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# Is corruption efficiency-enhancing? A case study of the Central and Eastern European region

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**Abstract**

We investigate the role of firm-level bribes in explaining the efficiency of within-sector production factor allocation across firms in nine Central and Eastern European (CEE) countries in 2003-2012. We find a positive association between corruption and both labour and capital misallocation dynamics, once country framework conditions are controlled for. The link is larger the smaller the country, the lower the degree of political stability and of civil liberties, and the weaker regulatory quality. Results hold when instrumenting corruption with female representation in Parliament and the freedom of the press. Targeted action against corruption in the CEE region would thus enhance within-sector allocative efficiency, in turn a determinant of sectorial, and aggregate, TFP growth.

JEL codes: D24, D73, O47

Keywords: bribes, allocative efficiency, capital, labour

## 1. Introduction

There is a vast, yet inconclusive, literature exploring the link between corruption and economic growth, measured by a whole range of indicators (GDP, total factor productivity growth, investment rates). Some authors argue that corruption may foster economic development in that it constitutes the necessary "grease" to lubricate the wheels of stiff government administration, helping to overcome bureaucratic constraints, inefficient provision of public services and rigid laws. Others point out that the direction of the impact depends on the context in which corruption takes place, because instead of speeding up procedures, corrupt officials have an incentive to cause greater administrative delay in order to attract more bribes. The advocates of the "sand-the wheels" hypothesis argue that corruption reduces economic performance due to rent-seeking, increases of transaction costs and uncertainty, inefficient investment and misallocation of production factors. Moreover, the size of a country and the "industrial organization" of corruption, i.e. the degree of centralization of control and the time horizon of bureaucrats in power, can also influence the significance and sign of the relationship between corruption and economic growth, suggesting that non-linearities are at play.

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The incidence of corruption in the business environment can affect aggregate total factor productivity (TFP) growth both directly and indirectly. Corruption influences individual firm performance *directly* by favouring or constraining productive activities. *Indirectly*, corruption may condition the degree of efficiency with which production factors are allocated across firms operating in a given sector, by diverting or channeling resources from the most to the least productive units. The reasons are manifold. Since corruption is illegal and must be kept secret, government officials will tend to induce substitution into the goods on which bribes can be more easily collected, shifting a country's investments away from the highest value projects to less useful projects if the latter offer better opportunities to collect bribes and avoid detection (Shleifer and Vishny 1993). Corrupt bureaucrats may also maintain monopolies, prop up inefficient firms, prevent firm entry, discourage innovation and allocate talent, technology and capital away from their most productive uses (Murphy, Shleifer and Vishny 1991; 1993; Campos, Estrin and Proto 2010). When profits are extracted from firms via bribes, entrepreneurs may choose to expand less rapidly or to forgo productive activity altogether, to shift their savings towards the informal sector, to organize production to minimize the need for public services and therefore interaction with public officials, thus leading to a sub-optimal size of their enterprise. By giving preference to businesses that are not necessarily on the cusp of innovation, corruption can impede "creative destruction". Indeed, the better connected firms, which successfully pay bribes to obtain government services and not necessarily are the most productive, can operate with far from optimal input combinations and survive (Garcia-Santana et al. 2016). More in general, enormous time is lost by entrepreneurs engaged in corrupt activities, at the expense of firms productively running their business. On the other hand, it has been argued that corruption can guarantee efficient outcomes in competitions for government services: more productive entrepreneurs can afford higher bribes, so that licenses and government contracts are assigned to the most efficient firms (Lui 1985; Beck and Maher 1986). Moreover, bureaucrats themselves have an incentive to drive the most inefficient firms out of business, thereby enhancing the profitability of remaining firms, which in turns allows demanding higher bribes (Bliss and Di Tella 1997). More generally, corruption may promote allocative efficiency by allowing firms to correct pre-existing government failures, such as weak institutions or stiff regulations. Ultimately, the impact of corruption on input allocation is an empirical question that we intend to explore in this article.

Most of the empirical literature has focused either on the effect of firm-level bribery on firm productivity (for example, De Rosa, Gooroochurn and Görg 2010; Hanousek and Kochanova 2016) or on the impact of total-economy corruption on a country's aggregate economic performance (for instance, Mauro 1995; Tanzi and Davoodi 1997). In this study, instead, we use firm-level data on bribes, which allow exploring the variance in firm experiences with corruption within countries, and we investigate the relationship between bribes and one specific determinant of sectorial TFP growth, that is the within-sector allocative efficiency of both capital and labour. To our knowledge, this is the first attempt in the literature to employ corruption data, collected at firm level and appropriately aggregated at the sector level, in order to explain sectorial input (mis)allocation.[1]

[1] A similar field of research is being conducted on organized crime. For example, in a recent paper, Mirenda, Mocetti and Rizzica (2017) find that the impact of infiltrations of 'Ndrangheta, an organized crime clan centered in Southern Italy, on healthy firms operating in Central and Northern Italy is

We focus on nine Central and Eastern European (CEE) economies, namely Croatia, the Czech Republic, Estonia, Hungary, Lithuania, Poland, Romania, Slovakia and Slovenia, over time, thereby employing a three-dimensional dataset (*i* countries, *j* sectors, *t* time-periods). These countries, selected on the basis of firm-level data availability, represent a fascinating case study for the analysis of the link between corruption and input misallocation. First, following their entry into the European Union, significant action was undertaken to fight corruption, albeit to a varying extent across countries and sectors. Second, according to total-economy, qualitative measures, corruption is still high in CEE countries relative, for example, to core euro-area countries, suggesting large scope for improvement still. Finally, to our knowledge, with the exception of Benkovskis (2015) which focuses on Latvia, not included in our sample, this is the first cross-country/sector study on allocative efficiency in the CEE region.[2]

Based on Hsieh and Klenow's (2009) seminal model, input misallocation can be measured by the dispersion in the marginal productivity of inputs across firms within a sector. In the absence of distortions and assuming all firms in the sector face the same marginal costs, in equilibrium the marginal productivity of a given input should be equalised across firms, i.e. the dispersion should be zero. The CompNet data we employ in this article show a significant increase in within-sector input dispersion in CEE countries over the period 2003-2012, albeit with different time patterns according to the type of production factor (labour or capital).

We adopt a narrow measure of corruption, focusing on a synthetic indicator we construct based on the frequency and amount of bribes to engage in productive activities reported by private non-financial firms, in turn taken from the World Bank and the European Bank for Reconstruction and Development's Business Environment and Enterprise Performance Survey (BEEPS). We therefore clearly distinguish corruption from organized crime and from industrial fraud by outsiders or by employees of the firms involved.

In our empirical analysis, framed within a neoclassical conditional convergence model, we find that that corruption dynamics negatively affect changes in the efficiency with which both capital and labour are allocated across firms within given sectors, especially in economies which are small and politically unstable, with lesser civil freedom and with a weaker regulatory framework. "Contextual" variables are thus crucial in determining the effect of changes in bribery on input misallocation dynamics. These results are robust to the use of two instrumental variables for corruption, the share of female representation in Parliament and the degree of freedom of the press.

In conclusion, this article provides evidence on how fighting corruption in the CEE region is a significant means to reduce both capital and labour misallocation across firms and thus, via this channel, to boost aggregate TFP growth. We, however, necessarily underestimate the impact of eliminating corruption on TFP growth for at least two reasons: a) our definition of corruption is very narrow, so we are not considering other potential forms of corruption which can affect a country's

significantly distortionary and asymmetric: generally, competitors experience a loss in terms of revenues and their likelihood of exiting the market significantly increases, while the propensity of new firms to enter infiltrated markets decreases, thereby exacerbating input misallocation.

2 In particular, Benkovskis (2015) finds that low competition in domestic markets, tighter credit supply and legal issues are correlated with high input misallocation in Latvia.

development process and b) due to restricted data availability (i.e. the fact that the CompNet database only provides the distribution of firm's productivity within a sector and not the productivity of all firms in a given sector), in this article we cannot analyze the effect that bribes may exert on individual firms' productivity growth. The latter effect has been found to be sizeable in the literature (see, for example, Hanousek and Kochanova 2016) and would therefore have to be considered in addition to our results, when computing aggregate TFP gains from reducing corruption.

This article is structured as follows. Section 2 provides the theoretical and empirical framework underpinning the measures of input misallocation used herein and presents some evidence on resource misallocation in CEE countries since 2003. Section 3 provides a detailed analysis of BEEPS bribe data in the CEE region in the same period. Section 4 presents our empirical results referring to the relationship between changes in corruption and input misallocation. Section 5 concludes.

## 2. Labour and capital misallocation dynamics in CEE countries

### 2.1. A theoretical model for input misallocation

To measure input misallocation we adopt the theoretical approach developed by Hsieh and Klenow (2009; 2013), based on an economy with S intermediate goods sectors and one final goods producer that combines the output of the S sectors using a Cobb-Douglas production technology. In turn, each sector *s* is a CES aggregate of *M* differentiated products ($Y_{si}$):

$$Y_s = \left(\sum_{i=1}^{M} Y_{si}^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma-1}{\sigma}} \tag{1}$$

where $\sigma > 1$ is the elasticity of substitution across any pair of intermediate goods. The production function of intermediate goods of firm *i* in sector *s* is given by a Cobb-Douglas function:

$$Y_{si} = A_{si} K_{si}^{\alpha_s} L_{si}^{1-\alpha_s} \tag{2}$$

where $Y_{si}, L_{si}$ and $K_{si}$ are, respectively, the valued added produced and the labour and capital inputs employed by firm *i* and $\alpha_s$ denotes the share of capital in the production process. Capital and labour shares are allowed to differ across sectors (but not across firms within a sector) and sum to one under constant returns to scale. As in Melitz (2003), firms differ in terms of their productivity level $A_{si}$. Additionally, however, firms also differ in the output and input constraints they face. We denote with $\tau_{Ysi}$ firm-specific distortions that increase the marginal products of capital and labour by the same proportion and $\tau_{Ksi}$ as firm-specific distortions that raise the marginal product of capital relative to labour. Assuming that all firms in the same sector face the same wage ($w_s$) and rental cost of capital ($r_s$), profits are defined as:

$$\pi_{si} = (1 - \tau_{Ysi})P_{si}Y_{si} - w_s L_{si} - (1 + \tau_{Ksi})r_s K_{si} \tag{3}$$

where $P_{si}$ is the output price fixed by the firm *i*. Profit maximization yields the standard condition that the firm's output price is a fixed mark-up over its marginal cost:

$$P_{si} = \frac{\sigma}{(\sigma-1)}\left(\frac{r_s}{\alpha_s}\right)^{\alpha_s}\left(\frac{w_s}{1-\alpha_s}\right)^{(1-\alpha_s)}\frac{(1+\tau_{Ksi})^{\alpha_S}}{A_{si}(1-\tau_{Ysi})} \tag{4}$$

Manipulations of the first order conditions yield the following expressions for the capital-labour ratio, labour and output:

$$\frac{K_{si}}{L_{si}} = \frac{\alpha_s}{(1-\alpha_s)}\frac{w_s}{r_s}\frac{1}{(1+\tau_{ksi})} \tag{5}$$

$$L_{si} \propto \frac{{A_{si}}^{\sigma-1}(1-\tau_{Ysi})^{\sigma}}{(1+\tau_{Ksi})^{\alpha_s(\sigma-1)}} \tag{6}$$

$$Y_{si} \propto \frac{{A_{si}}^{\sigma-1}(1-\tau_{Ysi})^{\sigma}}{(1+\tau_{Ksi})^{\alpha_s\sigma}} \tag{7}$$

The relative size of firms depends therefore not only on firm productivity levels (with capital and labour increasing the more productive the firm), but also (negatively) on the output and capital distortions firms face. Idiosyncratic distortions prevent firms from equalising their capital-labour ratios. This also translates into differences in the marginal revenue products of labour and capital across firms. Specifically, the marginal revenue product of labour ($MRPL_{si}$) is proportional to revenue per worker:

$$MRPL_{si} = (1 - \alpha_s)\frac{\sigma-1}{\sigma}\frac{P_{si}Y_{si}}{L_{si}} = w_s\frac{1}{1-\tau_{Ysi}} \tag{8}$$

and the marginal revenue product of capital $(MRPK_{si})$ is proportional to the revenue-capital ratio:

$$MRPK_{si} = \alpha_s\frac{\sigma-1}{\sigma}\frac{P_{si}Y_{si}}{K_{si}} = r_s\frac{1+\tau_{Ksi}}{1-\tau_{Ysi}} \tag{9}$$

Hsieh and Klenow (2009) further define physical total factor productivity of firm *i* operating in sector *s* as $TFPQ_{si} = A_{si}$ and the revenue total factor productivity as $TFPR_{si} = P_{si}A_{si}$. Only the availability of firm-specific price deflators allows the computation of TFPQ, whereas $TFPR_s$ is computed on the basis of the more frequently available sector-specific price deflators. This distinction allows deriving an expression that links firm physical total factor productivity to the dispersion in the marginal product of capital and labour. Specifically, using equations 8 and 9, we can express $TFPR_{si}$ in the presence of distortions as follows:

$$TFPR_{si} \propto MRPK_{si}^{\alpha_s} MRPL_{si}^{1-\alpha_s} \propto \frac{(1+\tau_{Ksi})^{\alpha_s}}{1-\tau_{Ysi}} \tag{10}$$

and sectorial productivity $A_s$ as follows:

$$A_s = \left( \sum_{i=1}^{M} \left( A_{si} \frac{\overline{TFPR_s}}{TFPR_{si}} \right)^{\sigma-1} \right)^{\frac{1}{\sigma-1}} \tag{11}$$

where $\overline{TFPR_s}$ is the average revenue productivity in the sector *s*. If marginal products were equalized across plants, implying an absence of capital and output distortions, TFPR would not vary across firms within the same sector and TFPQ= $\overline{A_s} = (\sum_{i=1}^{M} A_{si}^{\sigma-1})^{\frac{1}{\sigma-1}}$. Conversely, in the presence of distortions, equation 11 implies a negative relationship between the degree of dispersion in firms' TFPR within a given sector and the degree of inefficiency in the same sector. This property can be fully established in a special case when TFPQ and TFPR are jointly log-normally distributed, such that $A_s$ can be expressed as:

$$logA_s = \frac{1}{\sigma-1} log\left(\sum_{i=1}^{M_s} A_{si}^{\sigma-1}\right) - \frac{\sigma}{2} var(logTFPR_{si}) \tag{12}$$

Sectorial TFP therefore depends on individual firms' TFP (the first term of equation 12) and on the dispersion of TFPR across firms (the second term), which in turn depends on how efficiently production factors are allocated across firms, a result of distortions. Allocative efficiency implies the absence of dispersion of TFPR across firms, and therefore a second term equal to zero. The extent of input misallocation is worse the higher the within-sector dispersion of marginal productivity of inputs across firms and therefore of the second term in equation 12.[3]

One must be aware that distortions might not be the only explanation behind the observed dispersion in TFPR. Indeed, Hsieh and Klenow's (2009) model is based on restrictive assumptions on preferences and on the production technology. TFPR dispersion could be the result of firms setting firm-specific, as opposed to fixed, mark-ups (see, for example, Peters 2013). Additionally, the Cobb-Douglas assumption might be too demanding. In this respect, Bartelsman, Haltiwanger and Scarpetta (2013) show that the within-sector dispersion in labour productivity is larger than the within-sector dispersion in TFP. This finding is difficult to reconcile with a Cobb-Douglas production function and the assumption that profit-maximizing firms equate their MRPL to wages

[3] Because of the presence of omitted factors in the Hsieh-Klenow model and of measurement errors, the benchmark value of zero variance in TFPR across firms is often replaced by the TFPR dispersion observed in a benchmark, "frictionless" economy, such as the U.S. (see, for example, in addition to Hsieh and Klenow 2009, Bellone and Mallen-Pisano 2013), assuming that the above-mentioned omitted factors and measurement errors are similar across countries.

since these two conditions would imply that there is no dispersion in labour productivity. Furthermore, Asker, Collard-Wexler and De Loecker (2014) show that in a dynamic setting with capital adjustment costs the within-sector dispersion in MRPK can be largely explained by changes in the volatility of productivity across sectors, suggesting the role of distortions may be negligible. In other terms, resource allocation may seem inefficient in a static sense (i.e. since the dispersion in MRPK is different from zero) even in an undistorted economy, but actually be efficient in a dynamic sense.

In order to verify the soundness of the information on input misallocation stemming from Hsieh and Klenow's (2009) model, we have also analysed an alternative measure used by the recent literature on labour misallocation, in particular the so-called OP gap (Olley and Pakes 1996). The (log) labour productivity of a sector is equal to the weighted average of the labour productivity of the firms active in the sector, where the weights are each firm's share in sectorial employment. Sectorial labour productivity can be decomposed into two parts: *a)* the unweighted average of firm-level productivity and *b)* the within-sector cross-sectional covariance between the relative productivity of a firm and its relative weight, given by its size (i.e. the OP gap). Given the unweighted sectorial mean, the higher the covariance the larger the contribution of the allocation of resources across firms to the sectorial productivity level, relative to a situation in which resources had been allocated randomly across firms.[4] Mathematically, this is defined as:

$$lp_t = \sum_{i=1}^{N} s_{it} lp_{it} = \overline{lp_t} + \sum_{i=1}^{N} \Delta s_{it} \Delta lp_{it} \quad (13)$$

where $lp_t$ is the sectorial labour productivity, $\overline{lp_t}$ represents the unweighted average productivity of all firms in the sector and the second term on the right-hand side represents the covariance between the relative size and productivity of each firm. The relative size, in relation to the unweighted sectorial average, is given by $\Delta s_{it}=s_{it}-\overline{s_t}$ where $s_{it}$ is the employment of firm *i* and $\overline{s_t}$ is the unweighted employment average. The relative productivity, again with respect to the unweighted sectorial average, is given by $\Delta lp_{it} = lp_{it}-\overline{lp_t}$ where $lp_{it}$ is firm-level productivity.

Being grounded on a statistical decomposition, the OP gap has the advantage of being simple to compute and, according to Bartelsman, Haltiwanger and Scarpetta (2013), quite robust to mismeasurement. Additionally, it is easy to interpret, given that it provides the gain (in log points) in sectorial labour productivity stemming from the actual allocation of resources, relative to that obtained if resources were allocated randomly. On the other hand, the indicator also presents some disadvantages. Without the standard assumptions on the production function and/or demand curvature, the OP gap would be maximum if all resources were concentrated within the most efficient firm. But given that there are preferences for product variety, this would not be welfare-optimising. Secondly, the decomposition is cross-sectional and does not accommodate entry and exit, in the sense that it does not decompose aggregate productivity changes into components that are driven by entry and exit.[5] Lastly, Bartelsman, Haltiwanger and

[4] Clearly, firms need to be heterogeneous since, if all firms were the same, a random allocation of resources would deliver the same aggregate productivity as any different allocation.

[5] However, regarding the latter Melitz and Polanec (2015) have recently proposed a dynamic OP gap able to account for the contribution of net entry to industry productivity growth.

Scarpetta (2013) show that in the presence of overhead costs, the covariance between productivity and size is not zero, thereby suggesting that cross-country differences in the OP gap could be reflecting cross-country differences in overhead costs rather than differences in allocative efficiency.

## 2.2. Input misallocation in the CEE region, 2003-2012

In order to measure input misallocation we employ the Competitiveness Research Network (CompNet) micro-based database, described in Lopez-Garcia et al. (2015), and further enriched with data for the Czech Republic (Gamberoni et al. 2016). CompNet data sources are different across countries, although most rely on administrative data (firm registries). The period under study is generally 2003-2012, with some country or sector exceptions. The samples include firms with employees in the non-financial private sector, excluding sole proprietors. Data are available for nine 1-digit sectors of the economy, namely manufacturing, construction and seven service sectors. In our analysis we consider firms with at least one employee in all countries except Poland and Slovakia, where only data for firms with at least 20 employees are available.

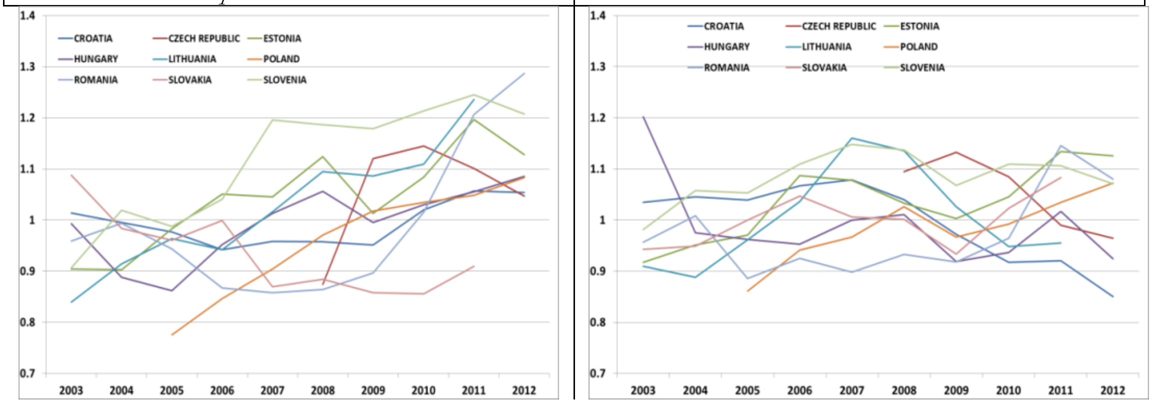
To compute the dispersion in marginal productivity of inputs we estimate a Cobb-Douglas production function *à la* Levinsohn and Petrin (2003) and Wooldridge (2009), as explained in more detail in Lopez-Garcia et al. (2015). The real stock of capital is defined as the book value of fixed tangible assets deflated with the GDP deflator and labour as the full-time-equivalent average number of employees in year *t*. The average technology coefficients of labour and capital of firms operating in a given country and 2-digit industry are estimated. The marginal revenue productivity of capital or labour is given by the product of the estimated coefficients and the average revenue productivity of capital and labour, respectively. Next, we purge the time-variation of the marginal productivity of the input at the firm level from developments common to all firms in the 2-digit industry (driven by price dynamics or technology improvements for example)[6] and compute its within-sector standard deviation. Lastly, we compute the dispersion of marginal productivity in a given 1-digit sector as the median of the standard deviation of marginal revenue productivity across all 2-digit industries in the 1-digit sector.

In order to compare country developments aggregate resource misallocation is computed as a value-added weighted average of the sector-specific MRPK and MRPL dispersions (Figure 1). Capital misallocation has been on an upward trend at least since the mid-2000s in all countries with the exception of Slovakia, where it slightly decreased on the whole. The upward trend appears to have steepened in several countries during the Great Recession, whereas it inverted in the Czech Republic. Overall labour misallocation increased, albeit to a lower extent than capital, in all countries (with the exception of Croatia and the Czech Republic, where it was set on a downward trend since the beginning of the period). It declined during the Great Recession in the Czech Republic and Lithuania, whereas in the remaining countries a temporary drop was followed by resumed growth.

[6] This purge was proposed by Kehrig (2011) and controls partially for the Asker, Collard-Wexler and De Loecker (2014) critique.

Figure 1. Input misallocation in the CEE region (country-specific weighted averages of the dispersion in MRPK and MRPL across sectors, respectively)

| *Capital misallocation* | *Labour misallocation* |
|---|---|



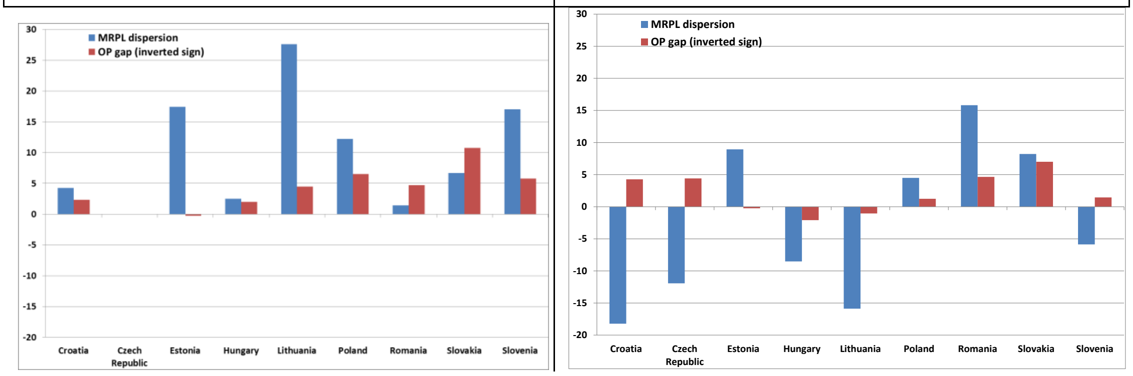

*Source: Authors' calculations based on CompNet data.*

*Note: Weighted average values, where the weights are the time-varying country-specific sectorial shares of value added. Data for the Czech Republic are available starting in 2008, for Poland in 2005, while data for Lithuania and Slovakia end in 2011.*

The OP gap, the alternative proxy of labour misallocation discussed in Section 2.1, broadly confirms these findings, with the minor exceptions of Croatia, Czech Republic and Slovakia during the Great Recession where developments appear to be less favourable than those registered by the dispersion in MRPL (Figure 2).

Figure 2. Labour misallocation: a comparison of two alternative measures (average annual growth rates)

| *2003-2007* | *2008-2012* |
|---|---|




*Source: Authors' calculations based on CompNet data.*

*Note: Weighted average values, where the weights are the time-varying country-specific sectorial shares of value added. The sign of the OP gap is inverted so that an increase in this indicator signals a rise in labour misallocation. Data for the Czech Republic are only available for the second sub-period.*

## 3. Corruption in the CEE region, 2002-2013

Given its illegal nature, the measurement of corruption is not straightforward. Perception-based total-economy indicators, published for example by Transparency International or by the World Bank, have the advantage of good cross-country coverage but they are mainly ordinal measures, providing the relative rankings of each country considered. Moreover, perceptions on corruption may be inaccurate for many reasons.

First, individual characteristics, such as education and gender, may have more power in predicting perceived corruption than actual corruption itself (Olken 2009). Second, the perception of corruption is affected by public awareness, public expectations and political bias issues (European Commission 2014). For example, if a country takes stronger action against corruption as a result of a scandal widely covered by the media, thereby contributing to reduce it, perception measures could erroneously signal a rise in corruption (e.g. Rizzica and Tonello 2015). Moreover, individuals in countries where government consistently underperforms will probably expect less from public officials and therefore provide a more benign view on corruption. Furthermore, the more unpopular the running government the greater dissatisfaction with respect to its policies and the more negative are views on corruption.[7]

In this paper we instead employ measures based on firm-level surveys, which, as well as having the advantage of being granular, should also capture actual corrupt transactions between public officials and firms as declared by the latter in interviews. In particular, we use the Business Environment and Enterprise Performance Survey (BEEPS), taken jointly by the World Bank and the EBRD. This survey was carried out on a representative sample of firms in the non-financial private sector in 1999, 2002, 2005, 2009 and 2013 for transition economies.[8] It provides information on both the frequency and the amount of bribes paid by firms to generally "get things done", as well as the frequency of bribes paid to, more specifically, deal with courts, pay taxes and handle customs.[9] In Section 4 we construct and employ a synthetic indicator of these five variables.

The drawback of survey-based corruption measures is that mis- or non-reporting by firms may be a serious issue (Jensen, Li and Rahman 2010). Indeed there is evidence that corruption is amongst the least reported crimes in surveys in that they imply an active involvement of the firms themselves in the illegal activity (Dugato et al. 2013). However, careful interview techniques and an accurate design of survey questions help building trust towards the interviewer and avoid implicating the respondent of wrongdoing, thereby encouraging accurate reporting. In particular, BEEPS questions are formulated indirectly by asking whether irregular payments occur for "establishments like this one". By avoiding a direct questioning, they increase the ability of the interviewee to potentially reply honestly.

Despite the design of the survey questions, not all firms replied to the BEEPS bribery-related questions, which present "no-response" or "I do not know" options. Figure 3 summarizes the percentages of missing data in each country for these questions. Across countries fewer respondents provide a reply to the question related to the amount of bribes (panel b) compared to the frequency question (panel a). With

[7] See Trésor (2016) for further issues concerning these perception-based measures, such as the fact that the stakeholders interviewed are not necessarily representative of the public directly impacted by corruption in the country under study.

[8] We are able to consider the different waves of the BEEPS, although the overall design in the survey has changed over time, since we only draw the measures of bribery, consistent over the different waves, from this source.

[9] In BEEPS bribes include both monetary payments and irregular gifts, with no possibility of distinguishing between cash and non-cash bribes. See Goel, Budak and Rajh (2012) for an analysis of this distinction in Croatia with cash payments being found to be more frequent in the case of "monopolistic" bureaucrats.

respect to the more detailed questions, non-response rates for the question related to the frequency of payments to deal with customs are generally the highest across countries (panel c). The countries with the highest non-response rates are Estonia, Poland and Romania for the frequency question (panel a) and Hungary, Poland and Slovakia for the bribery amount question (panel b).[10] Interestingly, in many countries non-response rates spiked in 2009, the worst year of the recent recessionary phase.

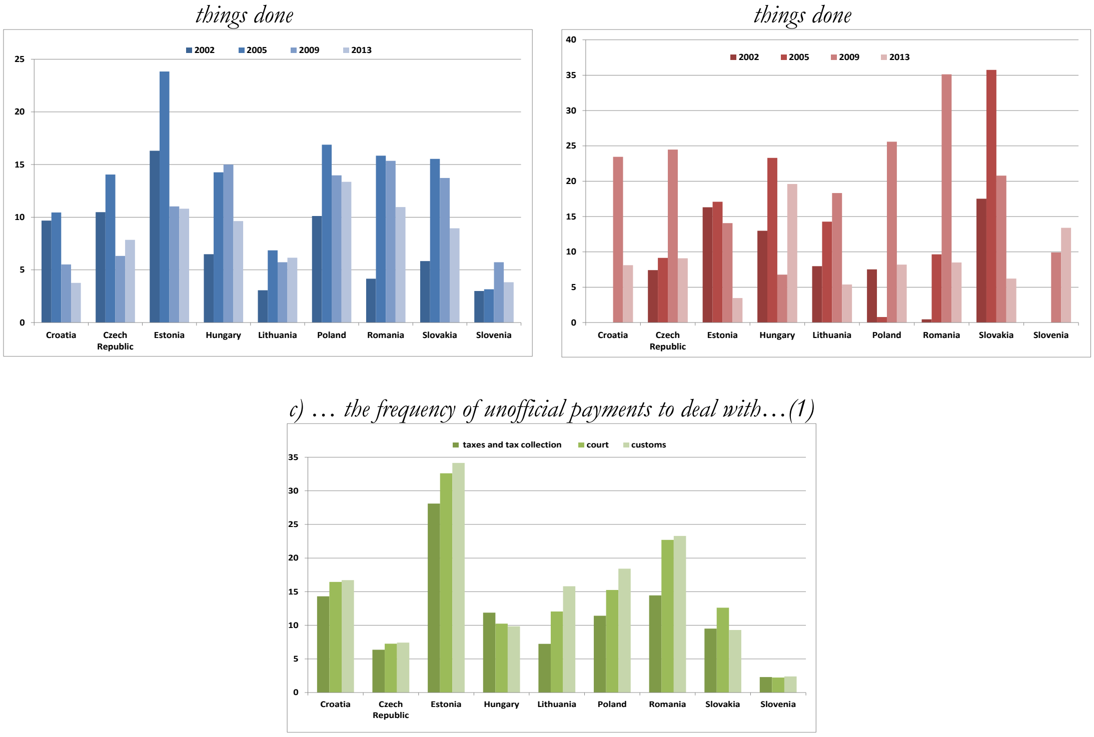
Since the non-negligible non-response rate raises concern about possible selection bias in replying, we estimate whether observable firm characteristics are correlated with missing bribery data. In particular, because the BEEPS sample of firms was selected using stratified random sampling techniques with strata based on firm size, sectors and regions, we here focus only on the 2009 and 2013 survey wave, which contains sample weights to increase the precision of the point estimates.[11]

Figure 3. Non-response rates to various BEEPS questions on… (percentage shares)

*a) …the frequency of unofficial payments to get things done*

*b) …the amount of unofficial payments to get things done*

*c) … the frequency of unofficial payments to deal with…(1)*




*Source: Authors' calculations based on BEEPS data.*

*Note: Country averages in the four BEEPS vintages considered in this paper. (1) Averages across the four BEEPS vintages.*

[10] The high non-response rate in Estonia to the frequency of payments questions in 2005 (which also affect the mean values shown in panel c) is driven mainly by non-responses by firms in the manufacturing, trade and food and accommodation sectors. In the same year the non-response rate of Estonian firms also to other BEEPS questions, such as those referring to the perception of the court system or of laws and regulations, was much higher relative to firms in other CEE countries, suggesting low trust in the BEEPS questionnaire as a whole.

[11] With stratification the probability of selection of each unit is, generally, not the same. Consequently, individual observations must be weighted by the inverse of their probability of selection.

**Table 1. Statistical correlations between response rates to alternative BEEPS questions and firm characteristics**

| **2009** | **Size (employees)** | | | | | **Size (sales)** | | | | | **Firm age** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | b/se | b/se | b/se | b/se | b/se | b/se | b/se | b/se | b/se | b/se | b/se | b/se | b/se | b/se | b/se |
| *Frequency of bribes to get things done* | -2.76 | | | | | -0.03 | | | | | -0.46 | | | | |
| | (3.69) | | | | | (0.16) | | | | | (0.69) | | | | |
| *Amount of bribes to get things done* | | -4.14 | | | | | -0.17 | | | | | 0.146 | | | |
| | | (2.65) | | | | | (0.12) | | | | | (0.54) | | | |
| *Frequency of bribes to deal with courts* | | | -0.78 | | | | | -0.06 | | | | | 0.622 | | |
| | | | (2.93) | | | | | (0.15) | | | | | (0.61) | | |
| *Frequency of bribes to deal with taxes* | | | | -3.3 | | | | | -0.08 | | | | | 0.689 | |
| | | | | (3.48) | | | | | (0.17) | | | | | (0.62) | |
| *Frequency of bribes to deal with customs* | | | | | 1.546 | | | | | 0.041 | | | | | -0.21 |
| | | | | | (2.63) | | | | | (0.13) | | | | | (0.66) |
| *Adjusted R-squared* | *0.065* | *0.065* | *0.064* | *0.065* | *0.065* | *0.142* | *0.143* | *0.142* | *0.142* | *0.142* | *0.073* | *0.072* | *0.073* | *0.073* | *0.072* |
| *Number of observations* | *2866* | *2866* | *2866* | *2866* | *2866* | *2375* | *2375* | *2375* | *2375* | *2375* | *2866* | *2866* | *2866* | *2866* | *2866* |
| **2013** | **Size (employees)** | | | | | **Size (sales)** | | | | | **Firm age** | | | | |
| *Frequency of bribes to get things done* | 0.125 | | | | | 0.22 | | | | | -0.45 | | | | |
| | (4.16) | | | | | (0.18) | | | | | (0.65) | | | | |
| *Amount of bribes to get things done* | | -7.321* | | | | | -0.13 | | | | | -0.75 | | | |
| | | (3.83) | | | | | (0.16) | | | | | (0.63) | | | |
| *Frequency of bribes to deal with courts* | | | 3.416 | | | | | 0.191 | | | | | -0.49 | | |
| | | | (3.84) | | | | | (0.14) | | | | | (0.64) | | |
| *Frequency of bribes to deal with taxes* | | | | 2.16 | | | | | 0.158 | | | | | -0.4 | |
| | | | | (3.86) | | | | | (0.15) | | | | | (0.66) | |
| *Frequency of bribes to deal with customs* | | | | | 1.696 | | | | | 0.177 | | | | | -0.81 |
| | | | | | (3.79) | | | | | (0.14) | | | | | (0.65) |
| *Adjusted R-squared* | *0.116* | *0.118* | *0.117* | *0.116* | *0.116* | *0.138* | *0.137* | *0.138* | *0.138* | *0.138* | *0.097* | *0.098* | *0.097* | *0.097* | *0.098* |
| *Number of observations* | *3265* | *3265* | *3265* | *3265* | *3265* | *2277* | *2277* | *2277* | *2277* | *2277* | *3268* | *3268* | *3268* | *3268* | *3268* |

* p<0.10, ** p<0.05, *** p<0.01
Weighted least squares regressions controlling for country and sector fixed effects, here not displayed

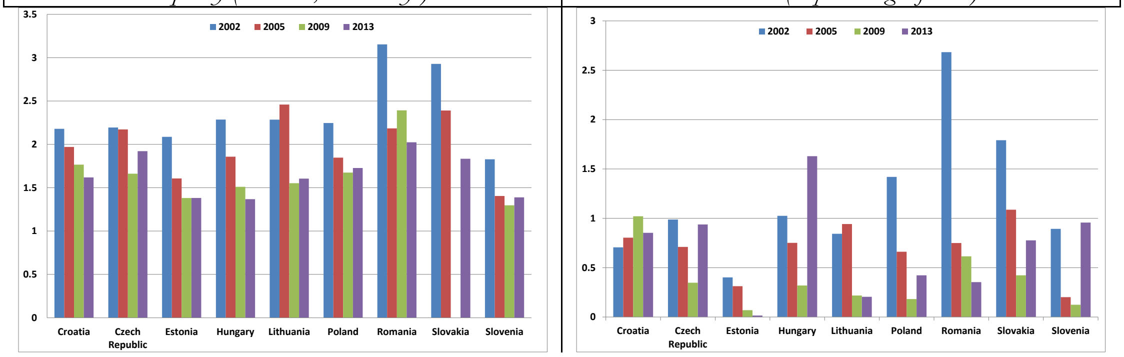
*Notes: Weighted Least Squares regressions controlling for country and sector fixed effects, here not displayed. * p<0.10, ** p<0.05, *** p<0.01. Standard errors are reported in brackets.*

In Table 1 we provide the estimated correlations between the main firm characteristics (namely employment, sales and age) and a dummy variable, which takes the value of one if a firm refused to reply to a bribery question. We further control for country and sector fixed effects. As in Svensson (2002), on average we do not find any significant difference between the two groups of firms, answering and refusing to answer the bribery questions, in either 2009 or 2013, suggesting that the respondents and non-respondents do not differ in a statistically significant sense based on their observable characteristics.

Discarding the non-response items, there is evidence of a general fall in the frequency of bribe payments, between 2002 and 2013 (Figure 4, left-hand side panel). Furthermore, we observe an overall decline in the percentage of sales spent for unofficial payments in all countries except Croatia and Hungary (Figure 4, right-hand side panel).[12] However, in several countries the frequency of unofficial payments increased between 2009 and 2013, although in 2013 they were lower than in 2002. This increase was even sharper when considering the amount of bribes. The reason of this hike can be either demand- or supply-driven. One possible explanation could be the concurrent fall in public officials' incomes, owing to fiscal consolidation after the global financial crisis, which led to bureaucrats requesting higher amounts. Another possible explanation is that during the recent recessionary phase firms had to compete more aggressively to obtain more scarce government goods and services, thereby offering to pay higher or more frequent bribes.

Figure 4. Frequency and amount of bribes
to get things done in CEE countries, 2002-2013

| *Frequency (1=never; 6= always)* | *Amount (in percentage of sales)* |
|---|---|




*Sources: Authors' calculations on BEEPS data.*
*Note: Averages across all firms in a given country and year.*

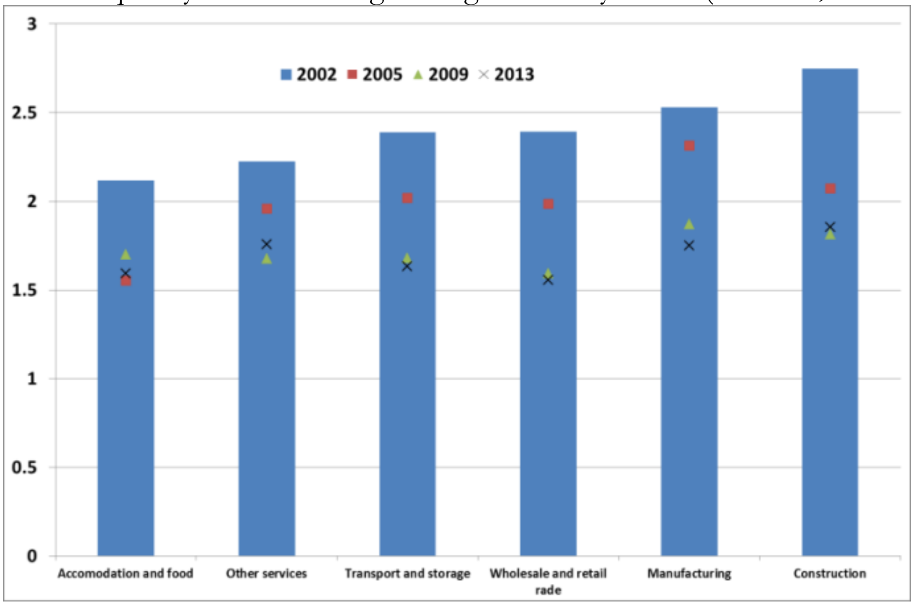
In addition to total-economy developments described thus far, firms operating in different industries interact with public officials to a different extent, as they require different amounts and types of licenses and permits due to the specific characteristics of their production processes, which could result in sector differences in terms of corruption.[13] There are indeed significant differences in terms of corruption across sectors (Figure 5), which are broadly consistent with an indicator of sectorial

[12] On average over the whole period and across all countries and sectors, 1.8 per cent of total sale revenues were allocated to pay bribes (the median is instead lower, standing at 0.7 per cent).

[13] On sectorial evidence of bribery see also Beck, Demirgüc-Kunt and Maksimovic (2005); Reinikka and Svensson (2006); Dugato et al. (2013); European Commission (2014).

dependence on the public sector constructed by Pellegrino and Zingales (2014). Construction is in fact the sector with both the highest government dependence and the highest frequency of bribe payments.[14] On the other extreme, firms in hotels and restaurants, trade and "other" service sectors are, on average, amongst the least affected by bribery. The country-wide decline in corruption is found to be widespread across sectors, although rarely monotonic. Similarly, amounts paid in bribes, here not shown, are generally higher in the construction sector.

Figure 5. Frequency of bribes "to get things done" by sector (1=never; 6= always)

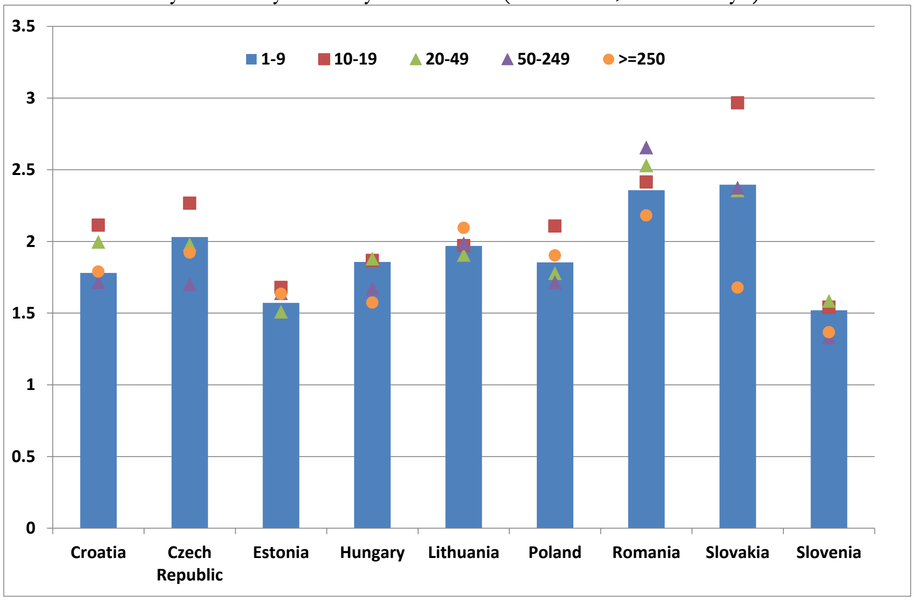



*Source: Authors' calculations on BEEPS data.*
*Note: Average across all firms and all countries for each sector and year.*

Finally, the existing literature on corruption and firm size is inconclusive. On the one hand, there is some evidence that smaller firms are less affected by bribes, possibly because they are exempt from some regulatory standards (such as reporting and keeping records for inspection, but also labour market legislation) and taxes, and therefore encounter demands for bribes less frequently (Hanousek and Kochanova 2016), or simply because larger organizations are more visible to bureaucrats and cannot evade regulations easily (Fisman and Svensson 2007). On the other hand, small and medium-sized firms may operate in markets that are local in nature and therefore this reduces their ability to use a relocation threat in dealing with corrupt officials (Beck, Demirgüc-Kunt and Maksimovic 2005; O'Toole and Tarp 2014). We find that firms with less than 10 employees and large firms pay bribes to get things done less frequently (Figure 6). Conversely, small to medium-sized firms are those that pay bribes with the highest frequency, suggesting an inverted-U relationship between bribery frequency and firm size. This could be because small and medium-sized firms are not exempt from regulatory procedures, unlike the micro-firms, and they do not have the bargaining power or influence of the large firms.

[14] Sectorial patterns are very similar across CEE countries, therefore we only plot the average across countries.

Figure 6. Frequency of bribes to get things done
by country and by firm size (1=never; 6= always)




*Sources: Authors' calculations on BEEPS data.*
*Note: Average across all firms in a sector and across all years in a given country.*

## 4. Investigating the links between corruption and input misallocation in the CEE region

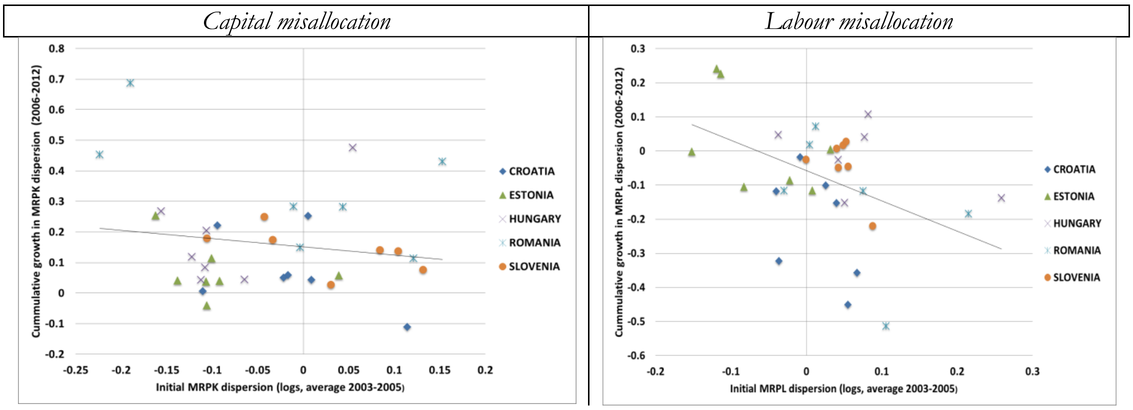
After having discussed the developments in both capital and labour misallocation, on the one hand, and in corruption on the other in the CEE region, we explore the links between these dynamics, using a conditional convergence framework.

### 4.1. The conditional convergence framework

The conditional convergence model (Barro and Sala-i-Martin 2004) implies a negative correlation between the growth rate of GDP per capita in a given country and its initial level, after having "conditioned" on the country's steady-state level. This type of convergence is called $\beta$–convergence. Amongst others, Friedman (1992) and Quah (1993) have emphasised that β–convergence can be the result of a more general statistical, not economic, phenomenon of regression to the mean (the so-called "Galton fallacy") and that actual convergence concerns the reduction in the dispersion of the cross-sectional distribution of economic performance. This second type of cross-country convergence, called σ-convergence, requires, as a necessary although not sufficient condition, a process of $\beta$–convergence. The reduction in the cross-sectional standard deviation of GDP per capita is a joint outcome of capital deepening and TFP growth convergence. The later will depend among other things on the dynamics of allocative efficiency across countries.

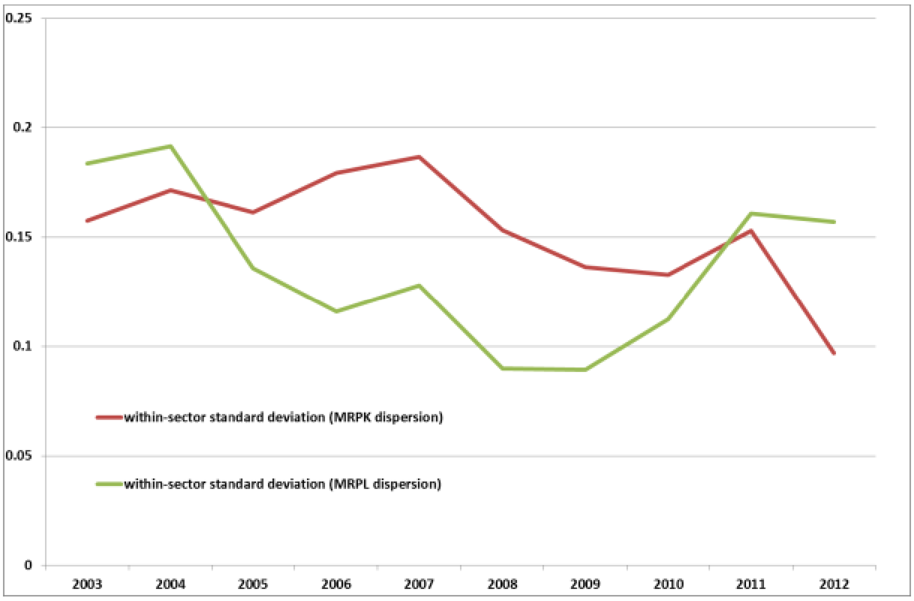
We find descriptive evidence of an (unconditional) $\beta$–convergence process of capital and, mostly, labour allocative efficiency in our sample of countries, seen as their inverse, i.e. input misallocation (Figure 7): the further away a sector is from maximum allocative efficiency, the faster the subsequent growth in allocative efficiency.[15] Regarding some direct evidence on σ-convergence, the average cross-country and cross-sector dispersion in both capital and labour misallocation has decreased, albeit not monotonically, with a possible pick-up in divergence in labour misallocation after 2009 (Figure 8). Hence, the observed $\beta$–convergence in input misallocation seems to have been related to σ-convergence at least until the Great Recession.

Figure 7. Correlations between average annual growth in input misallocation and initial levels of misallocation




*Source: Authors' calculations on CompNet data.*
*Note: The Czech Republic is excluded from the sample owing to data unavailability for initial years*

Figure 8. Average cross-country and cross-sector standard deviation in input misallocation




*Source: Authors' calculations on CompNet data.*

[15] We computed growth rates for the whole period excluding the first sub-period in order to avoid endogeneity.

Given these descriptive findings, we start off by considering an equation for within-sector resource misallocation consistent with the neoclassical conditional convergence model:

$$\Delta var(MRPI)_{t/t-1,i,j} = \alpha_{t,i,j} + \beta var(MRPI)_{t0,i,j} + \mu_{t,i,j} + \mathrm{FE(t,i,j)} + \varepsilon_{t,i,j} \qquad (14)$$

where the dependent variable is either capital (I=K) or labour (I=L) misallocation, $\Delta$ indicates cumulative sub-period growth rates, $i$ indicates the country, $j$ indicates the sector, $t$ the time dimension (in particular, 2003, 2005, 2009, 2012 if the variables are in levels and 2003-2005, 2005-2009, 2009-2012 if the variables are expressed in growth rates) and $\mu_{t,i,j}$ are shocks reflecting changes in production conditions or in consumers' preferences. In this context, we consider the changes in bribes paid by firms, described in Section 3.2, as changes to the business environment and therefore as the shocks $\mu_{t,i,j}$, whereas the steady-state level of input misallocation $\alpha_{t,i,j}$ may be affected by other constant or slowly varying country and sector-specific variables.[16] Sector, country and time fixed effects (FE) are also included.

## 4.2. The augmented empirical specification

The most recent cross-country convergence literature has however emphasized the role of non-linearities and interactions amongst covariates in explaining economic development (for example, Tan 2010). Moreover, the recent corruption literature has suggested that an interplay between corruption and the geographical, political and institutional setting in which bribes take place is common, thereby affecting the impact of corruption on economic growth. We take these findings into account in order to select our control "steady state" variables.

In particular, Rock and Bonnett (2004) find that the relationship between corruption and economic growth depends on the *size of the country*. Larger countries have relatively big domestic markets and labour supply, which make them less reliant on foreign markets and may help resist international pressures to fight corruption. Also, the large size of certain countries may make them more appealing for foreign investors, who could accept bribes as a means to access the large local markets. Corruption is therefore found to be less harmful for economic performance in larger countries. A second, concurrent factor that matters for the empirical relationship between corruption and economic growth is the *political economy of corruption*. As suggested by Olson (1993), "stationary bandits" in power will monopolize theft (i.e. corruption) in their country while limiting what they steal since they realise their future profits will depend on the incentives of their subjects to invest and flourish. Conversely "roving bandits" have short time horizons and no incentive to limit corruption since seizing assets will be a dominant strategy if their position is unstable. Moreover, from a theoretical standpoint Ehrlich and Lui (1999) argue that autocratic regimes, which centralize the direction of the administration in a country, similarly to governments with a long time horizon, wish to maximize their rents but at the same time internalize the deadweight loss associated with corruption. These regimes therefore have incentives to avoid impairing firms'

[16] As discussed in Islam (2003), the three/four year spans in our analysis should not be too short to study growth processes, especially because we combine three sub-periods to produce the estimates.

productivity, incentives that do not exist in more decentralized, democratic regimes, where there is a coordination problem. Empirical studies (Mendez and Sepulveda 2006; Aidt, Dutta and Sena 2008) confirm that the link between corruption and economic growth depends on the type of political regime in power, although results are more nuanced. Proxies of country size, political stability and the degree of autocracy are therefore included in our regressions, also interacted with changes in corruption, in order to verify whether the theoretical findings in the literature are robust in our set of countries.

Moreover, the *quality and tightness of regulation* may play a critical role in defining the relationship between corruption and input misallocation. The "grease-the-wheel" theory of corruption mainly rests on the assumption that bribes foster productive activity by speeding up administrative processes and circumventing red tape (e.g. Leff 1964). Another strand of the literature points to corruption being beneficial for growth when the quality of institutions is poor and allows firms to overcome misguided government policies. Méon and Weill (2010), for example, find evidence that corruption is an efficient grease in the economy for countries with less effective institutions, whereas Méon and Sekkat (2005) find the opposite result that corruption is detrimental under the same conditions. Focusing specifically on CEE countries, De Rosa, Gooroochurn and Görg (2010) show that bribery does not emerge as a second-best option to achieve higher firm productivity in order to circumvent institutional deficiencies. We too therefore attempt to test the "grease-the-wheel" hypothesis empirically.

We therefore estimate the relationship between changes in input misallocation and changes in corruption, controlling for all the discussed framework conditions which might affect this link. Equation 14 is therefore augmented in the following manner:

$$\Delta var(MRPI)_{t/t-1,i,j} = \alpha_{t,i,j} + \beta var(MRPI)_{t0,i,j} + \mu_{t,i,j} + \alpha_{t,i,j}\, \mu_{t,i,j} + \mathrm{FE(t,i,j)} + \varepsilon_{t,i,j} \quad (15)$$

so that an interaction term between the corruption shocks and the contextual variables are included. More concretely, we run the following OLS regression, where variables are expressed in logs:

$$\begin{aligned}\Delta var(MRPI)_{\frac{t}{t}-1,i,j} &= \beta_0 + \beta_1\, var(MRPI)_{2003,i,j} \\ &+ \beta_2\, \Delta corruption_{t-\frac{1}{t}-2,i,j} + \beta_3\, pop_{t-1,i} + \beta_4\, pop_{t-1,i} \\ &* \Delta corruption_{t-\frac{1}{t}-2,i,j} \\ &+ \beta_5\, politicalorg_{t-1,i} + \beta_6\, politicalorg_{t-1,i} \\ &* \Delta corruption_{t-\frac{1}{t}-2,i,j} + \beta_7 regul_{i,t-1} + \beta_8\, regul_{t-1,i} \\ &* \Delta corruption_{t-\frac{1}{t}-2,i,j} + \gamma_j + \theta_i + \tau_t + \varepsilon_{t,i,j}\end{aligned} \quad (16)$$

In order to investigate the empirical relationship between corruption and input misallocation, we use BEEPS corruption data, aggregated at the country-sector level, and CompNet data on input misallocation, available at the same country-sector level. In particular, the sectors we consider are those reported in Section 2.1 with the exception of real estate, professional, scientific and technical services, and administrative and support services, which are grouped together as "other services". In order to match the two datasets, BEEPS data are calibrated as close as possible to the time period covered by CompNet data, which implies BEEPS data for 2002 are assigned to 2003 and data for 2013 to 2012. Moreover, it is worth recalling that the BEEPS survey questions on corruption refer to the previous three years, so that the changes in corruption are lagged relative to the corresponding changes in input misallocation.

Changes in corruption are measured as the changes in a synthetic indicator of the five BEEPS variables on bribes described in Section 3. In particular, we compute the first component in a principal component analysis. As "contextual" variables, we employ population for country size, political stability for the time horizon of public officials, civil freedom for the extent to which citizens of a country are able to participate in the selection of the government and therefore influence policy choices indirectly. Moreover, we consider two different dimensions of regulation: the restrictiveness of product market regulation and the quality of overall government regulation. Sources and details concerning the mentioned contextual variables are displayed in Appendix A.

### 4.3. The baseline results

We explore how corruption affects input misallocation, according to alternative model specifications. Regression results, referring to Equation (16), are presented in Tables 2a and 2b, where the dependent variable is respectively changes in capital and labour misallocation. Column 1, presenting the simplest specification, shows a statistically significant and negative link between changes in corruption and both labour and capital misallocation in CEE countries, which would bring evidence in favour of studies such as Lui (1985) and Beck and Maher (1986) that support the view that corruption can lead to efficient outcomes. However, as also shown by the low goodness of fit of the model, this specification is not capturing other significant variables.[17] We therefore turn to the regressions augmented with the interaction terms. The overall marginal effect of corruption growth on resource misallocation dynamics can be represented graphically. In Figure 9 we plot the point estimates of the marginal impact of growth in corruption on input misallocation dynamics, conditioned respectively on population, on political stability, on the degree of democracy and on regulatory quality, holding all other interacted framework variables constant at their sample mean.[18]

[17] Following Hsieh and Klenow (2009) and in regressions available upon request, we also assess whether the share of state-owned enterprises by country-sector could have affected input misallocation dynamics, in addition to changes in corruption (we thank an anonymous referee for this suggestion). We construct these shares on the basis of Orbis data. Indeed, we find that the correlation is positive, implying that the higher the share of State-owned firms, the higher input misallocation dynamics, and the rest of the coefficients do not change. The coefficient is not however statistically significant at conventional levels of confidence, plausibly owing to the low number of observations. Indeed this variable is not available for several countries in our sample. We therefore chose to discard this potential explanatory variable in our analysis in order to preserve the highest sample numerosity possible, but the topic of State-owned firms warrants further research, possibly based on a different country sample (e.g. all EU countries for which data are available).

[18] In particular, we refer to specifications in column 3 in Table 2a and Table 2b for the first two charts, to column 4 for the third chart and to column 5 for the fourth chart. Charts on the marginal effect of

Confirming the theoretical predictions in Olson (1993) and the empirical evidence in Rock and Bonnett (2004), in small CEE countries and in those with higher political instability, the overall effect of corruption on input misallocation is positive, thereby suggesting that an increase in bribery is related to an inefficient allocation of resources across firms within a given sector.[19] Our results instead are at odds with Ehrlich and Lui's (1999) argument, showing that the fewer the civil liberties in a country the larger the positive marginal impact of corruption on input misallocation, implying that in more autocratic regimes the internalization of the deadweight loss of corruption appears to be an excessively benign view on how autocratic political leaders and bureaucrat appointees act in a corrupt environment. Moreover, we can see that in countries with low regulatory quality changes in corruption positively affect input misallocation growth. Finally, columns 6 point to the effect of bribery on resource misallocation not depending on the intensity of the regulatory burden in starting up a business, leading to no evidence in favour of the "grease-the-wheel" hypothesis and confirming the comparable finding for a similar set of countries by De Rosa, Gooroochurn and Görg (2010). To sum up, we identify non-linearities in the relationship between corruption and input misallocation: the link can be both positive and negative at the sector level depending on the framework conditions, thereby reconciling the mixed empirical evidence. Across all specifications considered, the marginal effect of changes in corruption is larger on capital, rather than labour, misallocation. This may be due to the fact that bribes are often paid out by firms to obtain permits authorising the expansion of existing productive capacity, thereby affecting investment first and foremost. Anyhow, corruption also affects labour misallocation in that in a highly corrupt environment firms likely employ a non-optimal amount of labour, owing to the fact that a share of workers is engaged in unproductive activities, such as bargaining with public officials (see also Hanousek and Kochanova 2016 on this point) or simply new firms do not enter the market (Campos, Estrin and Proto 2010).

corruption on input misallocation based on actual values for all interacted framework variables simultaneously are also available upon request.

[19] Further descriptive evidence confirming Olson' (1993) prediction is that in countries with higher-than-average political stability the frequency of bribes is slightly higher, whereas the amount of bribes paid is significantly lower relative to more politically unstable countries.

## Table 2a. Capital misallocation estimation results

| Dependent variable: change in dispersion of MRPK<br>Corruption measure: synthetic indicator of frequency and amount of bribes paid | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| **corruption (change t/t-1)** | -0.1328*** | 1.5976** | 4.0580** | 6.0503*** | 2.5755* | 4.1695** | 10.1532** | 16.2387*** |
| | (0.0406) | (0.7430) | (1.6253) | (1.5589) | (1.3720) | (1.6993) | (4.0176) | (6.2050) |
| dispersion in mrpk in 2003 (ln) | -0.9057 | -0.8279 | -0.8353 | -0.7417* | -1.0352* | -0.7659 | -1.0618* | -1.4971 |
| | (0.7612) | (0.7242) | (0.6275) | (0.4154) | (0.6010) | (0.6381) | (0.5975) | (1.0689) |
| population (t-1) (ln) | | 9.3093* | 9.5407** | 14.1490*** | 5.0461 | 11.7994** | 11.4808 | 14.3117 |
| | | (5.5107) | (4.5819) | (4.5488) | (7.1812) | (5.5087) | (7.2821) | (9.2743) |
| **population (t-1) (ln) * corruption (change t/t-1)** | | -0.1095** | -0.2402** | -0.1697*** | -0.1511* | -0.2484** | -0.5739** | -0.8968*** |
| | | (0.0474) | (0.0940) | (0.0503) | (0.0797) | (0.0990) | (0.2306) | (0.3454) |
| political stability (t-1) | | | 1.5466** | | 2.4348*** | 1.8774* | 0.8815 | -0.8821 |
| | | | (0.6558) | | (0.8759) | (0.9581) | (0.9404) | (1.4189) |
| **political stability (t-1) * corruption (t/t-1)** | | | -0.6325** | | 0.4809 | -0.7894** | -2.1390*** | -4.1869*** |
| | | | (0.2760) | | (0.3212) | (0.3325) | (0.6920) | (1.5321) |
| civil liberties (t-1) | | | | 0.1964*** | | | | |
| | | | | (0.0417) | | | | |
| **civil liberties (t-1) * corruption (t/t-1)** | | | | -0.0695*** | | | | |
| | | | | (0.0176) | | | | |
| regulatory quality (t-1) | | | | | -3.5298** | | | |
| | | | | | (1.3886) | | | |
| **regulatory quality (t-1) * corruption (t/t-1)** | | | | | -0.8443*** | | | |
| | | | | | (0.2350) | | | |
| startup costs (t-1) | | | | | | -0.1279 | | |
| | | | | | | (0.1130) | | |
| **startup costs (t-1) * corruption (t/t-1)** | | | | | | 0.0437 | | |
| | | | | | | (0.0341) | | |
| Constant | YES | YES | YES | YES | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 105 | 105 | 105 | 105 | 105 | 105 | 99 | 105 |
| R-squared | 0.26 | 0.31 | 0.44 | 0.65 | 0.51 | 0.45 | | |
| Adjusted R-squared | 0.12 | 0.17 | 0.30 | 0.57 | 0.38 | 0.31 | | |

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

*Notes: Estimates are obtained via OLS with White's correction for heteroscedasticity until column 6. Estimations are run using a 2SLS procedure in columns 7 and 8. See the text and Appendix A for details on the instruments used. Standard errors are reported in brackets.*

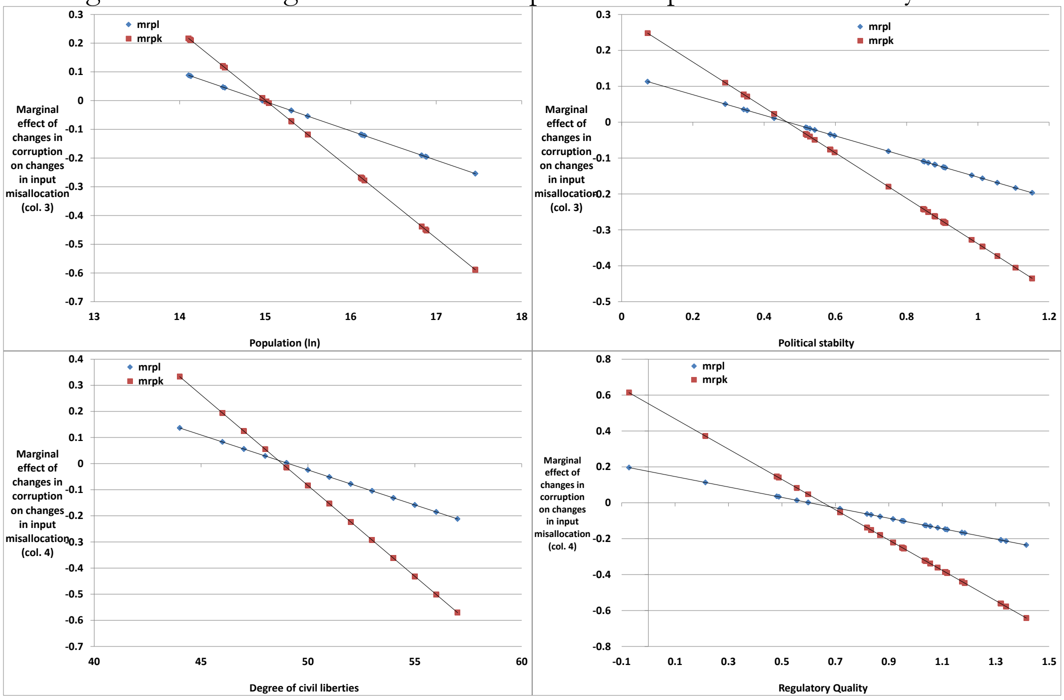
## Table 2b. Labour misallocation estimation results

| Dependent variable: change in dispersion of MRPL<br>Corruption measure: synthetic indicator of frequency and amount of bribes paid | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| **corruption (change t/t-1)** | -0.0470** | 0.4718 | 1.7388* | 2.1260* | 1.2276 | 1.7369* | 4.1890* | 7.5188** |
| | (0.0203) | (0.3633) | (0.9455) | (1.1324) | (0.8049) | (0.9754) | (2.2724) | (3.0646) |
| dispersion in mrpl in 2003 (ln) | -0.5206* | -0.5015 | -0.5268* | -0.4695* | -0.5193* | -0.5109* | -0.5926** | -0.7265** |
| | (0.2878) | (0.3030) | (0.2802) | (0.2439) | (0.2945) | (0.2858) | (0.2474) | (0.3568) |
| population (t-1) (ln) | | 3.4174 | 3.1249 | 5.0592 | 1.4623 | 3.7649 | 2.6642 | 4.8446 |
| | | (3.1645) | (2.9829) | (3.2865) | (4.3888) | (3.4196) | (3.9395) | (5.5478) |
| **population (t-1) (ln) * corruption (change t/t-1)** | | -0.0330 | -0.1021* | -0.0517 | -0.0713 | -0.1025* | -0.2338* | -0.4129** |
| | | (0.0233) | (0.0547) | (0.0358) | (0.0466) | (0.0568) | (0.1299) | (0.1712) |
| political stability (t-1) | | | 0.1936 | | 0.5105 | 0.4002 | 0.1076 | -0.9124 |
| | | | (0.3428) | | (0.4685) | (0.4889) | (0.4380) | (0.6876) |
| **political stability (t-1) * corruption (t/t-1)** | | | -0.2868* | | 0.0980 | -0.3408* | -0.8948** | -1.9684*** |
| | | | (0.1582) | | (0.1931) | (0.1828) | (0.3956) | (0.7474) |
| civil liberties (t-1) | | | | 0.0900*** | | | | |
| | | | | (0.0236) | | | | |
| **civil liberties (t-1) * corruption (t/t-1)** | | | | -0.0268** | | | | |
| | | | | (0.0125) | | | | |
| regulatory quality (t-1) | | | | | -1.2340 | | | |
| | | | | | (0.8175) | | | |
| **regulatory quality (t-1) * corruption (t/t-1)** | | | | | -0.2903* | | | |
| | | | | | (0.1567) | | | |
| startup costs (t-1) | | | | | | -0.0709 | | |
| | | | | | | (0.0555) | | |
| **startup costs (t-1) * corruption (t/t-1)** | | | | | | 0.0152 | | |
| | | | | | | (0.0171) | | |
| Constant | YES | YES | YES | YES | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 105 | 105 | 105 | 105 | 105 | 105 | 99 | 105 |
| R-squared | 0.26 | 0.29 | 0.34 | 0.54 | 0.38 | 0.35 | | |
| Adjusted R-squared | 0.13 | 0.14 | 0.19 | 0.43 | 0.21 | 0.18 | | |

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

*Notes: Estimates are obtained via OLS with White's correction for heteroscedasticity until column 6. Estimations are run using a 2SLS procedure in columns 7 and 8. See the text and Appendix A for details on the instruments used. Standard errors are reported in brackets.*

Figure 9. The marginal effect of corruption on input misallocation dynamics




*Notes: See text for explanation.*

Concerning the other covariates, labour misallocation growth is found to be dependent on initial values of misallocation, suggesting a significant convergence effect for this component of TFP growth;[20] this result is only significant at the margin for capital misallocation, as seen also by the weaker correlation in Figure 7. Moreover, both labour and capital misallocation growth is higher in countries with a lower regulatory quality *per se*.[21] Furthermore, capital misallocation dynamics are also positively correlated with size and with political stability/democracy *per se*. This result may reflect the fact that these countries received greater capital inflows (in proportion to GDP) during the 2000s, which for selected euro-area countries (Italy, Portugal and Spain) has been found to have increased capital misallocation in the same period (Gopinath et al. 2015). Indeed, a rise in the share of capital inflows in GDP (Appendix A) is found to be positively associated with capital (but not labour) misallocation dynamics when included in the specification in column 1. However this variable loses significance once we control for population and political stability/democracy, suggesting it suffers from a collinearity problem. We therefore do not include it in our baseline regressions, but we show these results in Appendix B.

In Appendix B we also provide regression results for our five alternative BEEPS corruption measures underlying the synthetic measure in our baseline regressions. Changes in the frequency of paying bribes to deal with taxes and to more generally get things done are significantly correlated with input misallocation. Conversely, the change

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20 Using the OP gap as a measure of (labour) allocative efficiency, Berthou (2016) also finds a significant negative coefficient attached to initial country/sector conditions on a mixed sample of European countries.

21 In the case of labour, the regulatory quality coefficient is marginally significant at a 14 per cent confidence level.

in the average amount of bribes paid to get things done, both *per se* and interacted with population and political stability, is not significantly correlated with the dispersion in either MRPL or MRPK. What fosters input misallocation appears therefore to be the time lost in engaging in bribery practices, rather than the amount of resources spent.

Finally, the presented results may be affected by different econometric issues. First, one may be concerned with the reverse causality between input misallocation and corruption. If labour and capital are allocated to the least productive firms, the payment of bribes may be a way for these firms to preserve the *status quo* and to avoid a more efficient allocation of inputs which would damage them. Moreover, changes in corruption could be affected by changes in input misallocation, in that countries with least misallocation and which are more competitive have more resources to control and to combat corruption. We attempt to reduce this possible reverse causality in various ways. First, by merging two independent datasets the endogeneity concern is reduced. Second, the repeated cross-section structure of the data allows us to control for sector fixed effects and therefore remove time-invariant sectorial factors that could affect both corruption and resource misallocation, also reducing a possible omitted variable bias. Third, by considering variables at the cell level we exclude that individual firms can influence market-level outcomes. As argued in Fisman and Svensson (2007), the average amount of bribes at the sector level is determined by underlying technologies and the rent-extraction inclinations and talents of bureaucrats and is therefore exogenous to firms. Within-sector misallocation across firms should not therefore affect average corruption in that sector. Group averaging is also useful to mitigate measurement error, since errors are largely idiosyncratic to firms and uncorrelated with average bribery values. Fourth, corruption at the sectoral level is interacted with aggregate contextual variables, making it even less plausible that causality runs from within-sector misallocation to these composite variables. Finally, all contextual variables are measured at the beginning of each time period to control for initial conditions and to reduce possible endogeneity between them and changes in input misallocation.

Owing to the low goodness of fit of even our richest baseline OLS regressions – which however is in line with that available in the existing literature – our results could still be plagued by an omitted variable bias. In particular, it is possible that changes in both input misallocation and in bribes respond simultaneously to an omitted factor in the specification. We attempt to overcome this issue by constructing valid instruments for corruption, that is to say variables that are significantly correlated with our corruption measure but uncorrelated with the error term in equation 15. Moreover, these instrumental variables should have no direct effect on input misallocation growth, except through the corruption variable we are instrumenting.

Our first instrument is the share of women in Parliament. There is evidence in the literature that greater political participation of women is associated with lower levels of corruption, owing to their greater risk aversion or fear of punishment in the case of detection, or owing to the fact that bribe seeking and paying is a male network that excludes women (e.g. Dollar, Fisman and Gatti 1999, Swamy et al. 2001), Brollo and Troiano 2016). Since we do not consider legislative corruption, what is relevant for our analysis is the fact that members of Parliament may influence the incidence of bureaucratic corruption through the passage of laws to deter bribery or to simplify regulatory and administrative requirements and through the selection of lower-level government officials. A general trend of increasing women empowerment and representation in the CEE region clearly stands out (Appendix B).

Our second, alternative instrument is the degree of freedom of the press. By increasing the threat of exposure, by raising public awareness and by reducing information asymmetries, free press can increase the cost of corrupt behaviour for government officials, thereby reducing bribery (Ahrend 2002; Brunetti and Weder 2003). Churchill, Agbodohu and Arhenful (2013) show that there is a non-linear relationship between freedom of the press and corruption, suggesting the inclusion of a quadratic term in our IV regressions. Some countries gained media freedom over time, such as the Czech Republic and Romania, and others lost freedom, such as Croatia, Hungary, Lithuania, Poland and Slovenia; moreover, we find that even for CEE countries there is a non-linear relationship between freedom of the press and corruption (Appendix A).

*A priori* there is no reason why either female representation in Parliament or freedom of the press, conditional on the covariates in equation 16, should be correlated with changes in input misallocation. Indeed, first we verify that no correlation exists, by including these two variables in the baseline regressions: they are not significant and the significance and sign of all other covariates are preserved.[22] Next, in the first stage of a two-stage least squares (2SLS) framework we find that both instruments, expressed in changes, are significantly correlated with changes in corruption and with the expected negative sign predicted by the literature (Table B7 in Annex B). In the case of freedom of the press, it is found to correlate negatively with corruption (i.e. higher freedom of press implies less corruption) until a certain threshold of freedom of the press, confirming Churchill, Agbodohu and Arhenful's (2013)'s findings.[23] Our second-stage results – referring only to the specification in column 3 for the sake of brevity – are presented in columns 7 (where the instrumental variable used is share of women in parliament) and 8 (where the instrument used is freedom of the press) of Table 2a and Table 2b, confirming all our baseline OLS findings concerning the relationship between corruption and input misallocation.

## 4.4. Robustness analysis

Sensitivity analyses conducted on our sample confirms our baseline results reported in the previous paragraph.[24] First, we excluded one country or one sector at a time, in order to rule out the possibility of any outliers driving our overall results. Our findings were confirmed with a sample size dropping to around 90 in each attempt. Second, in order to exclude endogeneity linked to the fact that the first sub-period (2003-2005) input misallocation growth rates depend on the initial level 2003, we excluded the first sub-period from our sample. Our baseline results were confirmed, although some explanatory variables lost statistical significance owing to the few observations (57) in the sample. Third, we examined whether our results are robust to the bribery metric: we excluded the country-sector cells in which the number of firms

[22] We also conduct a robust score test that tests the null hypothesis that instrumented variable is exogenous. The latter is rejected in our case (the p-value is equal to 0.0015 in the capital misallocation regressions and 0.0002 in the labour misallocation regressions), confirming the need to resort to instrumental variables.

[23] We also conducted Sargan's over-identifying test, which confirmed the validity of the two instrumental variables employed (freedom of the press and its square).

[24] All results described in this paragraph are available on request.

was less than 4 for the BEEPS corruption measures, in order to reduce the influence of highly idiosyncratic firm-level developments. Our findings were unchanged.[25]

In Section 3 we mentioned some alternative perception-based corruption measures, available only at the total economy level. In order to check the soundness of our results to an alternative measure of corruption to BEEPS, we use an appropriately sectorialised measure of the Control of Corruption Index, sourced from the World Bank. In particular, in the vein of Rajan and Zingales (1998), in order to measure the different degree of risk of each sector being exposed to corruption, we relied on the sectorial indicator of dependence on government services, developed by Pellegrino and Zingales (2014), and which we aggregated up to the 1-digit sector level considered in this paper. Our main findings are confirmed also by this alternative measure of corruption (Appendix B) although the goodness of fit of the model is lower with respect to that estimated on BEEPS data.

In Section 2 we discussed an alternative measure of labour misallocation, i.e. the OP gap. We find that changes in corruption, when conditioning variables are zero, lead to lower OP gap growth, which implies larger labour misallocation growth (Appendix B). In small economies or in economies with a low degree of civil liberties we find that the marginal effect of corruption on the OP gap is negative, suggesting that corruption fosters labour misallocation, as found when using Hsieh and Klenow's (2009) measure.

We also obtain similar findings when we consider corruption in levels, which affect the steady-state of the countries, instead of its changes (Appendix B). The marginal effect of the level of corruption on changes in input misallocation is positive the smaller the country and the weaker the regulatory framework. The interactions with the political variables are instead not significant when considering corruption levels.

## 5. Conclusions

Aggregate TFP growth reflects both within-firm productivity and the contribution stemming from the degree of (in)efficiency with which production factors in a sector are allocated across firms. Corruption may affect productivity both directly, by enhancing or deteriorating firm performance, and indirectly by affecting input misallocation. Using a three-dimensional dataset, this paper focuses on how corruption affects input misallocation in CEE countries, which is an open issue in both the theoretical and empirical literature.

An indicator of input misallocation widely used in the recent literature is the dispersion in the marginal revenue productivity of labour or capital across firms within a given sector. According to CompNet data used in this paper, labour misallocation mildly rose until the recent recessionary phase and declined thereafter, although only temporarily in some countries. Conversely, capital misallocation has been generally increasing sharply since the mid-2000s. To measure corruption we employ BEEPS, a survey taken in 2002, 2005, 2009 and 2013, to derive information on both the frequency and amount of bribes paid to generally "get things done", as well as the frequency of bribes paid to specifically deal with courts, pay taxes and handle customs. Starting from quite high levels in 2002, economy-wide corruption has decreased, although not

[25] On average the number of firms per cell for the corruption variables is approximately 44. A similar threshold of 4 firms was used in Hanousek and Kochanova (2016) and in Fungacova, Kochanova and Weill (2015).

monotonically and with varying intensity, in CEE countries. The frequency of bribery, and its changes, also varies across sectors and firm size classes.

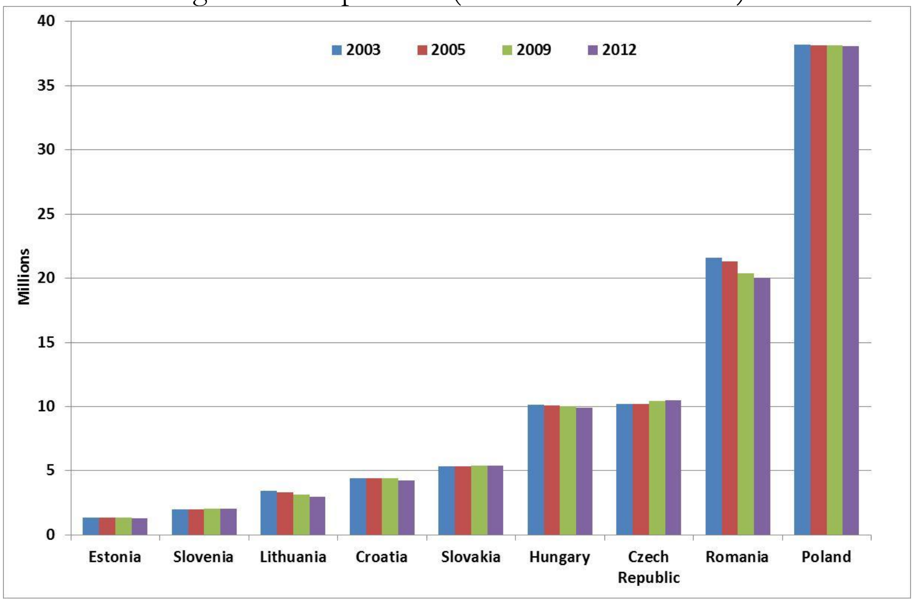
By combining BEEPS and CompNet data we investigate the link between corruption input misallocation in a neoclassical conditional convergence framework. We find that in small countries and in countries with low political stability, changes in corruption boost input misallocation dynamics. This is consistent with the fact that in small countries corruption cannot be offset by other productivity-enhancing factors and because bribe-seeking governments who stay in power for longer are more interested in the growth performance of their economy with respect to "roving bandits". Moreover, we find that increases in corruption foster higher input misallocation in countries with a lower degree of civil liberties within the CEE region, a result which is at odds with Ehrlich and Lui's (1999) theoretical argument that the negative impact of corruption on economic development is smaller in autocratic countries. Finally, the positive impact of changes in corruption on input misallocation dynamics is a decreasing function of the general quality of the regulatory environment, providing evidence against the general argument that corruption may be beneficial when institutions are weak or to circumvent burdensome regulations. Our results are robust also to the adoption of instrumental variables for corruption, in particular female representation in Parliament and freedom of the press.

In conclusion, we identify non-linearities in the relationship between corruption and input misallocation: the link can be both positive and negative at the sector level depending on the framework conditions, thereby reconciling the mixed empirical evidence. In particular, we bring evidence to the fact that the relationship between corruption and input misallocation is conditional on the geographical, institutional and political setting: targeted action against corruption in the CEE region should therefore be embedded in a more comprehensive strategy of institutional reform. Anti-corruption measures appear more efficiency-enhancing when implemented in small, politically unstable or more autocratic economies. Furthermore, improving the quality and the effectiveness of the regulatory environment is a means to foster faster TFP growth directly, as proved by other studies, but also indirectly by reducing the positive marginal impact changes in corruption exert on input misallocation dynamics.

## Appendix A. Additional information on contextual variables in our regression analysis

Population is heterogeneous across CEE countries, yet broadly stable across years, with the exception of Romania where it visibly decreased owing to emigration (Figure A1).

Figure A1. Population (millions of inhabitants)




*Source: Eurostat.*

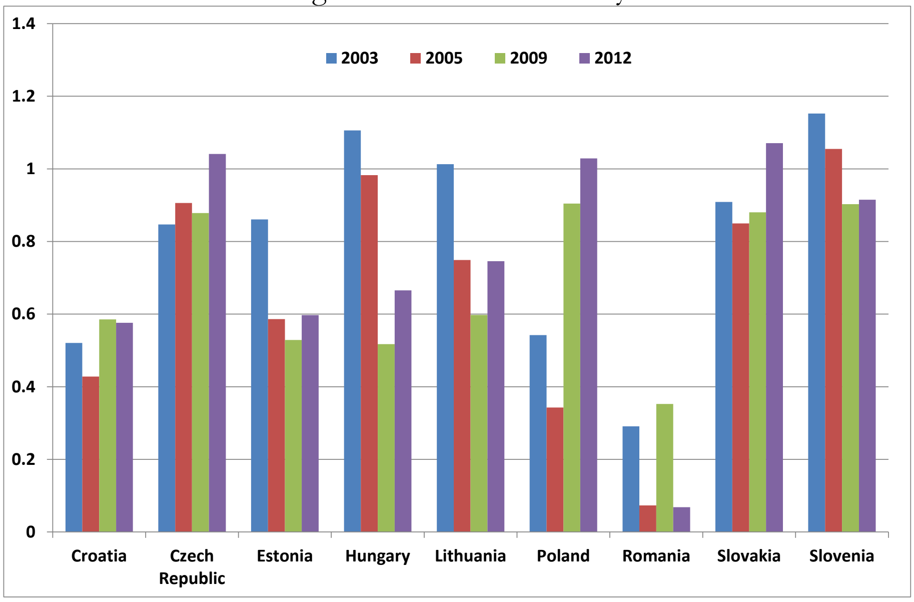
The time horizon of public officials is measured by an indicator of political stability from the World Bank Governance Indicators,[26] whereas the civil freedom indicator is taken from Freedom House. Romania and Croatia score badly in terms of both political stability and civil freedom (Figures A2 and A3).

Concerning the measure of regulatory stringency, we take the average of the Doing Business indicators of the time and number of procedures it takes to start a new limited liability business thereby capturing barriers to entry. These indicators are available at the country level. To disentangle start-up costs' sector-specific impact we follow Andrews and Cingano (2012), who use the U.S. establishment entry rate, sourced from the Census Bureau's Longitudinal Business Database, as an index of "natural" sectorial exposure to entry barriers (since industries with high natural entry barriers will also present low entry). We use the U.S. figures to proxy the technologically-driven entry rate of a given sector, because the U.S. is a country with low barriers to entry relative to the considered European countries. We therefore interact the aggregate start-up cost variable and the 2003-2007 sector-specific U.S. firm entry rate to obtain a sectorial measure of the stringency of product market regulation. The second dimension of regulation we consider is the World Bank's Governance Indicator on regulatory quality. As this is a more general assessment of the soundness of government regulations and policies we include it at the aggregate level. Although barriers to entry

[26] We are implicitly assuming that top bureaucrats are political appointees and not independent career civil servants, which is the case at least for some high-level positions also in democratic countries.

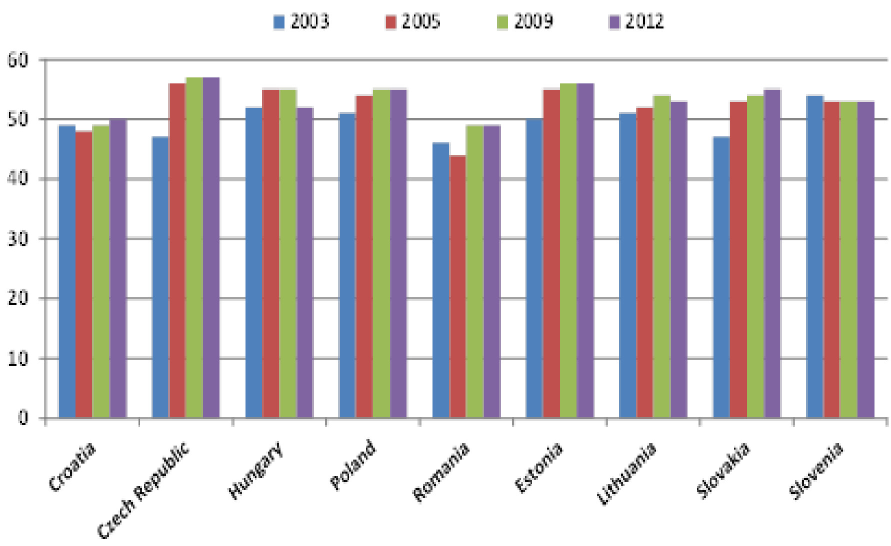
have fallen in the whole area since 2003, the quality of overall regulation still remains weak in some countries such as Croatia and Romania (Figure A4).

Figure A2. Political stability




*Source: World Bank Governance Indicators.*
*Note: The indicator measures perceptions of the likelihood of political instability and politically-motivated violence. It varies between -2.5 (weak political stability) and +2.5 (high political stability).*

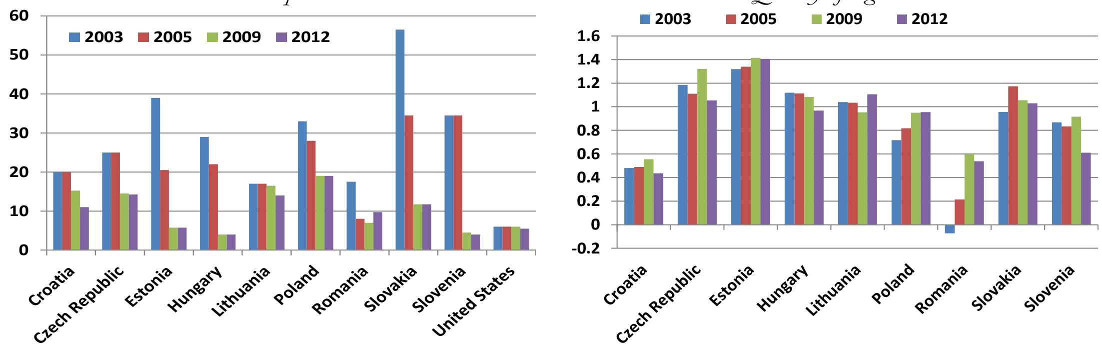
Figure A3. Civil freedom




*Source: Freedom House.*
*Note: The indicator varies from 0 to 60 and an increase signals an improvement in civil liberties.*

Figure A4. Regulation

*Start-up costs* *Quality of regulation*

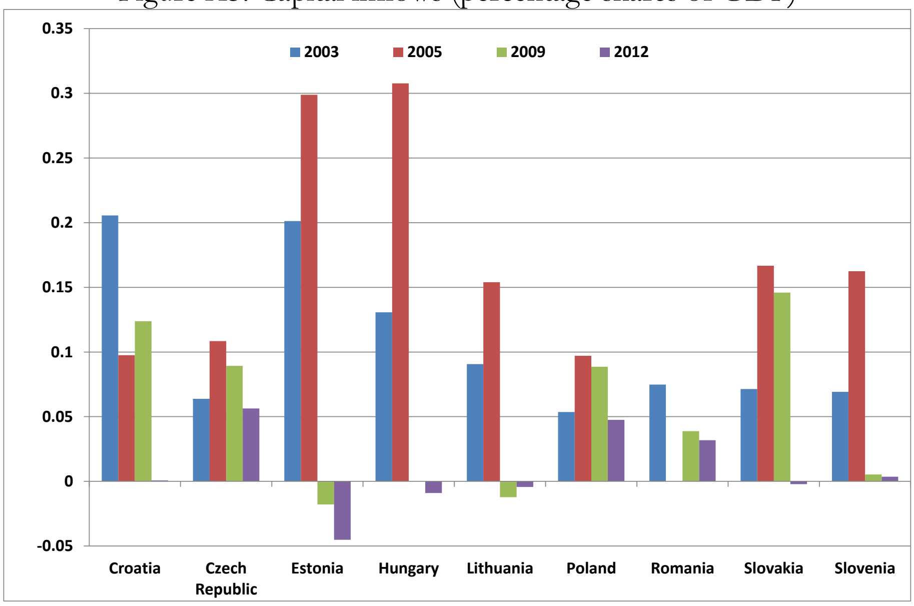



*Source: Authors' calculations on Doing Business and on Census Bureau's Longitudinal Business Database.*
*Note: Data on start-up costs in the U.S. refer to U.S. NYC.*

*Source: World Bank Governance Indicators.*
*Note: The regulatory quality indicator captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. It varies between -2.5 (weak) and +2.5 (high).*

In the run-up to the global financial crisis capital inflows reached 30 per cent share in GDP in Estonia and in Hungary (Figure A5). During the recent recessionary phase inflows dropped dramatically and in some countries, such as Estonia, Hungary and Lithuania, disinvestment ensued.

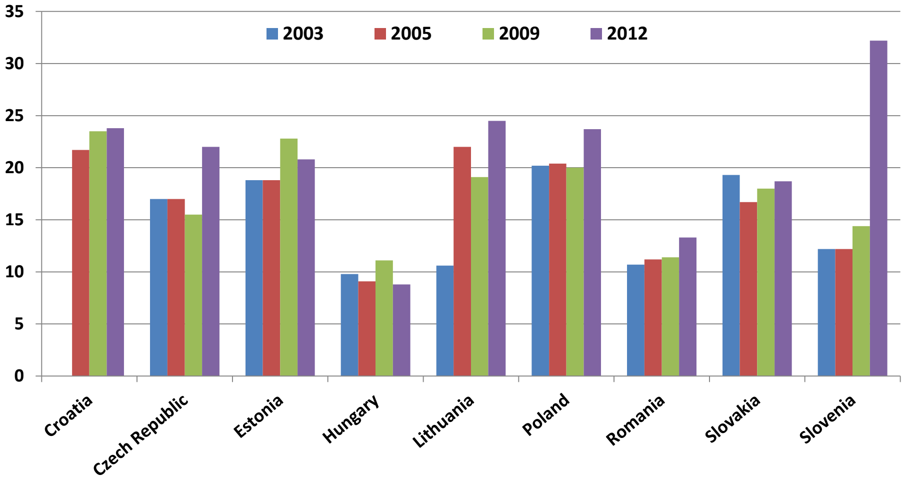
Figure A5. Capital inflows (percentage shares of GDP)




*Source: IMF.*
*Notes: The Czech Republic and Slovenia's data for 2009 refers to 2010; Estonia's data for 2012 refers to 2011; Hungary and Poland's data for 2005 refers to 2006; Romania's data for 2009 and 2012 refers to 2010 and 2011, respectively.*

The share of women in Parliament has increased since 2003 in the CEE region (Figure A6). Two notable exceptions are however Hungary and Slovakia, where it slightly decreased over the whole period considered.

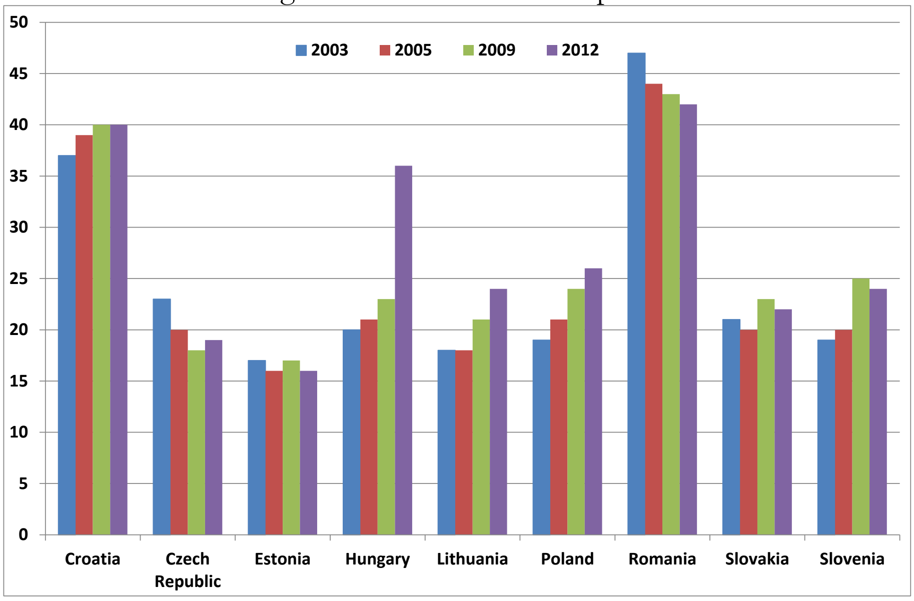
Figure A6. Parliamentary seats occupied by women (percentage shares)




*Source: Inter-Parliamentary Union.*

Freedom of the press is currently lowest in Romania and in Croatia (Figure A7). Churchill, Agbodohu and Arhenful (2013) show that in a sample of 133 countries there is a quadratic relationship between freedom of the press and corruption. A possible explanation of this non-linear relationship could be that, since measured corruption is based on firms' perceptions, it may understate the real extent of corruption in countries where freedom of the press is low. As this freedom increases, corruption becomes visible in the survey responses and the actual, negative effect of freedom of the press on corruption kicks in. Indeed we too find that in CEE countries a decrease in the freedom of the press (i.e. moving to the right along the horizontal axis in Figure A8) is associated with higher growth in corruption until a certain threshold after which decreases in freedom of the press are associated with decreases in corruption.

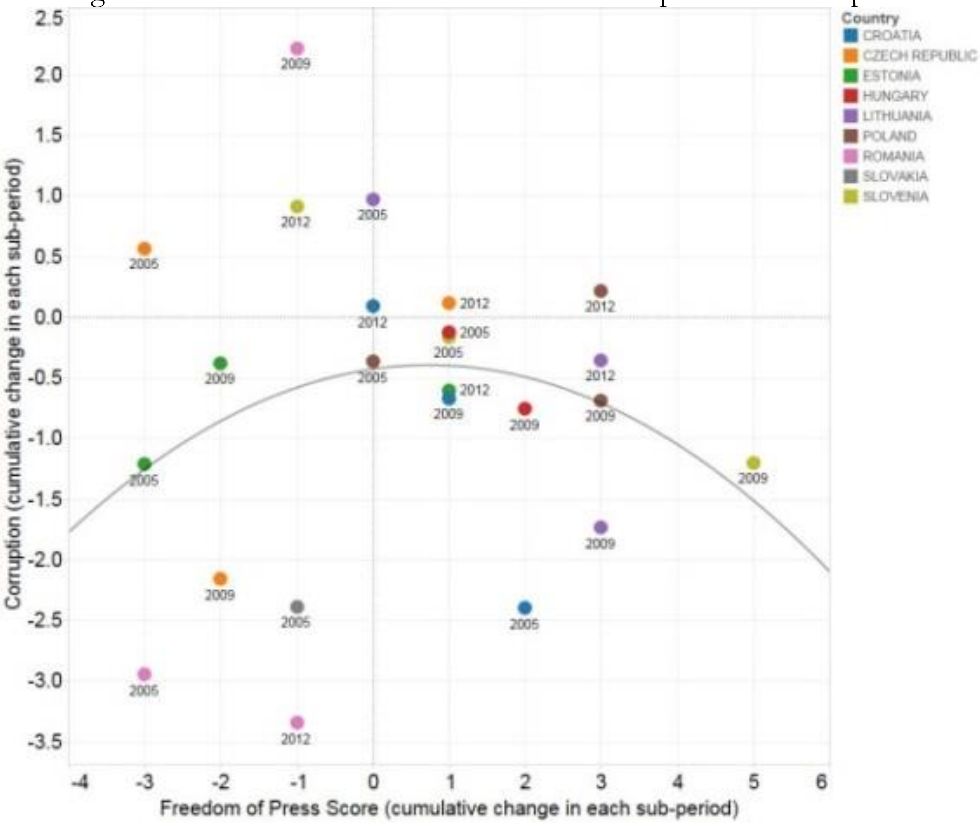
Figure A7. Freedom of the press




*Source: Freedom House.*

*Note: The indicator is based on 23 questions, divided into three broad categories: legal, political and economic environment. The final indicator (from 0 to 100) represents the total of the scores allotted for each question, with lower scores indicating higher freedom. The legal environment category encompasses laws and regulations that could influence media content and the extent to which they are used in practice to restrict the media's ability to operate. The degree of political control over the content of news media is also evaluated. The economic environment includes the structure of media ownership, the cost of establishing media, impediments to news production and distribution and the extent to which the economic situation in a country affects the development of the media.*

Figure A8. Correlation between freedom of the press and corruption




*Source: Authors' calculations on BEEPS and Freedom House data.*
*Note: A decrease in the Freedom of Press Score implies higher freedom of press.*

## Appendix B. Robustness checks and additional information

**Table B1. Controlling for capital inflows in the capital misallocation regression**

| Dependent variable: change in dispersion of MRPK<br>Corruption measure: synthetic indicator of frequency and amount of bribes paid | | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| **corruption (change t/t-1)** | -0.1338*** | 3.9388** | 2.5473* |
| | (0.0404) | (1.6193) | (1.3832) |
| dispersion in mrpk in 2003 (ln) | -0.8934 | -0.8337 | -1.0300* |
| | (0.7511) | (0.6266) | (0.6030) |
| population (t-1) (ln) | | 9.3419** | 4.9167 |
| | | (4.5246) | (7.1460) |
| **population (t-1) (ln) * corruption (change t/t-1)** | | -0.2329** | -0.1493* |
| | | (0.0936) | (0.0804) |
| political stability (t-1) | | 1.5312** | 2.4221*** |
| | | (0.6442) | (0.8752) |
| **political stability (t-1) * corruption (t/t-1)** | | -0.6315** | 0.4595 |
| | | (0.2767) | (0.3267) |
| regulatory quality (t-1) | | | -3.4847** |
| | | | (1.3896) |
| **regulatory quality (t-1) * corruption (t/t-1)** | | | -0.8271*** |
| | | | (0.2393) |
| capital inflows (t/t-1) | 1.2916* | 0.8111 | 0.3231 |
| | (0.7599) | (0.6783) | (0.6227) |
| Constant | YES | YES | YES |
| Time dummies | YES | YES | YES |
| Country dummies | YES | YES | YES |
| Sector dummies | YES | YES | YES |
| Observations | 105 | 105 | 105 |
| R-squared | 0.28 | 0.44 | 0.51 |
| Adjusted R-squared | 0.13 | 0.30 | 0.37 |
| Robust standard errors in parentheses.<br>*** p<0.01, ** p<0.05, * p<0.1 | | | |

*Notes: Estimates are obtained via OLS with White's correction for heteroskedasticity. Standard errors are reported in brackets.*

**Table B2a. Correlations between changes in the frequency of paying bribes for specific purposes and changes in labour misallocation**

| **Dependent variable:** change in dispersion of MRPL<br>Corruption measure: various BEEPS measures | FREQ COURTS | | | | FREQ TAXES | | | | FREQ CUSTOMS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **corruption (change t/t-1)** | -0.1344** | 4.8413 | 4.8369 | 1.6978 | -0.2863*** | 6.0187** | 7.8616*** | 4.8101* | -0.2410*** | 2.8165 | 2.2715 | 3.4076 |
| | (0.0629) | (3.3126) | (4.1336) | (3.2936) | (0.0925) | (2.7534) | (2.7572) | (2.6459) | (0.0826) | (1.9109) | (2.6622) | (2.2113) |
| dispersion in mrpl in 2003 (ln) | -0.5157* | -0.5427* | -0.5382** | -0.5571* | -0.5393** | -0.5271** | -0.4980** | -0.5485** | -0.5073* | -0.4968* | -0.5584** | -0.4944* |
| | (0.2715) | (0.2819) | (0.2383) | (0.2823) | (0.2563) | (0.2539) | (0.2231) | (0.2580) | (0.2658) | (0.2711) | (0.2278) | (0.2780) |
| population (t-1) (ln) | | 1.6279 | 0.6411 | -3.7499 | | 1.9244 | 2.0806 | -2.1949 | | 0.9752 | 2.0832 | -2.3492 |
| | | (2.8683) | (2.5330) | (3.9177) | | (2.5341) | (2.1734) | (3.2617) | | (2.7050) | (2.4663) | (3.5697) |
| **population (t-1) (ln) * corruption (change t/t-1)** | | -0.2922 | -0.0811 | -0.0968 | | -0.3549** | -0.2084* | -0.2755* | | -0.1705 | -0.0055 | -0.2023 |
| | | (0.1916) | (0.1179) | (0.1893) | | (0.1619) | (0.1126) | (0.1546) | | (0.1101) | (0.0881) | (0.1281) |
| political stability (t-1) | | 0.0922 | | 0.5827 | | 0.3392 | | 0.7603** | | 0.0035 | | 0.2668 |
| | | (0.2851) | | (0.4188) | | (0.2637) | | (0.3787) | | (0.2454) | | (0.3283) |
| **political stability (t-1) * corruption (t/t-1)** | | -0.5707 | | 1.0969 | | -1.0624** | | -0.4260 | | -0.5920 | | 0.3189 |
| | | (0.5962) | | (0.7044) | | (0.4127) | | (0.4387) | | (0.4159) | | (0.3949) |
| civil liberties (t-1) | | | 0.0913*** | | | | 0.0871*** | | | | 0.0844*** | |
| | | | (0.0241) | | | | (0.0224) | | | | (0.0213) | |
| **civil liberties (t-1) * corruption (t/t-1)** | | | -0.0711 | | | | -0.0921*** | | | | -0.0459 | |
| | | | (0.0522) | | | | (0.0254) | | | | (0.0289) | |
| regulatory quality (t-1) | | | | -1.7525** | | | | -1.0590* | | | | -1.2691** |
| | | | | (0.6855) | | | | (0.5416) | | | | (0.5530) |
| **regulatory quality (t-1) * corruption (t/t-1)** | | | | -1.3178*** | | | | -0.5149** | | | | -0.8345** |
| | | | | (0.4997) | | | | (0.2386) | | | | (0.3292) |
| Constant | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 |
| R-squared | 0.2051 | 0.2278 | 0.4016 | 0.3007 | 0.2639 | 0.3346 | 0.4885 | 0.3678 | 0.2561 | 0.2795 | 0.4161 | 0.3454 |
| Adjusted R-squared | 0.0844 | 0.0776 | 0.285 | 0.149 | 0.152 | 0.205 | 0.389 | 0.231 | 0.143 | 0.139 | 0.303 | 0.203 |

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Table B2b. Correlations between changes in the frequency of paying bribes for specific purposes and changes in capital misallocation**

| Dependent variable: change in dispersion of MRPK | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Corruption measure: various BEEPS measures | FREQ COURTS | | | | FREQ TAXES | | | | FREQ CUSTOMS | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **corruption (change t/t-1)** | -0.4325*** | 10.1572 | 12.5428 | 2.7932 | -0.7304*** | 17.1447*** | 19.1592*** | 14.5385*** | -0.5579*** | 6.4362 | 8.2624 | 7.1147 |
| | (0.1449) | (7.5271) | (7.7934) | (6.9641) | (0.2210) | (5.4056) | (5.2409) | (5.1087) | (0.1799) | (4.2977) | (5.6803) | (4.9657) |
| dispersion in mrpk in 2003 (ln) | -0.4036 | -0.4065 | -0.4888 | -0.4070 | -0.4903 | -0.5123 | -0.7295** | -0.5746 | -0.6512 | -0.7072 | -0.7235 | -0.7151 |
| | (0.6316) | (0.5988) | (0.4734) | (0.5345) | (0.5635) | (0.4204) | (0.3242) | (0.4073) | (0.6174) | (0.6092) | (0.4568) | (0.5557) |
| population (t-1) (ln) | | 7.4317 | 5.3645 | -6.8846 | | 8.5523* | 8.0933** | -1.0138 | | 5.4155 | 7.4428* | -4.4843 |
| | | (5.2817) | (4.3837) | (6.9633) | | (4.3847) | (3.8295) | (5.9910) | | (4.9939) | (4.1107) | (6.7577) |
| **population (t-1) (ln) * corruption (change t/t-1)** | | -0.6230 | -0.3243 | -0.1701 | | -1.0219*** | -0.6528*** | -0.8469*** | | -0.3992 | -0.1460 | -0.4289 |
| | | (0.4374) | (0.2318) | (0.4017) | | (0.3175) | (0.2058) | (0.2980) | | (0.2449) | (0.1857) | (0.2866) |
| political stability (t-1) | | 1.2658** | | 2.5968*** | | 1.8112*** | | 2.8482*** | | 1.1673** | | 2.0039** |
| | | (0.5579) | | (0.7944) | | (0.4723) | | (0.6694) | | (0.5547) | | (0.8087) |
| **political stability (t-1) * corruption (t/t-1)** | | -1.1044 | | 1.7013 | | -2.6481*** | | -0.8018 | | -1.0137 | | 0.8793 |
| | | (1.2342) | | (1.3445) | | (0.8603) | | (0.9603) | | (0.9730) | | (0.8012) |
| civil liberties (t-1) | | | 0.2246*** | | | | 0.2166*** | | | | 0.2176*** | |
| | | | (0.0453) | | | | (0.0379) | | | | (0.0413) | |
| **civil liberties (t-1) * corruption (t/t-1)** | | | -0.1502 | | | | -0.1797*** | | | | -0.1237** | |
| | | | (0.0933) | | | | (0.0496) | | | | (0.0618) | |
| regulatory quality (t-1) | | | | -3.9917*** | | | | -2.5747*** | | | | -3.3101*** |
| | | | | (1.2465) | | | | (0.9410) | | | | (1.0683) |
| **regulatory quality (t-1) * corruption (t/t-1)** | | | | -1.9890* | | | | -1.5415** | | | | -1.7185** |
| | | | | (1.0240) | | | | (0.6017) | | | | (0.6637) |
| Constant | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 | 130 |
| R-squared | 0.1767 | 0.2644 | 0.4863 | 0.3551 | 0.2589 | 0.4557 | 0.5863 | 0.5095 | 0.2254 | 0.3033 | 0.5113 | 0.3965 |
| Adjusted R-squared | 0.0517 | 0.121 | 0.386 | 0.215 | 0.146 | 0.350 | 0.506 | 0.403 | 0.108 | 0.168 | 0.416 | 0.266 |

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

*Notes: Estimates are obtained via OLS with White's correction for heteroskedasticity. Standard errors are reported in brackets*

**Table B3a. Correlations between changes in the frequency/amount of paying bribes to get things done and changes in labour misallocation**

| Dependent variable: change in dispersion of MRPL | FREQUENCY BRIBES | | | | AMOUNT BRIBES | | | |
|---|---|---|---|---|---|---|---|---|
| Corruption measure: frequency of bribes to get things done a | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **corruption (change t/t-1)** | -0.1357** | 4.1813** | 5.3452** | 4.0590** | 0.0023** | -0.1446 | -0.3118 | -0.1313 |
| | (0.0679) | (1.8297) | (2.2026) | (1.7863) | (0.0010) | (0.1352) | (0.2130) | (0.1567) |
| dispersion in mrpl in 2003 (ln) | -0.4883* | -0.4975* | -0.5071** | -0.4674* | -0.5143* | -0.5121* | -0.4699* | -0.5114* |
| | (0.2725) | (0.2646) | (0.2335) | (0.2733) | (0.2994) | (0.2829) | (0.2425) | (0.2869) |
| population (t-1) (ln) | | 1.5974 | 3.4543 | -3.4435 | | 1.8701 | 1.0835 | -4.3311 |
| | | (2.6820) | (2.5061) | (3.9140) | | (2.7619) | (2.5155) | (3.9665) |
| **population (t-1) (ln) * corruption (change t/t-1)** | | -0.2510** | -0.1514* | -0.2273** | | 0.0086 | 0.0173* | 0.0085 |
| | | (0.1077) | (0.0767) | (0.1042) | | (0.0085) | (0.0100) | (0.0099) |
| political stability (t-1) | | 0.1649 | | 0.7513* | | 0.5626 | | 1.0813** |
| | | (0.2583) | | (0.4157) | | (0.4033) | | (0.5165) |
| **political stability (t-1) * corruption (t/t-1)** | | -0.6073* | | -0.2056 | | 0.0322 | | 0.0298 |
| | | (0.3205) | | (0.2746) | | (0.0210) | | (0.0197) |
| civil liberties (t-1) | | | 0.0809*** | | | | 0.1057*** | |
| | | | (0.0208) | | | | (0.0250) | |
| **civil liberties (t-1) * corruption (t/t-1)** | | | -0.0609*** | | | | 0.0010 | |
| | | | (0.0229) | | | | (0.0019) | |
| regulatory quality (t-1) | | | | -1.5607** | | | | -1.3296** |
| | | | | (0.7469) | | | | (0.6184) |
| **regulatory quality (t-1) * corruption (t/t-1)** | | | | -0.5229** | | | | -0.0194 |
| | | | | (0.2398) | | | | (0.0223) |
| Constant | YES | YES | YES | YES | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 130 | 130 | 130 | 130 | 105 | 105 | 105 | 105 |
| R-squared | 0.2216 | 0.2800 | 0.4560 | 0.3344 | 0.2260 | 0.2716 | 0.5002 | 0.3226 |
| Adjusted R-squared | 0.103 | 0.140 | 0.350 | 0.190 | 0.0853 | 0.0981 | 0.381 | 0.141 |

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Table B3b. Correlations between changes in the frequency/amount of paying bribes to get things done and changes in capital misallocation**

| Dependent variable: change in dispersion of MRPK | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Corruption measure: frequency of bribes to get things done and amount of bribes | FREQUENCY BRIBES | | | | AMOUNT BRIBES | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| **corruption (change t/t-1)** | -0.2876* | 7.7276** | 10.1198** | 6.2803 | -0.0009 | -0.2192 | -0.7679* | -0.1998 |
| | (0.1462) | (3.8979) | (4.5105) | (4.0379) | (0.0021) | (0.3118) | (0.4597) | (0.3622) |
| dispersion in mrpk in 2003 (ln) | -0.5761 | -0.6638 | -0.6752 | -0.5439 | -0.7587 | -0.7449 | -0.6225 | -0.7211 |
| | (0.6350) | (0.5857) | (0.4234) | (0.5352) | (0.8194) | (0.7283) | (0.5236) | (0.6470) |
| population (t-1) (ln) | | 5.9149 | 9.2597** | -8.7642 | | 6.2704 | 3.5763 | -9.1554 |
| | | (5.0983) | (4.4851) | (7.2872) | | (4.5641) | (3.9572) | (7.1315) |
| **population (t-1) (ln) * corruption (change t/t-1)** | | -0.4736** | -0.2802* | -0.3456 | | 0.0121 | 0.0348 | 0.0127 |
| | | (0.2285) | (0.1626) | (0.2364) | | (0.0192) | (0.0228) | (0.0225) |
| political stability (t-1) | | 1.5584*** | | 3.0876*** | | 2.4283*** | | 3.6807*** |
| | | (0.5665) | | (0.8638) | | (0.8158) | | (1.0073) |
| **political stability (t-1) * corruption (t/t-1)** | | -0.9339 | | -0.2705 | | 0.0694 | | 0.0578 |
| | | (0.6940) | | (0.5772) | | (0.0505) | | (0.0460) |
| civil liberties (t-1) | | | 0.2180*** | | | | 0.2499*** | |
| | | | (0.0396) | | | | (0.0453) | |
| **civil liberties (t-1) * corruption (t/t-1)** | | | -0.1175** | | | | 0.0048 | |
| | | | (0.0459) | | | | (0.0043) | |
| regulatory quality (t-1) | | | | -4.0558*** | | | | -3.2815*** |
| | | | | (1.3381) | | | | (1.1550) |
| **regulatory quality (t-1) * corruption (t/t-1)** | | | | -0.9187** | | | | -0.0404 |
| | | | | (0.4594) | | | | (0.0493) |
| Constant | YES | YES | YES | YES | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES | YES | YES | YES |
| Observations | 130 | 130 | 130 | 130 | 105 | 105 | 105 | 105 |
| R-squared | 0.1738 | 0.2929 | 0.5334 | 0.3716 | 0.1702 | 0.3125 | 0.5732 | 0.3899 |
| Adjusted R-squared | 0.0484 | 0.155 | 0.443 | 0.235 | 0.0193 | 0.149 | 0.472 | 0.226 |
| Robust standard errors in parentheses.<br>*** p<0.01, ** p<0.05, * p<0.1 | | | | | | | | |

*Notes: Estimates are obtained via OLS with White's correction for heteroskedasticity. Standard errors are reported in brackets.*

**Table B4a. Correlations between changes in the sectorialised Control of Corruption indicator and changes in labour misallocation**

| Dependent variable: change in dispersion of MRPL<br>Corruption measure: Sectoralized control of corruption | | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| **corruption (change t/t-1)** | 0.0155 | 2.2208*** | 3.1604** | 2.5985** |
| | (0.0356) | (0.7337) | (1.2106) | (1.0060) |
| dispersion in mrpl in 2003 (ln) | -0.5146** | -0.5201** | -0.5177** | -0.4986** |
| | (0.2566) | (0.2515) | (0.2253) | (0.2451) |
| population (t-1) (ln) | | -0.7008 | -0.5833 | -10.9071*** |
| | | (2.5199) | (2.6202) | (3.4886) |
| **population (t-1) (ln) * corruption (change t/t-1)** | | -0.1295*** | -0.0855* | -0.2100*** |
| | | (0.0461) | (0.0473) | (0.0696) |
| political stability (t-1) | | -0.0169 | | 1.1199** |
| | | (0.2256) | | (0.4570) |
| **political stability (t-1) * corruption (t/t-1)** | | -0.2922 | | 0.4022 |
| | | (0.1838) | | (0.4102) |
| civil liberties (t-1) | | | 0.0583*** | |
| | | | (0.0193) | |
| **civil liberties (t-1) * corruption (t/t-1)** | | | -0.0348** | |
| | | | (0.0168) | |
| regulatory quality (t-1) | | | | -2.5442*** |
| | | | | (0.7348) |
| **regulatory quality (t-1) * corruption (t/t-1)** | | | | 0.0598 |
| | | | | (0.2134) |
| Constant | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES |
| Observations | 154 | 154 | 154 | 154 |
| R-squared | 0.1520 | 0.1810 | 0.3057 | 0.3223 |
| Adjusted R-squared | 0.0460 | 0.0507 | 0.195 | 0.202 |

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Table B4b. Correlations between changes in the sectorialised Control of Corruption indicator and changes in capital misallocation**

| **Dependent variable: change in dispersion of MRPK**<br>**Corruption measure: Sectoralized control of corruption** | | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| **corruption (change t/t-1)** | 0.1164 | 2.7854* | 6.7703*** | 3.7114* |
| | (0.0758) | (1.4524) | (2.2544) | (2.1163) |
| dispersion in mrpk in 2003 (ln) | -0.3796 | -0.3706 | -0.3640 | -0.3958 |
| | (0.5549) | (0.5076) | (0.3930) | (0.3881) |
| population (t-1) (ln) | | 2.3278 | 2.4499 | -20.2619*** |
| | | (4.5270) | (4.1686) | (5.7859) |
| **population (t-1) (ln) * corruption (change t/t-1)** | | -0.1430 | -0.1519 | -0.3270** |
| | | (0.0925) | (0.1026) | (0.1414) |
| political stability (t-1) | | 1.2652*** | | 3.7753*** |
| | | (0.4613) | | (0.9106) |
| **political stability (t-1) * corruption (t/t-1)** | | -0.5865* | | 1.0072 |
| | | (0.3515) | | (0.7819) |
| civil liberties (t-1) | | | 0.1794*** | |
| | | | (0.0381) | |
| **civil liberties (t-1) * corruption (t/t-1)** | | | -0.0806*** | |
| | | | (0.0300) | |
| regulatory quality (t-1) | | | | -5.6198*** |
| | | | | (1.3336) |
| **regulatory quality (t-1) * corruption (t/t-1)** | | | | 0.0792 |
| | | | | (0.4586) |
| Constant | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES |
| Observations | 154 | 154 | 154 | 154 |
| R-squared | 0.1272 | 0.2096 | 0.4258 | 0.3773 |
| Adjusted R-squared | 0.0181 | 0.0838 | 0.334 | 0.267 |
| Robust standard errors in parentheses.<br>*** p<0.01, ** p<0.05, * p<0.1 | | | | |

*Notes: Estimates are obtained via OLS with White's correction for heteroskedasticity. Standard errors are reported in brackets.*

**Table B5. Baseline estimation results with the OP gap as the labour misallocation measure**

| Dependent variable: cumulative change in dispersion of lopgap<br>Corruption measure: synthetic indicator of frequency and amount of bribes paid | | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| **corruption (change t/t-1)** | 0.0016 | -0.2083*** | -0.4223** | -0.6169** | -0.4954** | -0.3786* |
| | (0.0048) | (0.0784) | (0.2012) | (0.2377) | (0.2217) | (0.2091) |
| dispersion in lopgap in 2003 (ln) | -0.1029 | -0.1034 | -0.1061 | -0.0942 | -0.1094 | -0.1109 |
| | (0.0991) | (0.0966) | (0.0938) | (0.0867) | (0.0938) | (0.0939) |
| population (t-1) (ln) | | -1.2727** | -1.1736* | -2.1764*** | -2.0041* | -0.7527 |
| | | (0.6365) | (0.6570) | (0.6006) | (1.0571) | (0.7743) |
| **population (t-1) (ln) * corruption (change t/t-1)** | | 0.0133*** | 0.0253** | 0.0242*** | 0.0298** | 0.0225* |
| | | (0.0048) | (0.0115) | (0.0077) | (0.0129) | (0.0121) |
| political stability (t-1) | | | 0.0805 | | 0.1507 | 0.1014 |
| | | | (0.0693) | | (0.1002) | (0.0926) |
| **political stability (t-1) * corruption (t/t-1)** | | | 0.0394 | | 0.0434 | 0.0147 |
| | | | (0.0330) | | (0.0425) | (0.0413) |
| civil liberties (t-1) | | | | 0.0066 | | |
| | | | | (0.0055) | | |
| **civil liberties (t-1) * corruption (t/t-1)** | | | | 0.0049* | | |
| | | | | (0.0026) | | |
| regulatory quality (t-1) | | | | | -0.1399 | |
| | | | | | (0.1406) | |
| **regulatory quality (t-1) * corruption (t/t-1)** | | | | | 0.0018 | |
| | | | | | (0.0382) | |
| startup costs (t-1) | | | | | | -0.0143 |
| | | | | | | (0.0193) |
| **startup costs (t-1) * corruption (t/t-1)** | | | | | | 0.0062 |
| | | | | | | (0.0065) |
| Constant | YES | YES | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES | YES |
| Observations | 91 | 91 | 91 | 91 | 91 | 91 |
| R-squared | 0.2812 | 0.3499 | 0.3714 | 0.3966 | 0.3804 | 0.3964 |
| Adjusted R-squared | 0.126 | 0.187 | 0.192 | 0.224 | 0.180 | 0.201 |
| Robust standard errors in parentheses.<br>*** p<0.01, ** p<0.05, * p<0.1 | | | | | | |

*Notes: Estimates are obtained via OLS with White's correction for heteroskedasticity. An increase in the OP gap signals a fall in labour misallocation, therefore results present opposite signs to those in Table 3a in the text. Standard errors are reported in brackets.*

**Table B6a. Baseline estimation results for the labour misallocation regression with corruption levels**

| **Dependent variable: cumulative change in dispersion of MRPL**<br>**Corruption measure: synthetic indicator of frequency and amount of bribes paid** | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **corruption (t-1)** | -0.0659*** | 1.2120** | 1.3548** | 0.2841 | 1.6076*** |
| | (0.0212) | (0.5453) | (0.5564) | (0.8511) | (0.5739) |
| dispersion in mrpl in 2003 (ln) | -0.4572* | -0.3758 | -0.3655 | -0.4753* | -0.3611 |
| | (0.2747) | (0.2732) | (0.2718) | (0.2504) | (0.2765) |
| population (t-1) (ln) | | 1.7361 | 1.2108 | 1.5549 | -4.7924 |
| | | (2.5531) | (2.4071) | (2.2880) | (3.6624) |
| **population (t-1) (ln) * corruption (t-1)** | | -0.0802** | -0.0862** | -0.0183 | -0.0941*** |
| | | (0.0348) | (0.0343) | (0.0338) | (0.0336) |
| political stability (t-1) | | | 0.1336 | | 0.7425* |
| | | | (0.2330) | | (0.4159) |
| **political stability (t-1) * corruption (t-1)** | | | -0.0690 | | 0.0722 |
| | | | (0.0651) | | (0.0809) |
| civil liberties (t-1) | | | | 0.0826*** | |
| | | | | (0.0265) | |
| **civil liberties (t-1) * corruption (t-1)** | | | | -0.0002 | |
| | | | | (0.0081) | |
| regulatory quality (t-1) | | | | | -1.0394* |
| | | | | | (0.6012) |
| **regulatory quality (t-1) * corruption (t-1)** | | | | | -0.2365*** |
| | | | | | (0.0888) |
| Constant | YES | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES |
| Observations | 121 | 121 | 121 | 121 | 121 |
| R-squared | 0.2607 | 0.2942 | 0.2996 | 0.4228 | 0.3633 |
| Adjusted R-squared | 0.139 | 0.161 | 0.151 | 0.300 | 0.212 |

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

**Table B6b. Baseline estimation results for the capital misallocation regression with corruption levels**

| Dependent variable: cumulative change in dispersion of MRPK<br>Corruption measure: synthetic indicator of frequency and amount of bribes paid | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **corruption (t-1)** | -0.1676*** | 3.7028*** | 3.7469*** | 1.0345 | 4.4620*** |
| | (0.0571) | (1.1110) | (1.2105) | (1.4807) | (1.1126) |
| dispersion in mrpk in 2003 (ln) | -0.7475 | -0.8708 | -0.9067* | -0.7093 | -1.0844** |
| | (0.6023) | (0.5538) | (0.5226) | (0.4420) | (0.4572) |
| population (t-1) (ln) | | 7.0197 | 5.9282 | 6.7671* | -9.6667 |
| | | (4.7577) | (4.1176) | (3.6687) | (6.5527) |
| **population (t-1) (ln) * corruption (t-1)** | | -0.2428*** | -0.2351*** | -0.0853 | -0.2589*** |
| | | (0.0712) | (0.0737) | (0.0631) | (0.0653) |
| political stability (t-1) | | | 1.3933*** | | 2.9867*** |
| | | | (0.4343) | | (0.7476) |
| **political stability (t-1) * corruption (t-1)** | | | -0.2297 | | 0.1333 |
| | | | (0.1487) | | (0.1645) |
| civil liberties (t-1) | | | | 0.2043*** | |
| | | | | (0.0424) | |
| **civil liberties (t-1) * corruption (t-1)** | | | | 0.0055 | |
| | | | | (0.0131) | |
| regulatory quality (t-1) | | | | | -2.7208** |
| | | | | | (1.0490) |
| **regulatory quality (t-1) * corruption (t-1)** | | | | | -0.6219*** |
| | | | | | (0.1621) |
| Constant | YES | YES | YES | YES | YES |
| Time dummies | YES | YES | YES | YES | YES |
| Country dummies | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES |
| Observations | 121 | 121 | 121 | 121 | 121 |
| R-squared | 0.2350 | 0.3226 | 0.3814 | 0.5303 | 0.4960 |
| Adjusted R-squared | 0.109 | 0.195 | 0.250 | 0.431 | 0.377 |

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

*Notes: Estimates are obtained via OLS with White's correction for heteroskedasticity. Standard errors are reported in brackets.*

**Table B7. Correlations between corruption and female representation in Parliament and (the square) of freedom of the press.**

| **Dependent variable: synthetic indicator of frequency and amount of bribes paid** | | |
|---|---|---|
| | 1 | 2 |
| dispersion in mrpk in 2003 (ln) | -0.7255 | -0.8672 |
| | (-1.017) | (0.9699) |
| population (t-1) (ln) | -1.7518 | 30.65768* |
| | (-18.3739) | (18.0966) |
| political stability (t-1) | -5.2647*** | -6.52277** |
| | (-1.7821) | (2.4598) |
| **female representation in Parliament** | -2.1465** | |
| | (1.0217) | |
| female representation in Parliament* political stability | 0.9983** | |
| | (0.4976) | |
| female representation in Parliament*population | 0.0944 | |
| | (0.0628) | |
| **press freedom** | | -11.4087** |
| | | (-4.8250) |
| press freedom*political stability | | 2.2515** |
| | | (0.8830) |
| press freedom*population | | 0.5173* |
| | | (0.2738) |
| **press freedom squared** | | 0.0291** |
| | | (0.0118) |
| Constant | YES | YES |
| Time dummies | YES | YES |
| Sector dummies | YES | YES |
| Country dummies | YES | YES |
| Observations | 99 | 105 |
| Robust standard errors in parentheses.<br>*** p<0.01, ** p<0.05, * p<0.1 | | |

*Notes: Estimates are obtained via OLS with White's correction for heteroskedasticity. Column 1 is based on the share of women in Parliament and column 2 on freedom of the press as an instrumental variable, respectively. Standard errors are reported in brackets.*

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