Resource allocation, productivity and growth in Portugal

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ABSTRACT

Allocative efficiency in the Portuguese economy strongly deteriorated during the 1996-2011 period. According to our estimates, such deterioration may have shaved, on average, around 1.3 percentage points off the annual GDP growth during that period, contributing significantly to the decrease in productivity and the economic stagnation witnessed by the Portuguese economy after 2001. Allocative efficiency deterioration is a widespread phenomenon but the relative contributions differ significantly across industries being higher in the service sector than in manufacturing sector. Capital distortions emerge as more important than labor and output distortions in explaining potential value-added efficiency gains, especially in the service sector. Furthermore, their relative contribution to total efficiency gains increased over time.

Introduction

Financial integration of the Eurozone was supposed to improve resource allocation efficiency, facilitate risk sharing, and boost economic growth. However, this financial integration does not appear to have translated into higher growth or productivity at least for some southern and peripheral European countries, which have experienced stagnant or declining productivity and a loss of competitiveness, despite large capital inflows in the decade preceding the onset of the Eurozone crisis in 2009. In fact, as shown in Chart 1, total factor productivity (TFP) stagnated or decreased in countries like Spain, Greece, Italy, Ireland and Portugal during the period starting roughly in the year 2000 and spanning at least until 2009. The time profile of TFP in these countries in this period stands in stark contrast to other Eurozone countries like Germany, France, Finland and the Netherlands where productivity increased.

In this article, we investigate if, over time, there were changes in the degree of allocative efficiency of resources, which could have led to a significant decline in TFP and therefore to a poorer economic performance of the Portuguese economy. This is an interesting issue because substantial resources were channeled to the country beginning in the mid-1990s, by both official and private sources, and it raises the question of whether these resources were properly allocated. To answer this question, we study the evolution of resource misallocation in the Portuguese economy during the period 1996 to 2011 using firm-level data.

Recently, Reis (2013) in searching for the causes of the Portuguese economic slump of the 2000’s argued that certain characteristics of Portugal’s financial sector caused the capital inflows to be largely misallocated, leading to an expansion in the country’s relatively unproductive nontradables sector, and thus to a fall in measured productivity. This explains why, in his view, the case of Portugal is unique in the sense that it was the only country where GDP stagnated, while Greece, Ireland and Spain enjoyed a boom.

This article also looks at resource misallocation but departs from Reis (2013) in some important dimensions. While Reis (2013) looks at between-sector misallocation, we use firm-level data to investigate the evolution of within-industry resource misallocation and its implications for potential
Portuguese TFP and GDP growth. Additionally, our methodological approach allows us to identify the relative importance of the distortions prevailing in the economy and their negative implications for TFP growth, including not only capital distortions, but also labor and output distortions.

Theoretical framework

In order to identify the linkage between aggregate productivity and resource misallocation, we adopt the framework developed in Hsieh and Klenow (2009, 2011), but extend their model to consider a production function with intermediate inputs, as a third factor of production. This three-factor production function extension allows us to investigate resource misallocation by looking not only at firms’ gross output, but also at firms’ value added, with the important advantage that identified value-added efficiency gains are consistent with the efficient allocation of intermediate inputs, something that is not guaranteed by the two-factor model approach used so far in the literature.

A first assumption of the model is that within each industry there is monopolistic competition and the production function is the same for all firms. In particular, the gross output of a generic firm in industry is given by the following Cobb-Douglas production function with constant returns to scale:

\[ Y_i = A_i K_i^\alpha H_i^\beta Q_i^{1-\alpha-\beta} \]

where \( Y_i \), \( A_i \), \( K_i \), \( H_i \) and \( Q_i \) stand for the firm’s gross output, TFP, capital stock, labor and intermediate inputs, respectively. Parameters \( \alpha \) and \( \beta \) stand for the output elasticities of capital and labor, respectively.

A second assumption is the existence of distortions or wedges in the economy, the importance of which may vary from firm to firm, and can impact the prices of the inputs or directly affect the output of the firm. In particular, it is assumed that there are three distortions that we designate by the output distortion, the capital distortion and the labor distortion. Such distortions take the form of a tax on revenues, a tax on capital services and a tax on labor costs, respectively.
The list of potential distortions that may affect firms in the economy is long and varied. For instance, non-competitive banking systems may offer favorable interest rates on loans to some producers based on non-economic factors, leading to a misallocation of credit across firms. Or, financial institutions may be unable or unwilling to provide credit to firms that are highly productive but have no credit history or insufficient guarantees, preventing these firms from expanding their activities. In contrast, some small or medium-sized firms may have access to cheaper capital through special lines of credit. Governments may offer subsidies, special tax deals or lucrative contracts to specific producers. Enforcement activity of tax collection may focus on large and more productive firms implying a subsidy to small potentially less productive ones. Some labor-market regulations, such as the one that compels larger firms to have an internal worker health protection system, may drive up the cost of labor in those firms. Whereas, subsidies for hiring workers in smaller firms may drive down the cost of labor in these firms.

From the profit maximization conditions, given the model assumptions described above, it is possible to obtain the expression of the so-called total factor revenue productivity for firm $i$ in industry $S$ ($PTFR_{si}$):

$$PTFR_{si} = B_s \frac{(1 + \tau_k)^{\alpha_i} (1 + \tau_h)^{\delta_i}}{(1 - \tau_y)}$$

where $\tau_y$, $\tau_k$ and $\tau_h$ for the output, capital and labor distortions, respectively, and $B_s$ is a constant, which is common to all firms of industry $S$ (and is a function of the prices of inputs, as well as of other parameters of the model).

The output, capital and labor distortions are identified in the model by comparing the ratio of factor costs in the firm with the average ratio of these costs in the corresponding industry. For example, we infer the presence of a capital distortion in a firm when the ratio of intermediate consumption to the capital costs is high relative to what one would expect from the output elasticities with respect to capital and intermediate inputs.

Equation (2) is very important because it shows that in the context of the model, TFPR, which by definition corresponds to the product of the price of output and TFP, does not vary across firms within the same industry, unless they face some kind of distortion. Intuitively, this equation tells us that, in the absence of distortions, more capital, labor and intermediate inputs will be allocated to the most productive firms (with higher TFP) to the point where their higher output results in a lower price, implying the same TFPR for all firms. In contrast, in the presence of distortions, a high (low) TFPR is a sign that the firm confronts barriers (benefits from subsidies) that make it produce below (above) the optimal level.

Let us then assume a hypothetical exercise in which the distortions in a given industry are eliminated so that TFPR is equalized across firms. According to equation (2), however, there are several alternative solutions for this TFPR, which vary according to the assumptions we make to the distortions $\tau_y$, $\tau_k$ and $\tau_h$. One possibility would be to use the TFPR that would result if all distortions or wedges were equal to zero ($\tau_y = \tau_k = \tau_h = 0$). However, this definition does not guarantee that in equilibrium the demand for factors of production at the industry level will be the same before and after the reallocation of resources. This would have general equilibrium effects which would lead to changes in the prices of the factors of production. An alternative solution, that we will adopt here, is the one that is obtained when all firms face the same average wedges $\bar{\tau}_k$, $\bar{\tau}_h$ and $\bar{\tau}_y$, and these are such that the demand for factors of production at the industry level is the same before
and after the reallocation of resources. Thus, our hypothetical exercise will involve a reallocation of the available resources away from low productivity firms that were benefitting from subsidies towards high productive firms that were facing distortions. The new TFPR, common to all firms in the industry, which is obtained under these conditions, will be called the efficient TFPR of industry $S$, and will be represented by $PTFR^*_S$.

Given the expression for $PTFR^*_S$, it is possible to compute the output of the industry $S$ that would be obtained in the absence of distortions, i.e., the level of efficient output. Comparing the efficient output with the actual output, we can compute the industry, as well as the economy aggregate gross-output reallocation gains.

As the exercise fixes the total amount of inputs and calculates the additional output stemming simply from the reallocation of inputs among the firms in the industry, it follows that the potential gains in terms of gross output coincide with the potential gains in terms of productivity (TFP).

Once we have the gross-output reallocation gains at the industry level, obtaining the gains in terms of value added is straightforward. Value added is, by definition, the difference between gross output and intermediate consumption, and the latter, as we have seen, is constant at the industry level. The value-added gains for the whole economy are obtained by aggregating the value-added gains at the industry level.

The exercise assumes that eliminating all the distortions identified in the context of the model is a good thing to do. It may, however, be argued that there are distortions that cannot or should not be completely eliminated. For example, we can think of an optimum situation in which the cost of capital (interest rate) differs across firms according to some risk criteria. Further, it should be kept in mind that the distortions identified in the exercise also capture the effects of any friction whose impacts differ across firms. In particular, they may capture the presence of adjustment costs to varying factors or the effect of rationing due to quantity restrictions. All in all, it can be argued that the hypothesis of complete elimination of distortions at the industry level, as assumed in this exercise, may lead to efficiency gains higher than those that would result from the elimination of distortions caused by discretionary policies alone.

Main results

Let us now take a look at the efficiency gains both in terms of gross output and value added, which are obtained when we assume that distortions are eliminated from the economy. It is important to bear in mind that the efficiency gains are identified at a highly disaggregated level, industries being defined at the 3-digit level of the Classification of Economic Activities (NACE). Overall, this classification implies 212 distinct industries (115 for manufacturing, 9 for agriculture (including mining and quarrying) and 88 for services (including construction, production and distribution of electricity and water supply)).

The results for the 1996-2011 period are shown in Table 1 and allow us to draw some important conclusions. First, the potential gains from eliminating distortions in the Portuguese economy appear to be modest in terms of gross output, but are quite significant when evaluated in terms of value added. For instance, if we look at the gross-output gains for the whole economy, we conclude that in 2011 actual output would increase by around 28 percent if the identified distortions were eliminated from the economy. However, these gross-output gains would imply value-added gains of around 79 percent. The difference stems from the fact that gross-output gains at the industry level are computed under the assumption of constant intermediate inputs, so that even...
small gains in terms of gross output may imply very large value-added gains. This will especially be the case in the industries where intermediate inputs are a large proportion of gross output. It is important to note that the reallocation gains for Portugal regarding the manufacturing sector are not significantly different from the ones obtained for countries like the U.S. and France.\footnote{Note: Entries in the Table are the percentage increase in gross output or value added that would take place if distortions were eliminated from the economy, as discussed in the previous section.}

### Table 1 • Efficiency gains from equalizing TFPR within industries

#### Gross-output gains

<table>
<thead>
<tr>
<th>Years</th>
<th>Total economy</th>
<th>Agriculture</th>
<th>Manufacturing</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>16.91</td>
<td>24.84</td>
<td>11.21</td>
<td>24.42</td>
</tr>
<tr>
<td>1999</td>
<td>17.41</td>
<td>17.78</td>
<td>10.70</td>
<td>24.95</td>
</tr>
<tr>
<td>2004</td>
<td>23.69</td>
<td>19.26</td>
<td>12.37</td>
<td>32.27</td>
</tr>
<tr>
<td>2008</td>
<td>28.86</td>
<td>17.02</td>
<td>13.24</td>
<td>39.26</td>
</tr>
<tr>
<td>2011</td>
<td>28.03</td>
<td>31.29</td>
<td>13.66</td>
<td>38.44</td>
</tr>
</tbody>
</table>

#### Value-added gains

<table>
<thead>
<tr>
<th>Years</th>
<th>Total economy</th>
<th>Agriculture</th>
<th>Manufacturing</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>48.00</td>
<td>57.11</td>
<td>37.49</td>
<td>58.17</td>
</tr>
<tr>
<td>1999</td>
<td>48.15</td>
<td>38.62</td>
<td>35.34</td>
<td>58.63</td>
</tr>
<tr>
<td>2004</td>
<td>63.25</td>
<td>45.47</td>
<td>40.49</td>
<td>76.49</td>
</tr>
<tr>
<td>2008</td>
<td>78.94</td>
<td>40.61</td>
<td>47.86</td>
<td>93.93</td>
</tr>
<tr>
<td>2011</td>
<td>79.01</td>
<td>81.82</td>
<td>53.53</td>
<td>91.51</td>
</tr>
</tbody>
</table>

Note: Entries in the Table are the percentage increase in gross output or value added that would take place if distortions were eliminated from the economy, as discussed in the previous section.
A second important conclusion is that the largest gains take place in the service sector. In terms of value added, the potential efficiency gains in this sector are 92 per cent in 2011, almost twice as much as the gains in manufacturing. In other words, these results show that allocation of resources is significantly less efficient in the service sector than in manufacturing. A lower degree of competition in the service sector may help explain this result. Services are generally non tradable and often protected by specific regulations. Moreover, variables like location play a much more important role in services than in manufacturing. Extensive misallocation is a symptom of a lack of competition for the available resources, as policies, market failures or location advantages favor some firms relative to others, for reasons other than their relative efficiency.

A third important point to note from Table 1 and Chart 2, is that the efficiency gains for the overall economy increased significantly over time. This is a reflection of increasing misallocation over the sample period. Between 1996 and 2011 the hypothetical efficient levels of gross output increased from 17 percent to 28 percent above actual gross output levels, while efficient levels of value added increased from 48 percent to 79 percent above actual value added or gross domestic product (GDP) levels, respectively. Thus, the decline in allocative efficiency during the sample period implied cumulative losses of 9.5 percent of gross output (1.28/1.17-1) and 21 percent of GDP. Correspondingly, deteriorating allocative efficiency in the Portuguese economy may have shaved, on average, 0.6 pp off annual gross output growth or 1.3 pp off annual GDP growth in the 1996-2011 period. These are very large numbers because during the same time period, Portuguese real GDP increased only 25.2 percent (1.5 percent per year, on average).

Table 1 and Chart 2 also show that the service sector is the main driver of this result. In fact, not only has the importance of reallocation gains increased faster in this sector than in manufacturing or agriculture, underscoring the idea of increasing misallocation of resources in services, but also the importance of services in the economy has increased significantly during this period.

A more detailed analysis at the industry level shows that the deterioration of allocative efficiency over time is a widespread phenomenon. However, its importance is highly concentrated in a limited number of industries of the service sector. The top five most important industries account for 72 percent of the total variation of misallocation. “Construction” (buildings and roads) is the most important industry followed by “ground transportation”, “transportation support activities” (e.g., road and toll-road management and maintenance), “general support services” (accounting and auditing, law, fiscal consulting, market research, etc.) and “wholesale of food, beverage and tobacco”. In turn, the industries with the best performance, in the sense that they helped reduce the allocative efficiency deterioration, include, in descending order of importance, the “production, transportation and distribution of electricity”, “rental car”, “advertising”, “alcoholic and non-alcoholic drinks” and “wholesale of intermediate goods.”

The results presented in Table 1 are conditioned by the assumptions regarding some parameters of the model, by the way the labor input is measured and by the fact that the data sample does not include firms with less than 20 employees. However, some robustness tests showed that charts in that Table can be seen as conservative estimates for the levels of efficiency gains, as well as for the negative consequences for productivity and GDP growth in Portugal. In particular, when firms with less than 20 employees (which play a very important role in the Portuguese economy) are included in the sample, the efficiency gains become significantly higher than the ones presented in Table 1. This increase is mainly driven by the service sector, where gains in terms of value added in 2011 are about twice as large as those presented in Table 1. Overall, these results show that a very significant part of the misallocation problems is concentrated in the small firms of the service sector and that misallocation increased over time, implying significant productivity and value added losses.
The importance of distortions

The way the distortions vary across firms, as well as the relative importance of each distortion are two important aspects that help to characterize the sources of resource misallocation.

There are reasons to believe that the relative importance of distortions may vary with the size of the firms. For instance, if distortions are due to firm-size contingent policies that favor smaller firms by reducing the cost of capital (through special lines of credit) or the cost of labor (through especial labor regulations), then returns to additional capital and labor would be expected to be lower in smaller firms. In contrast, if misallocation is due to financial market failures that favor larger firms, we would expect the presence of many small firms that did not grow because they could not secure access to credit. Enforcement activity of tax collection may focus more on large and more productive firms implying a subsidy to small potentially less productive ones. Therefore, in order to identify the sources of distortions we start by investigating the relationship between misallocation and firm size.

Chart 3 shows the relationship between firms’ size in terms of gross output and their scaled TFPR. From the chart, we see that for the whole economy (upper panel) TFPR increases with size (in a non monotonic way) suggesting that, on average, small and medium-sized firms are benefiting from relatively smaller distortions (firms for which scaled TFPR is negative). This pattern for the whole economy closely reproduces what happens in the service sector (bottom panel).
The situation is distinct regarding the manufacturing sector: while TFPR increases with size for small firms, it is essentially uncorrelated with gross output for large and very large firms.

With the aim of identifying the most important type of distortion in each case, we may exploit the relationship between scaled TFPR and the wedges. It can be shown that the scaled TFPR for firms in a given industry $S$, can be decomposed as:

$$
\ln \left( \frac{PTFR^*_S}{PTFR^*} \right) = \alpha_s \ln \left( \frac{1 + \bar{r}_k}{1 + \bar{r}_k^S} \right) + \beta_s \ln \left( \frac{1 + \bar{r}_h}{1 + \bar{r}_h^S} \right) - \ln \left( \frac{1 - \bar{r}_y}{1 - \bar{r}_y^S} \right)
$$

where $\bar{r}_k$, $\bar{r}_h$, and $\bar{r}_y$ stand for the average wedges in industry $S$ that would prevail in an efficient allocation of resources. Thus, equation (3) allows us to decompose the scaled TFPR for each firm as a weighted sum of the scaled capital, labor and output wedges.

From Charts 4 and 5, which depict the relationships between each individual scaled wedge and gross output for the manufacturing and service sectors in 2011, we see that the three wedges increase with size, suggesting that, on average, small and medium-sized firms benefit from lower capital and labor costs, but tend to face higher output distortions.

In the Portuguese economy, capital distortions do not appear to affect small or medium-sized firms more heavily than they do to large firms, in contrast to what might be expected. Moreover, not only small but also medium-sized firms emerge as benefitting from lower labor costs. The fact that such
firms, both in the manufacturing and service sectors, emerge as benefiting from lower capital and lower labor costs is in line with the idea that smaller and medium-sized firms in Portugal benefit from firm’s size-contingent laws passed by the Portuguese Government that directly or indirectly reduce the costs of capital, as well as the costs of labor.  

We now evaluate the relative importance of the three types of distortions. Table 2 reports the value-added efficiency gains obtained by eliminating variation in one wedge at a time and fixing the quantity of the other two inputs. Capital distortions emerge as the most important type of distortions, with increasing importance over the sample period. Eliminating variation in the capital wedge implies value-added gains for the whole economy of 18 percent in 1996, 25 percent in 2004 and 32 percent in 2011. The corresponding charts for the labor wedge, which emerges as the second most important distortion, are 12, 15 and 17 percent, respectively. Interestingly, when we look at sectoral disaggregation we notice that the general picture changes somewhat. In the manufacturing sector, capital and labor distortions have about the same importance, while in the service sector, capital distortions have an impact about twice as large as labor distortions.  

| Table 2 • Relative importance of distortions (in terms of value added) |
|-----------------------------|------------------|------------------|------------------|
|                              | 1996             | 2004             | 2011             |
|                              | Total            | Manuf.           | Serv.            | Total            | Manuf.           | Serv.            | Total            | Manuf.           | Serv.            |
| Capital distortion           | 18.35            | 13.77            | 22.62            | 25.31            | 13.47            | 31.70            | 32.08            | 19.27            | 37.64            |
| Labor distortion             | 12.43            | 12.10            | 12.60            | 15.01            | 13.40            | 15.94            | 16.81            | 17.11            | 16.78            |
| Output distortion            | 8.68             | 7.84             | 9.42             | 8.58             | 10.50            | 7.65             | 9.39             | 11.50            | 8.56             |
| Total                       | 48.00            | 37.49            | 58.17            | 63.25            | 40.49            | 76.49            | 79.01            | 53.53            | 91.51            |

Note: Entries for each distortion are the gains obtained by eliminating variation in that distortion individually and fixing the quantity of the two other inputs. Entries for the total correspond to the gains of eliminating variation in the three distortions simultaneously and are reproduced from Table 1 above.  

Conclusions  

This article uses Portuguese firm-level data to investigate whether misallocation may have contributed to the poor performance of productivity and GDP growth of the Portuguese economy in the most recent years. We find that the potential efficiency gains obtained from eliminating distortions in the economy and reallocating resources to the most efficient firms within industries are significant and have increased over time. Equalizing TFPR across firms within an industry could have boosted valued-added 48 and 79 percent above actual levels in 1996 and 2011, respectively. These charts imply that deteriorating allocative efficiency may have shaved around 1.3 pp off annual GDP growth during the 1996-2011 period. This is significant given that the Portuguese GDP grew only 1.5 percent, on average, per year during this period. The main driver of the deteriorating allocative efficiency in the Portuguese economy is the service sector, where the importance of misallocation is significantly higher and increased much faster than in the manufacturing sector. Allocative efficiency deterioration during the sample period is a widespread phenomenon, but the relative contributions differ significantly across industries. We observe a high concentration in just a few industries of the service sector, with 5 industries accounting for 72 percent of the total increase in resource misallocation.
Capital distortions emerge as more important than labor and output distortions in explaining potential value-added efficiency gains, especially in the service sector. Furthermore, their relative contribution to total efficiency gains increased over time, from 46 percent in 1996 to 55 percent in 2011.

Smaller firms appear as having, on average, benefitted from capital and labor subsidies. This suggests that a large proportion of firms may have survived because they had access to cheap credit and labor, either because of firm size-contingent laws passed by the Portuguese Government, that directly or indirectly reduced the costs of inputs for these firms, or because they managed to evade taxes or circumvent some general labor and/or capital regulations. At the same time, these smaller firms also face larger output distortions, but in combination the distortions suggest that most of these firms should shrink in size.

The reasons that might explain why within-industry misallocation has increased overtime in the Portuguese economy are not easily identifiable. The fact that an important part of the misallocation problems appears to be concentrated in the micro or small firms especially of the service sector, and that the importance of such firms has increased over time (Braginsky et al. (2011)), probably because they benefitted from lower capital and labor costs, might help explain the observed time pattern of misallocation. Furthermore, the increasing importance of capital distortions suggests that the financial sector might have contributed to the survival of many small and relatively inefficient firms. This result is consistent with the message in Reis (2013), who argues that misallocation across sectors stemming from inefficiencies in the financial sector is the main responsible for the
Portuguese economic slump during the 2000’s. Still, we believe that further investigation is required in order to fully understand why misallocation increased in Portugal during that period.

The fact that productivity has stagnated or decreased in several southern and peripheral Eurozone economies in the 2000’s, as it did in Portugal, raises the question of whether these countries also witnessed a deterioration in allocative efficiency. This is certainly an issue deserving further investigation. It will also be important to study how the global financial crisis affected misallocation, in particular if it had a cleansing or scarring effect and whether there were asymmetric sectoral effects. We leave these important questions for future work.

References


Notes

1. This article reproduces the main results presented in Dias et al. (2014). The reader interested in the full set of results including the models used and the analytical derivations is referred to this publication. The opinions expressed in the article are those of the authors and do not necessarily coincide with those of the Banco de Portugal, the Eurosystem, the International Monetary Fund, its Executive Board, or its management. Any errors and omissions are the sole responsibility of the authors.

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5. Total factor productivity (TFP) may be defined as the quantity of output (or value added) that a firm can obtain from using one unit of mix of factors of production. This implies that TFP growth explains output (or value added) growth not explained by changes in the quantities of factors of production. The specific formula used to compute TFP in Chart 1 can be seen in https://www.conference-board.org.

6. The original data are balance sheet data for the 1996-2011 period and come from the Instituto Nacional de Estatística (INE), the Portuguese Statistics Institute. The source of information for the 1996-2004 subperiod is the Inquérito à Empresa Harmonizado (IEH), while for the 2004-2011 subperiod the information comes from the Sistema de Contas Integradas das Empresas (SCIE). In order to make the data from the two sources comparable, firms with less than 20 employees in the first year they are observed in the SCIE were excluded, because such firms are not included in the IEH. Therefore, it is important to bear in mind that the empirical results presented below for the 1996-2011 period are obtained from a sample that does not include firms with less than 20 employees.

7. The empirical evidence on efficiency gains, available in the literature for other countries, regards only the manufacturing sector and was mainly obtained using a two-factor model on value-added. Using this approach for Portugal we conclude that the value-added efficiency gains in the manufacturing sector are not significantly different from the ones obtained for the U.S. and France. Hsieh e Klenow (2009) get value-added efficiency gains of 43 percent for the U.S. in 1999, and Bellone e Mallen-Pisano (2013) get efficiency gains of 31 percent for France both in 1998 and 2005. For Portugal, we get efficiency gains of 29 percent in 1996 and of 38 percent in 2011.
8. Scaled TFPR is defined as the ratio \( \ln(PTFR \div PTFR^*) \) where \( PTFR^* \) stands for the efficient TFPR, as defined above. It can be shown that in an efficient allocation of resources the output of the firm will increase if its scaled TFPR is positive, i.e., if \( PTFR > PTFR^* \), and decreases if its scaled TFPR is negative.

9. Note that firms for which the scaled capital or labor wedges are negative may be thought of as being subsidized, i.e., facing lower capital and labor costs than firms for which those wedges are positive. In contrast, firms for which the scaled output wedge is negative are facing higher output distortions than firms for which it is positive.

10. Laws requiring large firms to maintain an internal worker health protection system, or that allow small firms to receive support to hire workers or to have access to special lines of credit, are examples of policies that give rise to labor and capital distortions that may help explain the results just described.