profitability; that is, firms with higher corporate profits but in regimes involving higher corporate tax rates are expected to have lower TFP than equivalent firms in low corporate tax regimes. The mechanism hypothesised to be at work here is the higher tax liability (or effective average tax rates) associated with higher profits acts as a disincentive towards undertaking those innovations that raise TFP.

Our contribution has been to re-examine the evidence of S&A (2008) of apparently large and persistent impacts of corporate tax on firm-level TFP, as mediated through profits, and to consider alternative indicators of firm-level innovation/technology that we argue provide better proxies for the impact of taxes on productivity via innovation effects than using firm profits.

Based on an economteric model of innovation and productivity proposed by Griffith et al. (2006) and Schwellnus and Arnold (2008), we show that:

- Using a similar sized sample to S&A (2008) but which does *not* exclude small (<20 employee) firms, the estimated impact of higher corporate tax rates on TFP *when interacted with firm profit levels* is no longer implausibly large and occurs relatively quickly (within 4-5, rather than 20+ years).
- However, using alternative measures of industries' innovative characteristics such as research intensity, the extent of intra-industry trade and firm entry-exit rates, we find stronger evidence that firms in those 'innovation intensive' industries are more adversely affected by high corporate tax rates than those in low 'innovation intensive' industries.
- Higher corporate tax rates, via their effect on the post-tax user cost of capital have adverse effects on firm's investment levels.

We have adopted approaches here that we believe largely deal with potential endogeneity concerns with such tests and our evidence seems to be supportive of adverse TFP impacts of higher corporate tax rates. In addition our evidence is consistent with these impacts being mediated substantially through their effect on industries that are intensive in R&D, intra-industry trade etc – all characteristics of innovative firms/industries.

References

- Abraham, F. and Van Hove, J. (2005) Intra-industry trade and technological innovation: the case of Belgian manufacturing. *Paper Presented to the 7th Annual ETSG Conference*, Dublin, 2005.
- Aghion, P. (2006) A primer on innovation and growth. Bruegal Policy Brief, 2006/06.
- Aghion, P., Blundell, R., Griffith, R., Howitt, P. and Prantl, S. (2006) The effects of entry on incumbent innovation and productivity. *NBER Working Paper* 12027, 2006.
- Altshuler, R. and Auerbach, A. J. (1990) The significance of tax law asymmetries: an empirical investigation. *Quarterly Journal of Economics*, 105, 61-86.
- Auerbach, A. J. (1986) The dynamic effects of tax law asymmetries. *Review of Economic Studies*, 53, 205-225.
- Auerbach, A.J. (2007) Why have corporate tax revenues declined? Another look. *CESifo Economic Studies*, 10.1093.
- Angelopoulos, K., Economides, G. and Kammas, P. (2007) Tax-spending policies and economic growth: theoretical predictions and evidence from the OECD. *European Journal of Political Economy*, 23, 885-902.
- Arnold, J. (2008) Do tax structures affect aggregate economic growth: empirical evidence from a panel of OECD countries. OECD Economics Department Working Paper No. 643.
- Balboni, A. (2005) A theoretical model of Vertical Intra-Industry Trade driven by technological differences across countries. *Paper Presented to the 7th Annual ETSG Conference*, Dublin, 2005.
- Barro, R. (1990) Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98, s103-117.
- Barro, R., Mankiw, N.G. and Sala-i-Martin X. (1995) Capital mobility in neoclassical models of growth. *American Economic Review*, 85, 103-115.
- Becker, B. and Sivadasan, J. (2006) The effect of financial development on investment-cash flow relationship: cross-country evidence from Europe. *ECB Working Paper* No. 689.
- Becker, J. and Riedel, N. (2008) Cross-border tax effects on affiliate investment evidence from European multinationals. Oxford University Centre for Business Taxation, Working Paper No. 08/16.
- Bleaney, M., Gemmell, N. and Kneller R. (2001) Testing the endogenous growth model: public expenditure, taxation and growth over the long run. *Canadian Journal of Economics*, 34, 36-57.
- Cooper, M. and Knittel, M (2006) Partial loss refundability: how are corporate tax losses used? *National Tax Journal*, 59, 651-663.
- Creedy, J. and Gemmell, N. (2009) Corporation tax revenue growth in the UK: a microsimulation analysis. *Economic Modelling*, 26, 614-625.

- Dar in, M, Di Giacomo, M and Sembenelli, A. (2010) corporate taxation and the size of new firms: evidence from Europe. *Journal of the European Economic Association*, 8 (2-3), 606-616.
- Devereux, M.P., Lockwood, B. and Redoano, M. (2008) Do countries compete over tax rates? *Journal of Public Economics*, 92, 1210-1235.
- Gentry, W.M. and Hubbard, R.G. (2004a) Entrepreneurship and household saving. *Advances in Economic Analysis and Policy*, 4, 1, article 8.
- Gentry, W.M. and Hubbard, R.G. (2004b) The effects of progressive income taxation on job turnover. *Journal of Public Economics*, 88, 2301-2322.
- Griffith, R., Redding, S. and Van Reenen, J. (2004) Mapping the two faces of R&D: productivity growth in a panel of OECD industries. *Review of Economics and Statistics*, 86, 883-895.
- Griffith, R., Redding, S. and Simpson, H. (2006) Technology catch-up and the role of multinationals, LSE Working Paper.
- Grubert, H. and Slemrod, J. (1998) The effect of taxes on investment and income shifting to Puerto Rico. *Review of Economics and Statistics*, 80, 365-373.
- Huizinga, H. and Laeven, L. (2008) International profit shifting within multinationals: a multi-country perspective. *Journal of Public Economics*, 92, 1164-82
- Kneller, R., Bleaney, M. and Gemmell, N. (1999) Fiscal policy and growth: evidence from OECD countries. *Journal of Public Economics*, 74, 171-190.
- Lee, Y. and Gordon, R.H. (2005) Tax structure and economic growth. *Journal of Public Economics*, 89, 1027-1043.
- Levinsohn, J. and Petrin, A. (2003) Estimating production functions using inputs to control for unobservables, *Review of Economic Studies*, 70, 317-342.
- Melitz, M.J. (2003) The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71, 1695-1725.
- Mintz, J. and Smart, M. (2004) Income shifting, investment, and tax competition: theory and evidence from provincial taxation in Canada. *Journal of Public Economics*, 88, 1149-78.
- Myles, D. (2007) Economic Growth and the Role of Taxation. Prepared for the OECD. Unpublished Report, University of Exeter and IFS.
- Padovano, F. and Galli, E. (2002) Comparing the growth effects of marginal vs average tax rates and progressivity. *European Journal of Political Economy*, 18, 529-544.
- Romer, C.D. and Romer, D.H. (2007) The macroeconomic effects of tax changes: Estimates based on a new measure of fiscal shocks. University of California, Berkeley, (forthcoming, *American Economic Review*).
- Rajan, R. and Zingales, L. (1998) Financial dependence and growth. *American Economic Review*, 88, 559-586.

- Romero-Avila, D. and Strauch, R. (2008) Public finances and long-term growth in Europe: Evidence from a panel data analysis. *European Journal of Political Economy*, 24, 172-191.
- Sapir, A.(2004): An Agenda for a Growing Europe: The Sapir Report, Oxford University Press: Oxford.
- Schaller, H. (2006) Estimating the long-run user cost elasticity, *Journal of Monetary Economics*, 533, 725-736.
- Samaniego, R.M. (2009) Entry, exit and investment-specific technical change. Second version, *Penn Institute for Economic Research, PIER Working Paper* No. 09-020.
- Schwellnus, C. and Arnold, J. (2008) Do corporate taxes reduce productivity and investment at the firm level? Cross-country evidence from the Amadeus dataset. *OECD Economics Department Working Paper* No. 641.
- Turnovsky, S.J. (2004) The transitional dynamics of fiscal policy: Long-run capital accumulation and growth. *Journal of Money, Credit and Banking*, 36, 883-910.
- Wildmalm, F. (2001) Tax structure and growth: are some taxes better than others? *Public Choice*, 107, 199-219.

Table 1 The Effect of Corporate Taxes and TFP Growth at the Firm Level

	S&A (2008)	1	2	3	4	5	6	7
			(Emp > 19)					
TFP growth frontier firms in the same	0.173	0.217	0.090	0.247	0.216	0.245	0.2221	0.234
industry	9.10	4.70	1.83	5.23	4.12	5.03	4.62	5.04
TFP gap with frontier firms	-0.190	-0.662	-0.212	-0.668	-0.678	-0.683	-0.678	-0.684
	12.67	10.25	2.13	10.20	10.09	10.08	10.30	10.19
Profitability <i>x</i> corporate tax	-0.307	-0.505	-0.282	-0.497				
	2.40	2.42	1.13	2.66				
Profitability <i>x</i> corporate tax					-0.167	-0.172		
(employment 1-5)					0.91	1.09		
Profitability <i>x</i> corporate tax					-0.799	-0.791		
(employment 6-19)					3.33	3.52		
Profitability x corporate tax					-0.516	-0.506		
(employment 20-30)					2.08	1.99		
Profitability x corporate tax					-0.810	-0.827		
(employment 31+)					2.97	2.89	0.550	<u> </u>
Profitability x corporate tax (firm age 7.10)							-0.572	-0.547
/-10)							2.28	2.70
Profitability x corporate tax (firm age 7.10)							-0.476	-0.429
/-10)							1.65	1.69
Profitability x corporate tax (firm age $11, 17$)							-0.523	-0.486
11-1/)							2.31	2.51
Profitability x corporate tax (firm age 10^{-10})							-0.596	-0.548
							2.03	2.85
Year, Country & Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Country <i>x</i> year dummies	YES	YES	YES	NO	YES	NO	YES	NO
Industry <i>x</i> year dummies	NO	NO	NO	YES	NO	YES	NO	YES
Industry * size dummies	NO	NO	NO	NO	YES	YES	NO	NO
Industry * age dummies	NO	NO	NO	NO	NO	NO	YES	YES
Observations	287,727	241,476	11,408	241,476	241,476	241,476	201,541	201,541
R-squared	0.10	0.05	0.05	0.06	0.06	0.06	0.06	0.06

	S&A model	1	2	3	4	5	6	7	8
	(small sample)								
TFP growth frontier firms in the	0.205	0.210	0.211	0.211	0.211	0.231	0.232	0.231	0.232
same industry	3.40	3.31	3.31	3.32	3.32	4.04	4.03	4.04	4.03
TEP can with frontier firms	-0.607	-0.619	-0.620	-0.619	-0.619	-0.634	-0.635	-0.634	-0.635
THE gap with nontier mins	6.62	6.73	6.69	6.73	6.73	6.49	6.47	6.49	6.47
Research intensity <i>x</i> corporate tax		-0.487	-0.456			-0.531	-0.485		
(value added)		6.27	7.38			6.50	7.20		
Research intensity <i>x</i> corporate tax				-0.684	-0.640			-0.746	-0.681
(production)				6.28	7.39			6.47	7.06
Profitability x corporate tax	-0.006		-0.001		-0.001		-0.001		-0.002
	1.69		0.70		0.71		0.94		0.96
Year, Country & Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country <i>x</i> year dummies	YES	YES	YES	YES	YES	NO	NO	NO	NO
Industry <i>x</i> year dummies	NO	NO	NO	NO	NO	YES	YES	YES	YES
Observations	86,745	86,745	86,745	86,745	86,745	86,745	86,745	86,745	86,745
R-squared	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09

Table 2 Testing Research Intensity Variables (as shares of value added or production)

	1	2	3	4	5	6	7	8
	R&D share of							
	Value added	Production						
TFP growth frontier firms in the	0.207	0.208	0.229	0.229	0.206	0.206	0.220	0.220
same industry	3.01	3.01	3.88	3.88	2.97	2.98	3.49	3.49
TFP gap with frontier firms	-0.627	-0.627	-0.639	-0.639	-0.622	-0.622	-0.636	-0.636
	6.59	6.58	6.43	6.42	5.41	5.41	5.16	5.15
Research intensity <i>x</i> corporate tax	-0.213	-0.302	-0.258	-0.364				
(employment 1-5)	3.67	3.70	3.96	3.94				
Research intensity <i>x</i> corporate tax	-0.718	-1.010	-0.778	-1.090				
(employment 6-19)	7.21	7.25	8.33	8.29				
Research intensity <i>x</i> corporate tax	-0.267	-0.372	-0.333	-0.461				
(employment 20-30)	2.97	2.96	2.69	2.68				
Research intensity <i>x</i> corporate tax	-0.481	-0.668	-0.623	-0.866				
(employment 31+)	4.37	4.48	4.07	4.13				
Research intensity <i>x</i> corporate tax					-0.586	-0.828	-0.601	-0.847
(firm age 1-6)					5.78	5.85	6.20	6.21
Research intensity <i>x</i> corporate tax					-0.499	-0.700	-0.542	-0.760
(firm age 7-10)					5.13	5.11	5.26	5.26
Research intensity <i>x</i> corporate tax					-0.483	-0.676	-0.512	-0.717
(firm age 11-17)					5.44	5.39	5.17	5.13
Research intensity <i>x</i> corporate tax					-0.502	-0.704	-0.528	-0.739
(firm age 18+)					5.60	5.57	5.01	4.99
Year, Country & Industry dummies	YES							
Country <i>x</i> year dummies	YES	YES	NO	NO	YES	YES	NO	NO
Industry <i>x</i> year dummies	NO	NO	YES	YES	NO	NO	YES	YES
Industry * size (or age) dummies	YES							
Observations	86,745	86,745	86,745	86,745	72,022	72,022	72,022	72,022
R-squared	0.08	0.08	0.09	0.09	0.12	0.12	0.13	0.13

Table 3 Testing Research Intensity Interacted with Firm Employment and Age

Table 4 Testing Intra-industry Trade Interacted with Corporate Tax

TFP growth frontier firms in the	0.205	0.156	0.220	0.173	0.230	0.167
same industry	3.88	2.83	4.18	3.09	4.38	2.39
TFP gap with frontier firms	-0.630	-0.657	-0.682	-0.706	-0.687	-0.714
	5.16	5.27	5.31	5.44	5.13	5.15
Intra-industry trade <i>x</i> corporate tax	-0.008	-0.009				
	1.98	2.83				
Intra-industry <i>x</i> corporate tax <i>x</i>			-0.003	-0.003		
emp 1-5			0.69	0.91		
Intra-industry <i>x</i> corporate tax <i>x</i>			-0.012	-0.013		
emp 6-19			2.39	3.26		
Intra-industry <i>x</i> corporate tax <i>x</i>			-0.007	-0.008		
emp 20-30			1.79	2.34		
Intra-industry <i>x</i> corporate tax <i>x</i>			-0.012	-0.013		
emp 31+			2.39	2.69		
Intra-industry <i>x</i> corporate tax <i>x</i> age					-0.008	-0.008
1-6					1.35	1.74
Intra-industry <i>x</i> corporate tax <i>x</i> age					-0.006	-0.007
7-10					1.90	2.33
Intra-industry <i>x</i> corporate tax <i>x</i> age					-0.012	-0.011
11-17					2.32	2.88
Intra-industry x corporate tax x age					-0.012	-0.012
18+					2.26	2.82
Year, Country & Industry dummies	YES	YES	YES	YES	YES	YES
Country <i>x</i> year dummies	YES	NO	YES	NO	YES	NO
Industry <i>x</i> year dummies	NO	YES	NO	YES	NO	YES
Industry * size (or age) dummies	NO	NO	YES	YES	YES	YES
Observations	26,128	26,128	26,128	26,128	22,479	26,128
R-squared	0.06	0.06	0.07	0.07	0.07	0.08
Table 5 Entry and Exit Rates of Firms Interacted with Corporate Tax

TFP growth frontier firms in the same	0.224	0.251	0.215	0.244	0.223	0.228
industry	4.89	5.48	4.09	5.26	4.75	5.45
TFP gap with frontier firms	-0.694	-0.700	-0.708	-0.712	-0.702	-0.710
	10.35	10.26	10.07	10.07	10.16	10.06
Entry-exit rate of firms <i>x</i> corporate tax	-0.008	-0.005				
	1.29	2.15				
Entry-exit <i>x</i> corporate tax <i>x</i> emp 1-5			-0.007	-0.003		
			1.08	1.11		
Entry-exit <i>x</i> corporate tax <i>x</i> emp 6-19			-0.012	-0.007		
			1.62	2.77		
Entry-exit <i>x</i> corporate tax <i>x</i> emp 20-30			-0.010	-0.005		
			1.34	1.29		
Entry-exit <i>x</i> corporate tax <i>x</i> emp 31+			-0.011	-0.007		
			1.95	1.58		
Entry-exit <i>x</i> corporate tax <i>x</i> age 1-6					-0.007	-0.005
					1.14	2.28
Entry-exit <i>x</i> corporate tax <i>x</i> age 7-10					-0.008	-0.005
					1.27	2.39
Entry-exit <i>x</i> corporate tax <i>x</i> age 11-17					-0.007	-0.004
					1.08	1.85
Entry-exit <i>x</i> corporate tax <i>x</i> age 18+					-0.008	-0.005
					1.27	2.12
Year, Country & Industry dummies	YES	YES	YES	YES	YES	YES
Country <i>x</i> year dummies	YES	NO	YES	NO	YES	NO
Industry <i>x</i> year dummies	NO	YES	NO	YES	NO	YES
Observations	206,877	206,877	206,877	206,877	174,500	174,500
R-squared	0.06	0.06	0.06	0.06	0.07	0.07

Table 6 User cost of capital and investment

	1	S&A	Emp >19	2	3	4	5	6
Lagged tangible investment to capital	0.135	0.532	0.162	0.139	0.136	0.138	0.134	0.133
stock ratio	4.84	20.46	3.94	5.44	5.34	5.50	5.19	5.25
Squared lagged tangible investment	-0.117	-0.415	-0.120	-0.126	-0.122	-0.125	-0.123	-0.123
to capital stock ratio	2.59	16.60	1.95	2.89	2.87	2.91	2.88	2.89
Lagged output to capital ratio	0.000003	0.000***	0.0004	0.000008	0.000003	0.000007	0.000006	0.00008
	0.37	0.000	1.98	0.86	0.29	0.76	0.65	0.96
Lagged cash-flow to capital ratio	0.000039	0.048	-0.0003	0.000018	0.000037	0.000019	0.000044	0.000027
	0.57	16.00	0.56	0.22	0.46	0.22	0.48	0.26
Lagged user cost of capital	-1.062	-0.829	-2.91	-0.404				
	2.60	2.02	1.99	1.84				
Lagged user cost of capital					-0.935	-0.325		
<i>x</i> employment 1-5					1.96	1.34		
Lagged user cost of capital					-0.958	-0.361		
<i>x</i> employment 6-19					2.15	1.55		
Lagged user cost of capital					-1.383	-0.677		
x employment 20-30					2.33	1.68		
Lagged user cost of capital					-0.596	0.074		
x employment 31 or more					1.28	0.29		
Lagged user cost of capital							0.220	0.247
<i>x</i> age 0-6							1.24	1.34
Lagged user cost of capital							-0.122	-0.022
<i>x</i> age 7-10							0.52	0.11
Lagged user cost of capital							-0.120	-0.150
<i>x</i> age 11-17							0.91	1.20
Lagged user cost of capital							-0.002	-0.002
x age 18+							0.91	1.33
Year, Country & Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Country <i>x</i> year dummies	YES	YES	YES	NO	YES	NO	YES	NO
Industry <i>x</i> year dummies	NO	NO	NO	YES	NO	YES	NO	YES
Industry* size (age) dummies	NO	NO	NO	NO	YES	YES	YES	YES
Observations	138,318	211,599	10,472	138,318	138,318	138,318	138,318	138,318
R-squared	0.03	0.12	0.10	0.04	0.04	0.05	0.04	0.05

Table 7 User cost of capital and investment (Continuation)

	1	2	3	4	5	6	7	8
Lagged tangible investment to	0.134	0.139	0.123	0.121	0.124	0.121	0.153	0.153
capital stock ratio	4.86	5.46	3.46	3.37	3.46	3.37	4.03	4.33
Squared lagged tangible investment	-0.116	-0.124	-0.071	-0.072	-0.071	-0.072	-0.092	-0.087
to capital stock ratio	2.60	2.89	1.31	1.25	1.31	1.25	2.31	2.34
Lagged output to capital ratio	0.000004	0.000009	-0.000002	0.000002	-0.000002	0.000002	-0.00001	0.000007
	0.47	1.01	0.30	0.43	0.31	0.43	0.61	0.29
Lagged cashflow to capital ratio	0.000037	0.000016	0.000299	0.000250	0.000299	0.000250	0.001345	0.001173
	0.54	0.19	0.94	0.82	0.94	0.82	2.67	0.82
Lagged user cost of capital	-0.974	-0.265	-1.011	-0.166	-0.998	-0.167	-6.785	-0.332
	2.28	1.24	1.57	0.74	1.55	0.74	6.37	0.76
Lagged user cost of capital	-0.108	-0.167						
interacted with profitability	0.76	1.05						
Lagged user cost of capital <i>x</i> R&D			-0.000037	0.000010				
intensity (% value added)			0.69	0.16				
Lagged user cost of capital * R&D					-0.000043	0.000017		
intensity (% production)					0.60	0.20		
Lagged user cost of capital x Intra-							0.625	0.222
industry trade							3.43	0.80
Year, Country & Industry dummies	YES	YES	YES	YES	YES	YES	YES	YES
Country <i>x</i> year dummies	YES	NO	YES	NO	YES	NO	NO	NO
Industry <i>x</i> year dummies	NO	YES	NO	YES	NO	YES	YES	YES
Observations	138,318	138,318	53,471	53,471	53,471	53,471	18,991	18,991
R-squared	0.03	0.04	0.03	0.05	0.03	0.05	0.04	0.05

Appendix 1: Construction of the Dataset

Countries

Firm data is taken from the Amadeus database (from Bureau van Dijk). This database covers 30 European OECD member countries over the time period 1995-2008. To ensure that the final sample is representative of the underlying population of firms we combine this with information on the distribution of firms by size class and industry from the OECD's Structural and Demographic Business Statistics Database. More detail on this process is provided below. Data on 18 of the 30 countries is available within the OECD SDBS database. As is evident from the table the excluded countries are mostly Central and Eastern European Countries. Given their transition from central planning to a market economy over the sample period other motivations for the exclusion of these countries might also be found. There are many missing observations for Switzerland and Luxembourg in the OECD SDBS database; we therefore also choose to exclude these two countries from the analysis. This leaves a final sample of 16 countries.

Available in	Available in	Final	Available in	Available in	Final
Amadeus	OECD SDBS	Sample	Amadeus	OECD SDBS	Sample
Austria	Х	Х	Italy	Х	Х
Belarus			Latvia		
Belgium	Х	Х	Luxembourg	Х	
Bosnia			Netherlands	Х	Х
Bulgaria			Norway	Х	Х
Croatia			Portugal	Х	Х
Czech Republic	Х	Х	Romania		
Denmark	Х	Х	Serbia		
Estonia			Slovak Republic		
Finland	Х	Х	Slovakia		
France	Х	Х	Slovenia		
Germany	Х	Х	Spain	Х	Х
Greece			Sweden	Х	Х
Iceland	Х	Х	Switzerland	Х	
Ireland	Х	Х	UK	Х	Х

Table A1: Countries available in Amadeus	, OECD	SDBS	and Final	Sample
--	--------	------	-----------	--------

Industries

Firms within Amadeus are classified according to the 4-digit ISIC industry classification. We focus the analysis on firms in both the manufacturing and services sectors (Nace 15-93). We however exclude the sectors of recycling (Nace 37), refuse disposal (Nace 90) and utilities (Nace 40, 41), because of the high share of public ownership in some countries over the sample period. In addition financial services (Nace 65-67), real estate (Nace 70) and holding companies (Nace 7415) are excluded due to different reporting standards in these sectors. Finally, due to the presence of many non-profit organisations in the

public administration (Nace 75), education (Nace 80), health (Nace 85) and activities of membership organisations (Nace 91), these four sectors have been also excluded from the sample. The (2-digit) industries covered within the analysis are listed in Table A2.

Table A2: Industries Used in the Analysis (ISIC 2-digit)

ISIC Code	MANUFACTURING
	Food products, beverages and tobacco
15	Manuf. of food products and beverages
16	Manuf. of tobacco products
	Textiles and textile products
17	Manuf. of textiles
18	Manuf. of wearing apparel, dressing and dyeing of fur
19	Tanning and dressing of leather, luggage, handbags, saddlery, harness and footwear
20	Manuf. of wood and of products of wood and cork, except furniture, straw and plaiting
	Paper, paper products, printing and publishing
21	Manuf. of paper and paper products
22	Publishing, printing and reProd. of recorded media
	Energy products, chemicals and plastic products
23	Manuf. of coke, refined petroleum products and nuclear fuel
24	Manuf. of chemicals and chemical products
25	Manuf. of rubber and plastics products
26	Manuf. of other non-metallic mineral products
	Basic metals and fabricated metal products
27	Manuf. of basic metals
28	Manuf. of fabricated metal products, except machinery and equipment
29	Manuf. of machinery and equipment n.e.c.
	Electrical and optical equipment
30	Manuf. of office, accounting and computing machinery
31	Manuf. of electrical machinery and apparatus n.e.c.
32	Manuf. of radio, television and communication equipment and apparatus
33	Manuf. of medical, precision and optical instruments, watches and clocks
	Transport equipment
34	Manuf. of motor vehicles, trailers and semi-trailers
35	Manuf. of other transport equipment
	Manufacturing nec, recycling
36	Manuf. of furniture, manufacturing n.e.c.
37	Recycling

45	CONSTRUCTION							
	WHOLE SALE AND RETAIL TRADE							
50	Sale, maint. and repair of motor vehicles/cycles, retail sale of fuel							
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles							
52	Retail trade, except of motor vehicles and motorcycles, repair of personal and household goods							
55	HOTELS AND RESTAUTANTS							
	TRANSPORT, STORAGE AND COMMUNICATIONS							
60	Land transport, transport via pipelines							
61	Water transport							
62	Air transport							
63	Supporting and auxiliary transport activities, travel agencies							
64	Post and telecommunications							
	REAL ESTATE, RENTING , BUSINESS ACTIVITIES							
70	Real estate activities							
71	Renting of machinery without operator and of household goods							
72	Computer and related activities							
73	Research and development							
74	Other business activities							

Firms

Two important limitations on the use of cross-country data drawn from the Amadeus database are (1) that the data is a non-representative sample of firms within each country; and (2) pooling the data across countries exceeds the limits of available computer power. To generate a useable database we therefore attempt to address both of these issues by randomly sampling from each country such that the final sample matches the size distribution within an industry within a given country reported within the OECD Structural and Business Demographic Database. This is done in such a way such that the final database can be thought of as representative within a country, but also across the database as a whole. Large countries have greater number of firms than small countries within the final dataset.

In more detail, the sample selection process involved first deleting any outliers and obvious data entry errors from the Amadeus data. All variables with negative values were eliminated from the sample. Firms reporting a higher value of investment than their capital stock, or with extreme decreases in capital stock (and not exiting the market) were dropped from the database, as were firms whose employment growth was above 200% (the top 1 per cent of observations) in a single period or sales growth above 500%.

The second step was to determine the number and type of firms to randomly sample. The OECD SDBS database reports the number of firms within one of 5 employment size bands (<10, 10-19, 20-49, 50-249, >250), by each ISIC (2-digit) industry according to the census of production within each country. From here we calculate the ratio of the number of firms within each of these size/industry/country cells relative to the total number of firms across the 16 countries that make up

the sample. This is a data demanding process and so we perform this sampling based on Amadeus and OECD SDBS data for 2003 only (the exception to this is Ireland which is based on data for 2007). This represents the middle of our sample period. Our sample will therefore remain representative of the population of firms within our 16 countries to the extent that there is no net drift between size bands within an industry, and that the overall distribution of firms did not change markedly over time. The confidence with which we might make this assumption might be reasonably thought to diminish as we move further forward or backward from 2003.

Using the ratio of the number of firms in each size/industry/country cell to the total number of firms we then calculated the number of observations from that cell that would be needed to generate a final sample of 200,000 firms in 2003, a number chosen so that the final dataset would include around 1 million firm-year observations. The number of firms in each cell was rounded to the nearest integer. The final step was to randomly sample with replacement from an equivalent size/industry/country cell within the Amadeus database such that the number of observations drawn for 2003 was equal to that suggested by the OECD SDBS database necessary to generate a total figure of 200,000 firms in that year.

Further detail on the data by size class for country totals are provided in Tables A3 and A4. In Table A3 we report the number of firms within each size class suggested by the OECD SDBS dataset, and that available in Amadeus before and after (labelled Final Sample) randomly sampling. In Table A4 we present information on the distribution of firm size within the OECD SDBS, Amadeus and the Final Sample. A number of points can be made using these two tables. Firstly, the number that the OECD SDBS database suggests should be available from these 16 countries is far greater than can be obtained from Amadeus (14.4 million versus 585,017). The size bias in Amadeus is also clear. According to the OECD SDBS 91.4 per cent of firms have less than 10 employees, whereas the raw Amadeus data suggests that this figure is only around 50 per cent. Similarly according to the OECD SDBS 0.2 per cent of firms have more than 250 employees, whereas in the Amadeus data these firms make up 3 per cent of the total number of observations. As Table A4 makes clear, the extent of this size bias differs markedly across country datasets.

Also evident from the tables are clear differences in the number and distribution of firms that are not evident when using the Amadeus database. Perhaps most obviously Italy has by far the largest number of firms according to the OECD SDBS, a result that in part at least reflects the greater proportion of small firms in that country. At the other end Austria, Denmark and the UK tend to have more large firms than the average. In the case of the UK at least this translates into more large firms within the final database than is the case for other countries.

Finally, according to Table A4 the stratified random sampling would appear to have been successful in controlling for this. Within Table A4 it also becomes obvious however that this has occurred in part because the same firms have been repeatedly sampled. Perhaps most stark within this is the repeated sampling of the 130 Danish firms in the Amadeus dataset that have less than 10 employees.

After completing the sampling exercise across all years of the sample we are left with a final sample of 1,034,933 firm-year observations (Table A5). As suggested by comparing this figure with the 200,000 firms collected in 2003 this is not a balanced panel with a noticeable reduction in the number of observations towards the beginning and the end of the period. On average there are 6 observations per firm (inter-quartile range is 5-8 years per firm).

Table A3:Number of Firms by Employment and Country in OECD SDBSDatabase, Amadeus and the Random Sample

	Employment:	<10	10-19	20-49	50-249	>250	Total
	Sample:						
Austria	OECD SDBS	224816	19532	9657	4298	875	259178
	Amadeus	2453	636	313	124	17	3543
	Random Sample	3089	255	117	44	0	3505
Belgium	OECD SDBS	345212	16066	9756	3772	828	375634
	Amadeus	17866	3569	4021	2780	735	28971
	Random Sample	4759	210	119	38	0	5126
Czech Republic	OECD SDBS	706858	21802	11278	6197	1289	747424
	Amadeus	4934	2070	1832	2773	857	12466
	Random Sample	9767	288	142	71	0	10268
Denmark	OECD SDBS	159217	12571	6633	3537	628	182586
	Amadeus	130	16	19	30	12	207
	Random Sample	2063	131	52	23	0	2269
Finland	OECD SDBS	161890	6817	4228	2173	534	175642
	Amadeus	12152	2964	2189	1180	422	18907
	Random Sample	2224	77	40	16	0	2357
France	OECD SDBS	1997753	83454	57022	23026	4942	2166197
	Amadeus	33965	23675	23181	11236	2922	94979
_	Random Sample	27642	1138	772	301	5	29858
Germany	OECD SDBS	1508161	143280	72866	30083	5901	1760291
	Amadeus	18170	5613	3579	2752	1806	31920
	Random Sample	20861	1965	988	398	3	24215
Iceland	OECD SDBS	4183	231	115	29	4	4562
	Amadeus	146	17	8	1	0	172
	Random Sample	57	2	0	0	0	59
Ireland	OECD SDBS	62116	6432	3562	1347	265	73722
	Amadeus	4864	1751	1388	594	85	8682
	Random Sample	850	77	41	12	0	980
Italy	OECD SDBS	3497540	129151	49543	18784	2834	3697852
	Amadeus	4404	4368	9143	8814	1450	28179
	Random Sample	48409	1771	668	243	3	51094
Netherland	OECD SDBS	417510	29275	17305	8295	1540	473925
	Amadeus	476	187	309	404	73	1449
	Random Sample	5668	379	205	98	0	6350
Norway	OECD SDBS	199763	10949	5267	2279	465	218723
	Amadeus	34461	6312	2993	1019	141	44926
	Random Sample	2748	139	58	16	0	2961
Portugal	OECD SDBS	523530	23557	12189	4946	684	564906
	Amadeus	13317	9085	8700	4327	685	36114
	Random Sample	6196	280	151	51	0	6678
Spain	OECD SDBS	1588125	65374	37431	13422	2328	1706680
	Amadeus	66370	39188	29103	11031	2086	147778
	Random Sample	21972	889	500	170	1	23532
Sweden	OECD SDBS	475876	13702	7977	3758	833	502146

	Amadeus	79270	10255	6625	3430	908	100488
	Random Sample	6571	172	94	37	0	6874
United Kingdom	OECD SDBS	1314004	120449	52358	25940	5602	1518353
	Amadeus	3276	2716	5114	9976	5154	26236
	Random Sample	18175	1650	708	338	20	20891
Total	OECD SDBS	13186554	702642	357187	151886	29552	14427821
	Amadeus	296254	112422	98517	60471	17353	585017
	Random Sample	181051	9423	4655	1856	32	197017

Table A4: Distribution of Firm by Employment Size, Country and Database

	Employment: Sample:	<10	10-19	20-49	50-249	>250	% of observations of country in total for all countries
Austria	OECD SDBS	86.74	7.54	3.73	1.66	0.34	1.80
	Amadeus	69.24	17.95	8.83	3.50	0.48	0.61
	Random Sample	88.13	7.28	3.34	1.26	0.00	1.78
Belgium	OECD SDBS	91.90	4.28	2.60	1.00	0.22	2.60
	Amadeus	61.67	12.32	13.88	9.60	2.54	4.95
	Random Sample	92.84	4.10	2.32	0.74	0.00	2.60
Czech Republic	OECD SDBS	94.57	2.92	1.51	0.83	0.17	5.18
	Amadeus	39.58	16.61	14.70	22.24	6.87	2.13
	Random Sample	95.12	2.80	1.38	0.69	0.00	5.21
Denmark	OECD SDBS	87.20	6.88	3.63	1.94	0.34	1.27
	Amadeus	62.80	7.73	9.18	14.49	5.80	0.04
	Random Sample	90.92	5.77	2.29	1.01	0.00	1.15
Finland	OECD SDBS	92.17	3.88	2.41	1.24	0.30	1.22
	Amadeus	64.27	15.68	11.58	6.24	2.23	3.23
	Random Sample	94.36	3.27	1.70	0.68	0.00	1.20
France	OECD SDBS	92.22	3.85	2.63	1.06	0.23	15.01
	Amadeus	35.76	24.93	24.41	11.83	3.08	16.24
	Random Sample	92.58	3.81	2.59	1.01	0.02	15.16
Germany	OECD SDBS	85.68	8.14	4.14	1.71	0.34	12.20
	Amadeus	56.92	17.58	11.21	8.62	5.66	5.46
	Random Sample	86.15	8.11	4.08	1.64	0.01	12.29
Iceland	OECD SDBS	91.69	5.06	2.52	0.64	0.09	0.03
	Amadeus	84.88	9.88	4.65	0.58	0.00	0.03
	Random Sample	96.61	3.39	0.00	0.00	0.00	0.03
Ireland	OECD SDBS	84.26	8.72	4.83	1.83	0.36	0.51
	Amadeus	56.02	20.17	15.99	6.84	0.98	1.48
	Random Sample	86.73	7.86	4.18	1.22	0.00	0.50
Italy	OECD SDBS	94.58	3.49	1.34	0.51	0.08	25.63
	Amadeus	15.63	15.50	32.45	31.28	5.15	4.82
	Random Sample	94.74	3.47	1.31	0.48	0.01	25.93
Netherland	OECD SDBS	88.10	6.18	3.65	1.75	0.32	3.28
	Amadeus	32.85	12.91	21.33	27.88	5.04	0.25

	Random Sample	89.26	5.97	3.23	1.54	0.00	3.22
Norway	OECD SDBS	91.33	5.01	2.41	1.04	0.21	1.52
	Amadeus	76.71	14.05	6.66	2.27	0.31	7.68
	Random Sample	92.81	4.69	1.96	0.54	0.00	1.50
Portugal	OECD SDBS	92.68	4.17	2.16	0.88	0.12	3.92
	Amadeus	36.87	25.16	24.09	11.98	1.90	6.17
	Random Sample	92.78	4.19	2.26	0.76	0.00	3.39
Spain	OECD SDBS	93.05	3.83	2.19	0.79	0.14	11.83
	Amadeus	44.91	26.52	19.69	7.46	1.41	25.26
	Random Sample	93.37	3.78	2.12	0.72	0.00	11.94
Sweden	OECD SDBS	94.77	2.73	1.59	0.75	0.17	3.48
	Amadeus	78.89	10.21	6.59	3.41	0.90	17.18
	Random Sample	95.59	2.50	1.37	0.54	0.00	3.49
United Kingdom	OECD SDBS	86.54	7.93	3.45	1.71	0.37	10.52
	Amadeus	12.49	10.35	19.49	38.02	19.64	4.48
	Random Sample	87.00	7.90	3.39	1.62	0.10	10.60
Total	OECD SDBS	91.40	4.87	2.48	1.05	0.20	100.00
	Amadeus	50.64	19.22	16.84	10.34	2.97	100.00
	Random Sample	91.90	4.78	2.36	0.94	0.02	100.00

Table A5: Observations by Year

Year	Random
	Sample
1995	291
1996	588
1997	2,347
1998	7,932
1999	56,189
2000	73,644
2001	88,264
2002	125,238
2003	196,037
2004	133,392
2005	121,690
2006	116,503
2007	112,661
2008	157
Total	1,034,933

Final Sample

The focus on total factor productivity as the firm performance variable of interest also leads to the loss of observations from the dataset. A lack of information on materials in particular leads to the loss of Austria, Denmark, Ireland, Iceland, Netherlands, Norway and the UK. The final sample is therefore

restricted to 9 countries. It also leads to the loss of observations within countries. To understand the implications of this we re-present information from Table A4 for the final set of firms. In practice the effect is relatively small. The distribution for the total remains very similar to that suggested by the OECD SDBS data. This occurs in part because the countries where the loss of observations was the greatest and the effect on the distribution most marked, Belgium and Germany, now account for a very small proportion of the total sample. There are for example, only 78 firms left for Germany for 2003.

	Employment					
	Sample:	<10	10-19	20-49	50-249	>250
Belgium	OECD SDBS	91.90	4.28	2.60	1.00	0.22
	Random sample	92.84	4.10	2.32	0.74	0.00
	Final Sample	67.19	11.20	15.36	6.25	0.00
Czech Republic	OECD SDBS	94.57	2.92	1.51	0.83	0.17
	Random sample	95.12	2.80	1.38	0.69	0.00
	Final Sample	91.36	4.56	2.84	1.23	0.00
Finland	OECD SDBS	92.17	3.88	2.41	1.24	0.30
	Random sample	94.36	3.27	1.70	0.68	0.00
	Final Sample	93.98	3.28	1.09	1.64	0.00
France	OECD SDBS	92.22	3.85	2.63	1.06	0.23
	Random sample	92.58	3.81	2.59	1.01	0.02
	Final Sample	92.58	4.18	2.54	0.70	0.00
Germany	OECD SDBS	85.68	8.14	4.14	1.71	0.34
	Random sample	86.15	8.11	4.08	1.64	0.01
	Final Sample	17.95	7.69	14.10	60.26	0.00
Italy	OECD SDBS	94.58	3.49	1.34	0.51	0.08
	Random sample	94.74	3.47	1.31	0.48	0.01
	Final Sample	93.66	4.15	1.62	0.57	0.01
Portugal	OECD SDBS	92.68	4.17	2.16	0.88	0.12
	Random sample	92.78	4.19	2.26	0.76	0.00
	Final Sample	90.60	4.82	3.13	1.45	0.00
Spain	OECD SDBS	93.05	3.83	2.19	0.79	0.14
	Random sample	93.37	3.78	2.12	0.72	0.00
	Final Sample	93.57	4.01	2.00	0.43	0.00
Sweden	OECD SDBS	94.77	2.73	1.59	0.75	0.17
	Random	95.59	2.50	1.37	0.54	0.00

	sample					
	Final Sample	96.21	2.61	1.02	0.17	0.00
Total	OECD SDBS	92.38	4.30	2.24	0.91	0.17
	Random sample	92.75	4.24	2.17	0.83	0.01
	Final Sample	93.16	4.09	2.05	0.69	0.00

Appendix 2: Present Value of Tax Depreciation.

This appendix summarizes some analytical expressions used in the computation of the user cost of capital.

The countries considered in this paper distinguish three basic tax methods to account for economic depreciation: straight-line depreciation, constant declining balance depreciation or the method of the sum-of-the-years'-digits. The basic expressions in continuous time used in computing the user cost of capital are shown below:

Straight-line depreciation:

$$Z_{SL} = \int_{0}^{\infty} \frac{1}{l} \cdot e^{-i \cdot t} dt = \frac{1}{l \cdot i}$$

where *l* represents the tax lifetime, which is specific for each asset in each country.

Constant declining balance:

$$Z_{PC} = \int_{0}^{\infty} V \cdot e^{-(i+V) \cdot t} dt = \frac{V}{i+V}$$

where *V* indicates the *country-specific* exponential rate at which each year the depreciation of a given asset is granted.

The 'sum-of-the-years'-digits method:

$$Z_{SD} = \int_{0}^{\infty} (l-t) \cdot \frac{2}{l^2} e^{-i \cdot t} dt = \frac{2}{l^2} \cdot \left[\frac{l}{i} - \frac{1}{i^2}\right]$$

	Top marginal		User cost of capital						
Country	corporate tax rate								
		Debt &	Equity &	Debt &	Equity &	Debt	Equity		
		Buildings	Buildings	Machinery	Machinery	&Technology	&Technology		
Belgium	37.6	6.9	12.7	7.7	9.2	4.4	6.1		
Czech Republic	31.2	7.3	11.8	7.1	11.7	5.4	9.7		
Finland	27.9	8.5	12.4	6.9	10.5	8.8	12.9		
France	37.0	6.6	11.9	6.2	11.3	8.5	14.7		
Germany	45.3	6.5	14.0	5.4	11.4	6.7	9.5		
Italy	41.5	4.6	10.2	1.1	5.8	-2.0	3.6		
Portugal	33.3	6.6	11.4	5.7	10.1	6.2	11.2		
Spain	34.8	7.4	12.8	6.9	11.8	8.0	13.4		
Sweden	28.0	6.9	10.5	6.9	10.5	8.8	13.0		
Average	35.2	6.8	12.0	6.0	10.3	6.1	10.5		

Appendix III: User cost of capital by country (1996-2007)

Appendix IV Descriptive statistics

a) TFP growth by country

	Observations	Mean	Standard deviation
Growth in TFP	262,294	0.90	54.1
Growth in TFP Belgium	1,891	2.81	69.4
Growth in TFP Czech Republic	4,343	-8.82	354.9
Growth in TFP Finland	6,168	0.27	34.5
Growth in TFP France	75,261	0.57	14.9
Growth in TFP Germany	133	0.78	6.5
Growth in TFP Italy	86,167	1.94	31.6
Growth in TFP Portugal	440	3.42	13.1
Growth in TFP Spain	71,283	0.66	35.3
Growth in TFP Sweden	16,508	0.53	27.1

b) Descriptive statistics by industry

		TFP		Duction	R&D	R&D	Intra-	Entry-
	Obs.	growth	S.C.	Profit.	value added)	(production)	trade	exit rate
15. Manufacture of leather and related products	1640	0.3	6.3	25.7	0.2	0.1	18.8	17.7
16. Manufacture of wood and of products of wood and cork. except furniture	4045	0.0	23.1	19.2	0.4	0.1	42.6	17.3
17. Manufacture of paper and paper products	399	0.7	4.9	46.5	0.3	0.1	89.0	-
18. Printing and reproduction of recorded media	1195	-2.0	31.4	35.6	0.1	0.0	80.8	-
20. Manufacture of chemicals and chemical products	1128	-0.5	21.8	50.2	9.5	3.5	93.3	15.7
21. Manufacture of basic pharmaceutical products and pharmaceutical prep.	80	1.1	7.9	50.2	9.5	3.5	93.3	15.7
22. Manufacture of rubber and plastic products	2089	1.2	7.1	31.4	0.9	0.3	87.3	14.0
23. Manufacture of other non-metallic mineral products	2479	5.0	51.5	39.9	1.1	0.5	61.5	14.7
24. Manufacture of basic metals	327	0.6	14.2	24.3	1.2	0.4	65.4	-
25. Manufacture of fabricated metal products	8781	2.7	51.1	29.5	4.5	2.0	77.4	-
26. Manufacture of computer. electronic and optical products	1514	1.9	19.6	36.6	16.8	6.3	85.3	-
27. Manufacture of electrical equipment	648	3.8	57.5	44.1	3.5	1.6	79.6	-
28. Manufacture of machinery and equipment n.e.c.	3462	1.2	13.8	31.9	6.2	2.4	94.8	22.5
29. Manufacture of motor vehicles. trailers and semi-trailers	375	0.2	33.6	41.0	16.0	3.8	61.7	-
30. Manufacture of other transport equipment	378	0.9	18.3	28.2	6.5	2.6	66.2	-
31. Manufacture of furniture	1427	0.5	6.6	30.2	-	-	44.3	-
32. Other manufacturing	2058	0.8	37.2	30.2	-	-	44.3	-
33. Repair and installation of machinery and equipment	813	1.8	23.1	31.9	6.2	2.4	94.8	22.5
35. Electricity. gas. steam and air conditioning supply	87	-4.5	37.0	53.1	-	-	-	-
38. Waste collection. treatment and disposal activities	255	-1.5	22.1	43.4	-	-	-	-
42. Civil engineering	1186	-13.2	56.9	23.6	-	-	-	-
43. Specialised construction activities	19464	0.7	10.4	23.6	-	-	-	-
45. Wholesale and retail trade and repair of motor vehicles and motorcycles	13662	1.3	45.6	25.4	-	-	-	18.9

46. Wholesale trade. except of motor vehicles and motorcycles	39912	1.1	46.6	22.3	-	-	-	17.4
47. Retail trade. except of motor vehicles and motorcycles	74275	1.0	23.8	23.2	-	-	-	-
49. Land transport and transport via pipelines	17039	0.5	7.4	36.7	0.2	0.1	-	23.1
50. Water transport	60	0.0	14.2	38.9	0.4	0.1	-	17.5
51. Air transport	11	-5.0	26.9	-0.6	0.2	0.1	-	23.2
52. Warehousing and support activities for transportation	1794	1.0	25.9	22.8	0.0	0.0	-	20.2
53. Postal and courier activities	378	1.2	10.4	33.6	0.1	0.1	-	33.1
55. Accommodation	11119	3.6	17.8	21.8	0.0	0.0	-	25.9
56. Food and beverage service activities	5257	0.0	8.0	21.8	0.0	0.0	-	25.9
58. Publishing activities	3303	2.0	64.2	27.1	3.3	2.1	-	29.0
59. Motion picture. video and television programme production. sound	203	-0.7	11.3	44.8	-	-	-	-
61. Telecommunications	63	-21.0	39.9	33.6	0.1	0.1	-	33.1
62. Computer programming. consultancy and related activities	2767	1.5	26.9	27.1	3.3	2.1	-	29.0
63. Information service activities	603	-1.8	21.6	27.1	3.3	2.1	-	29.0
68. Real estate activities	7745	-1.5	24.6	33.1	-	-	-	19.6
69. Legal and accounting activities	3202	0.9	9.6	30.7	0.0	0.0	-	20.8
71. Architectural and engineering activities	7084	0.2	39.9	30.7	0.0	0.0	-	20.8
72. Scientific research and development	263	2.3	35.1	6.0	-	-	-	22.6
73. Advertising and market research	8081	-4.2	250.2	30.7	0.0	0.0	-	20.8
74. Other professional. scientific and technical activities	1051	1.7	76.5	30.7	0.0	0.0	-	20.8
77. Rental and leasing activities	2421	1.5	34.1	45.6	10.0	5.1	-	22.3
78. Employment activities	160	0.0	11.4	30.7	0.0	0.0	-	20.8
79. Travel agency. tour operator and other reservation service	885	-0.3	12.2	44.8	-	-	-	-
81. Services to buildings and landscape activities	1911	-1.2	11.2	30.7	0.0	0.0	-	20.8
82. Office administrative. office support and other business support activities	5215	5.4	41.4	30.7	0.0	0.0	-	20.8

Note: Data for profitability. R&D intensity, intra-industry trade and entry-exit rates are for the US.

c) Structure of firms by employment and age

Employment	Share	Age	Share
	17.1		20.5
Firms with less than 5 employees	45.1	Firms aged 0 to 6 years	30.7
Firms with 6 to 19 employees	49.4	Firms aged 7 to 10 years	19.8
Firms with 20 to 30 employees	1.9	Firms aged 11 to 17 years	25.2
Firms with 31 or more employees	3.6	Firms aged 18 or more years	24.3
Total	100.0	Total	100.0

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 <i>Value at Risk</i> Mariano González Sánchez
161/2000	Tax neutrality on saving assets. The spahish 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. Llorenc Pou, Joaquín Alegre
173/2002	Modelos paramétricos y no paramétricos en problemas de concesión de tarjetas de credito. 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 sumi- nistro de agua. Mª Ángeles García Valiñas
184/2004	Estimación de la economía sumergida es 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 jerár- quicos 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 in- dex 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 com- mon 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 li- quidez? 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 han- dling 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 aproxi- mación 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 dis- tance functions Sergio Perelman and Daniel Santin
218/2005	La gobernanza de los procesos parlamentarios: la organización industrial del congreso de los di- putados 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 me- didas 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 Faíña y Jose Lopez Rodríguez
223/2005	Auditors' Forecasting in Going Concern Decisions: Framing, Confidence and Information Proc- essing 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 Faíña and Jesús López-Rodríguez
225/2005	The effects of ownership structure and board composition on the audit committee activity: Span- ish 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 cen- tral 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 Maxi- mum 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 deter- minantes 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 Withadditive 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 Faíña
251/2006	Funciones abreviadas de bienestar social: Una forma sencilla de simultanear 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-Ocnoa y Carmen Almansa-Saez
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 Em- presas 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 Econó- mica 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 Tram- ways, 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 liberali- zación del Sector Eléctrico Fernando Hernández Martínez
291/2006	Further considerations on the link between adjustment costs and the productivity of R&D invest- ment: 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 Rodriguez-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 Vanesa 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 Iráizoz, 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 Ciu- dadanos 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 Bedia 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-Rodriguez
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 Víctor 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 Ballestero, 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 Know- ledge 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 Feria 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 founda- tions 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 Vanesa 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-Rodriguez
376/2008	Measurement of intra-distribution dynamics: An application of different approaches to the European regions
	Adolfo Maza, Maria Hierro and Jose 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 Ñíguez 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 Rod- riguez 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 farmaceúticas, 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 Mª Leticia Santos Vijande, Mª 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 litera- tura 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 Montaño Sanz
394/2008	Efectos externos del endeudamiento sobre la calificación crediticia de las Comunidades Autóno- mas Andrés Leal Marcos y Julio López Laborda
395/2008	Technical efficiency and productivity changes in Spanish airports: A parametric distance func- tions 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 CO ₂ emissions: A computational modelling approach using Arti- ficial 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 Mª del Pópulo Pablo-Romero Gil-Delgado y Mª 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 uem: ¿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 ana- lysis 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 sanita- rios 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 electri- cidad 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 interna- cional 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 Feria-Domínguez & José Luis Martín-Marín
442/2009	Costes de mitigación y escenarios post-kyoto en España: un análisis de equilibro 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 Abínzano & Javier F. Navas
451/2009	Information technologies and financial prformance: 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 Montaño 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 Del- gado 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 Víctor 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 Vanesa 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	Sructural 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-Etxeberria & Francisco Requena Silvente
526/2010	Why do firms locate r&d outsourcing agreeements offshore? the role of ownership, location, and externalization advantages Andrea Martínez-Noya, Esteban Gárcía-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