Structural policies and productivity: Evidence from Portuguese firms

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STRUCTURAL POLICIES AND PRODUCTIVITY: EVIDENCE FROM PORTUGUESE FIRMS

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ABSTRACT/RÉSUMÉ

Structural Policies and Productivity: Evidence from Portuguese Firms

This paper provides empirical evidence on links between the productivity of Portuguese firms and a number of policy variables in Portugal. The analysis is based on a census of Portuguese manufacturing companies, covering more than 40,000 firms between 2006 and 2011. The results suggest that a number of these variables matter for firm performance, including the number of procedures required to start a business, a more extensive coverage of collective wage bargaining agreements, the tax burden, tax compliance costs and the number of procedures required to enforce a contract.

This Working Paper relates to the 2014 *OECD Economic Survey of Portugal* (www.oecd.org/eco/surveys/economic-survey-portugal.htm).

JEL classification: D2, J3, J5, K2, K4, H2, L5
Keywords: Total factor productivity, structural policies, firm-level analysis

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Politiques structurelles et productivité : Résultats empiriques du Portugal

Ce document présente des résultats empiriques sur la productivité des entreprises au Portugal et une série de variables de politiques. L'analyse est basée sur plus de 40 000 entreprises Portugaises entre 2006 et 2011. Les résultats suggèrent une influence significative de ces politiques sur la productivité des entreprises, notamment pour le nombre de procédures requises pour créer une entreprise, l'extension administrative des accords de négociations salariales, les impôts et leur complexité ainsi que le nombre de procédures requises pour exécuter un contrat.

Ce Document de travail se rapporte à l'Étude économique de l'OCDE du Portugal, 2014 (www.oecd.org/eco/surveys/economic-survey-portugal.htm).

Classification JEL : D2, J3, J5, K2, K4, H2, L5
Mots clefs : Productivité totale des facteurs, politiques structurelles, données d'entreprise

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Introduction

Productivity growth has been weak in Portugal since at least the turn of the millennium (Figure 1). The weak performance of aggregate productivity reflects the productivity of individual firms in the economy. There are two kinds of developments at the level of individual firms that affect aggregate productivity. One is productivity growth within existing firms and the second is reallocations of resources across firms. Reallocations can improve aggregate productivity when new firms with strong productivity growth enter the market, when more productive firms manage to grow at the expense of less productive ones or when low-productivity firms shut down. Empirical literature at the firm level has demonstrated the importance of reallocation for productivity growth in OECD countries (Syverson, 2011).

Figure 1. Average annual total factor productivity growth in 2000-09 and 2010-15

Per cent[1]
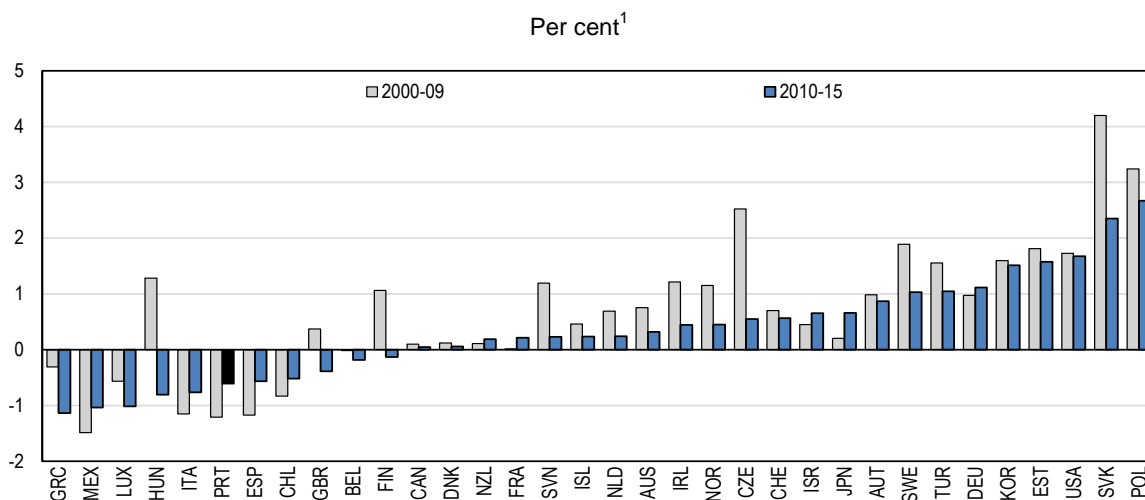
1.   2001-09 instead of 2000-09 for Estonia. Data for 2014 and 2015 are projections.

Source: OECD (2014), OECD Economic Outlook: Statistics and Projections (database), June.

While many factors can explain developments at the level of firms, policies are clearly one of them. The present paper uses firm-level data from Portugal to examine the links between several institutional characteristics and firm productivity. In almost all cases, firms rely on a large share of inputs from markets that are regulated or subject to public intervention, including labour markets. Moreover, they interact directly with public institutions when they pay taxes or comply with regulations, and their interactions with peers are shaped by the institutional framework, including civil law and its enforcement.

Four aspects of structural policy settings are examined in this paper. As regards labour market policies, Portugal has a long-standing tradition of collective wage bargaining at the sector level, and the resulting agreements have often been used to determine wage floors that became binding for the entire industry through administrative extension, even for firms that were not part of the bargaining process. By effectively stifling firm-level bargaining, this mechanism also discourages the entry of new firms and competition in product markets, as one way new firms can enter the market is by paying lower wages than incumbents for some time. Beyond labour markets, taxes on firms can also affect the productivity of firms in several ways (Arnold *et al, 2012*). First, higher corporate taxes may reduce incentives for productivity-enhancing innovations by reducing their post-tax returns. Second, higher corporate taxes may reduce the incentives to invest in physical capital by increasing investment costs. If new vintages of physical capital embody technological progress, this can also have a direct effect on TFP. Finally, compliance with taxes also draws directly on firms' resources without increasing their output, for example when dealing with taxes can consume substantial amounts of manpower. Beyond taxes, onerous administrative requirements, for example in the process of starting a business, also absorb resources, and maybe more importantly, entry barriers can discourage innovative and productive newcomers from entering a market and reduce the competitive pressures on incumbents. Finally, one area where firms rely strongly on public institutions is contract enforcement. The efficiency of public institutions for recovering outstanding debt contracts is likely to matter for firms' willingness to engage with new customers and suppliers, and for lenders' willingness to extend credit.

Firm-level data and productivity measurement

The empirical analysis provides an attempt to link firm-level productivity measures with policy variables, or outcome measures that are directly influenced by policies. Productivity estimates for 40,678 Portuguese manufacturing firms are obtained using firm-level information from the firm census *Sistema de Contas Integradas de Empresas*, compiled by the Portuguese National Institute of Statistics INE. The firm-level data contain information from annual balance sheets and profit and loss accounts, with sufficient data available to estimate total factor productivity for 175 559 firm observations between 2006 and 2011. The data cover the whole manufacturing sector, although tobacco products and refined petroleum products have been deliberately excluded from the analysis due to a highly concentrated industry structure and strong cyclical swings from commodity prices. The data also contain information on institutional settings that has been gathered from a number of sources, as indicated in the description of the respective empirical results.

Total factor productivity (TFP) has been obtained as the residual from sector-specific estimations of a logarithmic Cobb-Douglas production function of the form:

$$\log Y_{it} = \alpha_s \log L_{it} + \beta_s \log K_{it} + \gamma_s \log M_{it} + \varepsilon_{it} \qquad [1]$$

where the subscripts i stand for the firm, t for time and s for sector. The dependent variable of the production function is a firm's output Y (sales corrected for inventories), with labour L, capital K and intermediate inputs M as production factors. Labour inputs are measured as the number of employees, while primary information on the book value of tangible fixed assets has been used to account for capital inputs. Intermediate inputs contain materials, energy and other goods and services used in production.

Nominal values have been deflated using sector-specific price indices for output, a price index for investment goods for capital stocks and a general producer price index for intermediate inputs. The source for these price indices is Eurostat.

Equation 1 has been estimated using the semi-parametric estimator suggested by Levinsohn and Petrin (2003), and the sector-specific production function estimates are presented in table A.1 in the Appendix to this paper. The main advantage of this approach is that it controls for a potential bias stemming from the fact that firms choose their inputs simultaneously with changes to their productivity that they – but not the researcher doing the empirical analysis – may observe. If firms adjust their input choice to unobserved productivity shocks, this would generate a correlation between the explanatory variables and the error term in equation 1, thus causing ordinary least-square estimates to be biased, but not the estimates obtained using the semi-parametric Levinsohn and Petrin procedure. Gross output rather than value added was chosen as dependent variable, given the problems that may arise when using the semi-parametric estimator in a value-added specification (Gandhi et al., 2013). Each observation's productivity estimate is expressed relative to the median productivity in the same sector.

Estimating the link to policies

The methodology used for the empirical analysis rests on a difference-in-differences approach and exploits variation across both industries and time. The identification of the policy effect relies on Rajan and Zingales' (1998) basic insight that variation across industries can be applied to analyse the effects of factors that vary across other dimensions, such as time in this case. Changes in the policy variables occur over time, but relating changes over time in productivity to changes over time in policies is not convincing because it will be virtually impossible to isolate all the other possible time-varying factors that affect firm productivity.

The advantage of the difference-in-difference approach is that it adds variation across another dimension, industries, to facilitate identification. The basic idea is that there are differences across industries that make some industries more responsive to certain policy changes than others. For example, the effect of easing administrative procedures for starting a business is likely to be felt more strongly in industries where, in the absence of distortions, firm entry is a more common phenomenon. Similarly, the effect of taxes may be felt more strongly in industries that pay much taxes, for example because they rely on corporate profits to remunerate long-term investments. If one is willing to accept such industry-differences as a reasonable assumption, then any link between policy changes and outcome variables must be stronger in these more exposed sectors. For example, if the entry of new firms is beneficial for productivity, and a policy change makes it easier to start a business, then one would expect a stronger productivity effect in industries where firm entry rates are typically higher.

Instead of trying to identify the entire productivity increase that is associated with the policy change, the difference-in-difference approach aims to identify only this differential effect across industries, i.e. the degree to which firms in sectors with higher firm entry see their productivity rise more than firms in other sectors.[2] From an econometric point of view, the estimation coefficient is hence identified from an interaction of the policy variable with the sector-specific variable of firm turnover rates, which are highly correlated with firm entry because the overall number of firms in most sectors does not move much. Thus, the effect is estimated only from comparisons across firms in different industries within the same year. This rules out that productivity changes over time, which could come from many sources beyond the policy change, have an influence on the estimation coefficient. Since regressions with interaction

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2.   In their original approach, Rajan and Zingales (1998) identified the effect of financial development on firm growth only through the differential effect on firms in sectors that are more dependent on external financing.

coefficients require including the two constituent terms of the interaction in order to be unbiased, year- and industry-fixed effects are included in the regression. Their coefficients capture all influences of factors that vary only across time and only across industries. At the same time, since the identification is only based on the interaction coefficient for robustness reasons, it is difficult to provide a quantitative interpretation of the overall effect, as part of the effect is also absorbed in the coefficients of the fixed effects, together with other influences.

Administrative requirements to start a business

In most market economies, the set of firms that make up any industry changes regularly. New firms enter the market and will likely succeed if they perform better than incumbents, while some incumbent firms will leave the market, partially as a result of new entry. This Schumpeterian process of creative destruction is essential for constant improvement, and the productivity dynamics associated with this process are an essential part of aggregate productivity growth (Olley and Pakes, 1996; Bartelsman et al., 2013). Administrative procedures required to start a business will make firm entry more cumbersome, and will all other things equal reduce the intensity of the creative destruction process. With less competitive pressures resulting from the threat of entry, and less firm turnover, firms face lower incentives to improve their productivity, a link that has been confirmed both in empirical work and theory by Aghion et al. (2005) and other works surveyed by Syverson (2011).

Information on the number of administrative procedures required to start a business is compiled by World Bank (2014), and these data show that Portugal has made significant reductions in the procedural requirements. In fact, the number of procedures has more than halved in Portugal between 2003 and 2011, moving Portugal from a middle-range position among OECD countries to one of the least restrictive countries with respect to this variable (Figure 2).

Figure 2. Administrative procedures required to start a business
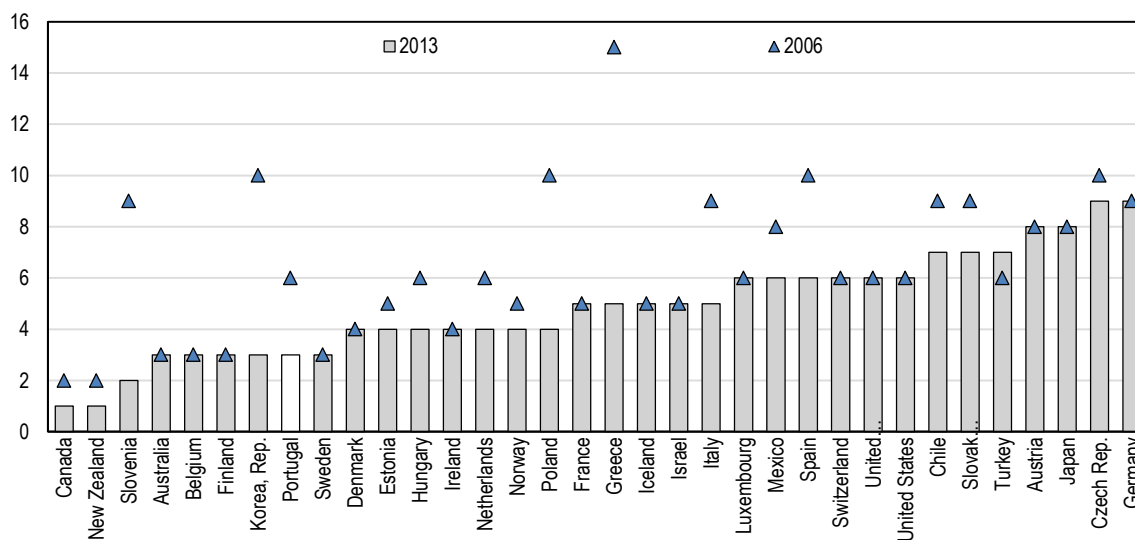
Source: World Bank (2014).

Since administrative procedures discourage firm turnover, this measure has been interacted with sector-specific gross firm turnover rates which have been calculated by Bartelsman et al. (2008). The idea behind interacting with turnover rates is that there are innate differences across sectors in technological, cost, and demand factors that drive firm dynamics, making firm turnover more frequent in that sector.

Rapid technological change could be one such factor, and indeed, turnover rates are particularly high in sectors producing electronic equipment such as office and computing machinery or radio, TV and communication devices. Changing consumer tastes could be another factor, supported by the high turnover rates in textiles, textile products and footwear, for example. By contrast, in other sectors, technology and tastes may move less rapidly, while long-term investments in production machinery or knowledge capital may be more relevant. This could explain why turnover rates are low in metals and metal products, for example.

If such differences are intrinsic to the sector, then these differences should be visible in all industrialised countries. In fact, they should be more visible in a country with few restrictions on the entry and exit of firms. Constructing this measure from Portuguese data would actually not be the best option, as it could result in an endogeneity of regressors if the observed turnover rates themselves are affected by policy settings in Portugal. For this reason, the interaction factors are constructed whenever possible from countries other than Portugal itself. In the case of turnover rates taken from Bartelsman et al. (2008), the measure is based on data from the United States, a country where firm entry and exit are arguably subject to fairly few restrictions. The same approach has been adopted in a similar context by Klapper et al. (2006).

The estimation equation is

$$\text{TFP}_{it} = \alpha + \beta \; Procedures\_to\_start\_business_t * Turnover\_rate_s^{USA} + D_t + D_s + \varepsilon_{it} \qquad [5]$$

Results are reported in column 4 of Table 1. More procedures required to start a business are associated with lower TFP, as evidenced by a significantly negative coefficient. Estimations relying on the time required for starting a business, rather than the number of procedures, have led to similar results. In practice, both these variables may measure quite similar things, as more procedures are likely to go hand-in-hand with longer delays.

Coverage of collective wage bargaining agreements

In Portugal, collective bargaining of wage agreements typically takes place at the level of entire sectors, and the resulting wage agreements are often made binding for all firms in the sector through administrative extension, even for those firms who did not participate in the negotiations. The economic literature has discussed the possibility that administrative extensions of wage agreements discourages the entry of new firms and hence reduces competition in product markets, because new firms often enter the market paying lower wages than incumbents for some time and administrative extensions rule out this entry strategy (Haucap et al., 2001). Measures of the coverage of collective wage bargaining agreements for a given sector can be constructed from a census of employees in Portugal called "Quadros de Pessoal". This data set allows calculating the fraction of workers in a given year whose wages were negotiated at a level higher than the firm where the employee works. In light of this interpretation of the extension of collective wage bargaining agreements as implicit barriers to entry, the interaction factor chosen for the difference-in-differences strategy is the same as in the case of administrative procedures required for firm entry, i.e. industry-level variation on firm turnover rates for the United States ($Turnover\_rate_s$) from Bartelsman et al. (2008).

The estimation equation is

$$\text{TFP}_{it} = \alpha + \beta \; Coverage\_collective\_bargaining_t * Turnover\_rate_s^{USA} + D_t + D_s + \varepsilon_{it} \qquad [2]$$

where the fixed effects for time and industries act as the constituent terms for the interaction term. Given that the dependent variable varies at the level of firms while the interaction variable varies at the level of

sectors and years, standard errors have been clustered to allow the error terms to be correlated in an unrestricted way across establishments within the same sector and year (Moulton, 1991). Results in Table 1, column 1 suggest that a higher share of workers affected by collective wage bargaining agreements is associated with lower productivity of Portuguese firms.

Taxes

High taxes on corporations can reduce productivity by driving down the after-tax return of productivity-enhancing investments. Since the firm only appropriates the fraction of the profit increase that is not taxed away, it has weaker incentives to engage in productivity-enhancing investments than in a situation without corporate taxes. Cross-country empirical evidence supporting this effect, including at the firm level, has been presented by Arnold et al. (2011). Their analysis assumes that there are characteristics inherent to the production conditions in an industry that result in some sectors paying more taxes than others, for example because they rely on investments in intangibles or other risky activities that need to be compensated out of higher average profits or because they are intensive in the use of heavily-taxed factors.

The overall tax burden on companies, as a share of gross profits, is measured by World Bank (2014), and this measure ($Effective\_tax\_rate_t$) has the advantage that it measures an effective rather than a statutory tax burden. The interaction factor chosen are differences in accounting profitability across sectors, thus resulting in a larger tax burden as measured by the share of taxes paid as a share of value added in a given industry ($Taxes\_VA_s$). This data is constructed on the basis of data from the national statistical institute INE. The rationale behind the interaction factors is that some sectors have larger tax bases than others due to their specific production technologies, such as the extent to which they rely on profits to remunerate investments in tangible and intangible assets. The same interaction factor has been used by Arnold et al., (2011).

The estimation equation is

$$\text{TFP}_{it} = \alpha + \beta \; Effective\_tax\_rate_t * Taxes\_VA_s + D_t + D_s + \varepsilon_{it} \qquad [3]$$

The results from estimating this equation are shown in column 2 of Table 1. The significant negative coefficient estimates is consistent with the notion that higher taxes reduce the productivity of firms in Portugal.

Another aspect of taxes is compliance costs, i.e. how much it costs to comply with the process of paying taxes. Resources in terms of wages, fees or time used to file tax returns or to comply with other tax obligations increases input costs without creating additional output, hence decreasing firm productivity. Information on the number of hours it takes to comply with all tax obligations is compiled on a regular basis by World Bank (2014), and has come down by over 20% over the period 2006 to 2011. The interaction factor chosen for this analysis is the same as in equation 3.

$$\text{TFP}_{it} = \alpha + \beta \; Hours\_tax\_compliance_t * Taxes\_VA_s + D_t + D_s + \varepsilon_{it} \qquad [4]$$

Column 3 of Table 1 shows the results from this estimation. The estimated coefficient is once again negative and highly significant at the 1 percent level. This suggests that higher time requirements for complying with tax obligations are associated with lower firm productivity.

Enforcing contracts

The efficiency of the judicial system with respect to the enforcement of commercial contracts is likely to matter for firms' willingness to engage with new customers and suppliers. The policy variable used here

is the cost to enforce contracts, as measured in World Bank (2014). This policy variable measures the number of procedures that are necessary to enforce an outstanding debt contract through the judicial system ($Debt\_procedures_t$). The industry-specific interaction factor used in this case is a variable that measures the "institution-intensity" of individual industries, which was constructed by Nunn (2007) for a similar analysis. The variable is a measure for how many inputs of a firm require relationship-specific investments. The underlying idea is that, in particular when investments are relationship-specific, under-investment occurs if contracts cannot be enforced. For more details on the construction of the variable see Nunn (2007). The estimation equation is

$$\text{TFP}_{it} = \alpha + \beta \, Debt\_procedures_t * Institution\_intensity_s + D_t + D_s + \varepsilon_{it} \qquad [2]$$

where the fixed effects for time and industries act as the constituent terms for the interaction term. Results are shown in Table 1, column 5. Results indicate that higher costs of enforcing contracts are associated with lower TFP.

Table 1.Empirical regression results

Dependent variable: TFP

Policy variable	Industry interaction factor	(1)	(2)	(3)	(4)	(5)
Number of procedures required to start a business	Firm turnover rates by industry in the US (Bartelsman et al. 2008)	-0.0016 ** (0.0007)				
Coverage of collective wage bargaining agreements in sector (constructed from Quadros de Pessoal microdata)	Firm turnover rates by industry in the US (Bartelsman et al. 2008)		-0.0749** (0.030)			
Tax burden on companies (from Doing Business data)	Taxes paid as share of value added, from an input-output tables (OECD)			-0.752** (0.391)		
Tax compliance costs (from World Bank, 2014)	Taxes paid as share of value added, from an input-output tables (OECD)				-0.00075*** (0.00021)	
Number of procedures necessary to enforce a contract	Institution-intensity by industry (Nunn, 2007)					-0.017** (0.009)
Industry fixed effects		included	included	included	Included	included
Time fixed effects		included	included	included	Included	included
Number of observations		111663	122726	122726	122701	169723

Note: ***, ** and * denote statistical significance at the 1, 5 or 10% level, respectively. Standard errors in parentheses, clustered at the level of industry and year.

Conclusion

The empirical analysis described in this paper provides evidence for significant links between policy variables and firm productivity in Portugal. The results are based on a census of Portuguese manufacturing companies, covering more than 40,000 firms between 2006 and 2011. They suggest that firm productivity is significantly affected by higher administrative requirements for starting a business, and by a more extensive coverage of collective wage bargaining agreements. One possible explanation for this effect could be that by curbing entry, administrative procedures and the extension of wage agreements to entire sectors reduce the competitive pressures on incumbent firms and hence their incentives to improve production efficiency. The results also provide evidence of a negative link between the tax burden and firm

productivity, and suggest that high tax compliance costs reduce firm productivity. Finally, the firm-level regressions also find a significant link between the number of procedures required to enforce a contract on one hand, and firm productivity on the other.

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Table A.1: Levinsohn-Petrin production function estimates by industry, 2006-2011 (Equation 1).

NACE Rev.2		Coefficient estimates			Estimated returns to scale	No. of obs.
		Labour	Capital	Material		
10	Manufacture of food products	0.29	0.03	0.71	1.02	22 222
11	Manufacture of beverages	0.14	0.05	0.71	0.91	2 250
13	Manufacture of textiles	0.37	0.07	0.51	0.95	10 408
14	Manufacture of wearing apparel	0.48	0.08	0.27	0.83	21 836
15	Manufacture of leather and related products	0.42	0.04	0.26	0.72	8 617
16	Manufacture of wood and of products of wood and cork, except furniture	0.25	0.04	0.71	0.99	14 013
17	Manufacture of paper and paper products	0.26	0.07	0.77	1.09	2 064
18	Printing and reproduction of recorded media	0.31	0.03	0.82	1.15	10 716
20	Manufacture of chemicals and chemical products	0.19	0.05	0.82	1.07	1 902
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.21	0.13	0.07	0.42	418
22	Manufacture of rubber and plastic products	0.24	0.01	0.65	0.90	4 875
23	Manufacture of other non-metallic mineral products	0.29	0.04	0.92	1.25	11 617
24	Manufacture of basic metals	0.29	0.03	1.00	1.32	1 923
25	Manufacture of fabricated metal products, except machinery and equipment	0.36	0.04	0.69	1.09	47 072
26	Manufacture of computer, electronic and optical products	0.27	0.05	0.96	1.28	332
27	Manufacture of electrical equipment	0.29	0.01	0.75	1.05	2 574
28	Manufacture of machinery and equipment not elsewhere classified	0.20	0.10	0.76	1.06	92
29	Manufacture of motor vehicles, trailers and semi-trailers	0.38	0.04	0.74	1.16	3 098
31	Manufacture of furniture	0.27	0.02	0.74	1.04	12 512
32	Other manufacturing	0.30	0.01	0.81	1.11	2 146
33	Repair and installation of machinery and equipment	0.39	0.08	0.34	0.81	7 405