BANCA D'ITALIA

EUROSISTEMA

Temi di discussione

(Working papers)

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June 2008

Number 675

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SERVICE REGULATION AND GROWTH: EVIDENCE FROM OECD COUNTRIES

by Guglielmo Barone* and Federico Cingano**

Abstract

We study the effects of anti-competitive service regulation by examining whether OECD countries with less anti-competitive regulation see a better economic performance of manufacturing industries using less-regulated services more intensively. Our results indicate that lower service regulation translates into faster value added, productivity, and export growth of downstream service-intensive industries. The negative growth-effect of anti-competitive regulation is particularly relevant in the case of professional services and energy provision. Our estimates prove robust to accounting for alternative forms of regulation (such as product and labor market regulation), for the degree of financial development and also to a number of other specification checks.

JEL Classification: O40, L51, L80.
Keywords: regulation, financial development, sector analysis, growth.

Contents

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** Bank of Italy, Economics, Research and International Relations.

1. Introduction[1]

Do countries with less anti-competitive service regulation perform better economically? Policy makers appear to think so as regulatory barriers have fallen in many countries. And their position is generally supported by a large empirical literature looking at the effects of entry barriers, red-tape costs or legal requirements on economic performance. Much of this literature examines the effects of service regulation on the performance of the regulated service. Less is known about how service deregulation affects the economic performance of downstream manufacturing activities, which is surprising as regulation affects many key service inputs.

In this paper we study how regulation in the supply of a variety of services impacts on the economic performance of downstream manufacturing industries. We do so by examining whether countries with less regulation of a given service see faster value added, productivity, and export growth in manufacturing industries using the service more intensively (this methodology was pioneered for financial service by Rajan and Zingales, 1998). Our measures of service regulation are OECD indicators designed to capture anti-competitive regulatory settings for the energy sector, the telecommunication sector, the transportation sector and for professional services. These include barriers to entry, the integration between *a priori* competitive activities and natural monopolies (in the case of energy) or restrictions on prices and fees, advertising, form of business etc. among professionals.

Our empirical findings indicate that lower service regulation have non-negligible positive effects on service intensive users in terms of value added, productivity and export growth. For example, our estimates imply that the annual value added growth differential between an industry at the 75th percentile (Pulp, paper and printing) relative to one at the 25th percentile (Fabricated metal products) of dependence on regulated services is approximately 0.8-1% higher in a country with regulation at the 25th percentile (as Canada) than in a country close to the 75th percentile (as France). Our analysis indicates the aggregate effect is mainly

[1] We are extremely grateful to Antonio Ciccone for his help and suggestions. We thank Tullio Jappelli, Andrea Ichino, Giovanni Pica, Fabiano Schivardi and seminar participants at the Bank of Italy, University of Bologna, University of Cagliari, CSEF Salerno, University of Modena-Reggio Emilia and MILLS 2007 for very useful comments. We are responsible for any mistakes. The opinions expressed here are our own and do not necessarily correspond to those of the Bank of Italy. Correspondence: Bank of Italy, Research Department, via Nazionale 91, 00184 Rome, Italy; Email: federico.cingano@bancaditalia.it; guglielmo.barone@bancaditalia.it.

driven by barriers to entry and vertical integration in the provision of energy (electricity and gas) and by anti-competitive regulation in professional activities. On the other hand, the level of regulation in transportation and telecommunication services does not seem to play a significant role for downstream industries. These findings have relevant implications in terms of competition policy. For example, our estimates imply that removing the regulation of price and tariffs among professions, industries making intense use of their services (as Chemicals and Pharmaceuticals) would grow by 0.5 percentage points more relatively to less intensive users (as Fabricated Metal Products). Similar results would be obtained from the complete separation between energy generation (or import) and other segments of the industry (as transmission or final sales). These findings are not affected by accounting for other forms of regulation and prove robust to a number of specification checks.

The nexus between service-efficiency and manufacturing-growth has been mainly examined in the case of financial development. In their seminal paper Rajan and Zingales (1998) argued that if financial development increases aggregate productivity growth by lowering the cost of external funds then growth in intensive external finance industries should be faster in financially developed countries. We apply a similar reasoning and examine the relative performance of industries relying more intensively on service inputs for technological reasons, in countries with different levels of regulation. Our paper differs from Rajan and Zingales' in three main respects, however. First, we extend previous research explicitly focusing on a number of key service inputs, including finance. Our results suggest that deregulation is not less relevant than financial development for the economic performance of downstream industries. Second, we focus on multiple performance indicators, showing that service regulation not only determines a reallocation of value added within manufactures but also impacts on downstream industries productive efficiency, measured as per worker productivity. Finally, our findings indicate service-efficiency matters for growth even in a restricted sample of high-income countries, for which the finance-growth nexus has often proved not significant in previous studies. Comparing the results obtained using nominal as opposed to real value added data we show that this somehow puzzling result can be explained with the negative effect output increases have on price dynamics at the country-industry level.

Two recent papers used the OECD regulation data to look at own-industry consequences of restrictions to competition. Nicoletti and Scarpetta (2003) look at regulation

and productivity in 17 manufacturing and 6 service sectors in OECD countries, finding strong effects on multifactor productivity growth for those countries located further away from the technological frontier. Alesina *et al.* (2005) show that regulatory reforms in sectors which were traditionally most heavily sheltered from competition (transport, communication and energy) have had a significant positive impact on their pattern of capital accumulation. Our evidence complements these findings suggesting that sectoral reforms might or might not translate into positive indirect effects on downstream industries. Our work also relates to a growing strand of recent research adopting the Rajan and Zingales approach to study the effect of overall regulation on manufacturing performance based on a variety of other technological characteristics. Fisman and Sarria-Allende (2004) look at the effects of barriers to entry on the industrial structure exploiting technology-determined differences in natural barriers to entry (as start-up costs or minimum scale of production). They find that regulation favours within-industry concentration of production, but does not affect its reallocation across industries within countries. Klapper, Laeven and Rajan (2006) show that European countries with more costly entry regulations experience slower growth in the number of firms in industries with high entry in the US. Ciccone and Papaioannou (2007) show that countries where it takes less time to register new businesses experienced more entry in industries benefiting from expansionary global demand and technology shifts. As we will show, our main findings are robust to accounting for these determinants of growth differentials at the industry level. The only other paper we are aware of relating service competition to users performance is Allegra *et al.* (2004) who find the average 1995-2002 growth rate of exports by Italian manufacturing industries to be lower the stronger their dependence on those services the antitrust authorities have been intervening more frequently over the same period.

2. Background

Anti-competitive sectoral regulation is associated to allocative and productive inefficiencies which eventually affect the level of final prices in the regulated sector.[2] When concerning the production of key intermediate inputs, regulatory barriers might therefore have relevant indirect effects on the performance of downstream industries. In particular, by influencing the

price of inputs that complement physical or organizational capital (as energy or business services) service regulation ends up entering users' costs of capital adjustment. As a consequence, service intensive industries in high regulated countries might tend to under-react to global investment opportunities relatively to low regulated countries.

We will check this implication comparing the growth performances of manufacturing industries with different degrees of technological dependence on service inputs in high and low regulated countries. Following the financial development literature, our cross-country and industry regressions would account for time-invariant country and industry differences in unobserved determinants of both regulation and economic performance, thus accounting for standard concerns with cross-country regressions, like reverse causation, multicollinearity, and omitted variable biases. This approach has recently been adopted to examine a variety of other technological characteristics that could lead to industries growing faster in some countries than others (see Levine 2005 for a survey of the literature).

We recover two measures of the degree of industry dependence on service inputs ($w_{j,s}$) from Input-Output (I-O) account matrices. We proxy direct dependence of industry *j* on service *s* with the ratio between the total cost of purchased services and the value of industry output (the so-called "technical coefficients"). Our second measure of dependence is recovered from the coefficients of the inverse Leontieff matrix and accounts for both direct and indirect contributions of service *s* to the value of production in industry *j*. These weights account for potential effects of anti-competitive service regulation working through industry *j* linkages with other non-regulated industries in the economy.[3]

In our baseline specifications, weights $w_{j,s}$ are computed based on US input-output tables, based on the fact that, according to OECD data, the US are the country having had the lowest average level of services regulation for the longest time period (see figure 1). As in the rest of the literature following Rajan and Zingales, we will therefore assume that US industries dependence on services reflects technological differences rather than other country-specific determinants, as the level of regulation itself. In the robustness section, however, we

[2] For example, Blanchard and Giavazzi (2003) emphasized how changes in regulation may affect the mark-up of prices over marginal costs through their impact on the equilibrium number of firms. Alesina *et al*. (2005) showed how anti-competitive barriers might determine sub-optimal investment decisions by regulated firms.

[3] See Appendix for detailed information on how the direct and indirect weights are obtained from the available input-output accounts. Note that in our empirical setting the two measures could yield different results only to the extent that they imply relevant changes in service dependence across downstream industries.

will exploit an alternative measure of industry-dependence not reflecting input intensities that are specific to a country or a level of regulation, to show that while apparently restrictive this assumption does not seem to be relevant to our results.

3. Data

All the data needed to perform our exercise are available from the OECD.[4] Cross-country measures of regulation in services are collected from the Product Market Regulation (PMR) database assembled coding a large amount of basic information into quantitative scores increasing on a common (0 to 6) scale in restrictions to competition. These measures quantify the degree to which regulatory settings in a given service are anti-competitive, that is "regulations that create barriers to entrepreneurship and restrict competition in domestic markets where technology and demand conditions make competition viable" (see Conway and Nicoletti, 2006). While PMR measures cover different regulatory areas for each sector, we focused on those designed to capture ex-ante anti-competitive measures as barriers to entry, vertical integration and market conduct. Entry barriers capture all regulations curbing entry and/or distorting market structure relative to a competitive outcome and are available for all service sectors.[5] Vertical integration measures whether *a priori* competitive activities (as electricity generation or the final supply of energy) are separated from natural monopolies such as the national grid and/or local distribution. Finally, conduct regulation includes restrictions on prices and fees, advertising, form of business etc. in professional services. Our results prove to be unaffected by extending the analysis to the additional indexes, intended to check ex-post enforcement of regulation (as those measuring market structure) or to the effects of privatizations. OECD-PMR data cover the main non-manufacturing services in the ISIC Rev-3 industry list: energy (electricity and gas), communication (telecommunication and postal services), transportation (air, road, rail transportation services) and professional services (including accountants, architects, engineers and legal services). While sectoral

[4] See the data appendix and Table 1 for detailed variables definition and sources.
[5] For example, in the energy sector they focus on terms and conditions for third party access and the extent of choice of supplier for consumers; in the communication sectors they measure legal limitations on the number of competitors allowed in each market, ranging from no limitations to limitations in all markets or franchising to a single firm; in professional services these are barriers to becoming a member of each of the professions, taking the form of licensing and educational requirements, quantitative constraints on the number of suppliers etc.

coverage dates back to 1975 for most sectors, only two points in time (1996 and 2003) are available for professions.

We combined PMR information with data on (current and constant price) value added, export and employment at the country-industry-year level contained in the OECD Structural Analysis (STAN) dataset. These data have been assembled complementing member countries' Annual National Accounts with information from other sources, such as national business surveys and censuses, and classified according to the International Standard Industrial Classification, Revision 3 (ISIC Rev. 3).

Finally, inter-industry technological dependences are measured using the OECD Input-Output database. This reports matrices of inter-industry transaction-flows of goods and services for several OECD countries around the mid-1990s. Consistently with the STAN database, the I-O tables are based on ISIC Rev. 3 industry list.

Assembling the data imposes some constraints on the number of available observations: in particular we are forced to restrict our analysis to a relatively limited growth period, starting in 1996. This is due to the fact that *(a)* there are no regulation indicators for professions available at earlier dates, and *(b)* shifting to earlier dates significantly increases the number of missing values in industry value added data, due to a reduction in both the number of available country data and in the industry breakdown within each country.[6] Interestingly, however, around the starting year of our growth period the simple correlations between OECD regulation indicators and own-sector measures of market outcomes, such as final prices to industrial users or indexes of market power at the sector-level, turns to be positive (fig. 2).[7] In this paper we are asking whether own-market distortions in services also reflect in the pattern of downstream industries economic performance.

The main variables used in the empirical part are summarized in Table 1 and correlations between regulation indicators are showed in Table 3.

[6] For example, in 1990 the number of observations falls by nearly 25% with respect to 1996.

[7] Specifically, the above mentioned evidence is obtained combining PMR indexes with Eurostat data on energy and telecommunication prices on one hand and with profitability-based variables (measuring the degree of market competition) in transportation and professional services. Details are available upon request.

4. Results

Regulation and growth: Table 4 reports the results obtained from our baseline value added growth regression

$$\hat{VA}_{j,c} = \alpha + \beta * \sum_{s} \left(w_{j,s} * X_{c,s} \right) + \phi SHARE_{j,c} + \mu_c + \mu_j + \varepsilon_{j,c}$$

where $\hat{VA}_{j,c}$ is the country-industry average compounded rate of real value added growth for the period 1996-2002, $X_{c,s}$ are the beginning-of-period regulation indicators in the four services (energy, communication, transportation and professional activities), the weights $w_{j,s}$ are the technical coefficients obtained from the 1997 US Input-Output matrix, measuring *direct* industry *j* dependence on service *s* inputs, and $SHARE_{j,c}$ is the beginning-of-period value-added share of industry *j* in country *c*. The weighted average $SERVREG = \sum_{s} \left(w_{j,s} * X_{c,s} \right)$ captures within-country differences in the relevance of service sectors regulation for each manufacturing industry *j*.

The coefficient reported in column 1 of Table 4 indicates that lowering beginning of period anti-competitive regulation in the provision of services has a significant and positive effect on industry growth. One way to interpret this effect is thinking of the annual value added growth differential between an industry with overall service-dependence ($D_j = \sum_{s} \left(w_{j,s} \right)$) at the 75th percentile (Pulp, paper and printing) and an industry at the 25th percentile (Fabricated metal products). The coefficient estimated in column 1 implies this differential would raise by approximately 0.75% if regulation were to be uniformly lowered in the four services by an amount corresponding to the difference in average regulation between the 75th (France) to the 25th (Canada) most regulated countries. For comparison, the median value added growth rate in our sample is 1.8%. Hence, our findings suggest that in heavily service regulated countries resources tend to be reallocated away from service intensive industries. This finding is confirmed irrespective of the weighting scheme adopted in the regression. This can be seen in column 2 where we replicate the baseline regression using the so-called Leontieff transformation of the technical coefficients, accounting for both direct and indirect inter-sectoral relationships. While the point estimate is unchanged, the implied effect of service deregulation would be slightly larger (about 1%) in this case.

Since a large body of work has analyzed the role of financial development for growth in a very similar empirical framework, it is important to check the robustness of our findings to accounting for the finance-growth nexus. This is obtained in columns 3 and 4 of Table 4 where the original specification is augmented with the interaction between US industry external finance dependence and two of the country-specific indicators of financial development used by Rajan and Zingales (1998): column 3 considers the ratio of total credit provided by the banking sector to GDP, while column 4 focuses on accounting standards. In both cases we still estimate significant negative effects of anti-competitive service regulation. On the other hand, financial development proves positively and significantly related to growth: for example the coefficient estimated in column 3 implies the growth differential between the industry at the 75th percentile and the industry the 25th percentile of external finance dependence (respectively Plastic products and Pulp and paper) would increase of approximately 0.2 percent moving from a country with private credit at the 25th percentile to a country close to the 75th percentile of financial development (Norway and the Netherlands, respectively).

Finally, the last two columns check the robustness of our estimate to changes in the regression specification. In column 5 we focused on the relationship between industry growth and average (as opposed to initial) service regulation in 1996-2002 using initial regulation as instrument, an approach recently followed in the financial development literature, obtaining even stronger estimates for the negative role of service regulation. Column 6 further account for the 1996-2002 change in regulation (*DSERVREG*) to show the estimated coefficient is not capturing the extent of subsequent deregulation, which might have contemporaneous effects on industry value added.

Our results so far suggest there is a relevant nexus between service-efficiency and manufacturing-growth in OECD countries. These are relevant findings in that the estimated finance-growth relationship has so far proven not significant when the analysis was restricted to sub-samples of high-income countries. For example, the estimated coefficient reported by Rajan and Zingales in tab. 4, column 2 (0.118, with a standard deviation of 0.037) falls to -0.004 (0.019) when the analysis is restricted to OECD countries, and to -0.021 (0.017) when further restricting to the same subset of developed countries used here. One possible interpretation of this result is the existence of significant heterogeneity in the effects of

financial development on growth between rich and poor countries (see Favara, 2003). An alternative explanation in a world where high income countries tend to produce differentiated goods relatively to poor countries might be the counteracting role of price dynamics following the increase in industry output. While we look at output growth, as measured by constant price value added, most of the existing cross-country cross-industry papers work with nominal value added data. Hence, if lower regulation of services raises output in service-intensive manufacturing industries by lowering service-input prices, then there are two countervailing effects on nominal manufacturing output. A positive effect due to higher output and a negative effect due to lower prices. We do in fact find that lower regulation and higher financial development translates into lower prices in service-intensive manufacturing industries in Table 5 (columns 1 to 3). As a result, when we replicate the real value added analysis in Table 4 using nominal value added as in most of the existing literature, the effect is largely insignificant (Table 5, columns 4 to 6).

Regulation, productivity and exports: Does regulation improve downstream industries productive efficiency or are the estimated value added growth differentials absorbed by offsetting shifts in sectoral employment? Despite its relevance we are not aware of any cross-country and cross-industry analyses specifically addressing the interaction between efficiency in service provision and average labour productivity in downstream industries. Estimates reported in the top panel of Table 6, obtained replicating the previous analysis, indicate that anti-competitive service regulation has a significant impact on growth of value added per worker, a result that is not affected by accounting for financial development or changing the regression specification as in the previous table. On the other hand, financial development does not prove a relevant determinant of productivity. To get a sense for the economic relevance of the coefficients reported in the first column of in Table 6, consider as before the annual value added growth differential between Pulp and paper and Fabricated metal products (respectively high and low service users): the coefficient estimated in column 6 implies this growth differential is approximately 0.9% higher in a low- than in a high-regulation country (respectively Canada and France). For comparison, the median productivity growth rate in our sample is 2.2%.

Finally, we exploited the availability of data on exports to explore whether the sectoral reallocation patterns implied by our value added results correspond to changes in international

specialization. Results reported in Panel B of Table 6 indicate that this is the case: throughout all the usual empirical specifications we find that exports by service intensive industries tend to grow disproportionately more in countries with low levels of anti-competitive regulation. Hence regulation of inputs causes users to lose competitiveness on the international markets compared to similar firms in less regulated countries.

All in all, our empirical findings point to the existence of non-negligible indirect effects of lack of competition in upstream markets for the economic performance of downstream manufacturing activities.

5. Robustness

Having established our baseline findings, we proceeded to a number of robustness checks considering the potential confounding role of country-wide regulation in other markets, the appropriateness of US weights in capturing technological dependence on services and the role of influential observations.

The role of product and labor market regulations: First we considered the possibility that our estimates are driven by omitted country-industry shocks not captured by either country- or industry-fixed effects and correlated with service regulation. If regulation is a country-wide phenomenon, our findings might in particular be capturing anti-competitive measures targeting other markets, as the labour or the product market. We checked for this possibility augmenting the baseline specification with regulation-related variables which have been shown to be significant determinants of cross country-industry growth. In columns 1 and 2 of Table 7 we accounted for country-level measures of employment protection and administrative (red-tape) barriers to entrepreneurships (Djankov *et al.*, 2002; Nickell, 2005; Nicoletti and Scarpetta, 2003) interacted with the appropriate industry-level indicator (see table note for a detailed description). Both indicators are negatively related to industry growth, although the relationship is statistically significant only in the case of red-tape costs. On the other hand, the estimated impact of anti-competitive services regulation is unaffected. Similarly, our findings prove robust conditioning the estimated effects of regulation on the role of central or municipal governments, as captured by the OECD measures of the extent of

public ownerships in energy, transportation and communication services (column 3). Finally, column 4 shows robustness to accounting for all regulation variables simultaneously.[8]

The appropriateness of US weights: Second, we dealt with the possibility that using I-O weights from a benchmark country does not allow to correctly measure technological dependence on service inputs because country-specific weights differ from "true" weights by a idiosyncratic component. Such component could be unrelated to other determinants of industry growth, a case in which our estimates would be subject to standard attenuation bias, or depend on the level of regulation itself, so that using a benchmark country would induce a priori ambiguous biases in the estimated coefficients (Ciccone and Papaioannou, 2006). These considerations suggest that neither choosing a different benchmark country nor using cross-country averages of I-O weights would appropriately tackle the measurement issue. An alternative procedure consists in exploiting cross country I-O weights to recover a measure of average service-dependence not reflecting input intensities specific to a country or to a level of regulation and use it as instrument of US-based service-dependence. Following Ciccone and Papaioannou (2006), one such measure could be estimated for each service sector *s* proceeding in two steps. First we regressed country-industry weights $w_{j,c}$ on country dummies, industry dummies and industry dummies interacted with country-level regulation in sector *s*, to estimate the marginal effect of regulation on intensity in each industry *j*: $w_{j,c} = \mu_j + \mu_c + \delta_j X_c + \varepsilon_{j,c}$.[9] In this regression, the most deregulated country $\bar{c}$ is excluded from the sample. Second, we estimated $\hat{w}_{j,\bar{c}}$ as the fitted values of $w_{j,c}$ when regulation is set at the minimum observed value ($X_{\bar{c}}$) and country-specific averages are set to zero: $\hat{w}_j = \hat{\mu}_j + \hat{\delta}_j X_{\bar{c}}$. The fitted weights $\hat{w}_j$ will thus not reflect input intensities that are regulation or country-specific, and can be used as instruments for US weights in the empirical specification.

[8] Not reported results proved the robustness of the estimated coefficient to other commonly used country-level controls as GDP per capita and legal inefficiency (Djankov *et al*. 2007). Finally, we also accounted for the fact that service intensive industries might benefit from high *direct* protection from competition (for example through barriers to trade) in countries with high services regulation. Augmenting the basic specification with country-industry specific variables accounting for the effects of protection on industry margins (the ratio between current prices value added net of labor costs and the value of production), or their exposure to foreign competition (import penetration) did not affect our findings, however.

[9] Following Papke and Wooldridge (1996) the estimated regressions account for the fact that the dependent variable is fractional.

The results obtained following this procedure are reported in columns 5 and 6 of Table 6 and confirm the negative role of anti-competitive service regulation for growth. The only difference between the two columns consists in the choice of the country excluded from the service-specific first stage regressions. In column 5 we excluded the US, according to the OECD measures the country experiencing the lowest regulation from an historical perspective. In column 6, we excluded the least regulated country in each service sector in 1996 (the US for communications, the UK for energy and transportation, Finland for professional services).

The role of influential observations: Our last robustness check consists in accounting for the role of influential observations. To this purpose we checked our results when *(a)* the most and least service intensive industries (respectively, Other non metallic mineral products and Machinery and equipment) are removed from the sample (column 7), and *(b)* the most and least service regulated countries (Greece and Sweden, respectively) are removed from the sample (column 8). The estimated coefficient on the growth effect of anti-competitive service regulation is robust to both exercises.

6. Sector-specific effects

Having assessed the relevance of service regulation and compared it to the financial development literature, we now allow for sector-specific impacts focusing on the unrestricted specification

$$\hat{VA}_{j,c} = \alpha + \sum_s \beta_s \left(w_{j,s} * X_{c,s} \right) + \phi SHARE_{j,c} + \mu_c + \mu_j + \varepsilon_{j,c} .$$

The estimated β_s are easier interpreted recalling they represent a second derivative $\beta = \partial \hat{VA} / \partial w \partial X$. Hence, evidence that, say, $\beta_s<0$ would indicate that, other things equal, manufacturing industries that are relatively more intensive users of service *s* fare better in those countries where the provision of such service is relatively less regulated.

Our results, reported in Table 8, point to the existence of significant sectoral heterogeneity underlying the aggregate estimate. This can be seen in columns 1 to 4 where we separately considered regulation in energy, professional services, communications and transportation, the four services covered by the OECD regulation database. All estimated coefficients are negative, but only the first two are statistically significant, a result confirmed

when all regressors are jointly considered (column 5). To get a sense for their economic relevance, consider the annual value added growth differential between an industry with an intensity in professional services at the 75th percentile (Textile and textile products) and an industry at the 25th percentile (Fabricated Metal Products). The estimated coefficient in column 5 implies this growth differential is approximately 0.8% higher in a country with regulation of professions at the 25th percentile (as the UK) than in a country close to the 75th percentile (as Spain). This effect is large relative to the median industry value-added growth rates in our sample (1.8%) and represents more than one-third of the observed 25^{th}-75^{th} difference in industry growth rates. A similar exercise performed with high/low energy intensive industries would imply a slightly larger growth-effect (1.1%) when moving from a heavily regulated energy market (e.g. Italy) to a deregulated country (e.g. Finland).

All specifications already account for the possibility of contemporaneous effects from labor and product market regulation. In column 6 we further checked for the potential confounding role of short-run shocks. This amounts to distinguishing whether low regulation induces faster growth by service intensive industries or rather facilitates downstream firms exploiting industry-level worldwide short-run shocks. While still of interest, evidence in favor of the second mechanism would imply that absent these shocks, deregulation would have no effects on growth. Fisman and Sarria-Allende, (2004) raised this point in the case of finance, suggesting a test for robustness to short run shocks obtained interacting the country-level variable of interest with a direct measure of worldwide shocks to industries, measured by US industries growth. The underlying idea is simple: if estimates in column 5 were to reflect short run shocks, they should be dominated by direct measures of industry-differences in the opportunities of expansion. Interestingly, our results indicate that lower regulation of professional services (but not energy) does help manufacturing industries accommodating short run shocks. On the other hand, however, our previous findings are unaffected and still statistically significant.[10]

Exact knowledge of how the OECD evaluates each component of its regulation measures allows us use these results to infer the potential effects of competition policies that

[10] Estimates in Table 8 proved also robust to removing, as in table 7, sector-specific influential observations at the country and industry level.

have been high in the recent policy agendas.[11] For example, we calculated that complete removal of the two main determinants of conduct regulation in professions, that is *(a)* bans to comparative or price advertising and *(b)* the regulation of price and tariffs, would imply the Textiles-Metal Products growth differential to raise by 0.3 and 0.5 percentage points, respectively. As to the energy market, our findings imply the industry growth differential associated to *(a)* creating a liberalized wholesale market for electricity, *(b)* allowing third party access to the electricity and gas transmission grid, or *(c)* imposing the separation of ownership between energy production and its distribution would amount to 0.4, 0.7 and 1.1 percentage points per year, respectively.[12]

7. Conclusions

Growing concerns that the existing levels of regulation might reflect "private" rather than "public" interests have recently motivated a number of academic and policy-oriented researches aimed at evaluating the impact of regulatory barriers on the performance of regulated firms.[13] We contribute to this debate highlighting the non-negligible indirect effects anti-competitive regulation of key service inputs has on the economic performance of downstream manufacturing industries in terms of value added, productivity and export growth. Unlike previous studies, our results indicate the nexus between service-efficiency and manufacturing-growth is strong even among high-income countries. Interestingly, the negative impact of service regulation appears to be particularly relevant for those activities (professional services and energy supply) the recent competition policy debate has been focusing on most intensively, both in Europe and in other developed countries.

Our results leave several interesting questions open to future research. On one hand the increased availability of detailed firm-level data should allow disentangling whether the aggregate growth effects we estimated here are mainly due to entry and exit flows of firms with different productivity, to the performance of existing firms or both. On the other, it

[11] See for example Paterson *et al.* (2003) research report on professional services or London Economics (2007) final report on energy sector competition inquiry, both prepared for the European Commission, DG Competition. See also the Ministry of Economic Affairs, The Hague (2004).

[12] For a detailed description of how different determinants of anti-competitive regulation are defined and enter the OECD-PMR indicators, see Conway and Nicoletti (2006).

would be important to look deeper into the mechanisms underlying our findings, focusing on how regulation affects the industrial organization of services (for example, in terms of number and size of firms, of turnover rates etc), on how this shapes service market outcomes and, eventually, the pattern of capital accumulation in downstream industries.

[13] This literature started with the work by Djankov *et al.* (2002) showing that the regulation of entry is on average associated with higher corruption and larger unofficial economies, but not higher quality of public or private goods.

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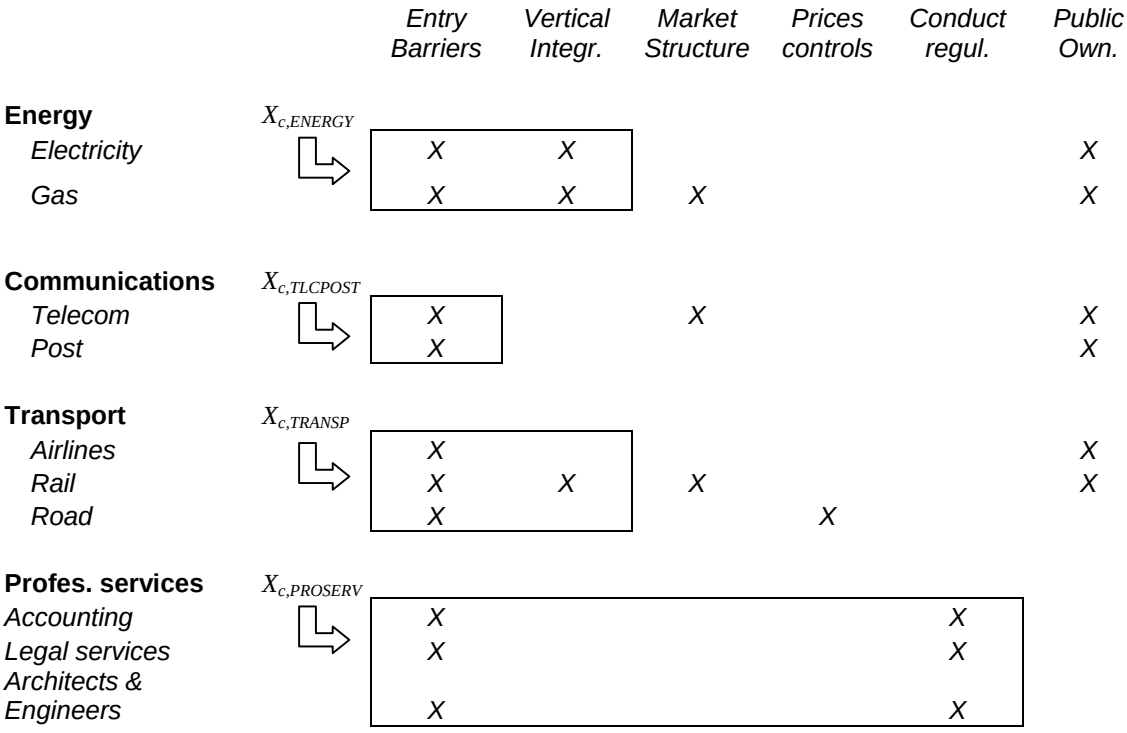
Data appendix

Country sample:
Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom and United States.

Industry sample:
"Food products, beverages and tobacco" (Isic Rev. 3 = "15-16"), "Textiles and textile products" (Isic Rev. 3 = "17-18"), "Leather, leather products and footwear" (Isic Rev. 3 = "19") , "Wood and products of wood and cork" (Isic Rev. 3 = "20") , "Pulp, paper, paper products, printing and publishing" (Isic Rev. 3 = "21-22"), "Coke, refined petroleum products and nuclear fuel" (Isic Rev. 3 = "23"), "Chemicals and chemical products" (Isic Rev. 3 = "24"), "Rubber and plastics products" (Isic Rev. 3 = "25"), "Other non-metallic mineral products" (Isic Rev. 3 = "26"), "Basic metals" (Isic Rev. 3 = "27"), "Fabricated metal products, except machinery and equipment" (Isic Rev. 3 = "28"), "Machinery and eqipment, N.E.C." (Isic Rev. 3 = "29"), "Electrical and optical equipment" (Isic Rev. 3 = "30-33"), "Transport equipment" (Isic Rev. 3 = "34-35"), "Manufacturing N.E.C., recycling" (Isic Rev. 3 = "36-37").

Dependence of manufacturing industries on service inputs
Throughout the paper our weights $w_{j,s}$ are mainly computed as the technical coefficients (see below) derived from the US Input-Output accounts in 1997. They are given by the elements of the matrix $\boldsymbol{T} = \boldsymbol{M}\ diag\ (\boldsymbol{y})^{-1}$ where $\boldsymbol{M}$ is the Industry by Industry (44 × 44) input-output matrix, $\boldsymbol{y}$ is the (44 × 1) vector of sectoral total output. In col. 2 of Tables 4 to 6, weights are computed as the product of the elements of the Leontieff inverse matrix and the share of value added on the output. In formulas, let $\boldsymbol{v}$ the (44 × 1) vector of sectoral added value. The Leontieff inverse matrix is given by $\boldsymbol{F} = (\boldsymbol{I} - \boldsymbol{T})^{-1}$ and satisfies $\boldsymbol{\iota}' = \boldsymbol{q}'\boldsymbol{F}$ where $\boldsymbol{q} = diag\ (\boldsymbol{y})^{-1}\boldsymbol{v}$ is the vector collecting the sectoral shares of value added on the output. . According to the last relation the value of production in each sector (set equal to one) is decomposed in the contribution of value added produced in all the sectors ($\boldsymbol{q}$) weighted with the (direct and indirect) measure of intersectoral dependence ($\boldsymbol{F}$). Without matrix notation the relation can be written as $1_j = \sum_{k=1}^{44} q_k\, f_{k,j}\ 1$ for $k = 1, ..., 44$. Weights are then given by the elements $q_k f_{k,j}$.

Data on regulation in selected non-manufacturing sectors
All the regulatory indicators range on a common (0-6) scale from least to most restrictive conditions for competition. Data are available for seven non-manufacturing industries: electricity and gas supply, road freight, air passenger transport, rail transport, post and telecommunications and professional services (accounting, architects, engineers and legal services) and consist of a set of indicators of barriers to entry, vertical integration, market structure, price regulation, conduct regulation and public ownership. The following table summarizes all the available elementary data and the derived indicators we use in the paper ($X_{c,s}$). $X_{c,s}$ variables computed as simple averages of elementary data.



Barriers to entry take into account legal limitations on the number of companies in potentially-competitive markets (for example, conditions for the determination of third party access in energy markets or the licensing rules in professional services). Vertical integration measures the degree of separation between production/import and other segments of the industry (in the energy sectors) or between the operation of infrastructure and the provision of railway services (in the rail industry). Market structure reflects the degree of concentration. Conduct regulation in professional services is referred to the existence of bans to advertising or minimum prices. Public ownership depends on the share of equity owned by central or municipal governments in firms of a given sector. See Nicoletti *et al*. (1999) and Conway and Nicoletti (2006) for a complete description of the regulatory indicators of the OECD PMR database.

TABLES AND FIGURES

Table 1: Variables definition and sources

Variable	Definitions and sources
	Industry level
$w_{j,s}$	Industry j's dependence on service s. $w_{j,s}$ includes $w_{j,ENERGY}$, $w_{j,TLCPOST}$, $w_{j,TRANSP}$ and $w_{j,PROSERV}$ that are referred to Energy, Telecommunications and Post, Transports and Professional services, respectively. Source: our calculations on 1997 USA Input-Output accounts. See also data appendix.
ED_j	Industry j's dependence on external finance defined as capital expenditure minus internal funds. Source: de Serres *et al.* (2006) on Thomson Financial Worldscope database.
$LABINT_j$	Industry j's labor intensity measured as the ratio between employees and total assets in the US in 1996. Source: OECD STAN database (total assets are computed from investments data using the perpetual inventory method with a 15% depreciation rate).
$GROP_j$	Annual compounded growth rate of production in real terms in industry j in USA over the 1996-2002 period. Source: OECD STAN database.
$\hat{w}_{j,s}$	Estimated industry j's dependence on service s net of regulation- and country-specific determinants of factor demand. For each of the four service sectors $\hat{w}_{j,s}$ have been estimated according to the following two-steps procedure (see also Ciccone and Papaioannou, 2006): (*a*) Regress $w_{j,s,c}$ on country dummies, industry dummies and industry dummies interacted with country-level regulation in sector s; the most deregulated country $\overline{c}$ is excluded from the regression and the estimation follows Papke and Wooldridge (1996) to account for the fact that the dependent variable is fractional. (*b*) Obtain $\hat{w}_{j,s}$ as the fitted values of $w_{j,s,c}$ when regulation is set at country $\overline{c}$ levels and country fixed effects are set to zero. Country $\overline{c}$ is set to either the USA in all four service sectors (tab. 7, col. 5) or Great Britain, USA and Finland for *ENERGY* and *TRANSP*, *TLCPOST* and *PROSERV*, respectively (Table 7, column 6).
$GLOPP_{j,s}$	Estimated world-average industry j's growth opportunities. For each of the four service sectors global opportunities ($GLOPP_j$) are the estimated industry value added growth over the period 1996-2002 obtained according to the following two-steps procedure (see also Ciccone and Papaioannou, 2006): (*a*) Regress $GROWTH_{j,c}$ on country dummies, industry dummies and industry dummies interacted with country-level regulation in sector s; the USA are excluded from the regression. (*b*) Obtain $GLOPP_j$ as the predicted values of $GROWTH_{j,c}$ for the USA.
	Country level
$X_{c,s}$	Regulation indexes on a 0-6 scale (from least to most restrictive conditions) in 1996 in four non-manufacturing industries. $X_{c,s}$ includes $X_{c,\ ENERGY}$, $X_{c,\ TLCPOST}$, $X_{c,TRANSP}$, $X_{c,PROSERV}$ referring to energy (electricity and gas), communications (posts and telecommunications), transports (air, rail and road), professional services (legal, accounting, engineering and architects). Source: OECD Product market Regulation database. $X_{c,\ ENERGY}$ takes into account the height of entry barriers and the degree of vertical integration in electricity and gas supply; $X_{c,\ TLCPOST}$ depends only on the height of entry barriers in postal and telecommunications services; $X_{c,TRANSP}$ depends on entry barriers in air, rail and road services and on vertical integration in rails; $X_{c,PROSERV}$ averages regulation creating entry barriers and regulation on market conduct in legal services, accounting services, engineers and architects. See also data appendix.
FD_c	Financial development in country c measured as Private Credit by Deposit Money Banks over GDP in 1996. Source: World Bank's financial development and structure database (based on IMF's Financial Statistics).
$ACCSTAN_c$	Indicator of financial disclosure in 1983. Source: Rajan, Zingales (1998).
LMR_c	Indicator of employment protection in 1988-1995. Source: Fonseca, Utrero (2005).
$COST_c$	Direct start-up costs of obtaining legal status to operate a firm as a share of per capita GDP in 1999. Source: Djankov *et al.* (2002).

Table 1: Variables definition and sources (continued)

Variable	Definition and source
	Industry - Country level
$GROWTH_{j,c}$	Annual compounded growth rate of real value added in industry *j* in country *c* over the 1996-2002 period. Source: OECD STAN database.
$NGROWTH_{j,c}$	Annual compounded growth rate of nominal value added in industry *j* in country *c* over the 1996-2002 period. Source: OECD STAN database.
$DEFGROWTH_{j,c}$	Annual compounded growth rate of the value added implicit deflator in industry *j* in country *c* over the 1996-2002 period. Source: OECD STAN database.
$LPGROWTH_{j,c}$	Annual compounded growth rate of labor productivity (value added at constant prices per employee) in industry *j* in country *c* over the 1996-2002 period. Source: OECD STAN database.
$EXGROWTH_{j,c}$	Annual compounded growth rate of exports at constant prices (current exports are deflated with the value added deflator) in industry *j* in country *c* over the 1996-2002 period. Source: OECD STAN database.
$SHARE_{j,c}$	Share of industry *j* in total value added in manufacturing in country *c* in 1996. Source: OECD STAN database.
$EXSHARE_{j,c}$	Share of industry *j* in exports in manufacturing in country *c* in 1996. Source: OECD STAN database.
$LLP_{j,c}$	Natural logarithm of labor productivity (value added at constant prices per employee) in industry *j* in country *c* in 1996. Source: OECD STAN database.
$SERVREG_{j,c}$	Index of exposure of manufacturing industry *j* to regulation in four selected service sectors (energy, communications, transport and professional services). It is computed as $\sum_s w_{j,s} X_{c,s}$ where *s* = *ENERGY*, *TLCPOST*, *TRASP*, *PROSERV*. Source: OECD Product market Regulation database and USA 1997 Input-Output accounts.
$DSERVREG_{j,c}$	Difference between $SERVREG_{j,c}$ in 1996 and in 2002. Source: OECD Product market Regulation database and USA 1997 Input-Output accounts.
$POWN_{j,c}$	Index of exposure of manufacturing industry *j* to the degree of public ownership in three selected service sectors (energy, communications, transport). It is computed as $\sum_s w_{j,s} POWN_{c,s}$ where $POWN_{c,s}$ is an index measuring on a 0-6 scale (increasing with the role of public sector) the degree of public ownership in 1996 and *s* = *ENERGY*, *TLCPOST* and *TRASP*. Source: OECD Product market Regulation database and USA 1997 Input-Output accounts.

Table 2: Summary statistics

Variable	Obs	Mean	St. Dev.	Min	Max
Industry level					
Dependence on energy [$w_{j,ENERGY}$]	15	0.018	0.010	0.007	0.039
Dependence on communications [$w_{j,TLCPOST}$]	15	0.004	0.001	0.002	0.007
Dependence on transports [$w_{j,TRANSP}$]	15	0.030	0.014	0.011	0.063
Dependence on professional services [$w_{j,PROSERV}$]	15	0.027	0.011	0.013	0.055
External dependence [ED_j]	15	0.697	1.595	-0.450	6.200
Labor intensity [$LABINT_j$]	15	0.028	0.013	0.004	0.052
Growth opportunities [$GROP_j$]	15	0.010	0.029	-0.028	0.093
Country level					
Regulation in energy in 1996 [$X_{c,ENERGY}$]	16	4.475	1.338	1.808	6.000
Regulation in communications in 1996 [$X_{c,TLCPOST}$]	16	2.868	1.614	0.000	5.680
Regulation in transports in 1996 [$X_{c,TRASP}$]	16	2.949	1.062	1.530	5.133
Reg. in professional services in 1996 [$X_{c,PROSERV}$]	16	2.464	1.160	0.830	4.178
Financial development [FD_c]	16	0.718	0.272	0.304	1.141
Labor market regulation [LMR_c]	16	1.359	0.491	0.300	1.933
Red tape costs [$COST_c$]	16	0.146	0.141	0.012	0.586
Industry - Country level					
Value added growth 1996-2002 (real terms) [$GROWTH_{j,c}$]	220	0.018	0.034	-0.081	0.204
Val. added gr. 1996-2002 (nominal terms) [$NGROWTH_{j,c}$]	220	0.032	0.038	-0.123	0.221
Implicit deflator growth 1996-2002 [$DEFGROWTH_{j,c}$]	220	0.014	0.030	-0.095	0.189
Labor productivity growth 1996-2002 [$LPGROWTH_{j,c}$]	220	0.025	0.026	-0.051	0.162
Export growth 1996-2002 [$EXGROWTH_{j,c}$]	205	0.050	0.050	-0.094	0.194
Value added share in 1996 [$SHARE_{j,c}$]	220	0.069	0.047	0.001	0.234
Log labor productivity in 1996 [$LLP_{j,c}$]	220	3.864	0.481	2.821	6.932
Export share in 1996 [$EXSHARE_{j,c}$]	220	0.068	0.068	0.000	0.364
Overall regulation [$OVREG_{j,c}$]	220	0.246	0.109	0.070	0.628

Table 3: Correlation between regulation indicators in four service sectors in 1996

	Energy [$X_{c,ENERGY}$]	Communications [$X_{c,TLCPOST}$]	Transports [$X_{c,TRASP}$]	Prof. serv. [$X_{c,PROSERV}$]
Energy [$X_{c,ENERGY}$]	1.000			
Communications [$X_{c,TLCPOST}$]	0.549	1.000		
Transports [$X_{c,TRASP}$]	0.801	0.541	1.000	
Professional services [$X_{c,PROSERV}$]	0.497	0.519	0.645	1.000

Table 4: Service regulation and growth

	(1) Baseline, direct weights	(2) Baseline, indirect weights	(3) Financial Development 1	(4) Financial Development 2	(5) Average 1996-02 regulation	(6) Deregulation (1996-2002)
Service regulation [$SERVREG_{j,c}$]	-0.172*	-0.170*	-0.176**	-0.158*	-0.198**	-0.287**
	(0.069)	(0.072)	(0.068)	(0.071)	(0.075)	(0.080)
Financial dev. × external dep. [$FD_c \times ED_j$]			0.010*		0.011*	0.009*
			(0.004)		(0.004)	(0.004)
Accounting stand. × ext. dep. [$ACCSTAN_c \times ED_j$]				0.013+		
				(0.007)		
Change in service regulation [$DSERVREG_{j,c}$]						0.320**
						(0.116)
Initial industry share [$SHARE_{j,c}$]	0.189**	0.198**	0.169*	0.187**	0.174**	0.163**
	(0.071)	(0.069)	(0.067)	(0.072)	(0.066)	(0.062)
Constant	0.037	0.048+	0.006	-0.001	0.005	0.014
	(0.023)	(0.025)	(0.019)	(0.020)	(0.019)	(0.019)
Observations	220	220	220	220	220	220
R-squared	0.66	0.66	0.67	0.67	0.68	0.69

+ significant at 10%; * significant at 5%; ** significant at 1%

Notes:

The dependent variable is the annual compounded growth rate of real value added at the country-industry level for the period 1996-2002 ($GROWTH_{j,c}$). $SERVREG_{j,c}$ measures exposure to service regulation at the country-industry level as a weighted average ($\Sigma_s w_{j,s} * X_{c,s}$) of country-level anti-competitive regulation indexes from the OECD-PMR databases. Service regulation ($X_{c,s}$) is measured in 1996 except in col. (5) where it is the 1996-2002 average value. Interaction weights $w_{j,s}$ are ("direct") technical coefficients of dependence between service sector s and manufacturing industry j computed on the 1997 USA Input-Output matrix, except for col. (2) where they are measured to account for both direct and indirect dependence (see the data appendix for computational details). Financial development is measured as Private Credit by Deposit Money Banks over GDP in 1996 (FD_c, col. 3) and as accounting standards in 1983 ($ACCSTAN_c$, col. 4). It is interacted with External dependence (ED_j) an industry-level measure of reliance on external finance obtained from US firm-level data. Both interactions follow Rajan and Zingales (1998). $DSERVREG_{j,c}$ measures exposure to service deregulation as $\Sigma_s w_{j,s} * \Delta X_{c,s}$, where $\Delta X_{c,s}$ is the 1996-2002 change in service regulation indexes. $SHARE_{j,c}$ indicates the industry share in total value added in manufacturing in 1996. All regressions include (unreported) country- and industry-fixed effects and use (employment) weighted least squares as estimation method. Robust standard errors are reported in parentheses.

Table 5: Financial development, prices and nominal growth

	Prices			Nominal growth		
	(1) Service Regulation	(2) Financial Development	(3) Regulation and Fin. Dev.	(4) Service Regulation	(5) Financial Development	(6) Regulation and Fin. Dev.
Service regulation [$SERVREG_{j,c}$]	0.210**		0.211**	-0.004		-0.006
	(0.072)		(0.070)	(0.078)		(0.078)
Financial dev. × external dep. [$FD_c \times ED_j$]		-0.009*	-0.009*		0.005	0.005
		(0.005)	(0.004)		(0.005)	(0.004)
Initial industry share [$SHARE_{j,c}$]				0.027	0.017	0.017
				(0.049)	(0.048)	(0.050)
Constant	0.015	0.056**	0.019	0.037*	0.036**	0.037*
	(0.014)	(0.006)	(0.013)	(0.016)	(0.012)	(0.016)
Observations	220	220	220	220	220	220
R-squared	0.62	0.60	0.63	0.64	0.64	0.64

+ significant at 10%; * significant at 5%; ** significant at 1%

Notes:

In cols. 1-3 the dependent variable is the annual compounded growth rate of value added implicit deflator at the industry-country level for the period 1996-2002 ($DEFGROWTH_{j,c}$); in cols. 4-6 the dependent variable is the annual compounded growth rate of nominal value added at the industry-country level for the period 1996-2002 ($NGROWTH_{j,c}$). $SERVREG_{j,c}$ measures exposure to service regulation at the country-industry level as a weighted average ($\Sigma_s w_{j,s} * X_{c,s}$) of country-level anti-competitive regulation indexes from the OECD-PMR databases. Service regulation ($X_{c,s}$) is measured in 1996. Interaction weights $w_{j,s}$ are ("direct") technical coefficients of dependence between service sector s and manufacturing industry j computed on the 1997 USA Input-Output matrix. Financial development is measured as Private Credit by Deposit Money Banks over GDP in 1996 (FD_c) and is interacted with External dependence (ED_j) an industry-level measure of reliance on external finance obtained from US firm-level data. $SHARE_{j,c}$ indicates the industry share in total value added in manufacturing in 1996. All regressions include (unreported) country- and industry-fixed effects and use (employment) weighted least squares as estimation method. Robust standard errors are reported in parentheses.

Table 6: Service regulation, productivity and exports

	(1) Baseline, direct weights	(2) Baseline, indirect weights	(3) Financial Development 1	(4) Financial Development 2	(5) Average 1996-02 regulation	(6) Deregulation (1996-2002)
Panel A: Productivity growth						
Service regulation [$SERVREG_{j,c}$]	-0.201*	-0.218*	-0.202*	-0.194*	-0.228*	-0.280**
	(0.081)	(0.100)	(0.080)	(0.085)	(0.090)	(0.106)
Financial dev. × external dep. [$FD_c \times ED_j$]			0.009		0.010	0.008
			(0.006)		(0.006)	(0.005)
Accounting stand. × ext. dep. [$ACCSTAN_c \times ED_j$]				0.006		
				(0.006)		
Change in service regulation [$DSERVREG_{j,c}$]						0.228
						(0.158)
Initial labor productivity [$LLP_{j,c}$]	0.031**	0.032*	0.028*	0.031**	0.030**	0.030**
	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)	(0.011)
Constant	-0.079+	-0.062	-0.069	-0.082+	-0.073	-0.066
	(0.047)	(0.048)	(0.047)	(0.047)	(0.046)	(0.045)
Observations	220	220	220	220	220	220
R-squared	0.58	0.58	0.59	0.58	0.60	0.60
Panel B: Export growth						
Service regulation [$SERVREG_{j,c}$]	-0.213+	-0.249*	-0.215*	-0.202+	-0.242*	-0.297*
	(0.108)	(0.111)	(0.106)	(0.108)	(0.119)	(0.121)
Financial dev. × external dep. [$FD_c \times ED_j$]			0.005		0.006	0.005
			(0.007)		(0.007)	(0.006)
Accounting stand. × ext. dep. [$ACCSTAN_c \times ED_j$]				0.010		
				(0.013)		
Change in service regulation [$DSERVREG_{j,c}$]						0.229
						(0.179)
Initial industry export share [$EXSHARE_{j,c}$]	-0.013	-0.007	-0.017	-0.015	-0.016	-0.024
	(0.054)	(0.053)	(0.052)	(0.055)	(0.052)	(0.050)
Constant	0.060**	0.081**	0.059**	0.055**	0.007	0.070**
	(0.018)	(0.025)	(0.018)	(0.019)	(0.023)	(0.019)
Observations	205	205	205	205	205	205
R-squared	0.72	0.72	0.72	0.72	0.72	0.72

+ significant at 10%; * significant at 5%; ** significant at 1%

Notes:

In Panel A the dependent variable is the annual compounded growth rate of labor productivity (value added per employed worker) at the industry-country level for the period 1996-2002 ($LPGROWTH_{j,c}$). In Panel B the dependent variable is the annual compounded growth rate of exports at the industry-country level for the period 1996-2002 ($EXPGROWTH_{j,c}$). $SERVREG_{j,c}$ measures exposure to service regulation at the country-industry level as a weighted average ($\Sigma_s w_{j,s} * X_{c,s}$) of country-level anti-competitive regulation indexes from the OECD-PMR databases. Service regulation ($X_{c,s}$) is measured in 1996 except in col. (5) where it is the 1996-2002 average value. Interaction weights $w_{j,s}$ are ("direct") technical coefficients of dependence between service sector s and manufacturing industry j computed on the 1997 USA Input-Output matrix, except for col. (2) where they are measured to account for both direct and indirect dependence (see the data appendix for computational details). Financial development is measured as Private Credit by Deposit Money Banks over GDP in 1996 (FD_c, col. 3) and as accounting standards in 1983 ($ACCSTAN_c$, col. 4). It is interacted with External dependence (ED_j) an industry-level measure of reliance on external finance obtained from US firm-level data. Both interactions follow Rajan and Zingales (1998). $DSERVREG_{j,c}$ measures exposure to service deregulation as $\Sigma_s w_{j,s} * \Delta X_{c,s}$, where $\Delta X_{c,s}$ is the 1996-2002 change in service regulation indexes. $LLP_{j,c}$ indicates the log of labor productivity in 1996. $EXSHARE_{j,c}$ indicates the industry share in total exports in manufacturing in 1996. All regressions include (unreported) country- and industry-fixed effects and use (employment) weighted least squares as estimation method. Robust standard errors are reported in parentheses.

Table 7: Robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Other regulation measures				Weights		Influential obs.	
	Empl. Protect.	Red tape	Public Own.	All	IV- US	IV-lowest country	Most/least dependent industries	Most/least regulated countries
Service regulation [$SERVREG_{j,c}$]	-0.191** (0.071)	-0.203** (0.067)	-0.232** (0.074)	-0.269** (0.074)	-0.193* (0.087)	-0.218* (0.105)	-0.274** (0.088)	-0.180* (0.072)
Fin. dev. × external dep. [$FD_c \times ED_j$]	0.011** (0.004)	0.010* (0.004)	0.010** (0.004)	0.011** (0.004)	0.010* (0.004)	0.010* (0.004)	0.008* (0.004)	0.013** (0.004)
Lab. market reg. × lab. int. [$LMR_c \times LABINT_j$]	-0.400 (0.323)			-0.547+ (0.297)				
Red tape costs × gr. opp. [$COST_c \times GROP_j$]		-1.449+ (0.871)		-1.639+ (0.862)				
Public ownership [$POWN_{j,c}$]			0.084+ (0.047)	0.061 (0.046)				
Initial industry share [$SHARE_{j,c}$]	0.182** (0.067)	0.135+ (0.069)	0.152* (0.063)	0.135* (0.066)	0.167* (0.068)	0.165* (0.068)	0.155* (0.071)	0.184* (0.073)
Constant	0.019 (0.024)	0.015 (0.019)	0.003 (0.019)	0.033 (0.023)	0.039 (0.025)	0.014 (0.026)	0.055* (0.027)	0.035 (0.024)
Observations	220	220	220	220	220	220	188	193
R-squared	0.68	0.68	0.68	0.69	0.67	0.67	0.67	0.69

+ significant at 10%; * significant at 5%; ** significant at 1%

Notes:

The dependent variable is the annual compounded growth rate of real value added at the industry-country level for the period 1996-2002 ($GROWTH_{j,c}$). $SERVREG_{j,c}$ measures exposure to service regulation at the country-industry level as a weighted average ($\Sigma_s w_{j,s}*X_{c,s}$) of country-level anti-competitive regulation indexes from the OECD-PMR databases. Service regulation ($X_{c,s}$) is measured in 1996. Interaction weights $w_{j,s}$ are ("direct") technical coefficients of dependence between service sector *s* and manufacturing industry *j* computed on the 1997 USA Input-Output matrix. Financial development is measured as Private Credit by Deposit Money Banks over GDP in 1996 (FD_c) and is interacted with External dependence (ED_j) an industry-level measure of reliance on external finance obtained from US firm-level data. Labor market regulation (LMR_c) is an indicator of employment protection in 1988-1995 and is interacted with labor intensity ($LABINT_j$) computed as the ratio between employees and total assets in the USA in 1996. Red tape costs ($COST_c$) are direct start-up costs of obtaining legal status to operate a firm as a share of per capita GDP in 1999; this variable is interacted with growth opportunities ($GROP_j$) measured as the compounded average growth rate of production in real terms in industry *j* in USA over the 1996-2002 period. Public ownership ($POWN_{j,c}$) is an index of exposure of each manufacturing industry *j* to the degree of public ownership in three selected service sectors (energy, communications, transport). It is computed as $\sum_s w_{j,s} POWN_{c,s}$ where $POWN_{c,s}$ is an index measuring on a 0-6 scale (increasing with the role of public sector) the degree of public ownership in 1996 and *s* = *ENERGY*, *TLCPOST* and *TRASP*. Weights $w_{j,s}$ are given by technical coefficients computed on the USA 1997 Input-Output matrix (see also data appendix). Cols. 5 and 6 report IV estimates obtained using $\sum_s \hat{w}_{j,s} X_{c,s}$ as instrument for $SERVREG_{j,c}$. $\hat{w}_{j,s}$ is the estimated industry *j*'s dependence on service *s* net of regulation- and country-specific determinants of factor demand. For each of the four services $\hat{w}_{j,s}$ are the estimated $w_{j,s}$ in the most deregulated country ($\bar{c}$) and are obtained, for each *s*, according to the following two-step procedure: (*a*) Regress $w_{j,s,c}$ on country dummies, industry dummies and industry dummies interacted with country-level regulation in sector *s*; country $\bar{c}$ is excluded from the regression and the estimation follows Papke and Wooldridge (1996) to account for the fact that the dependent variable is fractional. (*b*) Obtain $\hat{w}_{j,s}$ as the fitted values of $w_{j,s,c}$ for country $\bar{c}$ net of country $\bar{c}$ fixed effect. In col. 5 country $\bar{c}$ is the USA while in col. 6 it is set to Great Britain, USA and Finland for *ENERGY* and *TRANSP*, *TLCPOST* and *PROSERV*, respectively. Results in cols 7 and 8 are obtained removing from the sample the most and least intensive industrial users of regulated services ("Other non-metallic mineral products" and "Machinery and equipment N.E.C.") and the most and least service-regulated countries (Greece and Sweden), respectively. $SHARE_{j,c}$ is the industry share in total value added in manufacturing in 1996. All regressions include (unreported) country- and industry-fixed effects and use (employment) weighted least squares as estimation method. Robust standard errors are reported in parentheses.

Table 8: Sector-specific effects

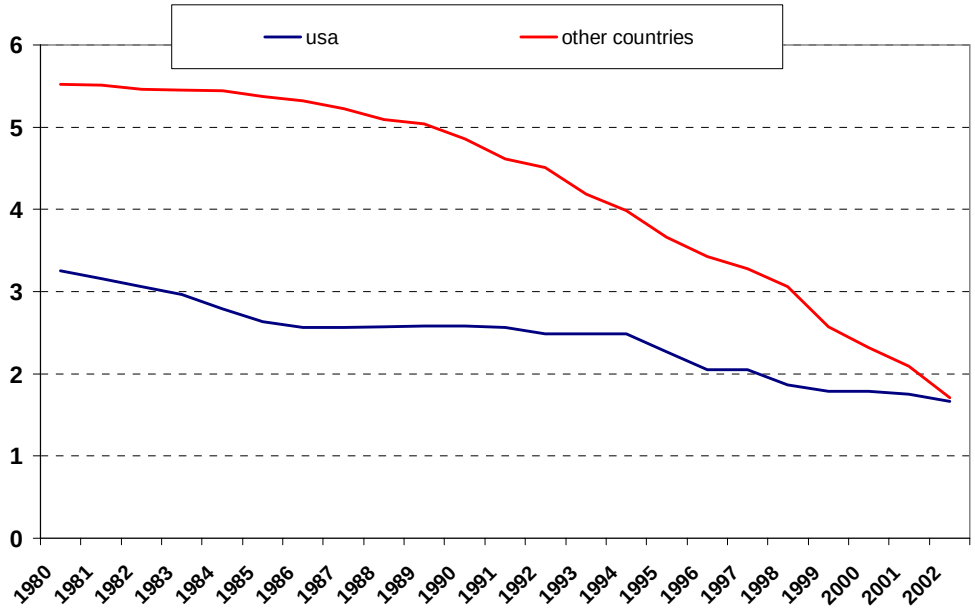
	(1) Energy services	(2) Prof. services	(3) Commun. services	(4) Transp. services	(5) All services	(6) Robs. to GLOPP
Energy Regulation × Energy dependence [$X_{c,ENERGY} \times w_{j,\ ENERGY}$]	-0.482** (0.147)				-0.540* (0.232)	-0.530* (0.232)
Prof. Serv. Regulation × Prof. Serv. dependence [$X_{c,PROSERV} \times w_{j,\ PROSERV}$]		-0.286* (0.124)			-0.254* (0.118)	-0.259* (0.114)
Communications Regulation × Comm. dep. [$X_{c,TLCPOST} \times w_{j,TLCPOST}$]			-0.417 (1.193)		0.115 (1.147)	0.206 (1.100)
Transports Regulation × Transports dependence [$X_{c,TRANSP} \times w_{j,\ TRANSP}$]				-0.231 (0.160)	0.101 (0.247)	0.112 (0.246)
Energy Regulation × Global opportunities (energy) [$X_{c,ENERGY} \times GLOPP_{j,\ ENERGY}$]						0.038 (0.072)
Prof. Serv. Regulation × Global opp. (prof. serv.) [$X_{c,PROSERV} \times GLOPP_{j,\ PROSERV}$]						-0.343** (0.131)
Financial dev. × external dep. [$FD_c \times ED_j$]	0.010* (0.004)	0.011** (0.004)	0.010* (0.005)	0.011* (0.005)	0.011** (0.004)	0.011** (0.004)
Initial industry share [$SHARE_{j,c}$]	0.171* (0.067)	0.156* (0.073)	0.169* (0.069)	0.167* (0.069)	0.159* (0.069)	0.182** (0.062)
Constant	0.004 (0.017)	0.014 (0.020)	-0.007 (0.022)	0.004 (0.020)	0.021 (0.030)	0.039 (0.031)
Observations	220	220	220	220	220	220
R-squared	0.69	0.68	0.67	0.67	0.70	0.71

+ significant at 10%; * significant at 5%; ** significant at 1%

Notes:

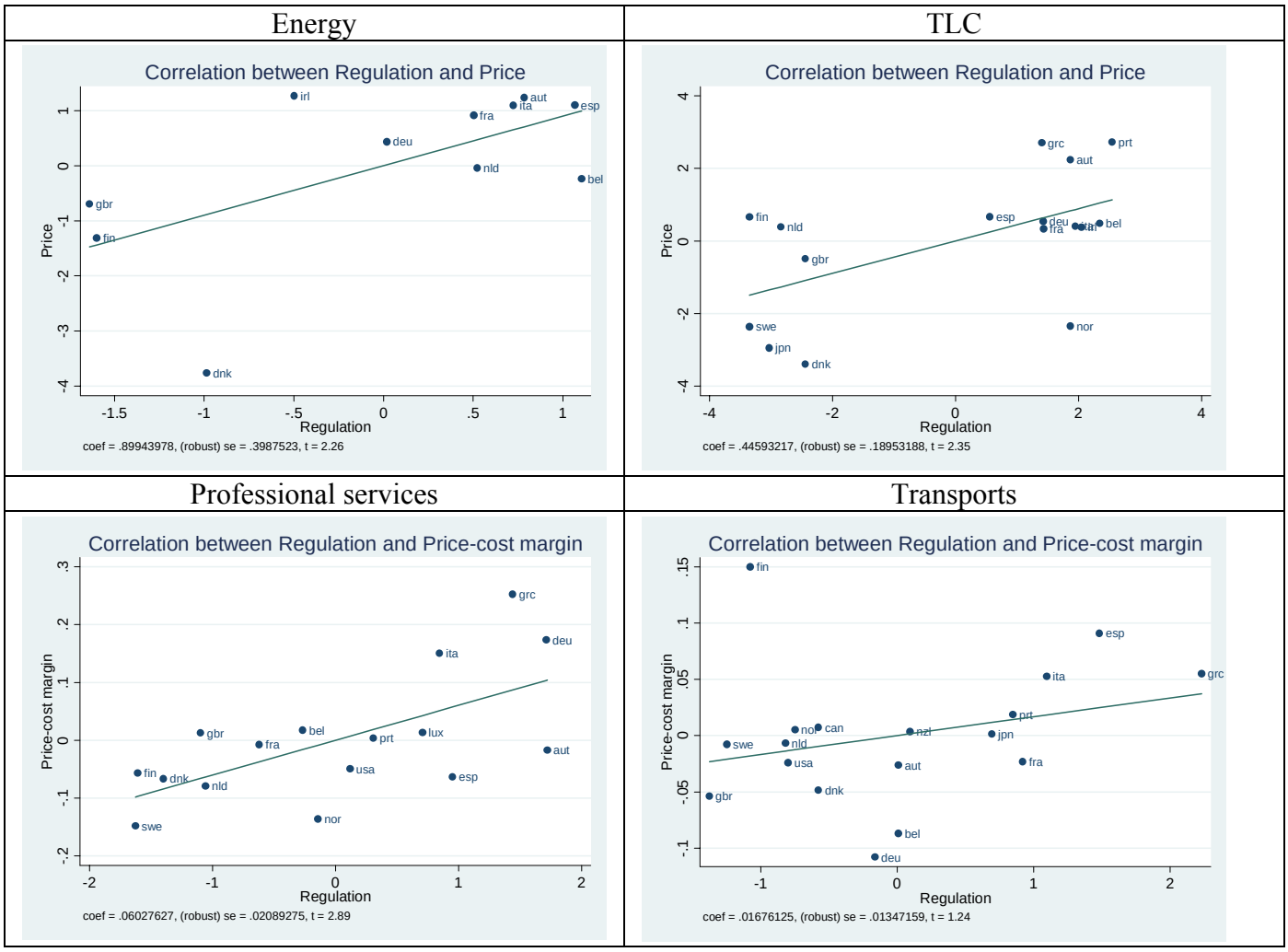
The dependent variable is the annual compounded growth rate of real value added at the industry-country level for the period 1996-2002 ($GROWTH_{j,c}$). $X_{c,s}$ * $w_{j,s}$ are interaction terms between country-level measures of regulation in energy, professional Services, communications, transports in 1996 ($X_{c,s}$) and the corresponding industry-level indicators of dependence ($w_{j,s}$). Interaction weights $w_{j,s}$ are ("direct") technical coefficients of dependence between service sector *s* and manufacturing industry *j* computed on the 1997 USA Input-Output matrix. Financial development is measured as Private Credit by Deposit Money Banks over GDP in 1996 (FD_c) and is interacted with External dependence (ED_j) an industry-level measure of reliance on external finance obtained from US firm-level data. $GLOPP_{j,\ ENERGY}$ and $GLOPP_{j,\ PROSERV}$ are the estimated industry value added growth in the USA. For each of the service sector *ENERGY* and *PROSERV*, global opportunities ($GLOPP_{j,s}$) are obtained according to the following two-steps procedure: (*a*) Regress $GROWTH_{j,c}$ on country dummies, industry dummies and industry dummies interacted with country-level regulation in sector *s*; USA are excluded from the regression. (*b*) Obtain $GLOPP_j$ as the predicted values of $GROWTH_{j,c}$ for the USA. $SHARE_{j,c}$ indicates the industry share in total value added in manufacturing in 1996. All regression include (unreported) interaction terms between labor market regulation (LMR_c) and labor intensity ($LABINT_j$) and between red tape costs ($COST_c$) and growth opportunities ($GROP_j$) (see table 1 and 7 for the definition of these variables). All regressions also include (unreported) country- and industry-fixed effects and use (employment) weighted least squares as estimation method. Robust standard errors are reported in parentheses.

Figure 1: Service regulation in USA and other OECD countries



Notes:
Service regulation is the simple average of the OECD measures of regulation ($X_{c,s}$) in energy, communications and transports. Other countries are: Austria, Belgium, Canada, Germany, Denmark, Finland, France, Great Britain, Greece, Italy, Japan, the Netherlands, Norway, Portugal, Spain and Sweden.

Figure 2: OECD Regulation indicators and own-sector outcomes (1996)



Notes:

The figures plot the adjusted-partial residual of sector-specific cross-country regressions of prices and price-cost margins in 1996 (1997 for TLC). Price data are available from Eurostat's Economic Reforms database. Energy prices are tons of oil equivalent weighted averages of Electricity prices for industrial users (expressed in Euro per kWh) and of gas prices for industrial users (Euro per Gigajoule). Telecommunications prices are obtained averaging prices for a 10 minutes local, national and international calls (to the USA). All prices are then converted in current US dollars using OECD purchasing power parities. Price-cost margins are calculated on OECD STAN database as the ratio of value added net of labor costs over gross output (see Aghion et al., 2002). Similar graphs would be obtained using a measure of mark-up, computed as the inverse of the labor income share in each sector.

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