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Regulating rates of return do gravitate in US manufacturing!

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Abstract

In this paper we test for the gravitation of regulating return rates, namely those return rates yielded by capital goods incorporating the best methods of production. We define them within a vintage capital model taking into consideration capacity utilization, capital depreciation, and wages of workers using past capital vintages. We consider two datasets regarding US manufacturing activities and we find that gravitation does take place. Our results are contrasted with those of the previous literature. Research and policy implications are discussed.

Keywords: capital mobility, gravitation, convergence, return rates on regulating capital, panel data.

JEL Codes: L16, L19, L60, L70, L80, L90, B51, B52

Introduction

Do industry return rates tend to equalize over time? The present paper tackles this issue in the light of recent developments in the relevant field of study, which stress that an answer to this question should be found adopting a vintage capital model, considering capacity utilization, capital depreciation and wages of those workers using past capital vintages.

The tendential equalization of industrial return rates attracts interest in economics both for theoretical and policy reasons. Prices of production (PP) are those that are charged under equal industrial profit rates (Sraffa, 1960). If this condition was empirically verified, then it would be possible to use PP to analyse real economies and infer policy implications. On the other hand, if industrial profit rates did not have any tendency towards equalization, then it would be necessary to analyse the reasons underlying their heterogeneous paths, a consequence of the absence of arbitrage among different industries.

Economists have often taken opposite theoretical views regarding the concept of PP. There have been clear supporters (Garegnani (1979), for instance), clear opponents (such as Robinson (1979)) and critical supporters arguing that PP could be a useful concept in some cases and not in others (Salanti, 1985).[1]

Models focusing on transitional dynamics obtained conflicting results. Kubin (1984) formally reaffirmed a point advanced by Robinson (1980), arguing that a changing structure of production can prevent the modelled economic system from attaining a uniform average rate of profits across sectors. Boggio (1984) obtained an instability result, Duménil and Lévy (1987) obtained stable results and Boggio (1985) concluded that obtaining either stability or instability in his model depends on considering or not consumption out of profits.

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[1] Other examples of this dispute are Mandler (2002) and Garegnani (2005).

As a consequence, disillusion has grown among some scholars regarding gravitation models. For instance, Benetti et al. (2012) revived Torrens's (1821/1965) ideas on capital accumulation. They proposed a model in which capitalists make plans on the basis of their expectations. Such plans are then selected by the market, generating a process whereby a long-run equilibrium is reached through a sequence of disequilibria. Some other authors, introduced additional stabilizing mechanisms, such as the interest rate in Franke (2000).

A group of economists took an alternative route (see for instance Shaikh (1982); Botwinik (1993, pp. 151-155); Shaikh (1997); Tsoulfidis and Tsaliki (2005); Shaikh (2008)). They departed from the analysis in Chapters 8 to 10 of Marx (1894/1977) - which was considered to be carried out at a high level of abstraction - and they introduced the concept of returns on regulating capital, i.e. capital that incorporates "the best-practice methods of production". At the heart of this definition, there is the hypothesis that there exist some adjustment costs in capital accumulation, whereby all businesses will not be able to instantaneously adopt the best available methods of production. Under such circumstances, only returns on regulating capitals will be equalized across sectors[2].

It is worth noting that this concept does not involve agent's perfect foresight at the moment of investing as done by the economic rate of return considered, for instance, by Fisher and McGowan (1983) and defined as the discount rate that equates investment expenditure to the present value of its future net revenues. The return on regulating capitals only entails that investors collect information and

[2] All the issues above are also important because they are connected to the distinction between the classical and neo-classical concepts of competition, as thoughtfully discussed in Tsoulfidis and Tsaliki (2005), Shaikh (1980) and Duménil and Lévy (1987).

accumulate knowledge on the best available and reproducible methods of production at a given moment in time. Therefore - though investors might do so because they expect these methods to yield the highest future returns possible - the behavioral assumption underlying the dynamics of regulating returns can be regarded as less demanding than those pertaining to the economic rate of return.

At the same time, it is not possible to conflate the concept of returns on regulating capital with that of returns of investments as these, for instance, can be carried out also by firms enjoying non-reproducible production conditions. Nonetheless, current empirical research on the present issues make extensively use of investment magnitudes.

The rest of the analysis focuses on the tendential equalization of return rates on regulating capital. In order to do so, first, some terminological distinctions, a number of empirical definitions and a description of a recent dispute on measurement issues are warranted and they are tackled in the next Section. We, further, propose a new measure for the return rate on regulating capital. This is able, in our view, to settle the bespoken measurement dispute thanks to an analysis of US data, whose sources and tabular and graphical descriptions are set out in Section 4. Then we perform econometric tests about the gravitation of return rates and we insert our results in a meta-regression to gauge them in the light of the past literature. Finally we conclude with some speculation on possible policy implications.

From theory to empirics

In the literature of reference, the same terms have been often used with different meanings. After D'Orlando (2007) we assume that the tendential equalization of industry return rates can have two forms: either convergence or gravitation. Convergence takes place when industry return rates are initially different, but, as time passes, they tend to assume the same value with the exception of some small stochastic deviations. Under gravitation, instead, return rates randomly oscillate around a common value. Figure 1 in Vaona (2011) offers an image of this distinction, while also discussing how these terms have assumed different meanings in various contributions of the literature of reference[3].

The present study finds motivation from the various empirical definitions of return rates that the literature offered. For this reason, we devote them the rest of this section.

The rate of profit can be defined in different ways, and each definition implies a distinctive method of calculation. A traditional measure of return rate is the average profit rate (π_t), defined as the ratio between the current total profits at time t (P_t) and the current cost capital stock at time t (K_t):

$$\pi_t = \frac{P_t}{K_t} \qquad (1)$$

Studies using this measure include Bahçe and Eres (2011), Duménil and Lévy (2002, 2004), Glick and Ehrbar (1988, 1990), Kambhampati (1995), Lianos and

[3] Note that the terms "convergence" and "gravitation" were used also in a different field of study with yet another meaning. Podkaminer (2010) analyses the connection between relative price levels and GDP at a cross-country level. It is found there that there exists a strong positive connection between them for EU members. "Convergence" is used there to denote the shrinking process of differences in income levels across countries as time passes. "Gravitation", instead, denotes short-term dynamics of countries along the price level-GDP schedule. Therefore, in Podkaminer (2010) "convergence" has a long-run meaning, while "gravitation" a short-term one. Here, "convergence" and "gravitation" could well be two very fast phenomena, distinguished only by the kind of path followed by return rates.

Droucopoulos (1993a, b), Maldonhado-Filho (1998), Rigby (1991), Shaikh (2008), Tsoulfidis and Tsaliki (2012), Vaona (2011, 2012b, 2013), Zacharias (2001).

Shaikh (1997), Tsoulfidis Tsaliki (2005) and Shaikh (2008) proposed, instead, the concept of incremental rate of return (IROR), as an approximation to the rate of return on the "regulating capital". In order to compute IROR, Shaikh (1997) distinguished current total profits (P_t) into those obtained from the most recent investments and those accruing from older ones, thus obtaining:

$$P_t = IROR_t \times I_{t-1} + P^* \tag{2}$$

where I_{t-1} is previous period investments, while P^* is the profits of all previous investments. Subtracting from both side of the equation above P_{t-1} and considering that for short time horizons it could be plausible that $P^* = P_{t-1}$, one can write

$$IROR \equiv \frac{P_t - P_{t-1}}{I_{t-1}} = \frac{\Delta P_t}{I_{t-1}}$$

This definition of industry return rate was also adopted by Vaona (2011, 2012b, 2013) and Bahçe and Eres (2011)[4].

Furthermore, Vaona (2012b) proposed a different approximation to the regulating rate of return. It is there assumed that the difference between P^* and P_{t-1} is not zero, but it is a random variable. By adopting panel varying coefficients methods, it is then possible to offer tests about convergence and gravitation of return rates. The

[4] Caminati (1981) writes that according to David Ricardo and Joseph Massie, for instance, the interest rate is a part of expected profits arising from invested capital as a remuneration to borrowed credit. If IROR is a good approximation to expected return rates then it might well drive interest rates as well (or, once relaxing the assumption of a bank based economy, stock market returns as showed in Shaikh, 1997) - one further path for future research.

meta-analyses offered in Vaona (2012a, 2013) showed that it is more likely to find evidence in favor of equalization once studying regulating return rates instead of industry average profits.

Recently, Duménil and Lévy (2012) criticized studies on IRORs because, though, they made an attempt to consider different capital vintages they would do so under very stringent assumptions, namely ignoring factors like levels and variations in capacity utilization rates[5], wages of workers using old capital vintages and the depreciation of these capital vintages. This is so because Shaikh (2008) argued that the role of capacity utilization and wage changes are empirically negligible for the dynamics of IROR. However, Duménil and Lévy (2012) disagree and they are very skeptical about the evidence regarding the regulating rates of return produced in the literature so far.

As a consequence, this study first adopts a very similar vintage capital model to Duménil and Lévy (2012) and it shows that, within this context, it is possible to derive an approximation to the regulating rate of return that can be computed by using publicly available data for US manufacturing.

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[5] The fact that capacity utilization is to be considered properly in classical economic modelling was advanced also by White (1996) with reference to the Sraffa's system of equations. Nikiforos (2013) offers instead a review of the role of capacity utilization in economic thinking and a firm level model where desired utilization rates are endogenous to demand changes.

A measurable approximation to the regulating rate of return in the spirit of Duménil and Lévy (2012).

In order to introduce a measurable approximation of the regulating rate of return *à la* Duménil and Lévy (2012), we start by recalling that the average profit rate is equal to:

$$r = \frac{Y - wL}{K} \tag{3}$$

where Y is output, L is labor, w is the wage and K the capital stock. Defining *a≡Y/K* e *b≡L/K* it is possible to obtain:

$$r = a - wb \tag{4}$$

When assuming that capacity utilization may change over time, the above equation turns out to be:

$$r = u(a - wb) \tag{5}$$

where *u* is the utilization rate of the productive capacity.

Furthermore the capital invested at time *t* will be - *n* period later - $K_t^n = I_t(1-\delta)^n$, assuming a depreciation rate of δ. As in Duménil and Lévy (2012), we make two further assumptions to compute the return rate of the last capital vintage, ρ_t: first, when investment is realized, $u \approx 1$ and, second, the relevant wage is the on-going one, w_t. In other words it is possible to write

$$\rho_t = a_t - w_t b_t \tag{6}$$

Assuming that all capital vintages are used, total profits can be written as

$$P_t = u_t(Y_t - w_t L_t) \tag{7}$$

where $Y_t = (1-\delta)^t A_t$, $L_t = (1-\delta)^t B_t, A_t = \sum_{n=0}^{\infty} \frac{K_{t-n}}{(1-\delta)^{t-n}} a_{\ t-n}$, and $B_t = \sum_{n=0}^{\infty} \frac{K_{t-n}}{(1-\delta)^{t-n}} b_{\ t-n}$. Therefore one has

$$P_t = u_t (1-\delta)^t (A_t - w_t B_t) \tag{8}$$

Consider that A_t and B_t can be respectively written as $A_t = A_{t-1} + \frac{I_t}{(1-\delta)^t} a_t$ and $B_t = B_{t-1} + \frac{I_t}{(1-\delta)^t} b_t$

From the definition of $\mathrm{IROR_t} \equiv \Delta P_t / I_{t-1}$, one has

$$IROR_t \equiv \frac{P_t - P_{t-1}}{I_{t-1}} = \frac{u_t (1-\delta)^t}{I_{t-1}} \left\{ A_{t-1} + \frac{I_t}{(1-\delta)^t} a_t - w_t \left[B_{t-1} + \frac{I_t}{(1-\delta)^t} b_t \right] \right\} - \frac{P_{t-1}}{I_{t-1}} \tag{9}$$

Recalling that $\rho_t = a_t - w_t b_t$, there follows

$$\frac{P_t - P_{t-1}}{I_{t-1}} = \frac{u_t I_t}{I_{t-1}} \rho_t + \frac{u_t (1-\delta)^t}{I_{t-1}} (A_{t-1} - w_t B_{t-1}) - \frac{P_{t-1}}{I_{t-1}} \tag{10}$$

Note that $Y_t = (1-\delta)^t A_t$ and $L_t = (1-\delta)^t B_t$, therefore

$$\frac{P_t - P_{t-1}}{I_{t-1}} = \frac{u_t I_t}{I_{t-1}} \rho_t + \frac{u_t (1-\delta)}{I_{t-1}} (Y_{t-1} - w_t L_{t-1}) - \frac{P_{t-1}}{I_{t-1}} \tag{11}$$

Simplifying $\frac{P_{t-1}}{I_{t-1}}$ and re-arranging one has

$$\rho_t = \frac{P_t}{I_t u_t} - \frac{(1-\delta)}{I_t} (Y_{t-1} - w_t L_{t-1}) \tag{12}$$

This last equation involves terms that can be computed on the basis of publicly available US data. We call ρ_t the IROR adjusted for capacity utilization and capital depreciation or AIROR.

Data: sources and description

We collected two different datasets regarding US manufacturing sectors. They can be distinguished according to their level of aggregation and time coverage. This choice was dictated by changes in the industry classification by US statistical offices and by the availability of data on capacity utilization rates at the industry level.

A first dataset runs from 1972 to 1997 and it only considers two broad manufacturing sectors: *Durable and Nondurable Goods.*

Our second dataset is shorter as it runs from 1999 to 2011, but it considers a finer level of industry disaggregation. The involved sectors are wood products; nonmetallic mineral products; primary metals; fabricated metal products; machinery; computer and electronic products; electrical equipment, appliances, and components; motor vehicles, bodies and trailers, and parts; other transportation equipment; furniture and related products; miscellaneous manufacturing; food and beverage and tobacco products; textile mills and textile product mills; apparel and leather and allied products; paper products; printing and related support activities; petroleum and coal products; chemical products; and, finally, plastics and rubber products.

In order to compute the AIRORs of the first dataset, we consider data from Gross Product Originating, Fixed Assets and NIPA tables. Capacity utilization rates at the industry level and industry weights[6] are available from the Federal Reserve website. From here after, we use the same acronyms as in our sources to detail how we computed our variables.

In keeping with the literature of reference, and specifically Duménil and Lévy (2002), nominal profits are the sum of Corporate Profits Before Taxes (PI) and Proprietors' income (PROINC) minus the wage equivalent of the self-employed COMP* - which is equal to the average wage times the number of the self-employed. Therefore , the

[6] Industry weights are necessary to aggregate capacity utilization rates at a corresponding level of the other series analysed in the present study.

wage equivalent of the self-employed is given by $\frac{COMP}{FTPT} * (PEP - FTE)$, where COMP is the compensation of employees, FTPT is Full-time and Part-time Employees, PEP is All Persons Engaged in Production and FTE Full-time equivalent employees.

The capital depreciation rate is given by (NCCA+CCCA)/K, that is the Non-corporate Capital Consumption Allowance (NCCA) plus Corporate Capital Consumption Allowance (CCCA) over the Current Net Stock of Non-residential Fixed Private Capital (K). Investments (I) are obtained as the annual change in K plus inventories (INV) by industries. Y is Gross Output (GO).

To sum up empirically the following equation holds:

$$AIROR = \frac{PI_{it} + PROINC_{it} - COMP_{it}^{*}}{I_{it}u_t} - \frac{(1 - \frac{NCCA_{it} + CCCA_{it}}{K_{it}})}{I_{it}} * (GO_{it-1} - \frac{COMP_{it}}{FTPT_{it}} * PEP_{it-1}) \quad (13)$$

where the *i* subscript is a sectoral index, $I_{it} = \Delta(K_{it} + INV_{it})$ and Δ is the first difference operator.

In our second dataset, we proceed in a slightly different manner. Profits are computed as the difference between the Gross Operating Surplus (GOS) and COMP*. Data for investments come from NIPA Table 3.7ES.[7]

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[7] The adoption of accounting data on profitability was subject to debate in the past (Fisher and McGowan, 1983; Muller, 1986 p. 107 and Muller, 1990 pp. 9-14). However, apart from the considerations about perfect foresight discussed in the introduction, industry dynamics cannot be reduced only to the evolution of the firms populating each economic sector. Industry analyses have an interest in themselves (Malerba, 2002) and at this level of aggregation there is hardly any alternative.

Our data are plotted in Figures 1 and 2. Series appear to have the same properties as those already showed in past studies regarding IRORs. They can experience large deviations, but these movements are quickly reversed. It is necessary to explain in more detail the large spike observable for AIROR in Durable goods in the early nineties. This was the result of the recession of that time. In 1991 the capital stock actually shrank by 6000 million dollars. The following year investments were weak as the capital stock increased by only 3900 million dollars. Note that in 1990 investments were 32300 million dollars and, in 1993, 23700 million dollars. Changes in profits, instead, were more muted as they were 41886 million dollars in 1990, 29104 in 1991, 38532 in 1992 and 54022 in 1993. So the reason for an AIROR of the order of 10 (namely of 1000%) for Durable goods in 1992 is the greater reactivity of investments than profits to the economic downturn of that period.

Regarding the first dataset, being it composed by only two sectors, we focus on the difference between return rates. Regarding our second dataset, instead, we analyse deviations of industry AIRORs from their cross-sectional means. In other words, let us call the AIROR in sector i at time t, x_{it}, we focus on $\tilde{x}_{it} \equiv x_{it} - \frac{\sum_i x_{it}}{N}$, where N is the number of sectors. Descriptive statistics about this magnitude are set out in Table 1 and they are not too different from customary descriptive statistics of return rates. Table 2 sets out the confidence interval of the time averages of the series under study, which in many cases is not statistically different from zero. This is a first sign of gravitation of AIRORs around their cross-sectional mean. However, more insights can be gained resorting to econometric tests.

Methods and results

Regarding our first dataset, we proceeded as follows. First we computed the difference between the AIRORs in the Durable and Nondurable sectors and then we performed a battery of unit root and stationarity tests.

If the hypothesis of gravitation is correct, then we will expect the difference between the two AIRORs to be stationary. In fact, Table 3 shows that all the tests we performed support this hypothesis. In addition, we fitted to this series an AR(1) model with a constant. The choice of the number of lags was dictated by the results of the Schwarz information criterion when performing unit root and stationarity tests. We obtained a constant equal to 0.28 and a lag coefficient of -0.22, with p-values equal respectively to 0.53 and 0.28. The F-statistic did not reject the null that both coefficients are equal to 0, returning a p-value of 0.28[8]. There did not appear to exist much autocorrelation in the residuals as the Durbin-Watson statistic is equal to 2.04.

We next move to consider our second dataset. In this case we stick to tests and methods already adopted in the literature (see Vaona, 2011, 2012a, 2012b, 2013). We model $\tilde{x}_{it}$ thanks to a nonlinear time trend:

$$\tilde{x}_{it} = \alpha_i + \frac{\beta_i}{t} + \frac{\delta_i}{t^2} + \frac{\varphi_i}{t^3} + \varepsilon_{it} \qquad (14)$$

where ε_{it} is a stochastic error and α_i, β_i, δ_i, φ_i are parameters to be estimated.

In our approach, it is possible to test the convergence hypothesis of industry rates of return, which entails

$$\alpha_i = 0 \text{ and } \beta_i \text{ or } \delta_i \text{ or } \varphi_i \neq 0 \text{ for all } i$$

and the gravitation hypothesis, which implies

$$\alpha_i = \beta_i = \varphi_i = \delta_i = 0 \text{ for all } i$$

[8] Bootstrapping or using the exactly median unbiased estimator by Andrews (1993) did not return different results. Further details are available from the authors upon request.

We start by looking for evidence of gravitation, which is more restrictive than convergence. A third order polynomial in the inverse of the time trend was proposed by Mueller (1986, 12). The literature of reference tended to stick to it because it has a number of advantages over other possible specifications. For instance, a linear time trend would imply that return rates continue to decline, even after attaining their competitive level, which could appear unrealistic. Furthermore, under specification (14), the dependent variable can take two direction changes, so that neither its peak nor trough are constrained to occur in the first observed time period. Finally, higher-order polynomials may be plagued by collinearity problems. However, in principle it could happen that a second order polynomial in the inverse of the time trend is a good local approximation of the time path followed by return rates. Therefore, we experiment with this specification too.

With difference to Vaona (2011, 2013) we do not use the the seemingly unrelated regression estimator robust to autocorrelation after Andrews (1993), Greene (2003, 272) and Meliciani and Peracchi (2006). This is because the time span of our dataset is short. For this very reason we do not resort to panel unit-root and cointegration techniques, because spurious regression was showed to play a role only in panels with very long time dimensions (Baltagi, (2001, p. 243) and Entorf (1997)).

Regarding model (14), instead, we perform a fixed effect estimator with an AR(1) error process to account for possible serial correlation in the disturbance. We prefer a fixed effect estimator because applying a random effect one would implicitly assume that return rates at least converge, since sector specific effects are only random draws that affect the variability of industry return rates and not their mean[9].

[9] Once adopting a random effects estimator our results would not change much. Further details are available from the authors upon request.

When adopting a third order polynomial in the inverse of the time trend, we could not reject the null that all the trend coefficients are equal to zero as an F test with 57 and 152 degrees of freedom returned a p-value of 1. The null that all fixed effects are equal to zero was not rejected by an F test with 18 and 152 degrees of freedom which returned a p-value of 0.99. We did not find much evidence of serial correlation as the Baltagi-Wu LBI test had a value of 2.52 and the modified Durbin-Watson test by Bhargava et al. (1982) a value of 2.46. Decreasing the order of the polynomial from 3 to 2, would not alter substantially these results. The same would happen once adopting a one-way fixed effects model without an autoregressive error. Further results are available from the authors upon request.

In our second model, we focus on the level of AIRORs and we insert time dummies to account for common time specific effects. Our model, therefore, turns out to be:

$$\mathrm{AIROR}_{it} = \alpha_i + \frac{\beta_i}{t} + \frac{\delta_i}{t^2} + \frac{\varphi_i}{t^3} + \bar{r}_{I,.t} + \zeta_{it} \qquad (15)$$

$\bar{r}_{I,.t}$ are time dummies and ζ_{it} is a random variable with zero mean and given variance. (15) can be estimated by resorting to a two-way fixed effects model with a third-order polynomial in the inverse of the time trend.

Also in this case the null that the all coefficients but the constant are equal to zero is not rejected by an F test with 66 and 162 degrees of freedom which returned a p-value of 0.94. The hypothesis that all the fixed effects are equal to zero was not rejected by an F test with 18 and 162 degrees of freedom, whose p-value was equal to 0.83. Once again results would not change once decreasing the order of the polynomial in the inverse of the time trend from 3 to 2.[10]

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[10] In principle one could think to other possible approaches to test for convergence and gravitation building on Cartelier and Froeschlé (1989), who checked for the

We inserted our results into a meta-regression, namely a regression that tries to explain the conclusions reached in a given literature as function of distinctive features of relevant studies. On the footsteps of Vaona (2012a, b and 2013), the literature of reference was defined as the one that considers industry profitability and its dynamics, by making reference to the advanced capital in the production process as in equations (1) and (2).[11]

Our explanatory factors are: the country of reference; the level of aggregation; the adopted estimation method; how the return rate is defined; the kind of equalization (whether return rates are assumed to converge or gravitate); the publication status; the adopted econometric model; whether the level of the return rates, their deviations from their cross-sectional means or their dispersion are considered; and the industry coverage. Previous studies performing similar analyses discusses why these characteristics are relevant and the specific details on how these characteristics are to be considered in the performed regression.

It is here worth recalling that the dependent variable is a binary one, assuming a value of 1 when there is evidence in favor of tendential equalization and zero

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stability of an economic model by using Lyapunov's coefficients and Kolmogorov'e entropy. Future research might gain further insights into return rates convergence and gravitation following this path.

[11] Table 3 in Vaona (2012a) describes the studies considered, namely Glick and Ehrbar (1988, 1990), Rigby (1991), Lianos and Droucopoulos (1993a, b), Kambhampati (1995), Maldonhado-Filho (1998), Zacharias (2001), Duménil and Lévy (2002, 2004), Tsoulfidis and Tsaliki (2005), Shaikh (2008), Bahçe and Eres (2012), Tsoulfidis and Tsaliki (2012), Vaona (2011, 2012a, 2013). Another tabular presentation of the literature is in Bahçe and Eres (2012).

otherwise. Our control group is made of the analyses by Shaikh (2008). He focused on 1 digit or greater industries in the US. He adopted descriptive statistics. He studied whether the level of average profit rates in all private sectors were gravitating. This work was published as a book chapter. Finally, we implement a linear probability model and neither a probit nor a logit model, because, even if we have a binary dependent variable, all the regressors are dummy variables (Wooldridge, 2001, 456-457). The linear probability model builds on a standard ordinary least squares regression.

The number of observations in our sample rises to 162. The features of the data do not change much compared to those already showed in Vaona (2012a, b, 2013). Also results are very similar to those already available in the literature and for sake of brevity we only illustrate here the main ones in words. As in Vaona (2012a), it is empirically more likely to find tendential equalization of return rates in Denmark, Finland, Norway and West Germany compared to the US. This was interpreted by arguing that barriers to capital mobility were possibly weaker there than in the US. A similar effect has considering the regulating rates of returns instead of average ones or manufacturing industries instead of all industries. It is interesting to note that now testing for gravitation is not less likely to produce evidence in favor of tendential equalization compared to convergence, notwithstanding that the former is a more restrictive assumption than the latter. The convergence dummy has a coefficient of 0.13 and a p-value of 0.055. It is only therefore significant at the 10% level. This is probably the result of the fact that we always found that AIRORs are gravitating. So it might be that defining regulating returns within a framework à la Duménil and Lévy (2012) makes it easier to find evidence of gravitation. However, this conclusion is premature because it is only grounded on the econometric tests here proposed. Finally, the dummy corresponding to the two-way components model with trend turns out to have a coefficient of 0.99 and a p-value of 0.036. A sign that visual inspection should be double-checked by equation modeling and proper econometric testing.

Conclusions and policy implications

The present paper met the challenge posed by Duménil and Lévy (2012). They contended that IROR proposed by Shaikh (2008) and others was a poor approximation of the regulating return rate. A better approximation should consider, in a vintage capital model, capacity utilization, capital depreciation and wages of workers using past capital vintages. We showed how to do this and we carried out econometric tests about the gravitation of this new approximation of regulating return rates in different sectors. We relied on US data.

Once inserting our results in a meta-regression of all the relevant results available in the literature, the overall scenario does not change much. There is not enough evidence to conclude that barriers to capital mobility across sectors are uniquely due to firms' adjustment costs towards "best practice" methods of production. As pointed out by Vaona (2011, 2012a, b, 2013) other kinds of barriers exist, connected to innovation capabilities, credit rationing, information asymmetries and an uneven distribution of risk across industries. Considering these carefully can lead to different policy implications that have been already discussed in the above mentioned papers. Furthermore, this would open up new research directions. An attempt to explain the causes of industry return rates differentials and the consequent proper selection of indicators and methods to deal with possible reverse causality could lead radical political economics and evolutionary economics to fruitful cross-fertilization. This is beyond the scope of the present paper.

One further point is worth discussing. In all our tests we found that AIRORs do gravitate. Suppose that this result means that studies on regulating returns could not produce such a consistent evidence only because they adopted a poor approximation to their variable of reference. Then, this would imply that PP would be charged in absence of capital adjustment costs and they could offer a guide to define industry subsidies and taxes. Underperforming sectors would be so only because they have greater adjustment costs and a policy maker, free from lobbying pressures, should offer some compensations for such costs. Taxes and subsidies would have the aim to make the industry distribution of adjustment costs evener. However, given the state of the art in the research field of reference, this conclusion cannot but be considered as preliminary.

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Figure 1 - Adjusted incremental return rates for Durable and Nondurable goods in the US, 1972 - 1997, levels

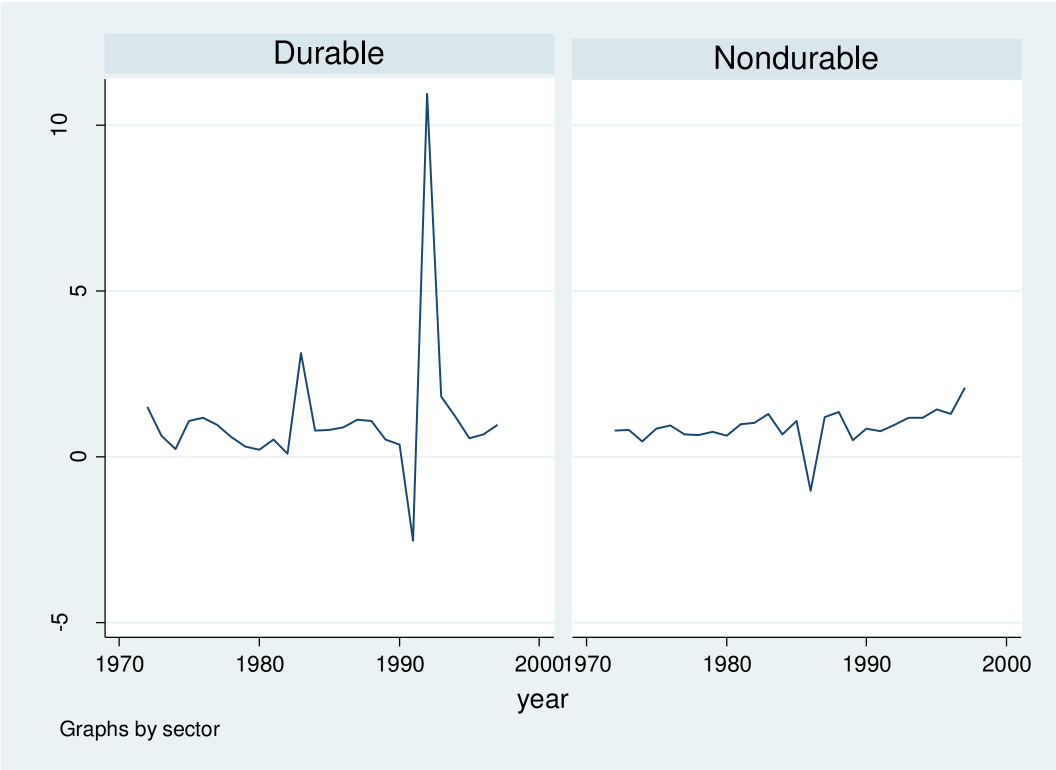

Figure 2 - Adjusted incremental return rates for various manufacturing sectors in the US, 1972 - 1997, levels

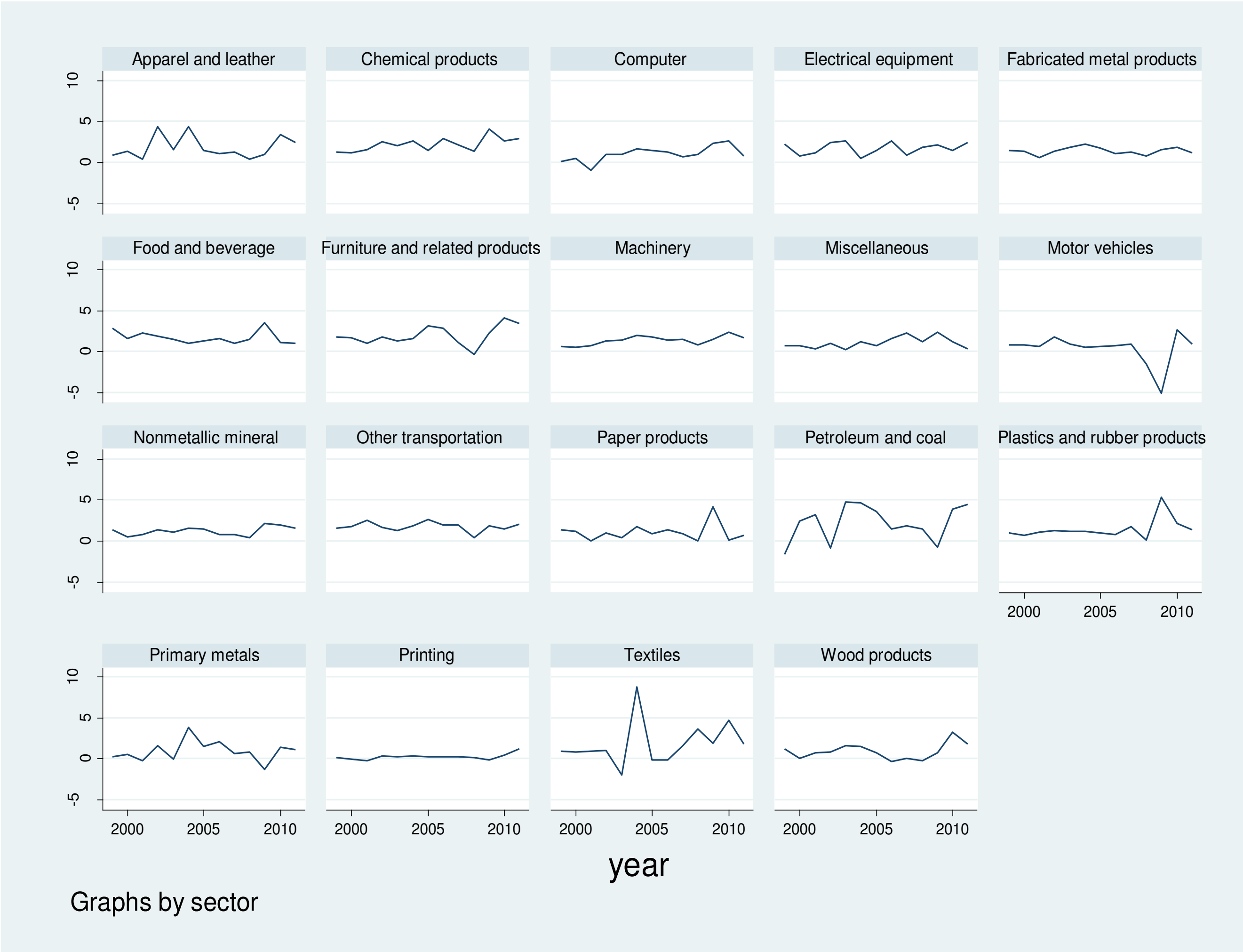

Table 1 - Descriptive statistics

Time-series data (1972-1997)	Obs.	Mean	Std. Dev.	Min	Max
Difference between durable and non-durable return rates	26	0.240729	2.203509	-3.29754	9.980934
Panel data (1999-2011)					
Sector					
Apparel and leather and allied products	13	0.462167	1.025003	-0.55647	2.882614
Chemical products	13	0.830436	0.66414	0.065039	2.514541
Computer and electronic products	13	-0.3602	0.668931	-1.78888	0.768813
Electrical equipment, appliances, and components	13	0.351578	0.940424	-1.78636	1.402986
Fabricated metal products	13	0.032484	0.352069	-0.54121	0.622377
Food and beverage and tobacco products	13	0.328144	1.032738	-1.22501	2.003516
Furniture and related products	13	0.614745	0.915687	-1.01122	1.865746
Machinery	13	-0.0216	0.245134	-0.4138	0.390518
Miscellaneous manufacturing	13	-0.29761	0.770101	-1.41982	1.08868
Motor vehicles, bodies and trailers, and parts	13	-0.99789	1.847527	-6.62921	0.368921
Nonmetallic mineral products	13	-0.17885	0.365767	-0.68129	0.568798
Other transportation equipment	13	0.355797	0.661596	-0.78303	1.645895
Paper products	13	-0.33256	1.094063	-2.13299	2.635099
Petroleum and coal products	13	0.799349	2.053315	-2.59921	3.532876
Plastics and rubber products	13	0.051202	1.202784	-1.0963	3.822282
Primary metals	13	-0.46418	1.064947	-2.86606	1.553665
Printing and related support activities	13	-1.14989	0.445764	-1.96252	-0.50048
Textile mills and textile product mills	13	0.442878	2.420814	-3.19699	6.543039
Wood products	13	-0.46601	0.724342	-1.65969	0.981213

Table 2 - Mean confidence interval

Time-series data (1972-1997)	Obs.	Mean	Std. Dev.	95% confidence interval	
Difference between durable and non-durable return rates	26	0.240729	0.432144	-0.64929	1.130746
Panel data (1999-2011)					
Sector					
Apparel and leather and allied products	13	0.462167	0.284285	-0.15724	1.08157
Chemical products	13	0.830436	0.184199	0.4291	1.231771
Computer and electronic products	13	-0.3602	0.185528	-0.76443	0.044032
Electrical equipment, appliances, and components	13	0.351578	0.260827	-0.21671	0.91987
Fabricated metal products	13	0.032484	0.097646	-0.18027	0.245237
Food and beverage and tobacco products	13	0.328144	0.28643	-0.29593	0.952221
Furniture and related products	13	0.614745	0.253966	0.061401	1.168089
Machinery	13	-0.0216	0.067988	-0.16973	0.126536
Miscellaneous manufacturing	13	-0.29761	0.213588	-0.76298	0.167754
Motor vehicles, bodies and trailers, and parts	13	-0.99789	0.512412	-2.11434	0.11856
Nonmetallic mineral products	13	-0.17885	0.101446	-0.39988	0.042183
Other transportation equipment	13	0.355797	0.183494	-0.044	0.755596
Paper products	13	-0.33256	0.303439	-0.9937	0.328572
Petroleum and coal products	13	0.799349	0.569487	-0.44146	2.040155
Plastics and rubber products	13	0.051202	0.333592	-0.67563	0.778038
Primary metals	13	-0.46418	0.295363	-1.10772	0.179363
Printing and related support activities	13	-1.14989	0.123633	-1.41926	-0.88051
Textile mills and textile product mills	13	0.442878	0.671413	-1.02001	1.905761
Wood products	13	-0.46601	0.200896	-0.90372	-0.02829

Table 3 - Unit-root and stationarity tests (sample observations: 26)

Test	Statistic	5% Critical value
Augmented Dickey-Fuller test statistic	-5.98	-2.98
Phillips-Perron test statistic	-6.20	-2.98
Elliott-Rothenberg-Stock test statistic	2.02	2.97
Ng-Perron test statistics MZa	-11.84	-8.10
Ng-Perron test statistics MZt	-2.41	-1.98
Ng-Perron test statistics MSB	0.20	0.23
Ng-Perron test statistics MPT	2.14	3.17
Zivot-Andrews test	-6.49	-4.80
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.14	0.46

All the test are for the presence of a unit root, with the exception of the Kwiatkowski-Phillips-Schmidt-Shin which is for stationarity. The Elliott-Rothenberg-Stock test statistic has to be smaller than the critical value to reject the null. The Zivot and Andrews test allows for a structural break in the intercept of the underlying model, which was found to happen in 1992. When tests requested the selection of lag length, we always used the BIC criterion which points to zero lags. Note that, for Ng-Perron MSB and MPT tests, smaller statistics than 5% critical values are a sign of rejection of the null hypothesis.