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Assessing the losses in euro area potential productivity due to the financial crisis[*]

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Résumé

Nous montrons dans cet article que la récente crise financière a réduit significativement la productivité globale des facteurs (PGF) potentielle des quatre plus grands pays de la zone euro, et également celle du reste de la zone euro. Nous avons utilisé une équation en forme réduite de la PGF, fondée sur une approche développée dans Cahn et Saint-Guilhem (2010). Nos résultats empiriques montrent que l'impact permanent sur la PGF potentielle varie selon les pays entre -3,9 et -1,3 points de pourcentage au T2 2012. Lorsque l'on prend en compte ces pertes, l'écart de PGF, défini comme l'écart entre la PGF et son potentiel, évolue pour chaque pays de façon très similaire au taux d'utilisation des capacités de production (TUC). De plus, dans le cas de la France, la prise en compte du TUC dans le modèle de la PGF permet de diminuer les révisions affectant l'écart de PGF en temps quasi-réel.

Mots clés : fonction de production, productivité globale des facteurs, crise financière, utilisation des capacités de production.

Codes JEL : E22, E23, E32, O47.

Abstract

In this paper, we show that the recent financial crisis has significantly affected the potential total factor productivity (TFP) of the four largest euro area economies, as well as that of the rest of the euro area. We used a reduced-form equation of TFP, based on an approach recently developed by Cahn and Saint-Guilhem (2010). Our empirical findings show that the permanent impact on potential TFP varies across countries from -3.9 points to -1.3 points in Q2 2012. When these losses are incorporated, TFP gaps develop closely in line with capacity utilisation rates (CUR). Moreover, in the case of France, including CUR in our TFP model improves the quasi real-time reliability of TFP gap estimates.

Key words: production function, total factor productivity, financial crisis, capacity utilisation.

JEL codes: E22, E23, E32, O47.

I. Introduction

The financial crisis continues to generate significant uncertainty regarding the measurement of the output gap (the gap between actual and estimated potential output). Reliable measures of this gap are especially valuable to policy makers as a vital tool for monetary and fiscal policy. The breakdown of TFP between a potential component and a cyclical one (the TFP gap) is crucial since the TFP gap contributes to the output gap proportionately in most standard production functions. In this paper we investigate the size and duration of the impact of the crisis on potential TFP.

The theoretical literature and firm-level empirical literature show that the effects of recessions on total factor productivity are ambiguous. Indeed, potential 'cleansing effects', where crises eliminate less productive firms, may increase TFP levels (Caballero and Hammour, 1994). But other factors may have a negative impact on TFP, such as 'scarring effects' where young, innovative firms have fewer incentives to continue their activities in an uncertain environment (Ouyang, 2009), or 'sullying effects', where the most productive firms face tighter financial constraints (Barlevy, 2002 and Barlevy, 2003). Long-term investment and R&D spending may also be reduced in times of tightened financial constraints, lowering total factor productivity (Aghion *et al.*, 2012).

According to the recent empirical literature on crises, the long-run impact of past financial crises[1] on potential output is a loss of around 1.5 to 2.4% on average, and of up to 4% for the most severe crises (Furceri and Mourougane, 2012). Moreover, Oulton and Sebastia-Barriel (2013) show that the long-run impact of past recessions on labour productivity is between 0.8% and 1.1% on average. Note that these assessments mainly rely on narrative approaches *à la* Romer and Romer (1989), where the authors consider a panel of countries that suffered a financial crisis between the 1960s and the 2000s, and where that crisis was generally confined to a single country or group of countries. The crises are proxied using dummy variables and the estimated impact is more or less the average of all the country-specific impacts. Since the last financial crisis was a global one, however, affecting all countries in the world simultaneously, it is likely that its impact on growth will be more pronounced.

The aim of this paper is to investigate how the recent recession has affected potential total factor productivity in the euro area, that is in France, Germany, Italy, Spain and in the rest of the euro area. Admittedly, potential TFP and the TFP gap are unobservable variables which can only be

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[1] Excluding the financial crisis of 2007-2008.

derived from theoretical and/or statistical models; for instance, the OECD uses an HP filter to identify potential TFP. However, we argue that economists have at their disposal a key survey variable, the capacity utilisation rate (CUR), which conveys crucial information about the TFP gap. Since any underutilisation of capital stock leads to a decline in apparent TFP, it is economically intuitive to view the CUR as a strong determinant of the TFP gap. Statistically, this variable also has a number of features that make it extremely valuable from a practical point of view: 1) the CUR is observable and available for many countries, which facilitates international comparisons (see the EU harmonised Business Tendency Surveys); 2) CUR surveys are rapidly available (generally at the beginning of the following month); 3) the CUR is not revised. By focusing on capacity utilisation, our approach builds heavily on Planas *et al.* (2013) but in a trend-stationary framework *à la* Perron (1989).

Our contribution to the literature is therefore threefold. We propose a new measure of TFP gaps closely correlated to capacity utilisation rates. In the case of France, we also show that including the CUR in our TFP model improves the quasi real-time reliability of TFP gap estimates. Our second contribution is that we consider the precise timing of the crisis and quantify the size of the losses in potential TFP. Lastly, these losses are broken down by source (permanent losses, capital ageing impact and construction sector impact).

II. TFP model

In this section, we extend a reduced-form equation developed by Cahn and Saint-Guilhem (2010) to measure the cost of the recent financial crisis in terms of potential euro area TFP. Economy-wide production technology is represented by a Cobb-Douglas-like production function with a constant return to scale on labour and capital. As described in Cahn and Saint-Guilhem (2010), the production function can be expressed analytically as:

$$Y_t = \sigma e^{\gamma t} \tilde{K}_t^{1-\alpha} \left(N_t H_t \right)^{\alpha}, \, 0 < \alpha < 1,$$

where Y stands for total GDP, $\tilde{K}$ for the stock of available productive capital, N for total employment, and H for per capita hours worked. The parameter α is the elasticity of output with respect to employment, γ is the growth rate of a pure exogenous deterministic technical change and σ a scale factor. Here, available productive capital is tied up with measured capital stock K and the age of capital according to:

$$\tilde{K}_t = CUR_t.K_t.e^{\varepsilon(t-\tau_t)}$$

where *CUR* is the capacity utilisation rate of the capital stock and τ, the age of capital assuming that, thanks to capital-embodied technological progress, one unit of investment shows a productivity gain at each period amounting to $(1 + \varepsilon)$, with $\varepsilon > 0$. We compute the age of capital as a weighted average

$$\tau_t = \sum_{j=0}^{l-1} \frac{(1-\delta)^j I_{t-j}}{\tilde{K}_t} \cdot j,$$ at each period *t*. This formula is derived from the accumulation of

investment flows, where δ denotes the depreciation rate of capital, $0 < \delta < 1$, and I_t denotes

investment.[2]

Therefore, the production function can be expressed as:
$$Y_t = G_t K_t^{1-\alpha} (N_t H_t)^{\alpha}$$

where $G_t = e^{\gamma t}.CUR_t^{1-\alpha}.e^{(1-\alpha)\varepsilon(t-\tau_t)}$ stands for the apparent total factor productivity (TFP). Thus, we

can measure TFP as the Solow residual of the neoclassical model:

$$G_t = Y_t / K_t^{1-\alpha} (N_t H_t)^{\alpha} \qquad (1)$$

TFP measures the effectiveness with which accumulated factors of production (capital *K* and labour *NH*) are used to produce output *Y*. Cahn and Saint-Guilhem (2010) deduce from the previous theoretical framework a reduced-form equation of the TFP logarithm. Here, we modify their TFP equation in two ways in order to take into account the impact of the financial crisis:

- we add an exogenous trend break $break_{I+1}$ in $T_{B,I+1} = 2008Q3$ for all countries, in order to test the possibility of a long-run effect of the crisis on TFP growth;

- we add a permanent shock in the AR(1) residuals, in order to allow for a long-run impact of the financial crisis on the level of TFP.

These modifications lead to the following equations, expressed in logarithmic form:

$$g_t = \alpha_1 + \alpha_2 ecur_t + \alpha_3 ecage_t + \alpha_4 t + \sum_{i=1}^{I+1} \alpha_{5,i} break_{i,t} + u_t \qquad (2a)$$

$$u_t = \rho u_{t-1} + \phi(1-\rho) s_{T_C,t} + \varepsilon_t \qquad (2b)$$

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[2] Intuitively $(1-\delta)^j I_{t-j} / \tilde{K}t$ represents the remaining share in the available capital stock of capital of vintage *j*.

with: $ecur_t = (cur_t - \overline{cur}), ecage_t = (age_t - \overline{age}), break_{i,t} = (t - T_{B,i}) \cdot 1_{t \geq T_{B,i}}$. CUR and the age of

capital stock are adjusted by their long-term averages $\overline{cur}$ and $\overline{age}$.[3] The parameter α_2 should be

positive, reflecting the fact that TFP grows as domestic production capacities are used more

intensively than usual. Moreover, a higher-than-average age of capital stock could have a negative

impact on TFP, so the parameter α_3 should be negative. In this TFP model, g is a function of the

CUR, the age of the stock of capital equipment and a deterministic trend with $I+1$ breaks at dates $T_{B,i}$

, $i = 1$ to I. The residual u_t captures the omitted variables and is supposed to follow an AR(1) process,

with dampening factor ρ, driven by a Gaussian white noise ε. A first impact of the onset of the

crisis in our model is captured through a long-lasting disturbance in the dynamics of u, which formally

materialises through s_{T_C}, a qualitative indicator of the crisis which is equal to 0 up to time T_C and to

1 thereafter.

We reformulate equations (2a) and (2b) as a single non-linear equation, which we estimate

with non-linear least squares (NLS):

$$g_t = \alpha_1(1-\rho) + \rho \cdot g_{t-1} + \alpha_2(ecur_t - \rho \cdot ecur_{t-1}) + \alpha_3(ecage_t - \rho \cdot ecage_{t-1}) + \alpha_4(t - \rho(t-1))$$

$$+ \sum_{i=1}^{I+1} \alpha_{5,i}(break_{i,t} - \rho \cdot break_{i,t-1}) + \phi(1-\rho)s_{T_C,t} + \varepsilon_t \qquad (2')$$

According to this specification with the qualitative indicator s_{T_C}, the parameter ϕ measures the

impact of the crisis on the *level* of potential TFP. The parameter $\alpha_{5,I+1}$ associated with T_C detects a

possible impact of the crisis on the *growth* of TFP. Let us note that the occurrence of s_{T_C} can be

interpreted as progressively impacting the constant term α_1 via the impulse response function of an

AR(1) to a shock that takes the form of a step of amplitude ϕ. For the sake of simplicity, we make the

assumption that the financial crisis diffuses at the same rate ρ as the other shocks affecting u

dampen.

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[3] This transformation does not change their elasticity (it only changes the estimated intercept). For the CUR, it allows us to disentangle the cyclical part related to the TFP gap from the long-run reference value of the CUR (measured by its mean) related to the potential TFP. For the age of capital, this transformation would be useful, if we were interested in a long-run potential TFP which would also exclude fluctuations in the age of capital.

Applying the Bai-Perron test to a linearised version of this equation[4] for the trend coefficient with a trimming factor of 10% and over the pre-crisis period (from 1960 to 2007), we find the following break dates: Q2 1973 and Q3 1985 for France; Q3 1978 and Q3 1997 for Germany; Q2 1997 for Italy; Q1 1996 for Spain; Q1 1995 for the rest of the euro area. For all countries, we also test an additional break at the date of the Lehman bankruptcy (Q3 2008).[5]

Finally, potential TFP is derived from (2') as follows:[6]

$$g_t^* = \alpha_1 + \alpha_3 ecage_t + \alpha_4 trend_t + \sum_{i=1}^{I+1} \alpha_{5,i} Break_{1,i_t} + \phi \frac{1-\rho}{1-\rho L} S_{TC}$$

Now, in equation (3) below, the TFP gap (*gap* which is equal to g-g*) is directly linked to the CUR. An additional term depicts AR(1) residuals that remain after fitting the gap with the CUR:

$$gap_t = \alpha_2 ecur_t + \frac{\varepsilon_t}{1 - \rho L} \qquad (3)$$

By over-differentiating the variables, we can write this equation in the spirit of an error correction representation:

$$\Delta gap_t = \alpha_2 \Delta ecur_t - (1-\rho)(gap_{t-1} - \alpha_2 ecur_{t-1}) + \varepsilon_t \quad (4)$$

where $\Delta gap_t = gap_t - gap_{t-1}$. Thus, we can interpret the parameter 1-ρ as an adjustment speed of the TFP gap to the CUR target.

III. Data

The data cover the period Q1 1960 to Q2 2012 for France, Germany, Italy, Spain and the rest of the euro area. Data on labour markets, output and investment are from national statistical institutes and Eurostat databases. Capital stock K is computed as the sum of two types of capital: *KM*, capital for 'machinery and equipment' and *KB*, capital for 'construction'. These stocks of capital are derived from the standard permanent inventory equation.[7] Capital for 'machinery and equipment' is determined using investments in 'machinery and equipment' with an obsolescence rate of 0.024,

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[4] If we relax the constraints relating to the coefficients of equation (2') by regressing the TFP on an intercept, its lag and lags of all regressors (ecur, ecage, the time trend, breaks and the qualitative indicator), we get a linear equation and we can apply the Bai-Perron test. Another possible approach would have been to test break dates with the non-linear equation, by using the test of Boldea and Hall (2013).

[5] Since this break date is exogenous, testing its significance does not require tests of endogenous break dates (Bai-Perron or Boldea-Hall tests) and we simply use the standard distribution of the Student test.

[6] L is the lag operator.

[7] $K_t = KM_t + KB_t$ with $KM_t = (1-0.024)*KM_{t-1} + IM_t$ and $KB_t = (1-0.004)*KB_{t-1} + IB_t$, at each date t.

equivalent to a lifetime of nearly 10 years, and capital for 'construction' is determined using investments in construction with an obsolescence rate of 0.004, equivalent to nearly 60 years (see Cahn and Saint-Guilhem, 2010). Age of capital is calculated using historical time-series on investments in machinery, vehicles and equipment.[8] Figure 1 shows the evolution of the age of 'machinery and equipment' capital for France, Germany, Italy, Spain and the rest of the euro area. CUR series are collected from regular national surveys on industrial sectors. The output elasticity of labour α is calibrated as the average shares of wages in GDP.

IV. Impact of the financial crisis on potential TFP

The estimation results obtained using the previous model for TFP are shown in Table 1 and summarised in Table 2. Table 1 presents the coefficient estimates of equation (2') for each of the economies under examination.[9] We find that introducing an indicator of the crisis matters: its parameter ϕ is significant for all the economies in question. This result shows that, for all countries, permanent losses in potential TFP are substantial. The parameter α_3 indicating the age of capital is significant and negative for France, Germany and Spain. This represents a loss resulting from capital ageing.

The TFP trend breaks assessed via the parameters $\alpha_{5,i}$ show that the dynamics of TFP trends differ across countries. The negative signs for $\alpha_{5,1}$ and $\alpha_{5,2}$ reflect decreases in TFP trends after the breaks. For France, Germany and Italy in particular, TFP trends reached 1.0%, 0.7% and -0.1% respectively before the crisis. For Spain, however, the parameter $\alpha_{5,3}$ captures a significant positive impact from the crisis on the *growth* of TFP in Q32008. In Spain, the TFP trend reached 0.7% over the period 2008-2012, after 0.2% over 1997-2008 and 1% over 1992-1997. These three sub-periods correspond to structural breaks in the Spanish construction sector (the percentage share of this sector in value added follows the same patterns as these TFP trends). An explanation for the increasing productivity trend over 2008-2012 could be the disappearance of the low-productivity firms that were created in the construction sector during the real estate bubble. For other countries, we wondered

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[8]Historical data on investment are derived from Maddison's databases for France and Germany, from Prados (2003) for Spain and from Baffigi (2011) for Italy.

[9] We have performed robustness tests on residuals which suggest homoscedasticity and non-autocorrelation. These additional results are available upon request from the authors.

whether bubbles had also occurred before the crisis, but we do not find any significant break in TFP growth over this period. This issue is discussed in Section IV.

The coefficient ρ represents the persistence of TFP shocks. The smaller this parameter, the faster TFP returns to its mean value. We find that losses are more persistent in France and in Italy than in other countries such as Germany and Spain. Impulse responses of s_{T_C} also illustrate this finding (Figure 2).

Table 2 shows that the total impact on potential TFP stands at 4 percentage points for the euro area in Q2 2012. Interestingly, this impact stems from a permanent impact (-2.8pp), a capital ageing impact (-1.4pp) and a construction sector impact (+0.2pp). Permanent losses reflect the long-run impact of the financial crisis. They appear to be greater in France (-3.3pp), in Italy (-3.7pp) and in the rest of the euro area (-3.9pp). The losses caused by capital ageing result from depressed investment in capital goods in France, Germany and Spain. There is no impact from the age of capital in Italy and the rest of the euro area (REA) since this variable is not statistically significant. The positive impact from the construction sector comes from Spain (with an impact of +2.1pp on Spanish TFP).

Figures 3 and 4 depict the TFP gap and potential TFP growth for the economies under examination. In Figures 3a to 3e, the magnitude of the permanent impact is observed in the TFP gap curve. After being adjusted for the permanent impact, the TFP gap is more closely correlated to the CUR, which now has a significant impact on TFP, except in the case of the REA (according to estimates of α_3 in Table 1). Figures 3a to 3e also compare the TFP gap for our TFP model ("TFP gap with production function") with the TFP gap obtained using the Hodrick-Prescott (HP) filter. We can see that, for both methods, the gaps obtained and therefore the loss of potential TFP, are comparable, particularly over the end of the period. Figures 4a to 4e show the growth of HP TFP trends and that of our potential TFP. The results reveal that HP estimates of TFP trend had already begun to decrease before the crisis in each euro-area country (e.g. in Q1 2006 for Germany), while our estimates of potential TFP growth start to decrease at the date of the crisis (Q3 2008).

In Figures 5a to 5f, the loss in potential TFP is broken down according to the contribution of each of the three impacts listed in Table 2: the impact of the crisis, of capital ageing and of the construction sector. We can see the sharp decrease in TFP and potential TFP after the end of 2008.

This loss results mainly from the permanent impact caused by the crisis, followed by the impact of capital ageing.

V. Robustness and quasi real-time reliability

How can we ensure that the analysis is not affected by a diagnosis error concerning the pre-crisis period? Our estimate of the impact of the crisis on potential TFP hinges crucially on the breakdown of effective TFP between its cyclical component and its trend during the pre-crisis period. Any overestimation of potential growth before the crisis may result in an underestimation of the pre-crisis (positive) output gap and an overestimation of the post-crisis loss of potential output. The question of a possible negative break in TFP growth in the decade preceding the crisis has been extensively discussed. Bénassy-Quéré *et al.* (2009) argue that between 1999 and 2007 "Cheap credit-facilitated debt financed investment in real estate and financial assets, and contributed to excessive risk taking. From a macroeconomic standpoint also, this crisis has been a crisis of leverage". Many other experts develop the same argument (Turner Review, Financial Services Authority, 2009; De Larosière (2009) report prepared at the request of the European Commission). Indeed, the main stylised fact of the 2000s was the generous availability of credit. Table 3 shows the significant rise in euro area debt levels between 1999 and 2007.

However, we argue that the hypothesis of credit-fuelled economic growth is rejected by our model. First, we note that Student tests confirm the stability of the TFP trend, since there was no negative break in TFP trend for the economies under examination in the period preceding the crisis, except in the case of Spain where the test detects a positive break. Secondly, a more convincing argument is that no prolonged increase of CUR can be observed during the pre-crisis period for these economies (except in the case of Spain, increases in CUR lasted less than two years on average during the pre-crisis period) and no instability in the relationship between the CUR and the output gap is observable. The CUR increases observed during bubble episodes in other countries appear to have been a symptom of excess demand: for example, in Japan, before the speculative bubble at the beginning of the 1990s, or in the United Kingdom, before the crisis at the end of the 1990s, the CUR increased continuously over the four years preceding the event (OECD, 1996; OECD, 1997). Consequently, for the economies studied here, we can consider that excess demand is not materialised. Figure 6 shows the residuals of the TFP model for the different countries in question, which detect

potential instabilities in the relationship (4) between the CUR and the TFP gap. Except for the rest of the euro area, the residuals of the TFP model for the different countries remain small (their standard deviation is small relative to that of the TFP gap). Moreover, Student mean tests indicate that their mean is zero over the estimation period, confirming the stability in the relationship between the CUR and the TFP gap.

Like Planas *et al.* (2013), but in a different framework, we find that including the CUR in our TFP model improves the quasi real-time reliability[10] of TFP gap estimates. We iteratively estimate the TFP equation over samples going from a fixed start date to a rolling end date. The end date rolls over the Q4 2008-Q2 2012 period, i.e. after the financial crisis. The results show that standard errors of quasi real-time revisions over the post-crisis period decrease when the CUR is included, as in our TFP model. For example for France, the standard errors decrease from 0.64 (when the CUR is not taken into account) to 0.23 (when the CUR is included, as in our TFP model).

Another issue is that errors in the measurement of TFP might affect our estimates of TFP losses. Working on the United Kingdom, O'Mahony and Oulton (1994) stress the importance of the depreciation rate for measuring productivity. In Table 4, as a first attempt to investigate the sensitivity of our results to depreciation rates, we examine the impact of using higher and lower values for these rates. We use the ranges proposed in O'Mahony and Oulton (1994) as the lower and upper bounds for our rates (from 4 to 14.27% for equipment and from 1.67% to 3.68% for buildings). The figures in Table 4 show the variation in the permanent losses between the baseline scenario and these two alternative estimates. We show that permanent losses caused by the crisis change by less than 0.4 at the euro area level with these alternative assumptions.

VI. Conclusion

In this article we extend a reduced-form equation developed by Cahn and Saint-Guilhem (2010) to measure the cost of the recent financial crisis in terms of potential TFP in the euro area. We find that euro area economies have seen significant losses in their potential TFP. In our model, TFP gaps closely follow the CUR. Moreover, in the case of France, including the CUR in our TFP model improves the quasi real-time reliability of TFP gap estimates.

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[10]We use the terminology of Orphanides and Van Norden (2002), who distinguish the quasi real-time reliability from the real-time one: the quasi real-time reliability is only based on revision related to the sample availability, while the real-time reliability also takes into account data revisions.

In future research, several factors might revise our diagnosis. First, we would like to find economic factors that could explain the heterogeneity of losses within the euro area. Second, with more hindsight, we should improve our tests of trend breaks (coefficient estimates of a break in TFP growth for France, Germany, Italy and the rest of euro area were not significant during the financial crisis). This result can be interpreted as the crisis having no impact on potential TFP *growth*. Perhaps a larger sample, in the years to come, may improve their significance.

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Figure 1: Age of capital for France, Germany, Italy, Spain and REA
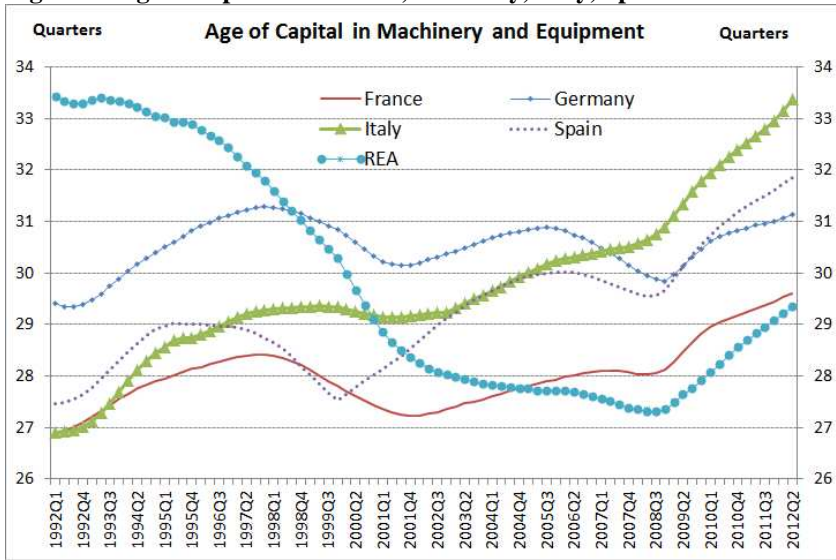
Figure 2: Impulse response function of s_{TC}
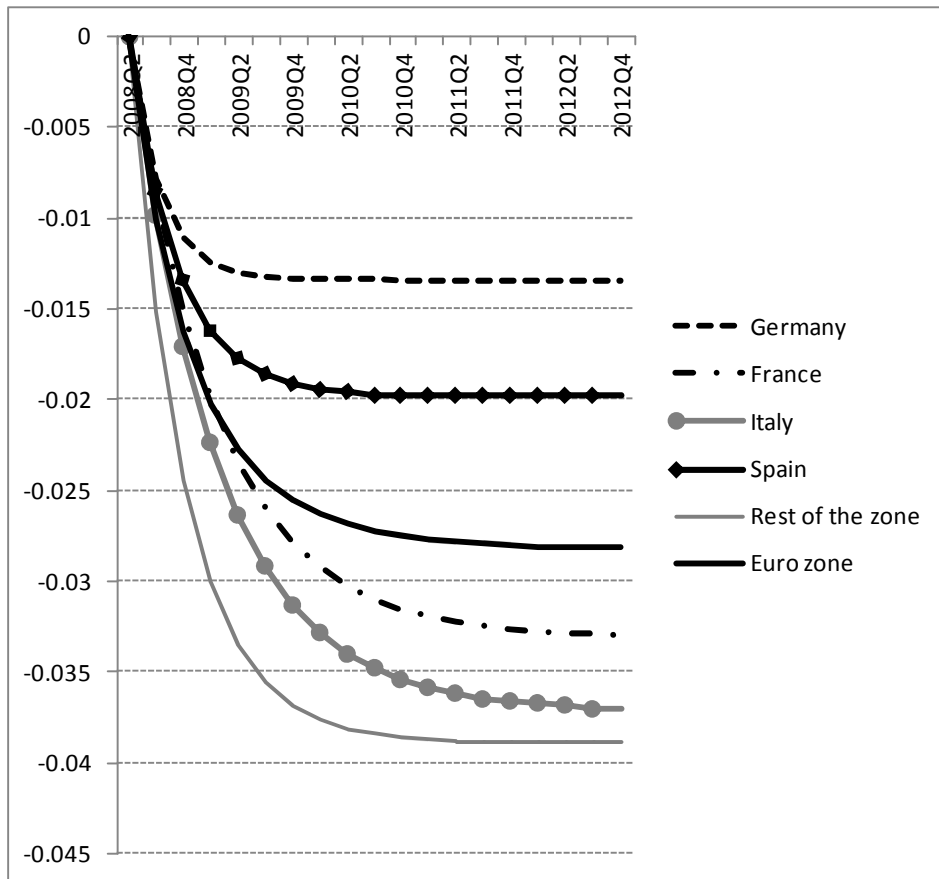
Note: Each curve represents the impact of the crisis on potential TFP through the variable s_{TC} in each economy. In Q3 2008, the impact is equal to $\phi S 2008Q3$. In the long-run, it is equal to $\phi/(1-\rho)$. For example, France has experienced a loss in its potential TFP of 3.3 points in the long run.

Table 1: Results of TFP estimations between 1960 and 2012

		Germany	France	Italy	Spain	REA
α1	const	-9.47	-3.78	-7.81	-7.88	-3.67
		0.02	0.02	0.06	0.02	0.03
α2	ecur	0.20	0.20	0.12	0.03	0.05*
		0.02	0.03	0.04	0.01	0.06
α3	ecage	-2.1E-02	-1.8E-02	-	-6.16E-03	-
		1.8E-03	3.7E-03		1.3E-03	
α4*400	trend	3.55	2.75	0.99	1.00	2.14
		0.07	0.09	0.18	0.06	0.12
α51*400	Break1**	-1.72	-0.85	-1.06	-0.84	-1.12
		0.06	0.19	0.23	0.06	0.24
α52*400	Break2**	-1.09	-0.86	-	-	-
		0.08	0.12			
α53*400	Break3**	-	-	-	0.52	-
					0.14	
φ/(1-ρ)	S2008Q3	-1.3E-02	-3.3E-02	-3.7E-02	-2.0E-02	-3.9E-02
		6.7E-03	7.9E-03	1.0E-02	4.1E-03	1.4E-02
ρ	AR(1)	0.42	0.73	0.73	0.56	0.61
		0.07	0.05	0.07	0.09	0.09
Breaks in TFP trends		**Germany**	**France**	**Italy**	**Spain**	**REA**
	t11	1978q3	1973q2	1997q2	1996q1	1995q1
	t12	1997q3	1985q3			

REA = Rest of the Euro Area. Figures in italics are standard errors in coefficient estimates.
* Non-statistically significant. Except for the CUR of REA, all coefficients are significant at the 5% level.
Estimations are robust to autocorrelation and heteroscedasticity tests.
** Coefficients (and standard errors) are multiplied by 400 in order to obtain the percentage annualised growth rate for TFP trend. For example, for France, the TFP trend growth reached 2.7% before 1973, 2.0% over 1973-1985 and 1.0% over 1985-2008.

Table 2: Impact of the financial crisis on euro-area potential TFP in Q2 2012

Figures are in pp	Germany	France	Italy	Spain	REA	Euro Area
Total impact on potential TFP, with:	-3.5	-6.2	-3.7	-1.5	-3.9	-4.0
- permanent impact	-1.3	-3.3	-3.7	-2.0	-3.9	-2.8
- capital age impact	-2.1	-2.9		-1.6		-1.4
- construction impact				2.1		0.2

REA = Rest of Euro Area.
Euro area is the weighted average of the four countries and REA.
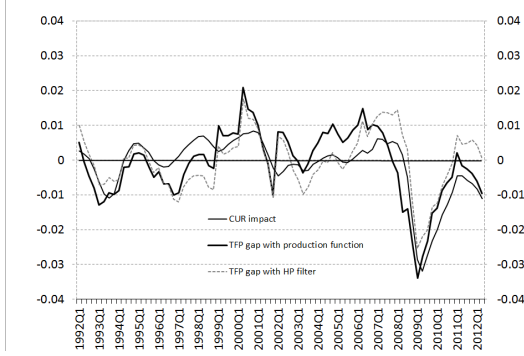
Figure 3a: TFP gap for France
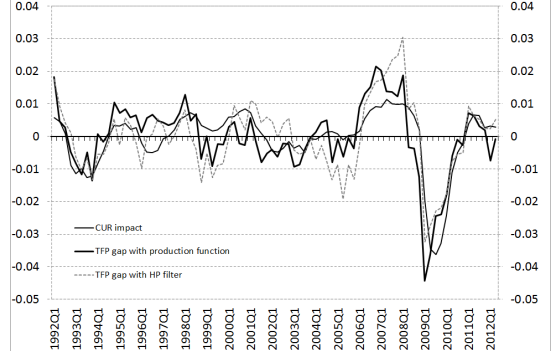

Figure 3b: TFP gap for Germany
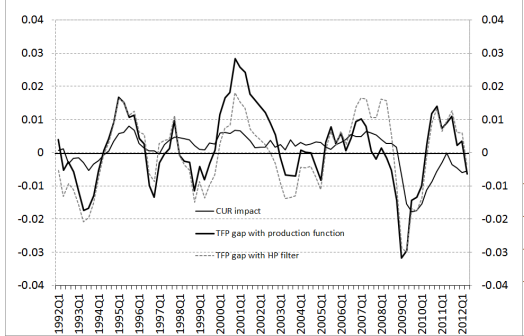

Figure 3c: TFP gap for Italy

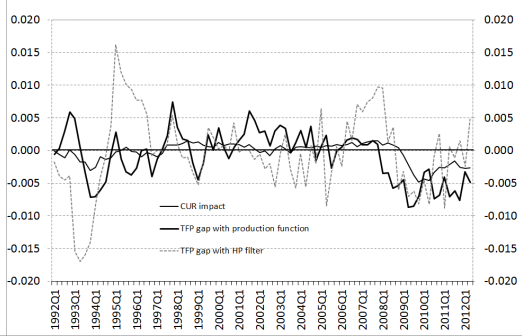**Figure 3d: TFP gap for Spain**

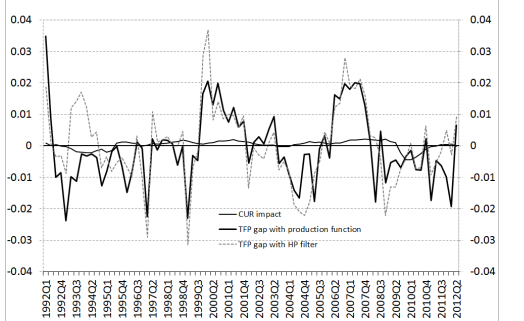**Figure 3e: TFP gap for the rest of the area**

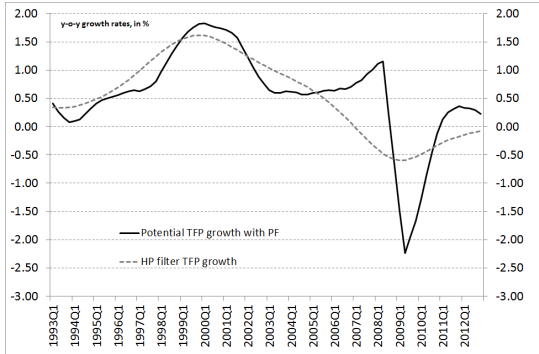**Figure4a: Growth of Potential TFP-France**

Figure4b: Growth of Potential TFP-Germany
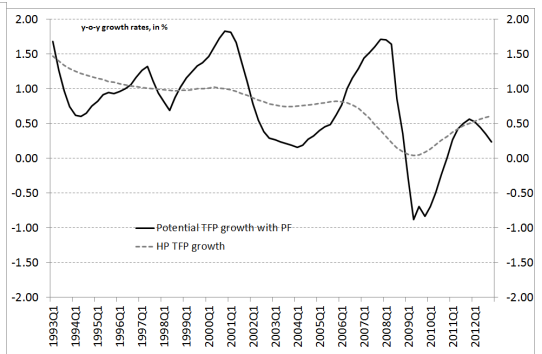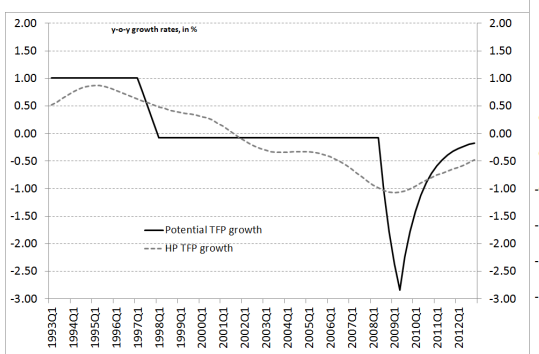

Figure4c: Growth of Potential TFP-Italy

Figure4d: Growth of Potential TFP-Spain

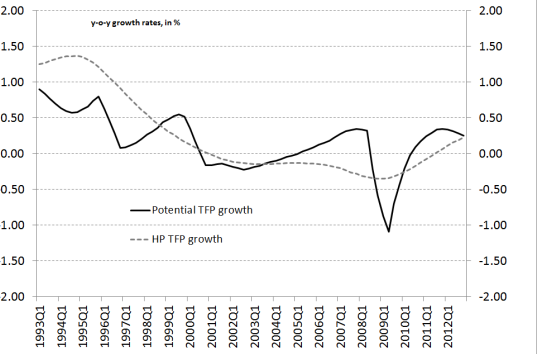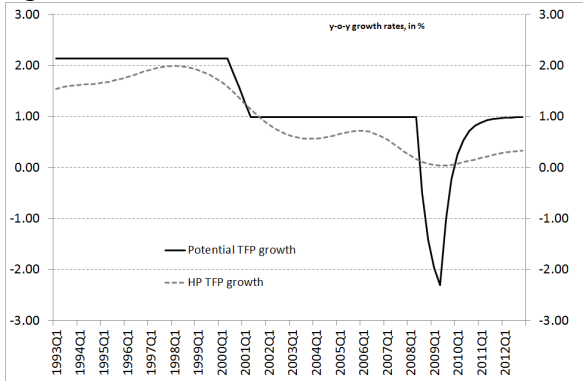**Figure4e: Growth of Potential TFP-Rest of the area**
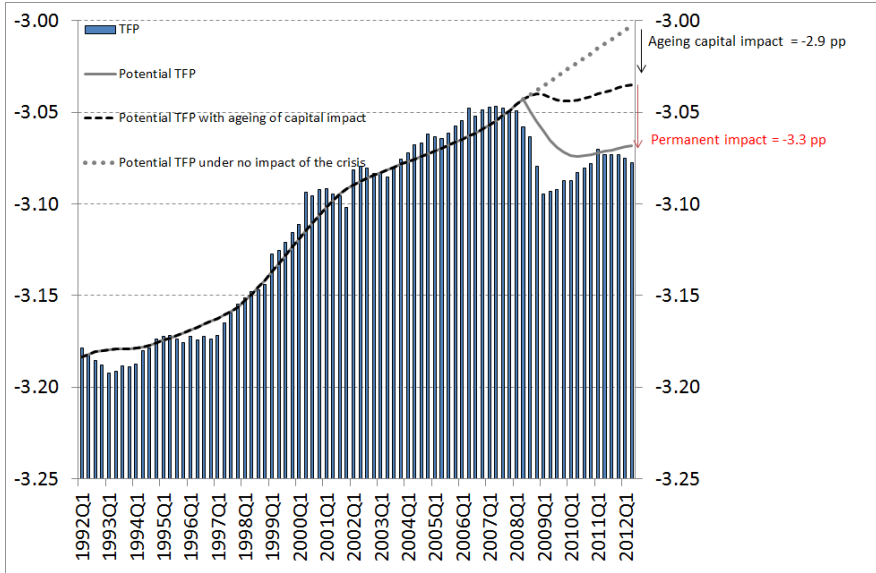
Figure 5a: TFP and potential TFP for France
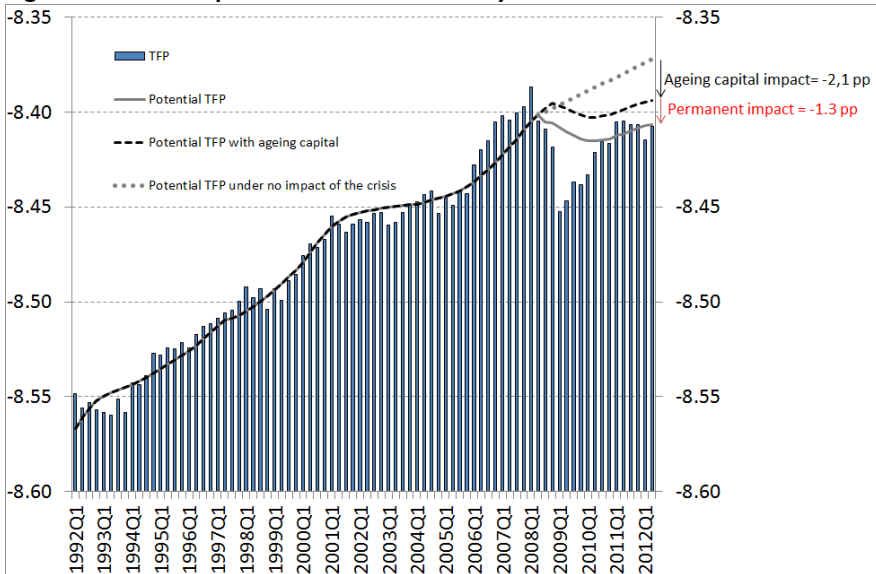

Figure 5b: TFP and potential TFP for Germany

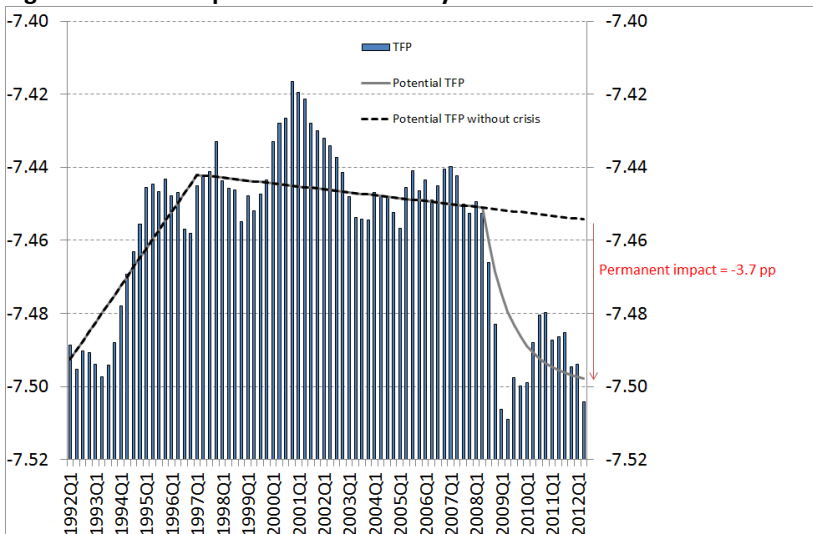**Figure 5c: TFP and potential TFP for Italy**

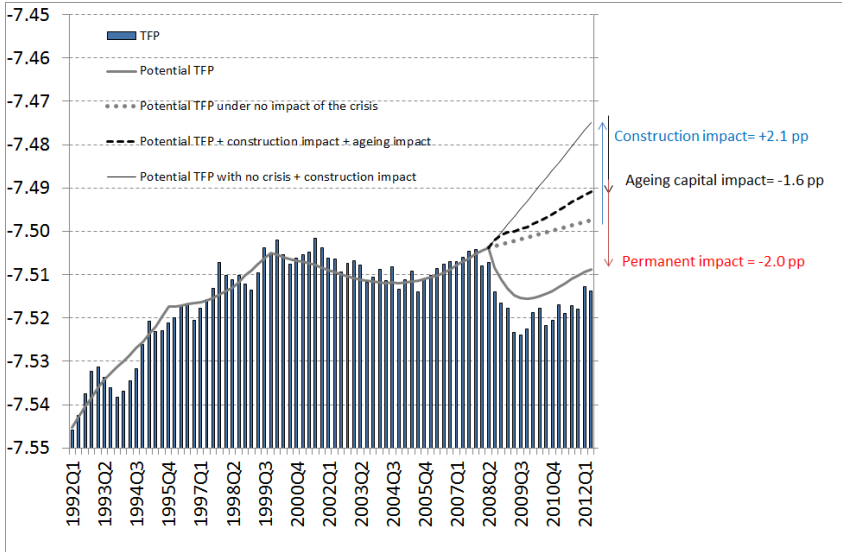**Figure 5d: TFP and potential TFP for Spain**

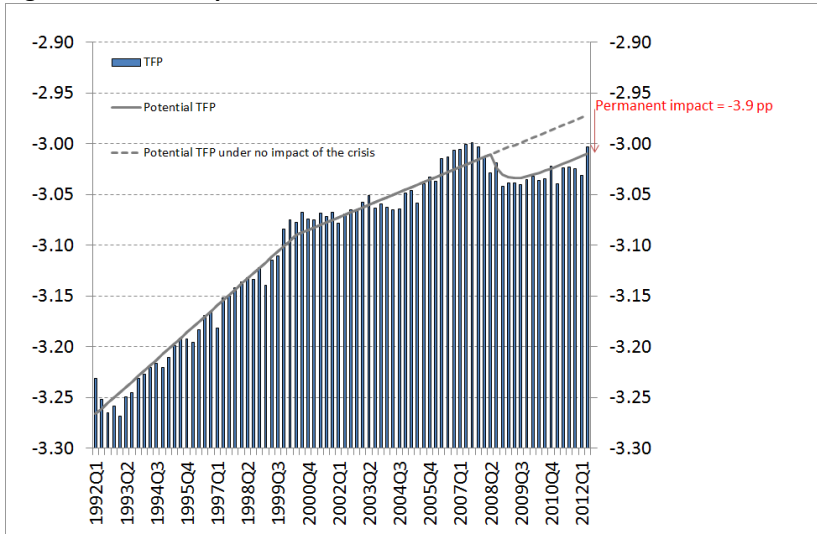**Figure 5e: TFP and potential TFP for the rest of the area**
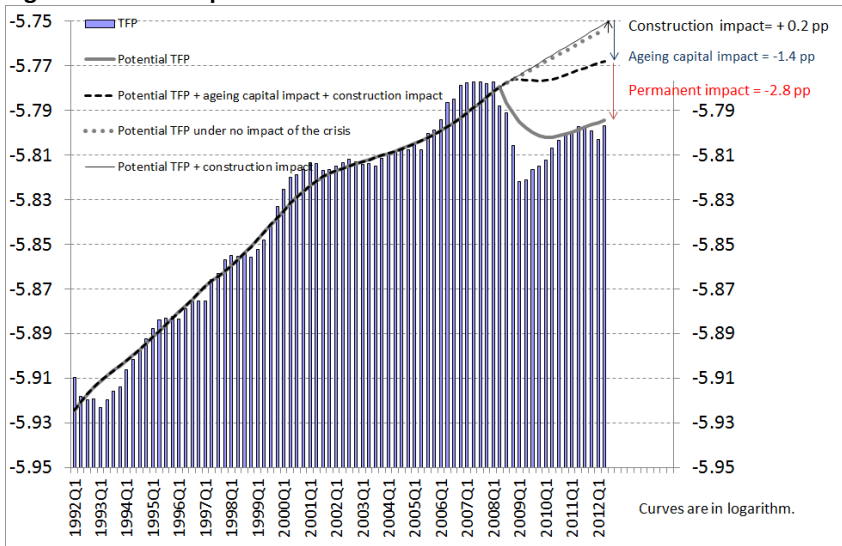

Figure 5f: TFP and potential TFP for the euro area

Curves are in logarithm.

Figure 6: Residuals of TFP model and basic statistics

In %
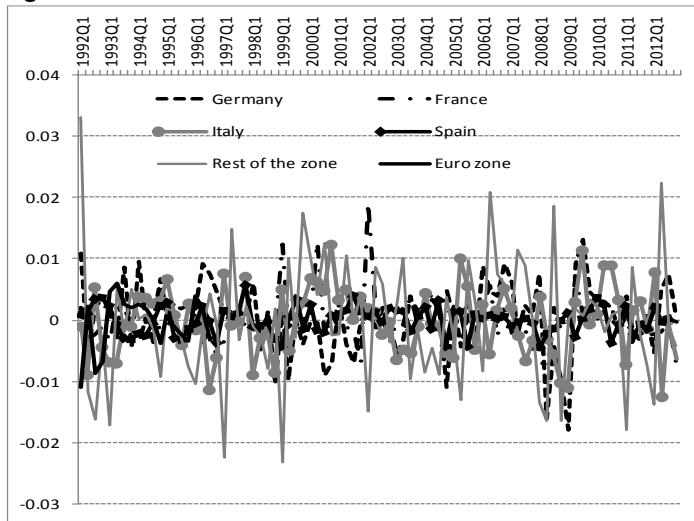
	France	Germany	Italy	Spain	REA	Euro area
Mean	-0.01	0.05	-0.02	0.00	-0.03	0.00
Std. dev.	0.40	0.58	0.55	0.22	1.01	0.32
Min	-1.01	-1.79	-1.25	-0.42	-2.31	-1.11
Max	1.90	1.31	1.24	0.58	2.23	0.63

Note: The TFP model residuals for the different countries remain small (except for REA, the standard deviations are small compared to the TFP gap standard deviations which are 0.98 for France; 1.09 for Germany; 1.11 for Italy; 0.38 for Spain and 1.14 for REA. Moreover, Student mean tests indicate that the mean of these residuals is zero over the period of estimation), confirming the stability in the relationship (equation 4) between the CUR and the TFP gap.

Table 3: The rise in private debt in the euro area between 1999 and 2007
Interest-rate liabilities (loans and non-equity securities) as % of GDP

	Households	Non-financial	Financial	Government	TOTAL
1999	41.8	57.4	59.5	66.5	225.2
2007	62.5	91.7	111.2	71.4	336.9

Source: ECB, author calculations.

Table 4: Changes in permanent losses with lower and higher depreciation rates

In percentage points	Low depreciation	High depreciation
France	-1.1	-0.2
Germany	-1.1	0.2
Italy	-0.1	0.3
Spain	0.3	-0.5
REA	0.6	0.9
Euro area	**-0.4**	**0.2**

Note 1: we use the estimates of O'Mahony and Oulton (1994) as the upper and lower bounds for our depreciation rates. These range from 4 to 14.27% for equipment and from 1.67% to 3.68% for buildings.
Note 2: we calculate the changes in permanent losses with respect to our baseline estimates based on depreciation rates of 9.99% for equipment and 1.64% for buildings.