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Please cite this paper as:

Andrews, D. and F. Cingano (2012), “Public Policy and Resource Allocation: Evidence from Firms in OECD Countries”, *OECD Economics Department Working Papers*, No. 996, OECD Publishing.
http://dx.doi.org/10.1787/5k9158wpf727-en

OECD Economics Department Working Papers No. 996

Public Policy and Resource Allocation

EVIDENCE FROM FIRMS IN OECD COUNTRIES

Dan Andrews, Federico Cingano

JEL Classification: D24, E23, K23, L11, L51

Unclassified **ECO/WKP(2012)73**

Organisation de Coopération et de Développement Économiques
Organisation for Economic Co-operation and Development

24-Oct-2012

English - Or. English

ECO/WKP(2012)73
Unclassified

ECONOMICS DEPARTMENT

PUBLIC POLICY AND RESOURCE ALLOCATION: EVIDENCE FROM FIRMS IN OECD COUNTRIES

ECONOMICS DEPARTMENT WORKING PAPERS No. 996

By Dan Andrews and Federico Cingano

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JT03329570

English - Or. English

ABSTRACT/RESUMÉ

Public policy and resource allocation: evidence from firms in OECD countries

The correlation between a firm's size and its productivity level varies considerably across OECD countries, suggesting that some countries are more successful at channelling resources to high productivity firms than others. Accordingly, we examine the extent to which regulations affecting product, labour and credit markets influence productivity, via their effect on the efficiency of resource allocation. Our results suggest that there is an economically and statistically robust negative relationship between policy-induced frictions and productivity, though the specific channel depends on the policy considered. In the case of employment protection legislation, product market regulations (including barriers to entry and bankruptcy legislation) and restrictions on foreign direct investment, this is largely traceable to the worsening of allocative efficiency (*i.e.* a lower correspondence between a firm's size and its productivity level). By contrast, financial market under-development tends to be associated with a higher fraction of low productivity relative to high productivity firms. Furthermore, stringent regulations are more disruptive to resource allocation in more innovative sectors, though the nature of innovation turns out to be important.

JEL classification codes: D24, E23, K23, L11, L51
Keywords: productivity; regulations; allocative efficiency; firm-level data

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**Politiques publiques et allocation des ressources :
des preuves provenant des entreprises dans les pays de l'OCDE**

La corrélation entre la taille d'une entreprise et son niveau de productivité varie considérablement selon les pays de l'OCDE, ce qui suggère que certains pays réussissent mieux à affecter les ressources à des entreprises à forte productivité que d'autres. Par conséquent, nous examinons dans quelle mesure les réglementations affectant les marchés des produits, du travail et du crédit influent sur la productivité, grâce à leur effet sur l'efficacité de l'affectation des ressources. Nos résultats suggèrent qu'il existe une relation économiquement et statistiquement négative robuste entre les frictions induites par la politique et la productivité, même si le canal spécifique dépend de la politique considérée. Dans le cas de la législation sur la protection de l'emploi, de la réglementation des marchés de produits (y compris les barrières à l'entrée et à la législation sur les faillites) et des restrictions à l'investissement direct à l'étranger, c'est en grande partie attribuable à la détérioration de l'efficacité allocative (i.e. une faible correspondance entre la taille de l'entreprise et son niveau de productivité). En revanche, le sous-développement du marché financier tend à être associe à une proportion plus élevée des entreprises à faible productivité par rapport aux entreprises à forte productivité. En outre, les réglementations strictes perturbent plus l'allocation des ressources dans des secteurs plus innovants, bien que la nature de l'innovation s'avère être importante.

Classification JEL : D24 ; E23 ; K23 ; L11 ; L51.
Mots-clés : productivité ; régulations : efficacité allocative ; données sur les entreprises.

TABLE OF CONTENTS

Tables

Figures

PUBLIC POLICY AND RESOURCE ALLOCATION: EVIDENCE FROM FIRMS IN OECD COUNTRIES

By Dan Andrews and Federico Cingano[1]

1. Introduction

1. The pace of reallocation of inputs and outputs is generally high in OECD countries: on average, about 15-20% of all firms and more than 20% of jobs are created or destroyed each year (Bartelsman and Doms, 2000; OECD, 2009). While resource reallocation is not always desirable – shifting resources entails costs for firms, workers and governments – continuous reallocation is nonetheless a key feature of well-functioning market economies. Indeed, at any point in time, aggregate productivity will be higher if the most productive firms are also the largest, which requires resources to be reallocated away from less productive to more productive businesses and activities over time.[2] In this context, adjustment frictions preventing the (re)allocation of resources towards their most productive use can significantly affect aggregate outcomes.[3] Given the potential for public policy to affect resource flows, this paper examines how regulations affecting product, labour and credit markets influence labour productivity *via* their effect on the efficiency of resource allocation.

2. The analysis exploits a harmonised firm-level data set covering a cross-section of non-farm business industries in 21 OECD countries around the mid 2000s. Using these data, a decomposition of aggregate productivity for more that 800 country-industry cells is performed to estimate the contribution of "allocative efficiency" (AE) – a measure of the extent to which the more productive firms in an industry have higher market shares. To the extent that patterns of resource reallocation tend to reflect factor adjustments *within*- rather than *between*-sectors, we focus on within-industry developments (see Foster *et al.,* 1996). For a given productivity distribution of firms within an industry, AE measures the gains in industry productivity that can be traced to the fact that firms with higher than average productivity have a greater market share (this metric would equal zero if resources were randomly allocated across firms). The decomposition also involves the first moment of the productivity distribution of firms (*i.e.* the simple – un-weighted – average of firm productivity). These estimates are then related to various measures of product, labour and credit markets policies.

3. The links between policies and the gains or losses in productivity traceable to AE are primarily estimated using a differences-in-differences identification strategy. Specifically, we examine whether a given policy has a disproportionally higher impact on AE in industries that are more heavily exposed to the policy (*e.g.* because they require more intensive amounts of factor reallocation than other industries). This allows us to empirically assess the role of countrywide institutions, while controlling for time invariant country and industry-specific factors.

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1. Corresponding authors are: Dan Andrews (Dan.Andrews@oecd.org) from the OECD Economics Department and Federico Cingano (Federico.Cingano@bancaditalia.it) from the Bank of Italy. The authors would like to thank Peter Gal, Eric Gonnard and Alexandros Ragoussis for their assistance with the ORBIS database, and Andrea Brandolini, Matteo Bugamelli, Jørgen Elmeskov, Giuseppe Nicoletti and Jean-Luc Schneider for their valuable comments. The authors would also like to thank Catherine Chapuis and Irene Sinha for providing statistical and editorial support. The views expressed in this paper are those of the authors and do not necessarily reflect those of the OECD and its member countries, or the Bank of Italy.

2. The key mechanisms through which this process occurs are firm turnover (*i.e.* entry and exit), shifts in resources across incumbent firms and resource reallocation within firms.

3. For example, see Restuccia and Rogerson, (2007); Hsieh and Klenow (2009) and Bartelsman *et al.,* (2011).

4. Looking across a sample of private non-farm sectors, we find evidence that more stringent product and labour market regulation weakens the correspondence between firms' productivity and their market shares. More precisely, we find that higher barriers to firm entry and more stringent bankruptcy legislation tend to disproportionately lower AE in industries characterised by high firm turnover relative to low turnover industries. Similarly, tighter employment protection legislation is found to disproportionately lower the efficiency of employment allocation in high layoff industries. These results are robust to a variety of robustness tests including instrumental variables regressions to control for the possible endogeneity of policies affecting product and labour markets. Indeed, our estimates may actually understate the overall impact of policy-induced distortions on resource allocation to the extent that they do not account for the impacts of regulation on resource flows *between* sectors, which are likely to reinforce the *within*-sector effects that we identify.

5. While restrictions to competition in finance and low financial development do not seem to be related to AE, both are associated with lower un-weighted average industry productivity than otherwise. In other words, the first moment of the productivity distribution of firms tends to be disproportionately lower in industries more dependent on external financing than in countries with low financial development (or high banking regulation). One possible interpretation of these findings is that less effective financial markets may affect aggregate productivity by shifting the distribution of active firms towards lower levels of productivity, rather than by altering the allocation of employment across existing productive units.

5. Additional exercises provide a sensitivity check on some of the policy conclusions and further insight into the possible channels through which policy distortions affect AE. First, in a well functioning economy, aggregate welfare will be maximised if productive resources flow toward innovating firms (see Andrews and de Serres, 2012). Accordingly, we explore the extent to which the impact of policies on AE varies with the innovative capacity of the sector, in order to provide some further evidence on the channels through which policy distortions affect AE. These results suggest that regulations are more disruptive to AE in innovative sectors. However, this result largely applies to innovative environments characterised by Schumpeterian patterns of creative destruction, as opposed to sectors where innovation patterns are more incremental and cumulative.

6. Second, we more directly examine the link between AE and regulation exploiting the availability of industry specific measures of regulation for a sub-sample of service industries. While these results are based on a relatively small number of sectors and are more exposed to the risk of reverse causality, they confirm earlier evidence on the adverse effects of stringent product market regulation on AE; they also suggest that restrictions on foreign direct investment (FDI) reduce the efficiency of resource allocation. One advantage of this estimation approach is that it allows us to infer the average effect of policy-induced distortions on AE, and in turn, the impact of policies on aggregate productivity. Indeed, if interpreted causally, our estimates imply a sizeable direct effect of service regulation on aggregate productivity. For example, a highly regulated country such as Spain would eventually experience a 4% rise in the level of aggregate productivity, if it reduced anti-competitive barriers in the services sector to the lower level of Denmark. Similarly, lowering FDI restrictions from the high levels of Poland to those of Germany could raise aggregate productivity by around 2%.

7. The paper proceeds as follows. The next section places our study in the context of the existing literature and discusses some evidence on resource allocation and growth and links with public policies. Section 3 describes the underlying data used in the analysis and presents some preliminary evidence on the links between AE and public policies. In Section 4, we describe our empirical approach to identify the impact of policies on AE while Section 5 discusses the econometric results. In Section 6, we subject the core results to a battery of robustness tests while Section 7 offers some concluding thoughts.

2. Policy-induced distortions and allocative efficiency: related literature

2.1 Model-based studies on the aggregate costs of resource misallocation

8. A growing literature attempts to link productivity differences between countries or industries to the misallocation of resources across firms within each country or industry. Building on early models of industry dynamics with heterogeneous firms (*e.g.* Hopenhayn, 1992), these studies assume the existence of (firm-specific) distortions implying that marginal product (or the marginal value) of inputs is not equated across productive units.[4] Alternative calibration exercises are then performed to assess the relevance of firm-level deviations from the optimal allocation of resources for aggregate productivity (Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009; Alfaro, Charlton and Kanczuk, 2008; and Bartelsman, Haltiwanger and Scarpetta, 2008).[5]

9. While these papers largely take an agnostic view as to the sources of distortions, another strand of literature more explicitly focuses on the consequences of specific policies. Hopenhayn and Rogerson (1993) quantify the average TFP losses due to the wedges on employment adjustment induced by layoff costs; Barseghyan and DiCecio (2011) demonstrate the negative consequences of entry costs for aggregate outcomes as they reduce the productivity of the marginal entrant through a general equilibrium effect on factor prices. Moscoso-Boedo and Mukoyama (2012) evaluate the effects of both entry regulation and firing costs. Buera *et al.,* (2010) highlight the role of financial frictions and credit underdevelopment in distorting the allocation of capital across heterogeneous production units and also their entry/exit decisions, thereby lowering aggregate and sector-level TFP.

10. Finally, very recent work explicitly focuses on the channel through which product, labour and credit market policies can induce "correlated" distortions, resulting in the reallocation of factors from more to less productive firms. "Size contingent" policies, such as special tax treatments or lower firing costs reserved to Small and Medium Enterprises, are an obvious candidate, as they might imply that relatively high productive firms remain undersized around the threshold determining the cost increase (see Garicano *et al.,* 2010; Braguinsky *et al.,* 2011). However, lower AE can also be an indirect outcome of non-specific policies, such as countrywide barriers to entry. Poschke (2010) shows that barriers to entry reduce the market share of more productive firms relative to low productivity firms in a heterogeneous firm setting in which a low number of competitors reduces the elasticity of substitution between varieties sold in the market.

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4. When considering deviations from the optimal allocation of resources across productive units, a distinction is sometimes made in the literature between "uncorrelated distortions" (which arise when units with the same productivity are not allocated the same amount of resources) and "correlated distortions", which arise when resources are reallocated from more to less productive firms (see Hopenhayn, 2011).

5. Restuccia and Rogerson (2008) calibrate to the US economy a model of firm dynamics featuring "scale distortions" (*i.e.* taxes and subsidies on revenues) and "factor mix distortions" (*i.e.* taxes and subsidies on capital). In turn, they quantify the potential extent of output losses due to misallocation associated with plausible alternative distributions of such distortions. Hsieh and Klenow (2009) fit a similar model to the data to directly estimate the distribution of marginal products in China and India and infer the extent of the underlying distortions by comparing the dispersion of productivity in those countries to that of the US. Similarly, Alfaro, Charlton, and Kanczuk (2008) argue that the distribution of firm size in most developing countries is markedly different from the presumed efficient US distribution. Finally, Bartelsman, Haltiwanger, and Scarpetta (2008) calibrate a model featuring policy-induced distortions and firm participation decisions, to match the patterns of AE (as measured in the present paper) in a relatively small sample of economies. They show that a considerable amount of the cross country variation in AE can be explained by differences in the extent and dispersion of distortions across firms, and increasing this dispersion yields a decline in AE.

2.2 Public policy and the efficiency of resource allocation

11. The available empirical evidence on the link between product, labour or financial market policies and the efficiency of resource allocation across firms is rather limited. Early papers on specific industries indicate that deregulation (*e.g.* Olley and Pakes, 1996) and higher competition (*e.g.* Syverson, 2004) have tended to improve resource reallocation, thereby increasing the correlation between firm size and productivity. More directly related to our analysis, Arnold, Nicoletti and Scarpetta (2011) look at the link between policy restrictions and AE, focusing on the indirect role of regulation in upstream service markets for allocation in downstream industries. They find that the effect is especially relevant for technology intensive downstream industries. We extend this approach to assess the *indirect* impact of a larger amount of potentially relevant policy measures, as well as the direct ("own-industry") effect of regulation for AE in service industries.

12. Given that cross-country differences in firm performance tend to be largest in high technology and emerging sectors – where the imperative for experimentation and the intensive use of intangible assets use is likely to be greatest (Bartelsman *et al.,* 2008) – we draw on the emerging literature on the links between innovation, resource allocation and public policy. Andrews and de Serres (2012) explore these ideas from the perspective of an intangible-based start-up firm, where profitability depends not only on technological success but crucially on the ability to leverage the fixed cost of investments in intangibles – which are subject to strong returns to scale – through increases in the scale of production (Bartelsman and Groot, 2004). The ability to rapidly reallocate tangible resources, such as labour and physical capital, in order to capture the value of the investment before imitation by followers is therefore crucial in such sectors. Likewise, in the event of technological failure, it is vital that firms in innovative sectors can rapidly scale down operations to facilitate exit and thereby release resources that can be used by other firms.[6]

13. Innovation is not a uniform concept, however, and it is likely that reallocation needs will vary with the nature of innovation. The literature distinguishes between radical innovations, typical of young entrepreneurial firms, and incremental innovations that build on but do not change the underlying characteristics of existing technologies, diffused among large incumbent firms (Saint-Paul 1997, 2002; Bartelsman *et al.,* 2008).[7] Reallocation is supposed to be more important for firms pursuing radical innovations – which are subject to higher uncertainty – and thus placing an option value on flexibility. Because they do not normally render existing factors of production obsolete, incremental innovations are less sensitive to rigidities in the reallocation process.[8] Accordingly, we also examine whether regulations are more disruptive to allocative efficiency in more innovative – particularly Schumpeterian – sectors, where reallocation is likely to be more intense.

14. With this background in mind, we propose a comprehensive statistical analysis to assess the strength of the link between the efficiency of resource allocation and policies or institutions that represent potentially relevant sources of distortion. Specifically, we focus on:

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6. This process is also necessary to provide the entrepreneur with sufficient space in order to experiment with alternate ideas. Indeed, this is consistent with anecdotal evidence that suggests that the most successful entrepreneurs have experienced some form of business failure in the past.

7. Models that focus on young entrepreneurial firms envisage a Schumpeterian world where technological opportunities (*i.e.* the returns to innovation) are high and knowledge is not very cumulative. In turn, this favours new entry and a high degree of market turbulence (*i.e.* creative destruction; see Breschi *et al.,* 2000), implying a considerable scope for reallocation.

8. By contrast, radical innovations are more likely to be accommodated through reallocation to the extent that they render the human capital of existing workers obsolete (Aghion and Howitt, 1998).

- Product market regulations: if regulations restrict the extent of competition through higher barriers to entry, there is likely to be less pressure on incumbent firms to allocate resources efficiently. Regulations affecting product markets may also raise the cost of reallocating resources through land-use regulations and overly cumbersome permitting processes, which may raise the costs of expanding production (*e.g.* opening new factories etc).

- Bankruptcy regimes: by increasing the costs associated with firm exit, more stringent bankruptcy legislation may result in valuable resources being trapped in inefficient firms, thereby reducing AE.[9] On the other hand, tighter bankruptcy laws imply a stronger guarantee for creditors, which may improve the supply of credit, thereby implying a theoretically ambiguous impact of bankruptcy laws on AE.

- Employment protection legislation (EPL): more stringent EPL may hinder the reallocation of workers across firms, thereby implying lower AE.

- Barriers to competition in financial markets (or, more broadly, an insufficient level of financial development): such barriers may hamper the efficient allocation of capital across firms.

15. As in Bartelsman *et al.,* (2008), our index of AE is a measure of the correspondence between firm size and labour productivity, which we compute for a large number of countries and industries. More specifically we focus on a decomposition of average productivity in a country-industry cell into: (i) the simple average of firm-level productivity (un-weighted productivity) and (ii) and the covariance between productivity and size (allocative efficiency).[10] For a given distribution of firms, then, AE measures the contribution to aggregate productivity that can be traced to the observed allocation of resources (labour) across productive units.[11]

3. Data

16. This section discusses the firm level data underlying the analysis and the dependent variable used throughout the paper – the index of allocative efficiency. In turn, an aggregate index of allocative efficiency is related to some country-level policy variables of interest, to provide some preliminary evidence on the links between policies and the efficiency of resource allocation.

3.1 Firm level data

17. Our analysis exploits cross-country firm-level data from ORBIS, a commercial database provided to the OECD by Bureau Van Dijk which contains administrative data on tens of millions of firms worldwide. The financial and balance sheet information in ORBIS is initially collected by local Chambers

9. This effect will be reinforced if tighter bankruptcy laws hamper entrepreneurship (by posing a greater burden on firms in the event of failure) and result in less firm entry than otherwise, therefore implying less competitive pressure on incumbents.

10. Such decomposition was first applied to the case of US telecommunications by Olley and Pakes (1996).

11. Bartelsman, Haltiwanger, and Scarpetta (2008) use a harmonized dataset of firm level data to show that, unlike most models of heterogeneous firms would predict, there is substantial dispersion in the distribution of labour productivity within narrow defined industries. They rationalize this finding by introducing a fixed cost of production (overhead labour) common to all firms irrespective of their efficiency, which implies that productivity and average product of labour are proportional.

of Commerce and in turn, is relayed to Bureau Van Dijk through some 40 different information providers (see Pinto Ribeiro *et al.*, 2010).[12]

18. While representing a potentially useful tool to analyse the cross-country patterns in productivity, ORBIS has a number of drawbacks. The main issue relates to representativeness, with firms in certain industries and many smaller and younger firms typically under-represented. Accordingly, the ORBIS sample of firms was aligned with the distribution of the firm population as reflected in the OECD Structural Demographic Business Statistics (SDBS), which is based on confidential national business registers. Following the procedure first applied in Schwellnus and Arnold (2009) and refined in Gal (2012), re-sampling weights – based on the number of employees in each SDBS industry-size class cell – are applied, which essentially "scales-up" the number of ORBIS observations in each cell so that they match those observed in the SDBS.[13] To further address measurement concerns, we focus solely on a turnover-based measure of labour productivity as opposed to total factor productivity, since not all firms report value added and capital and this problem tends to vary across countries (the use of a turnover-based measure of labour productivity does create some interpretation issues, which we return to in Sections 4.3 and 6.2 below). We also exclude firms with one employee as well as firms in the top and bottom 1% of the labour productivity distribution from the sample – a relatively common data cleaning technique in the literature. Finally, in ORBIS it is not possible to accurately distinguish entry into the market from entry into the sample and exit from the market from exit from the sample. This prevents us from undertaking a dynamic decomposition of industry productivity growth that accounts for the contribution of entry and exit, and thus we focus on a decomposition of the level of labour productivity at a single point in time.

19. For the purposes of the study, we focus on firms in the non-farm business sector – that is, industries 15-74 according to NACE Rev 1.1, excluding mining and financial intermediation – in 21 OECD countries for the year 2005 (data for the United States are also provided but this country is excluded from much of the analysis; see Section 3).[14] Data on labour productivity and employment are available from some 1.34 million firm-level observations, corresponding to 64,000 observations on average per country. From these firm-level data, indicators of AE and productivity at the 2-digit sectoral level are constructed, resulting in 834 country-industry observations or around 40 sectoral observations per country. See Table A1 in Appendix A for a summary of the firm level data that underpins the analysis in the paper.

12. See Pinto Ribeiro *et al.,* (2010) for a detailed description of the database and of the cleaning and checking undertaken by the OECD in order to increase data quality and comparability (see also Ragoussis and Gonnard, 2012).

13. For example, if SDBS employment is 30% higher than ORBIS employment in a given cell, then the 30% "extra" employment is obtained by drawing firms randomly from the pool of ORBIS firms, such that the "extra" firms will make up for the missing 30%. While this procedure is effective at aligning the industry-size structure of ORBIS to that of the population, it assumes that the firms in ORBIS within each specific cell are representative of the true population (see Gal 2012) – an assumption that may be problematic if the nature of selection varies across countries. We thank Peter Gal for his assistance with this procedure.

14. Countries included are Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Korea, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States. Financial intermediation is excluded due to lack of data. Mining and quarrying is excluded due to the low number of firms in these sectors in many countries. For more details, including a list of the industries covered, see Appendix A.

3.2 Allocative efficiency estimates

20. To compute allocative efficiency, we exploit the cross sectional decomposition of industry-level productivity developed by Olley and Pakes (1996). Defining productivity of industry *j* (P_{jt}) as the weighted average of firm-level productivity (P_{it}), yields the following decomposition:

$$P_{jt} = \sum_{i \in J} \theta_{it} P_{it} = \frac{1}{N} \sum_{i \in J} P_{it} + \sum_{i \in J} \left(\theta_{it} - \overline{\theta_{jt}}\right)\left(P_{it} - \overline{P_{jt}}\right) \qquad (1)$$

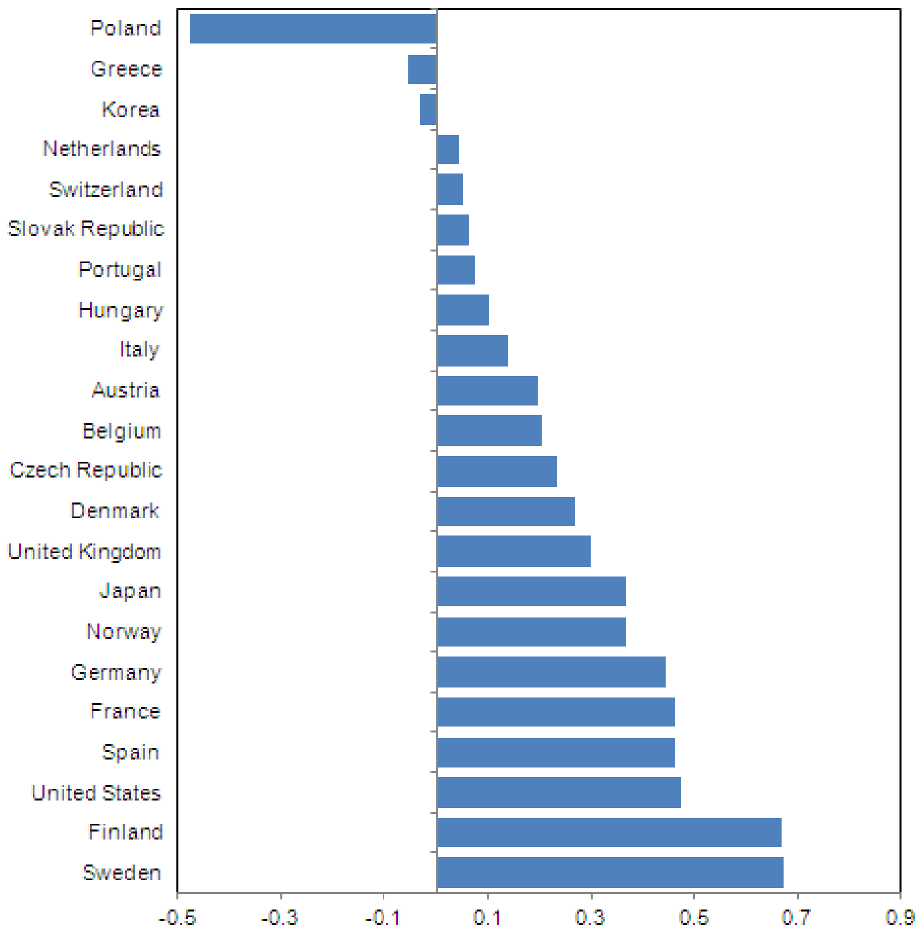
where N is the number of firms *i* in industry *J*, θ_{it} is a measure of the market share of each firm and $\overline{P_j}$ and $\overline{\theta_j}$ represent simple averages at the industry level. Hence, industry productivity can be written as the un-weighted average of firm-level productivity plus a cross term that reflects the extent to which firms with higher efficiency have a larger market share. This second term is the AE measure used in our analysis. We implement (1) following Bartelsman *et al.,* (2008) with log labour productivity as a measure of P_{it} and the firm's share of industry employment for θ_{it}.[15] For any given productivity distribution of firms in an industry, then, AE can be interpreted as the (log points) increase in industry productivity that can be traced to the actual allocation of employment across firms, relative to a baseline scenario in which employment is allocated randomly.

21. Figure 1 shows the distribution of our AE index across countries for the manufacturing sector in 2005. The co-variation between firms productivity and employment shares is positive everywhere, except Poland and Greece. For example, we find that AE is around 0.5 in the United States; that is, labour productivity in the US manufacturing industry is around 50 log points higher than it would be if employment were allocated randomly. Our results also suggest that AE is higher in the United States than in many Continental European countries. Both findings are similar to those obtained in the smaller but higher quality sample used by Bartelsman *et al.,* (2008) based on national business registers.

15. Bartelsman *et al.,* (2008) implement (1) exploiting data that is representative of the population of firms, in a subset of the countries available in ORBIS. One advantage of following the same approach is that we can qualitatively assess the reliability of our results by comparing them with the estimates published in Bartelsman *et al.,* (2008).

Figure 1. Contribution of the allocation of employment across firms to manufacturing labour productivity

Log points; selected OECD Countries in 2005



Notes: The figure reports the estimated values of allocative efficiency, as obtained applying decomposition (1). Positive values indicate that the actual allocation of employment boosts labour productivity (*e.g.* by around 50% in the US) compared to a situation where employment is allocated randomly across firms. See Section 3.1 for data sources.

3.3 Preliminary evidence on the links between policies and allocative efficiency

22. For illustrative purposes, in Figure 2 we relate the index of AE to various framework policy indicators, observed at the country level. Throughout the paper, we mainly focus on policy indicators provided by the OECD, such as those measuring anti-competitive product market regulations (OECD PMR and sub-components), Employment Protection (OECD EPL)[16] or Banking Regulation (de Serres *et al.,* 2006). We also utilise an indicator of the stringency of bankruptcy arrangements – measured as the time required to close a business – sourced from the World Bank.

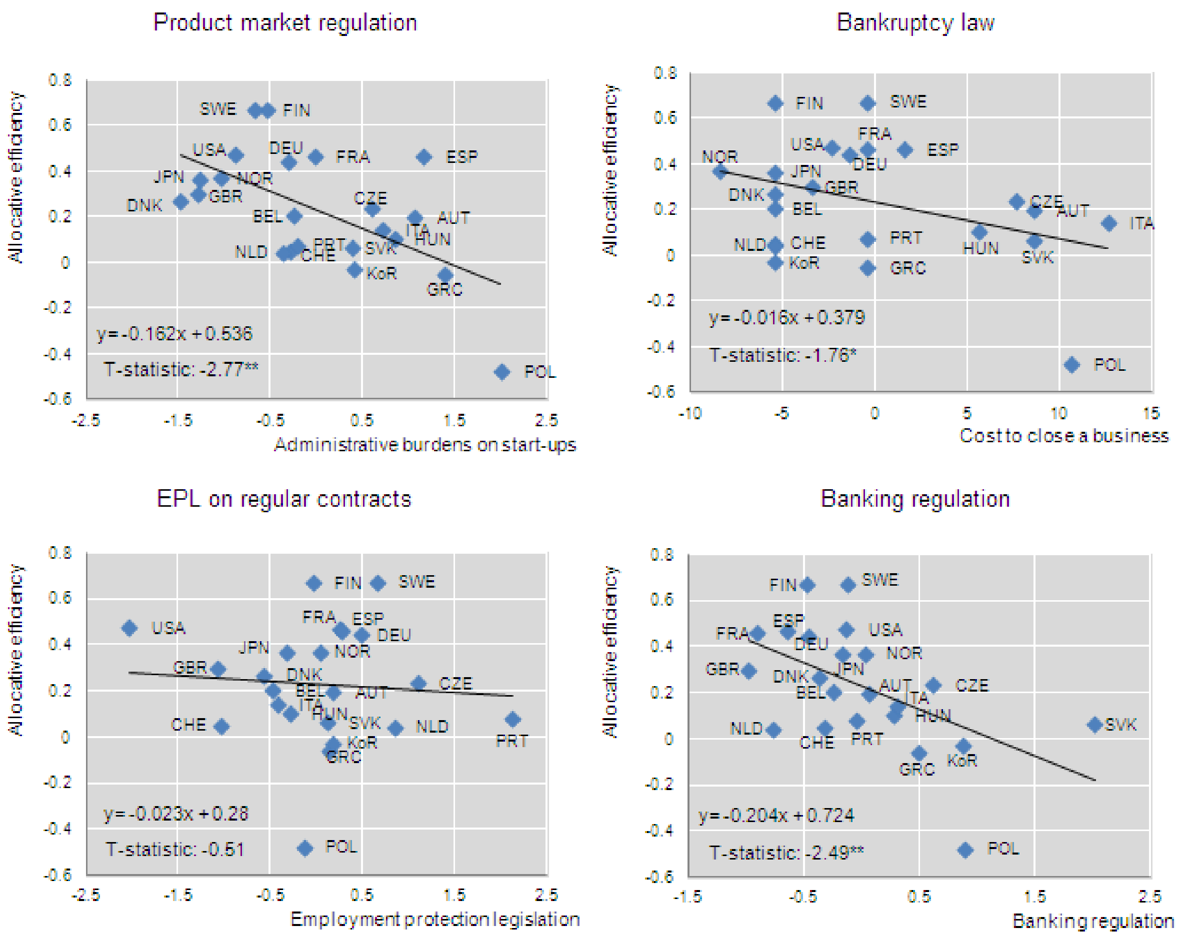
23. Countries with high barriers to entry and more stringent bankruptcy arrangements are characterised by lower covariance between firm size and their productivity (*i.e.* lower AE). The same is

16. The data and underlying documentation are publicly available at www.oecd.org/eco/pmr, and www.oecd.org/employment/protection, respectively.

true with respect to the stringency of Banking Regulation, while Employment Protection Legislation appears unrelated to AE.

24. Cross country correlations are clearly only suggestive of the possible link between policy induced distortions and the patterns of AE, due to the likely biases induced by observed and unobserved country-level confounding factors and reverse causality. The next section describes how these issues are tackled in the empirical analysis.

Figure 2. Allocative efficiency and framework policies



Notes: The chart shows cross-country correlations between allocative efficiency and available indexes of PMR and Bankruptcy Law, EPL and Banking Regulation (see Table 1 for a description of variables definition and sources).

4. Methodology and approach

25. To account for the potential sources of spurious correlation between country-level policies and economic outcomes, all our estimates are conditioned on country specific fixed-effects. Whenever plausible instruments are available, we also report 2SLS estimates. To gain within country variability in the policy variables of interest, we will exploit cross-industry heterogeneity in exposure to a given policy (*e.g.* regulations affecting entry costs). Identification will be obtained comparing the differential AE between highly exposed industries and marginally exposed industries in countries with different levels of regulation. In a complementary exercise, we more directly examine the link between AE and regulation exploiting the availability of industry specific measures of regulation for a sub-sample of service

industries. In this case, identification will be driven by within country variation in service-specific policies and AE.

4.1 Differences-in-differences estimation to identify the impact of country-level policies

26. In the absence of industry-specific policy indicators covering all industries in our sample, we first infer the relevance of policy-induced distortions by exploiting cross-industry cross-country data and a differences-in-differences specification accounting for country-level time invariant unobserved characteristics. This approach, popularised by Rajan and Zingales (1998) is based on the assumption that there exist industries that have 'naturally' high exposure to a given policy (*i.e.* the treatment group), and such industries – to the extent that the policy is relevant to the outcome of interest – should be disproportionally more affected than other industries (*i.e.* the control group). To see this more clearly, consider the case of entry regulation. In this case, the baseline assumption is that there exist industries that have 'naturally' high entry barriers (possibly due to capital intensiveness of production or technological complexity), and industries where these barriers are almost negligible, and this pattern does not vary across countries. In this case, the marginal impact of an increase in the administrative cost of entry (the treatment) on AE could be expected to be smaller in industries where 'natural' industry entry barriers are very high, than in industries where entry barriers are low. Under the additional identifying assumption that AE is only affected by entry regulations via the reallocation channel, this constitutes evidence that entry regulations affect resource allocation.[17] It is important to note, however, that this approach precludes inferences about the average effect of a policy on AE, and instead yields a differential impact.

27. If the presence of technological characteristics (*e.g.* natural entry barriers) affect industry exposure to regulation (in terms of its impact on AE), we would expect to see this effect empirically in the interaction of industry exposure and regulation, with regulation having a significant effect only in the case of strict regulation in highly exposed industries. Our regressions will thus take the form:

$$AE_{j,c} = \beta\left(Exp_j * \mathrm{Reg}_c\right) + \mu_j + \mu_c + \varepsilon_{jc} \qquad (2)$$

where $AE_{j,c}$ measures allocative efficiency (*i.e.* the productivity gains traceable to the allocation of employment shares across firms) at the country-industry level, Reg_c measures the stringency of product, labour or credit market policies in country c and Exp_j is an industry-level index aiming at capturing differences in the relevance of *Reg* for firms operating in different sectors. Interacting country-level policy variables with industry variables makes it possible to condition our estimates on country and industry fixed-effects, respectively μ_c and μ_j. Hence, the differences-in-differences coefficient β measures whether the easing regulation would boost AE disproportionately more in highly exposed industries (those for which the policy is more binding) than in less exposed industries.

28. Industry-level indexes of exposure are taken from the large literature exploiting the same framework to infer the relevance of country-level policies on a number of economic outcomes.[18] Empirical studies on the relevance of PMR (*e.g.* Fisman and Sarria Allende, 2010; Klapper *et al*., 2006) use firm

17. In other words, we to assume that other systematic differences in AE between exposed and non-exposed industries are similar across countries and do not depend on regulation. In our framework, these differences are captured by industry fixed effects.

18. Following Rajan and Zingales (1998) study of the finance-growth nexus, this approach has been used in a large amount of works on growth and productivity, on the industry structure and the patterns of comparative advantage. Aside for the huge literature on financial development, other papers have employed this approach to analyse the impact of entry barriers (Klapper *et al.,* 2006; Fisman Sarria Allende, 2010; Ciccone Papaionnou, 2007; Barone and Cingano, 2012), EPL (Micco Pages, 2006; Bassanini *et al.,* 2009) and property rights and contract enforcement (Claessens Leaven, 2003; Nunn, 2007; Levchenko, 2007).

turnover as index of industry exposure to entry barriers, since industries with high natural entry barriers will likely exhibit relatively low turnover rates.[19] Similarly, studies examining the role of EPL use measures of worker reallocation (job turnover or layoff rates, see Micco Pages, 2006; Bassanini *et al.,* 2009) in a benchmark country (*e.g.* the US) to identify industries that are more likely to be affected by relatively stringent employment protection.

29. Within the same estimation framework, we explore whether the impact of policies on resource allocation varies with one potential indicator of the innovative capacity of a sector – patenting intensity. Furthermore, to test the idea that stringent regulations are likely to be more disruptive to AE in Schumpeterian environments where knowledge is not very cumulative, the model is re-estimated within two sub-samples based on the distribution of firm turnover. Sectors in the top half of the distribution of US firm turnover are assumed to be subject to the Schumpeterian patterns of creative destruction, while the sectors in the bottom half of the distribution are assumed to be characterised by more cumulative forces. As a robustness test, we re-estimate the model in a sample of sectors where the cumulativeness of knowledge is low and sectors whether cumulativeness is higher.[20]

30. Industry-level exposure indexes are generally computed from US data to the extent that US is generally perceived to be a low regulation (*i.e.* "frictionless") country. Accordingly, the United States is excluded from the analysis. See Table 1 for details on the country level policy variables of interest and the corresponding industry-level exposure variables used in the difference in differences estimator (descriptive statistics of these variables are contained in Table A2 of Appendix A). We also experimented with a number of other policy variables but these produced inconclusive results (see Section 6.3).

19. Dunne and Roberts (1991) report high inter-industry correlations between entry and exit figures, justifying the characterization of industries with high natural entry barriers as those exhibiting relatively low turnover rates.

20. Peneder (2010) uses data from the Community Innovation Surveys to gauge the extent to which knowledge is cumulative in various sectors. A creative firm will operate under a highly cumulative regime if it reports that internal sources of knowledge are more, or at least as important as external sources, while cumulativeness will be low when external sources of knowledge are more important. This indicator takes three values and the broad conclusions in the empirical analysis are robust to re-estimating the model on samples for low, medium and high values of cumulativeness.

Table 1. Structure of the differences-in-differences estimator and data sources

Variable	Country-level variable	Industry-level exposure variable
BTE_c X $turnover_j$	Administrative Burdens on Start-Ups sub-component of the Barriers to Entrepreneurship indicator in the OECD Product Market Regulation (PMR) index. Data from 2003.	Firm turnover rate (defined as the entry rate + exit rate) at the industry level in the United States. Sourced from Bartelsman *et al.,* (2008).
$BTE2_c$ X $turnover_j$	Average of the Administrative Burdens on Start-Ups and Barriers to Competition sub-components of the Barriers to Entrepreneurship indicator in the OECD Product Market Regulation (PMR) index. Data from 2003.	Firm turnover rate at the industry level in the United States (see above).
$Bankrupty_c$ X $turnover_j$	The stringency of bankruptcy rules is measured by an indicator of the cost to close a business, sourced from the World Bank. Data from 2004.	Firm turnover rate at the industry level in the United States (see above).
$EPLR_c$ X $layoff_j$	EPLR is the OECD Employment Protection Legislation (EPL) sub-index of restrictions on individual dismissal of workers with regular contracts. Data from 2003.	Layoff rates (defined as the percentage ratio of annual layoffs to total employment) at the industry level in the United States. Sourced from Bassanini *et al.,* (2009).
$EPLO_c$ X $turn_j$	The overall OECD EPL index, which takes into account EPLR, restrictions on collective dismissals and the regulation of temporary contracts. Data from 2003.	Firm turnover rate at the industry level in the United States (see above).
$FinDevl_c$ X $ExtFinDep_j$	Financial development is measured as the log of the ratio of private credit to GDP and is sourced from the World Bank. Data from 2003.	The variable measuring industries' dependence on external finance is computed from information contained in the Thomson Financial Worldscope database for US listed firms with less than 1000 employees. These estimates are sourced from de Serres *et al.,* (2006) and following Rajan and Zingales (1998), a firm's dependence on external finance is defined as its capital expenditure minus internal funds (cash flow from operations) divided by capital expenditure.
$BankReg_c$ X $ExtFinDep_j$	Index of banking regulation sourced from De Serres *et al.,* (2006). The index is increasing in the degree of regulation and takes into account regulatory barriers on domestic and foreign bank entry, restrictions on banking activities (*i.e.* controls on the types of activity that bank can engage into) and the extent of government ownership (*i.e.* the impact of state control on the level playing field). Data from 2003.	External finance dependency at the industry level in the United States (see above).
BTE_c X $patenting_j$ $Bankrupty_c$ X $patenting_j$ $EPLR_c$ X $patenting_j$ $BankReg_c$ X $patenting_j$	Country-level policies as outlined above.	Patenting intensity is measured as the log of ratio of the number of patent applications to the number of firms in each sector in 2003, based on matched data from OECD ORBIS-PATSTAT.[21]

4.2 Exploiting sectoral-level variation in policies

31. To test the robustness of our some of our policy conclusions based on the differences-in-difference estimates, we utilise sectoral-level variation in PMR and FDI restrictions. One advantage of this estimation approach is that it allows us to infer the average effect of policies on AE, but as explained in Section 4.3, the resulting estimates may be more prone to bias arising from endogeneity and reverse causality than the differences-in-differences estimates. The influence of product market regulations that

21. The results are robust to using the number of patent applications. A key advantage of using patenting intensity is that it is available for a much wider range of sectors, than alternative proxies such as R&D intensity and skills.

restrict entry and competition on the contribution of AE to productivity is explored in a subset of seven service industries for which OECD indices of anti-competitive restrictions are available. These measure the extent of barriers to entry and of conduct regulation (such as restrictions on the legal form of businesses, bans to advertising etc.).[22] We estimate the following cross-sectional regression:

$$AE_{s,c} = \theta \mathrm{Reg}_{s,c} + \mu_c + \mu_s + \varepsilon_{s,c} \qquad (3)$$

where $AE_{s,c}$ represents allocative efficiency according to decomposition (1); μ_s and μ_c capture industry- and country fixed-effects, respectively, and $Reg_{s,c}$ measures the level of anti-competitive restrictions in Energy, Retail trade, Air and Land Transportation, Post and telecommunication, and Professional services. Unless otherwise noted, $Reg_{s,c}$ is a simple average of the barriers to entry, market conduct and price control sub-components of the OECD sectoral regulation index, and excludes public ownership. The estimated impact of anti-competitive regulation on AE in (3) exploits cross-industry variation within countries (and accounts for common industry-specific factors).

32. For the same industries, the OECD also collects specific measures of statutory restrictions on foreign direct investment (FDI Regulatory Restrictiveness Index). Accordingly, we extend the above analysis to test the influence of barriers to foreign competition through FDI in domestic service markets on AE.[23]

33. Within the same estimation framework, we also explore whether there is any evidence of policy complementarities between product market regulation in services and other framework policies. To test this idea, we augment specification (3) with the interaction terms between $\mathrm{Reg}_{s,c}$ and country-level policy variables affecting product, labour and credit markets.

4.3 Identification concerns

34. While the empirical approaches illustrated above allow to absorb country-specific time invariant observable and unobservable characteristics that might induce spurious correlation, endogeneity remains a concern. These concerns may be stronger in the case of equation (3), since service specific regulation might be a consequence, not a cause of the efficiency of resource allocation (*e.g.* reverse causality). This would be the case, for example if, within a country, service industries with low efficiency (that is, sectors where large firms are inefficient, on average) were characterised by high policy-induced entry barriers for political economy reasons (*i.e.* inefficient firms lobby for industry protection measures). Unfortunately, instruments for industry-level regulation across countries are not available.

35. Endogeneity and reverse causality are less of a concern in the context of specification (2), due to the differences-in-differences specification and the fact that the policy variables of interest do not vary at the country-industry level.[24] One could still argue, however, that inefficient incumbent firms in sectors

22. Specifically, we focus on Energy (nace 40), Wholesale and retail trade (50-52), Land and air transport (60 and 62), Post and telecommunication (64) and Professional services (74).

23. The OECD FDI Regulatory Restrictiveness Index (see Golub, 2003; Nicoletti *et al.*, 2003; Koyama and Golub, 2006), measures statutory restrictions on FDI in four main areas: foreign equity limitations; screening or approval mechanisms; restrictions on the employment of foreigners as key personnel and operational restrictions (e.g. restrictions on branching and on capital repatriation or on land ownership). The FDI index has been shown to be a good predictor of countries' inward FDI performance, and is available at the country level and for several mainly non-manufacturing sectors.

24. Nevertheless, Ciccone and Papaioannou (2010) caution about the potential bias associated with identifying off – in the context of specification (2) – 'natural' industry exposure to the policies using data from a benchmark country (e.g. the United States). They show that, if US industry exposure differs from natural exposure by an idiosyncratic component, then the approach might yield to biased estimates. The direction of such "benchmarking bias" is a priori ambiguous if

with higher natural turnover could be more vocal in lobbying for protection in the form of higher policy-induced entry costs than firms in sectors with lower natural turnover. As in the previous case, this would imply that our estimates would overstate the extent to which the negative impact of barriers to entry on AE in high turnover sectors exceeds the effect on low turnover ones. To test the robustness of our core estimates to the endogeneity critique, we re-estimate equation (2) using an instrumental variables approach. In order to address this issue, we need to find instruments that can predict the level of a given policy variable without affecting directly the difference in AE between industries which have naturally higher rates of exposure to the policy of interest, and other industries. Based on the existing literature, we were able to identify a few potential – albeit crude – instruments for two policy variables of interest: barriers to entry and EPL.

36. Following Barseghyan (2008), we use an indicator of legal origin, the fraction of the population speaking a major European language and geographic latitude and to instrument barriers to entry. Legal origin (*i.e.* a classification of countries based on the origin of their commercial laws) is shown to have a high explanatory power of governments proclivity to intervene in the economy (see La Porta *et al.,* 1999). For example, the common law tradition which started in the 17th century, reflects the English Parliament and aristocracy intent to limit the power of the sovereign, and therefore put emphasis on restraining the government and on protecting the individual against the government; a civil legal tradition, on the other hand, reflects the intent to build institutions to further the power of the State. The other two variables, taken from Hall and Jones (1999), more broadly discriminate between countries with different institutional quality based on past influence by leading European countries.

37. To generate exogenous variation in EPL, we follow Bassanini *et al.,* (2009) who use indicators regarding whether a country has a common law as opposed to a civil law system, and a refinement of this dichotomy including information on civil codes. According to Bassanini *et al.,* (2009), countries with common law systems tend to be attached to the principle of freedom of contracts and have relatively few regulatory provisions concerning labour contracts, while most civil law systems, and especially those with a single codified civil code, tend to regulate more. The underlying assumption is that any economic mechanism inducing an effect of legal systems on AE that varies across industries as a function of layoff propensity would operate through their effect on dismissal regulations.

38. In addition to the instrumental variable estimates outlined above, Section 6 contains a series of robustness checks to assess the sensitivity of our baseline estimates to the specification and sample used, and to measurement issues more broadly. One specific concern arises from our use of turnover – as opposed to value added – to estimate labour productivity. While this approach is a relatively common in the literature and reflects data constraints (see Section 3.1), it may be problematic if there is a relationship between outsourcing behaviour and our policy variables, such as EPL.[25] In fact, if outsourcing simultaneously inflates turnover based labour productivity (relative to a value-added based measure) and reduces firm size (in terms of measured employment), the observed correlation between productivity and size – that is, AE is likely to decline.[26] This will bias downwards our coefficient on, say, EPL if (within countries) firms with more intense reallocation needs are more prone to outsourcing (*e.g.* to exploit labour market flexibility in other countries). To verify that our findings are not driven by outsourcing behaviour,

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the idiosyncratic component depends on regulation itself. One potential method to correct for this problem involves recovering a "frictionless" measure of industry exposure from an auxiliary regression using data on exposure to the policy across countries and industries. Unfortunately, our industry measures of exposure are rarely available for multiple countries, due to the low quality or absence of the underlying necessary data.

25. We thank Jørgen Elmeskov for drawing our attention to this issue.

26. Outsourcing will likely inflate turnover based measures of labour productivity relative to value added based measures since it implies a substitution of primary factors of production, including labour, for intermediate inputs (OECD, 2001).

we re-estimated our model using a measure of AE based on value-added labour productivity (see Section 6.2), and obtained similar results.

5. Econometric results

39. This section discusses the results of the econometric analysis outlined in Section 4. We begin by discussing the core differences-in-differences results based on equation (2), which aims to assess the impact of the various public policy variables listed in Table 1 on AE. Section 5.1 also explores the extent to which the impact of policies on AE varies with the innovative capacity of the sector (equation 4), in order to provide some further evidence on the channels through which policy distortions affect AE. This analysis is based on 834 country-industry cells for the non-farm business sector. In turn, section 5.2 explores the impact of sector-specific regulations on AE in a smaller sub-set of services sectors (equation 3), which provides a useful sensitivity check for our core differences-in-differences estimates.

5.1 The impact of policies on allocative efficiency and productivity

40. Barriers in the product market (entry and exit) are negatively related to AE (columns 1 to 3 of Table 2; panel A). Results in columns 1 and 2 focus on economy-wide barriers to entry.[27] The estimated negative coefficients indicate that lowering entry regulation would increase AE disproportionately more in highly exposed (*i.e.* high firm turnover) industries. To evaluate the relevance of the estimated effects, consider the difference in AE between a high turnover industry (such as Retail) and a low turnover industry (such as Rubber and plastic products). If we take the estimates from Table 2 as causal (causality will be discussed in more detail in Section 6), then according to the estimates from column 1, reducing Administrative burdens on start-ups from the high level of Italy to the lower level of Finland implies a gain in the above differential of more than 5 percentage points. Similar results are obtained focusing on exit policies (*i.e.* the effectiveness of bankruptcy regulation). Our estimate in column 3 implies that reducing the cost to close a business from the high levels of Hungary or Spain to those of Denmark or the Netherlands would improve the differential AE in high relative to low turnover industries by 4.8 percentage points.

41. Employment protection legislation also makes the reallocation of resources across heterogeneous firms less efficiency enhancing (columns 4 and 5). To appreciate the relevance of the estimated effect, consider the difference in AE between a high layoff industry (as machinery and equipment) and a low layoff industry (as Chemicals). Our estimates imply that reducing EPL from the high levels of Spain to the lower level of Japan implies a gain in the above differential in excess of 4.5 percentage points. To the extent that such policy-induced distortions are also likely to hinder the reallocation of resources across sectors, the above estimates of the impact of policies on AE may represent a lower bound, and the overall impact on resource allocation could be somewhat larger.

42. By contrast, the interaction of banking regulation (respectively, financial development) with external finance dependence is negatively (respectively, positively) correlated with AE. However, neither coefficient is statistically significant.

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27. The only difference between the two variables is that in column 1 regulation is measured by the OECD sub-indicator of "Administrative burdens on start-ups", while in column 2 it is the average of the OECD sub-indicators of "Administrative burdens on start-ups" and "Barriers to competition"

Table 2. Public policies and allocative efficiency across OECD countries and industries

Panel A: Dependent variable - allocative efficiency

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
BTE X turnover	-0.008** (0.003)							-0.009** (0.004)	-0.007** (0.003)
BTE2 X turnover		-0.015** (0.006)							
Bankruptcy X turnover			-0.001* (0.000)					0.000 (0.000)	-0.000 (0.000)
EPLR X layoff				-0.052*** (0.015)				-0.051*** (0.015)	-0.052*** (0.015)
EPLO X turnover					-0.017*** (0.005)				
FinDev X ExtFinDep						0.015 (0.020)		0.014 (0.019)	
BankReg X ExtFinDep							-0.009 (0.015)		-0.010 (0.014)
Observations	834	834	834	834	834	791	828	791	828
R-squared	0.589	0.590	0.586	0.599	0.597	0.590	0.585	0.609	0.604
AdjR2	0.556	0.557	0.553	0.567	0.565	0.556	0.553	0.576	0.572
F	5.203	5.256	5.165	5.245	5.062	6.821	5.250	7.014	5.390

Panel B: Dependent variable - unweighted productivity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
BTE X turnover	-0.000 (0.003)							-0.000 (0.004)	0.002 (0.005)
BTE2 X turnover		0.006 (0.006)							
Bankruptcy X turnover			-0.000 (0.000)					-0.000 (0.001)	-0.000 (0.001)
EPLR X layoff				0.002 (0.027)				0.001 (0.028)	0.000 (0.027)
EPLO X turnover					0.003 (0.005)				
FinDev X ExtFinDep						0.045** (0.019)		0.045** (0.019)	
BankReg X ExtFinDep							-0.025* (0.014)		-0.025* (0.013)
Observations	834	834	834	834	834	791	828	791	828
R-squared	0.885	0.886	0.885	0.885	0.885	0.894	0.887	0.894	0.887
AdjR2	0.876	0.876	0.876	0.876	0.876	0.885	0.878	0.885	0.878
F	27.50	27.31	27.55	27.39	27.14	29.22	28.31	27.26	26.42

Notes: In panel A, the dependent variable is allocative efficiency as defined (1), computed in 2005. In Panel B, the dependent variable is unweighted productivity as defined (1), computed in 2005. See Table 1 for definitions and sources of the explanatory interaction variables. All specifications include country and industry fixed effects. Observations are weighted by the number of firms used to compute the productivity decomposition in (1). Robust standard errors in parentheses; *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

43. Columns 8 and 9 show that the results are largely unaffected when all variables are included simultaneously. Indeed, given a reduction in the entry barriers and EPL, AE rises disproportionately more in those industries that are more likely to be exposed to the policy.

44. The extent to which the negative association of regulation with AE has a bearing for industry productivity depends on whether regulation has an offsetting effect on the un-weighted productivity term in the OP decomposition (1). Accordingly, we run the same specifications replacing AE by un-weighted industry productivity. The results, which are reported in Panel B of Table 2, show no significant effects of

PMR, Bankruptcy legislation or EPL on the un-weighted productivity term, suggesting that the estimated gains to AE from easing the regulatory burden are indeed reflected in higher productivity.

45. On the other hand, less stringent banking regulation (and greater financial development) are associated with higher un-weighted average productivity (see columns 6-9, Table 2, Panel B). Thus, even if they do not imply significant differences in employment allocation across units, well-functioning financing mechanisms would seem to raise productivity by lowering the proportion of low productivity firms relative to high productivity firms in the market.

46. In Table 3, we explore whether the impact of regulations on AE varies with the innovative capacity of the sectors (the corresponding results for un-weighted productivity are contained in Table B2). For each policy, the initial (odd-numbered) column shows the interaction with patenting intensity, while in the even-numbered column, the policy interaction used in the earlier analysis is also included. Overall, there is little evidence that regulations are more disruptive to resource allocation in more innovative sectors, as the estimates are often not significant. However, in sectors with higher rates of patenting intensity, higher administrative burdens on start-up firms and more stringent bankruptcy regimes are associated with lower AE.

Table 3. Public policies and allocative efficiency in innovative sectors (1)

Full sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EPLR X patenting	-0.007 (0.008)	-0.008 (0.007)						
EPLR X layoff		-0.053*** (0.016)						
BTE X patenting			-0.008 (0.008)	-0.016* (0.008)				
BTE X turnover				-0.012*** (0.004)				
Bankruptcy X patenting					-0.001 (0.001)	-0.002** (0.001)		
Bankruptcy X turnover						-0.001*** (0.000)		
BankReg X patenting							-0.013 (0.009)	-0.012 (0.009)
BankReg X ExtFinDep								-0.002 (0.015)
Observations	834	834	834	834	834	834	834	828
R-squared	0.586	0.601	0.587	0.596	0.587	0.592	0.588	0.588
AdjR2	0.553	0.568	0.553	0.563	0.553	0.558	0.555	0.555
F	5.207	5.233	5.309	5.742	5.372	5.800	5.679	5.253

Notes: In panel A, the dependent variable is allocative efficiency as defined in (1), computed in 2005. See Table 1 for definition and sources of the explanatory interaction variables. All specifications include country and industry fixed effects. Observations are weighted by the number of firms used to compute the productivity decomposition in (1). Robust standard errors in parentheses; *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

47. In Table 4, the model is re-estimated in sub-samples according to the extent of firm turnover (the results for unweighted productivity are stored in Table B2). Since the sample is split between high and low rates of firm turnover (Turn), no baseline policy interactions (with firm turnover) are included for PMR and Bankruptcy. As a robustness test, we re-estimated the model in separate sub-samples according to the

cumulativeness of knowledge. Overall, the results broadly confirm the idea developed below that the adverse impact of regulation on AE in innovative sectors is concentrated in Schumpeterian environments, where firm turnover is expected to be higher.[28]

48. The results for EPL are consistent with earlier OECD research that shows that stringent EPL tends to undermine innovation in sectors where technologies are renewed through entry and exit of firms and extensive worker turnover (OECD 2003). By contrast, EPL may be less relevant in industries characterised by cumulative innovation processes, since innovation-driven labour adjustments are more likely to be accommodated through the skill-upgrading of existing employees than worker turnover (OECD 2003). The adverse effect of PMR on AE in more innovative sectors is also concentrated in Schumpeterian environments. Indeed, since new firms are the engine of innovations in such sectors, higher barriers to entry are likely to prevent the entry of some high potential firms and inhibit productivity-enhancing reallocation (Table 4; columns 3-4).

49. Similarly, the adverse impact of stringent banking regulation on AE is concentrated in Schumpeterian sectors (Table 4 columns 11-12). This provides some evidence that in sectors where entry is the engine of innovation, access to finance plays a key role in promoting reallocation through the financing of start-ups and post-entry growth. On the other hand, the stringency of bankruptcy regimes appears to adversely affect AE in sectors characterised by both Schumpeterian and cumulative patterns of innovation (Table 4; columns 7-8).

Table 4. Public policies and allocative efficiency in innovative sectors (2)

Sample split between industries with high and low firm turnover

	(1)	**(2)**	(3)	**(4)**	(5)	**(6)**	(7)	**(8)**	(9)	**(10)**	(11)	**(12)**
	Low Turn	**High Turn**	Low Turn	**High Turn**	Low Turn	**High Turn**	Low Turn	**High Turn**	Low Turn	**High Turn**	Low Turn	**High Turn**
EPLR X patenting	-0.010	**-0.018**	-0.003	**-0.019***								
	(0.013)	**(0.011)**	(0.013)	**(0.010)**								
EPLR X layoff			-0.067**	**-0.050*****								
			(0.032)	**(0.017)**								
BTE X patenting					-0.013	**-0.020***						
					(0.008)	**(0.011)**						
Bankruptcy X patenting							-0.002*	**-0.003***				
							(0.001)	**(0.002)**				
BankReg X patenting									-0.006	**-0.021***	-0.009	**-0.020***
									(0.011)	**(0.012)**	(0.012)	**(0.012)**
BankReg X ExtFinDep											0.012	**-0.004**
											(0.015)	**(0.019)**
Observations	412	**422**	412	**422**	412	**422**	412	**422**	412	**422**	412	**416**
R-squared	0.574	**0.623**	0.586	**0.639**	0.578	**0.627**	0.577	**0.623**	0.573	**0.624**	0.574	**0.624**
AdjR2	0.528	**0.581**	0.540	**0.598**	0.533	**0.585**	0.532	**0.581**	0.527	**0.582**	0.526	**0.583**
F	2.747	**6.893**	2.750	**7.096**	2.967	**7.550**	2.880	**7.493**	2.780	**7.822**	2.738	**7.185**

Notes: The dependent variable is allocative efficiency as defined in (1), computed in 2005. See Table 1 for definition and sources of the explanatory interaction variables. All specifications include country and industry fixed effects. Observations are weighted by the number of firms used to compute the productivity decomposition in (1). Robust standard errors in parentheses; *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

28. These results are not shown for sake of brevity. Results are available from the authors upon request.

5.2 Supporting evidence from a subset of service sectors

50. Table 5 shows the estimation results of equation (3) in a subset of service sectors. Lower anti-competitive regulations in services are associated with a significantly higher correspondence between firms' productivity and their employment share. For example, our baseline estimate in column 1 (where AE is computed in 2005) indicates that AE would increase by 11 percentage points if, holding constant other time-invariant country characteristics, $Reg_{s,c}$ was reduced by one point. In our data, such reduction corresponds to slightly less than the average within-country standard deviation of regulation, or the difference between average service regulation in France and in the UK. The result is similar using 2006 data and slightly lower focusing on 2007 (columns 2 and 3).

51. FDI restrictions are also associated with lower AE in services. The coefficient in column 4 implies that a reduction in FDI restrictions from the high level in Poland to the lower level in Germany would be associated with an increase in AE of nearly 5 percentage points. Both results are unaffected if we broaden the definition of $Reg_{s,c}$ to include the extent of public ownership (column 5).

Table 5. Public policies and allocative efficiency in the services sector

Panel A: Dependent variable - allocative efficiency

	(1) Base	(2) AE-2006	(3) AE-2007	(4) Base & FDI - 1	(5) Base & FDI - 2
Service sector regulation	-0.111** (0.053)	-0.125*** (0.045)	-0.080** (0.039)	-0.130*** (0.048)	
FDI restrictions				-0.917** (0.462)	-0.962* (0.529)
Service sector regulation (including public ownership)					-0.118** (0.060)
Observations	174	174	174	152	152
R-squared	0.687	0.812	0.823	0.700	0.671
AdjR2	0.624	0.774	0.788	0.629	0.593
F	4.031	8.485	14.86	3.616	3.617

Panel B: Dependent variable - unweighted productivity

	(1) Base	(2) AE-2006	(3) AE-2007	(4) Base & FDI - 1	(5) Base & FDI - 2
Service sector regulation	-0.029 (0.028)	-0.045 (0.031)	-0.077*** (0.029)	-0.009 (0.024)	
FDI restrictions				-0.118 (0.184)	-0.091 (0.194)
Service sector regulation (including public ownership)					0.006 (0.030)
Observations	174	174	174	152	152
R-squared	0.962	0.962	0.971	0.971	0.971
AdjR2	0.954	0.954	0.965	0.964	0.964
F	67.65	61.79	68.47	106.8	110.3

Notes: In panel A, the dependent variable is allocative efficiency as defined in (1), computed in 2005 (baseline specification, columns 1, 4 and 5), or in 2006 and 2007 (columns 2 and 3, respectively). In Panel B the dependent variable is unweighted productivity as defined in (1), computed in the same years. See Table 1 for definition and sources of the explanatory variables. All specifications include country and industry fixed effects. Observations are weighted by the number of firms used to compute the productivity decomposition in (1). Robust standard errors in parentheses; *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level

52. As in the previous exercise we find that the estimated gains in AE largely translate into higher industry productivity. In a regression of un-weighted productivity, the coefficient estimates are generally negative, though they are statistically significant in only one specification (see Table 3; Panel B).

53. If interpreted causally, these findings would imply a sizeable direct effect of service regulation on aggregate productivity. A highly regulated country such as Spain would see productivity in services increase by nearly 10% if it reduced anti-competitive barriers to the lower level of Denmark, which would translate into an increase in aggregate productivity of about 4%, given the high economic relevance of such industries. Similarly, lowering FDI restrictions from the high levels of Poland (or Korea) to those of Germany could raise aggregate productivity by around 2%, according to our estimates. While this figuring may provide a lower bound estimate to the extent that it does not account for the impact of regulation on resource flows across sectors, some caution is warranted in interpreting these effects owing to identification concerns (*e.g.* reverse causality) and the lack of suitable instruments for industry level regulation across countries (see Section 4.3). Accordingly, we interpret these results as evidence that supports the core results in Section 5.1 and complements existing research which finds negative indirect effects of service regulation on AE in downstream industries, where endogeneity concerns are likely to less serious (see Arnold *et al.,* 2011).

54. Finally, there is evidence that resource allocation in services sectors is shaped by the interaction between sector-specific product market regulations and framework policies affecting product, labour and credit markets at country level (see Table B3). In all cases except that of bankruptcy settings, we find that easing anti-competitive service regulation has stronger positive effects on AE when the other policy considered is also not restrictive. For example, results in column 3 show that the benefits from deregulation are diminished when EPL is relatively stringent (as in Greece, Spain and Portugal in 2003). Similarly, the effects of reform are favourable in countries where administrative burdens on start ups were low in 2003 (as in Denmark) but could be even detrimental in countries as Poland, Greece and Spain, where economy-wide barriers to entry were particularly high. One interpretation of these results is that while liberalising policy in one area (*e.g.* service regulation) will change the incentives for resource reallocation, this may not be sufficient if the mechanisms to accommodate reallocation are lacking (*i.e.* flexible labour, product and financial markets).

6. Robustness tests and extensions

6.1 Instrumental variables estimation to address the potential endogeneity of policies

55. The core results are also robust to instrument variable estimation, aimed at controlling for the potential endogeneity of product and labour market regulations. As outlined in Section 4.3, various combinations of: *i)* the fraction of the population speaking a major European language; *ii)* geographic latitude and *iii)* legal origin are used to instrument barriers to entry. These results are reported in Columns 1-3 of Table 6 and reinforce previous OLS findings, which uncover a negative relationship between entry regulation and AE. Similarly, the negative effect of EPL on AE is confirmed by the 2SLS estimation, which uses indicators regarding whether a country has a common law as opposed to a civil law system, and a refinement of this dichotomy including information on civil codes to instrument EPL (see columns 4-6 of Table 6).

Table 6. Public policies and allocative efficiency: instrumental variable estimates

	(1)	(2)	(3)	(4)	(5)	(6)
Instrument(s)	Legal origin & European languages	Legal origin & latitude	Legal origin & European languages & latitude	Common Law	Civil code	Common Law & Civil code
BTE X turnover	-0.016*** (0.005)	-0.015*** (0.005)	-0.012** (0.005)			
EPLR X layoff				-0.081*** (0.031)	-0.099*** (0.034)	-0.082*** (0.031)
R-squared	0.583	0.584	0.588	0.595	0.588	0.594
Over- identifying restrictions score test (p-value)	0.135	0.253	0.145	..	..	0.162
Endogenous Score Test (p-value)	0.066	0.071	0.315	0.050	0.013	0.042
First Stage Test (F-test)	158.886	130.393	136.460	292.908	29.796	168.899
Observations	834	834	834	834	834	834

Notes: 2SLS estimates of the OLS results in Columns 1 and 4 of Table 2. The dependent variable is allocative efficiency as defined in (1), computed in 2005. See Table 1 for definition and sources of the explanatory interaction variables. All specifications include country and industry fixed effects. Observations are weighted by the number of firms used to compute the productivity decomposition in (1). The test of over-identifying restrictions, which is possible when there are more instruments than endogenous variables, assumes that one instrument is valid and then tests for the "validity" of all other instruments (*i.e.* whether the instruments are uncorrelated with the error term in the second stage; the null hypothesis). The endogeneity test is the Durbin-Wu-Hausman test for the exogeneity of the regressors (the null hypothesis is that there are no endogeneous variables or that endogeneity does not affect the OLS estimator). The First stage test is a test for the strength of the instruments (*i.e.* the joint significance of all of the instruments; as a rule of thumb, the F-statistic should be bigger than 10 in case of a single endogenous regressor). Robust standard errors in parentheses; *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

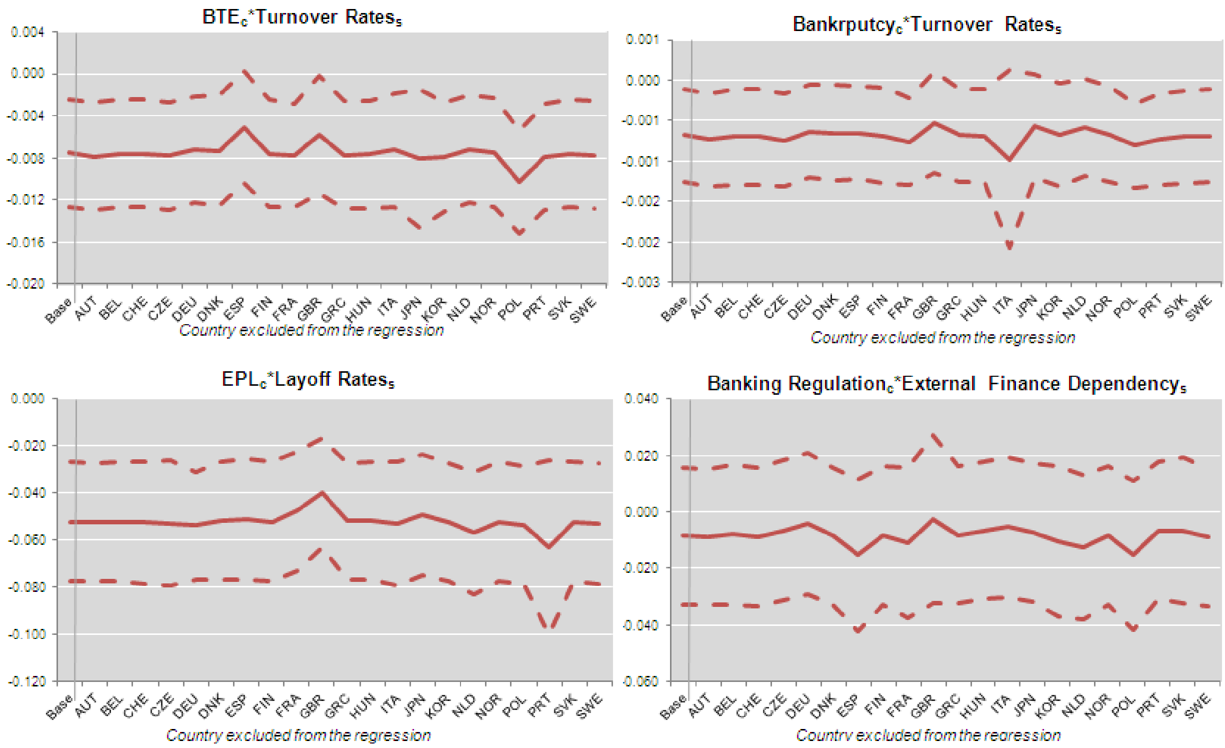
6.2 Sensitivity analysis

56. The baseline results reported in Table 2 are broadly robust to a number of sensitivity tests. First, while the core results are based on ORBIS data from 2005, they can be reproduced using data from 2006 and 2007. Second, the baseline coefficient estimates reported in Table 2 are broadly robust to excluding one country from the sample at a time (see Figure 3). While the estimated negative effect of EPL is always significant, there are a few instances where the barriers to entry and bankruptcy interactions are no longer significant at conventional levels when a given country is dropped from the regression. In both cases, however, the estimated coefficients are always significant at the 11-15 per cent level. Third, the results are also broadly robust to dropping one sector at a time.[29] Again, the estimated coefficient on the EPL interaction is always significant, while the barriers to entry and bankruptcy interactions turn marginally insignificant at the 14 and 22 per cent levels respectively when the construction sector (NACE sector 45) is excluded.

29. These results are not shown for sake of brevity and are available from the authors on request.

Figure 3. Impact on estimated coefficient of dropping one country at a time

Coefficient (thick line) and 90% confidence interval (dashed lines)



Notes: The charts show how the differences-in-differences coefficient estimate from Table 2 changes as one country is omitted from the regression at a time. 'Base' refers to the baseline coefficient estimate based on the full sample.

57. We also explored the extent to which the estimated coefficient on EPLR$_c$Xlayoff$_s$ is downwardly biased due to a potential influence of EPL on outsourcing behaviour, and at the same time, a mechanical relationship between outsourcing activity and turnover-based labour productivity (see Section 4.3). To do this, we exploited data on value-added – which is available for a much smaller sample of firms – to re-construct our dependent variable using a value-added based measure of labour productivity (AE-VA). For the same sample of firms, we also constructed an indicator of AE based on a turnover based measure labour productivity (AE-TURN), to provide an appropriate benchmark. In turn, we re-estimated our core model and compared the coefficient on EPLR$_c$Xlayoff$_s$ in the AE-VA specification with the AE-TURN specification. While this exercise resulted in a non-trivial reduction in sample size (685 country-sector cells compared to 833 cells in the core analysis), there was little discernable difference in estimated coefficient on EPLR$_c$Xlayoff$_s$ – in terms of statistically significant and economic magnitude – between the two specifications.[30]

6.3 Re-estimation with an alternative dependent variable

58. To further test the robustness of our core results, we re-estimate our models in a different sample of firms and with an alternate dependent variable. Since our measure of AE in Section 4 captures the extent to which the most productive firms in a given industry are also the largest, we would expect larger firms (*e.g.* firms with 250 or more employees) in a given industry to be relatively less productive in countries

30. For sake of brevity, these results are available on request from the authors.

where framework policies hinder the efficient allocation of resources. While we focus on large firms because they have important implications for AE, they are also likely to be better represented in the ORBIS database (see Gonnard and Ragoussis 2012; Gal 2012). Accordingly, we estimate the following models using data for the full sample (4a) and services sample (4b):

$$P_{j,c}^{Emp>249} = \gamma \overline{P_{j,c}} + \beta\left(Exp_j * \text{Re}\,g_c\right) + \mu_j + \mu_c + \varepsilon_{jc} \quad (4a)$$

$$P_{j,c}^{Emp>249} = \gamma \overline{P_{j,c}} + \theta \text{Re}\,g_{j,c} + \mu_c + \mu_j + \varepsilon_{j,c} \quad (4b)$$

where: $P^{Emp>249}$ is the average labour productivity of firms with 250 or more employees in each country and industry; $\overline{P}_{j,c}$ is average sector-wide labour productivity and the remaining terms are the same as described in equations (2) and (3). Controlling for average sectoral productivity is important as large firms might be less productive in a highly regulated economy simply because all firms in the industry have low productivity, but this would not necessarily have implications for AE.

59. The differences-in-differences estimation results (e.g. equation 4a) are contained in Table B4 and the service sector regressions (e.g. equation 4b) are stored in Table B5. Overall, these results for large firm productivity are broadly consistent with those based on AE reported in Table 2 and Table 3, further highlighting the impact of framework policies on the efficiency of resource allocation.

6.4 Unreported results

60. Unreported results include additional explorations of the impact of policies such as various taxation variables (*e.g.* taxes on labour, corporate profits and capital gains); tax incentives for research and development (R&D); intellectual property rights (IPR) regimes; supply of seed capital to GDP and quality of accounting standards. [31] These results were generally inconclusive. However, this does not necessarily imply that such policies have no effect on patterns of resource allocation. Instead, this ambiguity may reflect data limitations – our study focuses on the contribution of AE to the level of labour productivity at a given point in time and does not specifically model dynamic process, such as contribution of entry and exit to productivity growth.

7. Conclusion

61. We examine the extent to which regulations affecting product, labour and credit markets influence productivity, via their effect on the efficiency of resource allocation. Our results suggest that there is an economically and statistically robust negative relationship between policy-induced frictions and productivity, though the specific channel depends on the policy considered. In the case of employment protection legislation, product market regulations (including barriers to entry and bankruptcy legislation) and FDI restrictions, this is largely traceable to the worsening of allocative efficiency (*i.e.* a lower correspondence between a firm's size and its productivity level). By contrast, financial market under-development tends to be associated with a higher fraction of low productivity relative to high productivity firms. Moreover, regulations are more disruptive to AE and productivity in innovative sectors. However, this result largely applies to innovative environments characterised by Schumpeterian patterns of creative destruction, as opposed to sectors where innovation patterns are more incremental and cumulative.

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31. The impact of these country-level policies on allocative efficiency was modelled in a differences-in-differences framework. For example, the various taxation terms where interacted with sectoral measures of relative profitability and firm turnover; IPR regimes and R&D tax where interacted with sectoral measures of R&D and patenting intensity; seed capital and accounting standards where interacted with external finance dependency. Numerous other interactions were included but are not reported here for sake of brevity.

62. Given the limitations of our approach, further research into the links between framework policies and resource allocation is required. For example, our differences-in-differences estimates do not allow us to infer an average or direct impact of policies on resource allocation, which would be desirable from a policy perspective. Moreover, we focus only on the correlation between productivity and size at a single point in time (*i.e.* static allocative efficiency). While this metric should in principle reflect patterns of resource reallocation across incumbent firms and firm turnover (*i.e.* entry and exit) in preceding periods, more direct evidence on the influence of policies on dynamic allocative efficiency would be desirable. Given the limitations of ORBIS in reliability identifying entrants and exits over time, however, further evidence on the link between policies and firm turnover will depend on the availability of administrative data from national sources (*i.e.* business registers). Nevertheless, it should be possible to analyse the impact of framework policies on other aspects of dynamic resource allocation, such as reallocation across incumbent firms, through existing data sources such as ORBIS. Indeed, to the extent that cross-country differences in the post-entry performance of firms tends to be more marked than differences in entry and exit patterns (Bartelsman *et al.,* 2003), this would seem like a worthy endeavour.

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APPENDIX A: DATA

Assembled by Bureau Van Dijk, the commercial database ORBIS contains balance sheet data on firms in many advanced and developing countries. Table A1 reports some descriptive statistics on the main firm-level variables in ORBIS. See Pinto Ribeiro *et al.*, (2010) for a detailed description of the ORBIS database and of the cleaning and checking undertaken by the OECD in order to increase data quality and comparability (see also Ragoussis and Gonnard 2012). Table A2 shows the descriptive statistics for the key variables used in the regression analysis.

Table A1: Descriptive statistics on firm level data by country, 2005

Country	Number of Industries		Firms	Turnover (2005 €`000s)		Employment		(Log) Labour Productivity	
	Total	Services	Number	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Austria	39	8	9590	14350.4	95830.2	63.68	494.95	4.82	0.81
Belgium	40	8	26421	16347.4	142422.9	48.04	442.38	5.42	0.94
Switzerland	42	8	4071	114645.6	718876.3	461.75	3391.83	5.47	0.76
Czech Rep.	40	8	44928	4083.7	44953.8	44.36	428.81	3.80	1.29
Germany	40	8	88247	87842.5	1603664.0	348.91	6403.97	5.00	0.87
Denmark	40	8	6396	19643.9	99672.3	74.60	427.66	5.11	0.91
Spain	40	8	377488	3113.4	53427.4	19.45	272.16	4.47	0.89
Finland	39	8	37663	5209.7	143526.5	22.87	214.89	4.60	0.84
France	40	8	290566	5648.2	158301.6	25.94	373.07	4.75	0.72
United Kingdom	40	8	40714	56357.0	493636.6	265.62	2347.80	5.04	1.19
Greece	40	8	18765	6351.2	48412.8	37.13	350.86	4.78	1.10
Hungary	39	7	3320	19761.0	134381.2	152.29	1199.03	4.27	1.06
Italy	40	8	87747	15213.6	134617.4	54.59	656.44	5.30	0.98
Japan	42	8	142880	31170.9	398374.6	72.92	570.04	5.34	0.83
Korea	39	7	24525	3473.8	4867.4	17.53	11.51	4.90	0.91
Netherlands	40	8	5446	146513.6	1277706.0	497.15	5369.86	5.50	1.35
Norway	36	8	1793	3522.7	20755.7	24.98	337.59	4.83	0.99
Poland	40	8	18231	13968.8	70506.9	139.74	973.20	4.36	1.06
Portugal	38	8	1607	25491.8	104845.2	155.90	665.27	4.77	1.08
Slovak Rep.	40	8	11311	5160.5	46409.6	56.22	353.48	3.62	1.70
Sweden	40	8	99732	3902.7	66692.7	16.71	188.33	4.80	0.76
United States	*excluded*	8	303562	14858.2	427152.7	80.84	2335.50	4.34	0.87

Source: Authors calculations based on the ORBIS firm level database. The sample excludes firms with one employee as well as firms in the top and bottom 1% of the labour productivity distribution. To enhance representativeness, sampling weights based on administrative information on the number of employees (by country, industry, firm size and year) from the OECD Structural Demographic Business Statistics are applied (see Gal 2012).

Country sample: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Korea, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom and the United States.

Industry sample: Nace 15: Food products and beverages, Nace 16: Tobacco products, Nace 17: Textiles, Nace 18: Wearing apparel, Nace 19: Leather leather products and footwear, Nace 20: Wood and products of wood and cork, Nace 21: Pulp, paper and paper products, Nace 22: Printing and publishing, Nace 23: Coke refined petroleum products and nuclear fuel, Nace 24: Chemicals and chemical products, Nace 25: Rubber and plastics products, Nace 26: Other non-metallic mineral products, Nace 27: Basic metals,Nace 28: Fabricated metal products except machinery and equipment, Nace 29: Machinery and equipment n.e.c., Nace 30: Office accounting and computing machinery, Nace 31: Electrical machinery and apparatus, Nace 32: Radio television and communication equipment, Nace 33: Medical precision and optical instruments, Nace 34: Motor vehicles trailers and semi-trailers, Nace 35: Other transport equipment, Nace 36: Manufacturing n.e.c., Nace 37: Recycling, Nace 40: Electricity, gas, steam and hot water supply, Nace 41: Collection purification and distribution of water, Nace 45: Construction, Nace 50: Sale maintenance and repair of motor vehicles and motorcycles - retail sale of automotive fuel, Nace 51: Wholesale trade and commission excl. motor vehicles, Nace 52: Retail trade excl. motor vehicles repair of household goods, Nace 55: Hotels and restaurants, Nace 60: Land transport - transport via pipelines, Nace 61: Water transport, Nace 62: Air transport, Nace 63: Supporting and auxiliary transport activities, Nace 64: Post and telecommunications, Nace 70: Real estate activities, Nace 71: Renting of machinery and equipment, Nace 72: Computer and related activities, Nace 73: Research and development, Nace 74: Other business activities

Table A2: Summary statistics of key variables used in the regression analysis

Variable	Obs	Mean	Median	Standard deviation	p10	p90
			Industry - Country level			
Allocative efficiency	834	0.10	0.12	0.42	-0.37	0.51
Unweighted productivity	834	4.86	4.89	0.72	3.93	5.68
			Country level			
Barriers to entrepreneurship (BTE) -- administrative burdens on start-ups	22	1.94	1.69	0.93	0.63	3.06
BTE2 -- average of administrative burdens on start-ups and barriers to	22	1.89	1.74	0.56	1.23	2.56
Bankruptcy (cost to close a business)	22	9.54	9.00	6.16	4.00	18.00
Employment Protection Legilsation (EPL) on Regular Contracts	22	2.29	2.31	0.70	1.63	3.05
EPL -- Overall Index	22	2.02	2.02	0.67	1.34	2.98
Financial Development (log of ratio of private credit to GDP)	20	-0.22	-0.01	0.54	-1.23	0.39
Banking Regulation	21	2.43	2.31	0.69	1.66	3.31
			Industry level			
Service sector regulation	174	2.17	2.30	1.27	0.37	3.70
Service sector regulation (including public ownership)	174	2.40	2.47	1.07	0.93	3.87
FDI restrictions	152	0.08	0.00	0.21	0.00	0.25
Firm turnover rate (USA)	42	19.42	20.79	4.50	14.58	24.00
Job layoff rates (USA)	42	3.81	3.57	1.09	2.72	5.40
External Finance Dependency (USA)	40	1.00	0.44	1.37	0.00	3.35

Source: see Table 1 for details.

APPENDIX B: ADDITIONAL EMPIRICAL TABLES

Table B1: Public policies and unweighted productivity in innovative sectors (1)

Full Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EPLR X patenting	-0.002 (0.008)	-0.002 (0.008)						
EPLR X layoff		0.002 (0.026)						
BTE X patenting			-0.007 (0.006)	-0.009 (0.007)				
BTE X turnover				-0.003 (0.003)				
Bankruptcy X patenting					-0.000 (0.001)	-0.000 (0.001)		
Bankruptcy X turnover						-0.000 (0.001)		
BankReg X patenting							-0.010 (0.008)	-0.005 (0.009)
BankReg X ExtFinDep								-0.023 (0.015)
Observations	834	834	834	834	834	834	834	828
R-squared	0.885	0.885	0.886	0.886	0.885	0.885	0.886	0.887
AdjR2	0.876	0.876	0.877	0.877	0.876	0.876	0.877	0.878
F	27.64	27.03	27.54	27.24	27.52	26.90	26.85	27.47

Notes: The dependent variable is unweighted productivity as defined in (1), computed in 2005. See Table 1 for definition and sources of the explanatory interaction variables. All specifications include country and industry fixed effects. Observations are weighted by the number of firms used to compute the productivity decomposition in (1). Robust standard errors in parentheses; *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

Table B2: Public policies and unweighted productivity in innovative sectors (2)

Sample split between industries with high and low firm turnover

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Low Turn	High Turn	Low Turn	High Turn	Low Turn	High Turn	Low Turn	High Turn	Low Turn	High Turn	Low Turn	High Turn
EPLR X patenting	0.015 (0.020)	-0.010 (0.011)	0.009 (0.022)	-0.010 (0.011)								
EPLR X layoff			0.061 (0.049)	-0.007 (0.028)								
BTE X patenting					0.001 (0.010)	-0.016* (0.010)						
Bankruptcy X patenting							0.001 (0.002)	-0.001 (0.002)				
BankReg X patenting									-0.010 (0.012)	-0.019* (0.011)	0.002 (0.013)	-0.014 (0.013)
BankReg X ExtFinDep											-0.042*** (0.012)	-0.014 (0.020)
Observations	412	422	412	422	412	422	412	422	412	422	412	416
R-squared	0.793	0.906	0.796	0.906	0.791	0.907	0.791	0.906	0.792	0.907	0.796	0.907
AdjR2	0.770	0.895	0.774	0.895	0.769	0.896	0.769	0.895	0.769	0.896	0.773	0.897
F	13.52	38.22	11.56	36.47	11.30	38.36	11.22	37.17	10.14	36.92	11.42	38.95

Notes: The dependent variable is unweighted productivity as defined in (1), computed in 2005. See Table 1 for definition and sources of the explanatory interaction variables. All specifications include country and industry fixed effects. Observations are weighted by the number of firms used to compute the productivity decomposition in (1). Robust standard errors in parentheses; *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

Table B3: Allocative efficiency, service regulation and country-level policy settings

	(1)	(2)	(3)	(4)
Service sector regulation	-0.111** (0.053)	-0.389*** (0.090)	-0.301*** (0.040)	-0.210* (0.126)
Service sector regulation X BTE		0.169*** (0.037)		
Service sector regulation X EPLO			0.165*** (0.018)	
Service sector regulation X Bankruptcy				0.009 (0.008)
Observations	174	174	174	174
R-squared	0.687	0.757	0.802	0.695
AdjR2	0.624	0.706	0.761	0.631
F	4.031	5.130	15.44	3.894

Notes: The dependent variable is allocative efficiency as defined in (1), computed in 2005. See Table 1 for definition and sources of the explanatory interaction variables. All specifications include country and industry fixed effects. Observations are weighted by the number of firms used to compute the productivity decomposition in (1). Robust standard errors in parentheses; *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

Table B4 Public policies and the productivity of large firms (250 employees or more)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
BTE X turnover	-0.010***							-0.013**	-0.013**
	(0.003)							(0.006)	(0.006)
BTE2 X turnover		-0.016***							
		(0.006)							
Bankruptcy X turnover			-0.001**					0.001	0.001
			(0.000)					(0.001)	(0.001)
EPLR X layoff				-0.070***				-0.071***	-0.070***
				(0.020)				(0.019)	(0.019)
EPLO X turnover					-0.014***				
					(0.005)				
FinDev X ExtFinDep						0.037		0.035	
						(0.029)		(0.025)	
BankReg X ExtFinDep							-0.036*		-0.034*
							(0.022)		(0.019)
Observations	713	713	713	713	713	709	709	709	709
R-squared	0.871	0.871	0.870	0.872	0.871	0.870	0.871	0.876	0.876
AdjR2	0.859	0.858	0.857	0.859	0.859	0.858	0.859	0.864	0.864
F	41.07	41.52	40.38	42.24	35.70	39.09	39.45	42.00	41.84

Notes: The dependent variable is average productivity of firms with 250 or more employees in 2005, as outlined in Section 6.3. See Table 1 for definition and sources of the explanatory interaction variables. All specifications include country and industry fixed effects. Observations are weighted by the number of firms used to compute the productivity decomposition in (1). Robust standard errors in parentheses; *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

Table B5 Public policies and the productivity of large firms in the service sector (250 employees or more)

	(1)	(2)	(3)	(4)	(5)
	Base	AE-2006	AE-2007	Base & FDI - 1	Base & FDI - 2
Service sector regulation	-0.086**	-0.080**	-0.089*	-0.092**	
	(0.043)	(0.039)	(0.050)	(0.043)	
FDI restrictions				-0.363	-0.389
				(0.302)	(0.311)
Service sector regulation (including public ownership)					-0.093*
					(0.049)
Observations	161	163	165	141	141
R-squared	0.901	0.911	0.913	0.905	0.903
AdjR2	0.879	0.891	0.894	0.880	0.878
F	48.44	55.07	69.55	44.52	41.41

Notes: The dependent variable is average productivity of firms with 250 or more employees in 2005, as outlined in Section 6.3. See Table 1 for definition and sources of the explanatory interaction variables. All specifications include country and industry fixed effects. Observations are weighted by the number of firms used to compute the productivity decomposition in (1). Robust standard errors in parentheses; *** denotes statistical significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

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