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MISALLOCATION OF RESOURCES IN LATVIA: DID ANYTHING CHANGE DURING THE CRISIS?

CONTENTS

ABBREVIATIONS

AMECO – annual macro-economic database of the European Commission
CES – constant elasticity of substitution
CSB – Central Statistical Bureau of Latvia
ECB – European Central Bank
GDP – gross domestic product
GMM – generalised method of moments
MRPK – marginal revenue product of capital
MRPL – marginal revenue product of labour
MRPM – marginal revenue product of intermediate inputs
NACE – Statistical Classification of Economic Activities in the European Community
OECD – Organisation for Economic Co-operation and Development
TFP – total factor productivity
TFPR – total factor productivity revenue
WDN – Wage Dynamics Network

SUMMARY

This paper evaluates misallocation of resources in Latvia during 2007–2013 using firm-level data. I found that allocation of resources worsened before 2010 and improved afterwards. Initially, misallocation of intermediate inputs was the major source of aggregate TFP losses, while the importance of capital misallocation increased after the financial crisis. Determinants of changes in allocation efficiency may include growing competition in domestic markets, tighter credit supply and legal issues. However, I show that fragmentation of production induces bias to the estimates of firm-specific distortions. Thus, in the absence of inter-firm trade data, the conclusions on misallocation should be treated with some caution.

Keywords: misallocation, TFP, productivity, firm-level data, Latvia

JEL codes: D24, L11, O11, O41, O47

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INTRODUCTION

Latvia's economy recently underwent several huge shocks that caused the GDP growth rate to fluctuate between positive and negative two-digit numbers in 2005–2009 and finally to stabilise at around 4%–5% in 2011–2013. Economic growth is not the only volatile indicator in Latvia. According to the AMECO, Latvia's performance in terms of productivity growth was outstanding between 1995 and 2007 when the average annual TFP growth amounted to 6.8%. The financial crisis and structural transformations led to a temporary drop in productivity, with TFP declining by 2.8% every year between 2007 and 2010. Afterwards, the TFP growth was back on the positive track (close to 2%–3%), yet far behind the pre-crisis numbers. The rapid growth of productivity in the 1990s and early 2000s was driven by unique factors: initial convergence due to transformation of the economy and credit boom led by foreign banks. As these factors are not likely to repeat in the foreseeable future, other ways to stimulate TFP growth in Latvia are to be looked for.

In this paper, I investigate the allocation of resources in Latvia. The motivation for this study is twofold. First, I study how the changes in within-sector allocation of resources affected Latvia's TFP growth before and after the crisis. Second, I make an attempt to understand the driving forces behind the misallocation.

The issue of resource allocation has a long-standing history in empirical economics, starting with the seminal work by Olley and Pakes (1996) who show how to evaluate the empirical effect of reallocation of capital towards more productive enterprises. The Olley–Pakes decomposition became increasingly popular and was applied to the analysis of resource allocation in various countries. For example, Bartelsman et al. (2009) perform decomposition for a wide range of countries and report that in the 1990s Latvia's resources were allocated less efficiently compared with the old EU Member States. These results suggest that Latvia could increase its productivity and GDP by reallocating resources from less productive to more productive firms.

In this paper, I analyse the allocation of resources and potential TFP gains using the Hsieh and Klenow (2009) framework, namely, its modified version with intermediate inputs introduced by Dias et al. (2014). This model is applied to Latvia's firm-level data between 2007 and 2013 to assess how effective was the allocation of resources and what were the driving forces behind misallocation.

While interpreting the obtained results, I highlight two important issues that may affect the perception of misallocation but are not captured by the Hsieh and Klenow (2009) framework. The first issue is the fragmentation of production. Outsourcing increases the role of intermediate inputs with respect to capital and labour, thus producing a systematic bias in the estimates of misallocation. Although it is not possible to quantify this bias due to the lack of data on inter-firm trade, I stress the presence of outsourcing phenomenon in the obtained results. The second issue is related to export activities and different levels of competition in domestic and external markets.

The paper is structured as follows. Section 1 explains the main idea behind the Hsieh and Klenow (2009) framework. Section 2 describes Latvia's firm-level database; Section 3 presents the level of misallocation for total economy and main economic sectors and checks the robustness of results. Section 4 uncovers several potential factors behind distortions in Latvia's economy. The econometric model for firm-specific TFP and distortions is reported in Section 5, while the final section concludes.

1. THEORETICAL FRAMEWORK

1.1 Firm-specific distortions and allocation of resources

In this section, I briefly describe the framework of Hsieh and Klenow (2009) modified in the style of Dias et al. (2014). This is a monopolistic competition model with firm heterogeneity a la Melitz (2003) where firms face various distortions. Hsieh and Klenow (2009) assume that a representative assembly firm combines the output of different industries into a homogenous final good using a Cobb–Douglas production technology:

$$Y = \prod_{s=1}^{S} Y_s^{\theta_s}; \qquad \sum_{s=1}^{S} \theta_s = 1; \qquad \theta_s = \frac{P_s Y_s}{PY} \tag{1}$$

where Y represents a homogenous final good, Y_s is output of industry s, P_s and P refer to the price of industry output and final good respectively. There are S industries in the economy, while the output of each industry is a CES aggregate of N_s differentiated products Y_{si}. Unlike Hsieh and Klenow (2009), I allow for industry-specific elasticity of substitution between products (σ_s), thus accounting for heterogeneous level of competition:

$$Y_s = \left(\sum_{i=1}^{N_s} Y_{si}^{\frac{\sigma_s - 1}{\sigma_s}} \right)^{\frac{\sigma_s}{\sigma_s - 1}} \tag{2}.$$

I follow the approach of Dias et al. (2014) and modify the benchmark model by introducing intermediate inputs into the production function for a differentiated product:

$$Y_{si} = A_{si} K_{si}^{\alpha_s} L_{si}^{\beta_s} M_{si}^{1-\alpha_s-\beta_s} \tag{3}$$

where A_{si} denotes firm-specific TFP, K_{si} is firm's capital, L_{si} shows the number of employees, and M_{si} is intermediate inputs. The coefficients of Cobb–Douglas production function (α_s and β_s) can vary across industries but not across firms within the same industry.

The motivation for augmenting the production function by intermediate inputs is threefold. The first motivation relates to wider possibilities in empirical conclusions. The three-factor production function as in Dias et al. (2014) requires three different distortions (instead of two in Hsieh and Klenow (2009)):

$$\pi_{si} = (1-\tau_{Ysi}) P_{si} Y_{si} - (1+\tau_{Ksi}) R_s K_{si} - (1+\tau_{Lsi}) w_s L_{si} - P_s^M M_{si} \xrightarrow{L_{sj}, K_{si}, M_{si}} \max \tag{4}$$

where π_{si} represents firm's profits, P_{si} denotes the price of firm-specific output, R_s, w_s and P_s^M are industry-specific capital costs, wage and price of intermediate inputs respectively. Like in the benchmark model, τ_{Ksi} refers to firm-specific capital distortion and τ_{Ysi} to size distortion. The third distortion is τ_{Lsi}, which relates to labour.

An additional production factor leads to more comprehensive conclusions regarding driving forces of misallocation. Size and labour distortions are observationally equivalent in Hsieh and Klenow (2009). In the model with three production factors, one can separate the distortions related to the labour market from the size distortions. Moreover, the size distortion corresponds to the firm-specific output more naturally (e.g. transportation costs or subsidies are proportional to output, not value added).

Fragmentation of production provides a second motivation for the inclusion of intermediate inputs. The growing role of outsourcing and tendency to split a company into several enterprises increase the significance of intermediate inputs in production. While it is not possible to draw a strong conclusion without accessing network data on sales between enterprises, the presence of intermediate inputs in the framework may provide some useful findings.

Finally, modification of Dias et al. (2014) helps solve the problem of enterprises with negative value added. The share of firms (indirectly) reporting negative value added is rather high in Latvia, close to 20% after 2009. Such firms would be simply ignored in two-factor production function when real value added serves as proxy for Y_{si}. However, negative-value-added firms have extremely low TFP, and the exclusion of such observations may seriously affect conclusions about misallocation of resources. Adding intermediate inputs to the production function and defining Y_{si} as real output help solve the problem.

According to the framework in equations (1)–(4), the allocation of resources is solely driven by firms' TFP levels in the absence of distortions. Marginal revenue products (of capital, labour and intermediate inputs) would equalise across enterprises in this ideal case. When firms face various distortions, marginal revenue products are higher for discriminated firms, indicating lower-than-normal allocation of the respective resource:

$$MRPK_{si} = R_s \frac{1+\tau_{Ksi}}{1-\tau_{Ysi}} \quad (5),$$

$$MRPL_{si} = w_s \frac{1+\tau_{Lsi}}{1-\tau_{Ysi}} \quad (6),$$

$$MRPM_{si} = \frac{P_s^M}{1-\tau_{Ysi}} \quad (7).$$

The TFPR of the firm ($TFPR_{si}$) is defined as revenue productivity that is proportional to geometric average of marginal revenue products of capital, labour and intermediates. Thus, a higher enterprise's TFPR indicates underuse of resources due to capital, labour or size discrimination:

$$TFPR_{si} \equiv P_{si} A_{si} \propto \left(MRPK_{si}\right)^{\alpha_s} \left(MRPL_{si}\right)^{\beta_s} \left(MRPM_{si}\right)^{1-\alpha_s-\beta_s} \propto \frac{\left(1+\tau_{Ksi}\right)^{\alpha_s}\left(1+\tau_{Lsi}\right)^{\beta_s}}{1-\tau_{Ysi}} \quad (8).$$

The industry TFP is defined as

$$TFP_s \equiv \frac{Y_s}{\left(\sum_{i=1}^{N_s} K_{si}\right)^{\alpha_s} \left(\sum_{i=1}^{N_s} L_{si}\right)^{\beta_s} \left(\sum_{i=1}^{N_s} M_{si}\right)^{1-\alpha_s-\beta_s}} = \left[\sum_{i=1}^{N_s} \left(A_{si} \frac{\overline{TFPR_{si}}}{TFPR_{si}}\right)^{\sigma_s-1}\right]^{\frac{1}{\sigma_s-1}} \quad (9)$$

where $\overline{TFPR_s} \propto \left(\overline{MRPK_s}\right)^{\alpha_s}\left(\overline{MRPL_s}\right)^{\beta_s}\left(\overline{MRPM_s}\right)^{1-\alpha_s-\beta_s}$.[1] If all firms were equally treated in terms of the access to production factors (i.e. all firms were facing the same capital, labour and size distortions), all marginal revenue products would be equal across enterprises in a given industry. In this "efficient" case, industry TFP would equal

$$\overline{A_s} = \left(\sum_{i=1}^{Ns} A_{si}^{\sigma_s-1}\right)^{\frac{1}{\sigma_s-1}} \qquad (10).$$

Following Hsieh and Klenow (2009), I calculate the ratio of actual industry output to hypothetical output under efficient allocation of resources. After aggregating all industries using equation (1), I arrive at the following ratio of actual to efficient output:

$$\frac{Y}{Y_{efficient}} = \prod_{s=1}^{S}\left[\sum_{i=1}^{N_s}\left(\frac{A_{si}}{\overline{A_s}}\left(\frac{\overline{TFPR_s}}{TFPR_{si}}\right)\right)^{\sigma_s-1}\right]^{\frac{\theta_s}{\sigma_s-1}} \qquad (11).$$

I will use the ratio in equation (11) as the measure of potential gains from reallocation of resources in Latvia. In particular, I will analyse potential gains by industry and year, decomposing into potential gains from reallocating capital, labour and intermediate inputs within sectors.

1.2 Identification of firm-specific TFP and distortions

Following the maximisation problem in equations (1)–(4), the unobservable firm-specific TFP and distortions are expressed as a function of observable data on firm's output, capital, labour and intermediate inputs. Firm-specific TFP equals to

$$A_{si} = \kappa_s \frac{\left(P_{si}Y_{si}\right)^{\frac{\sigma_s}{\sigma_s-1}}}{K_{si}^{\alpha_s}\left(w_s L_{si}\right)^{\beta_s} M_{si}^{(1-\alpha_s-\beta_s)}}\ ;\ \kappa_s = w_s^{\beta_s}\frac{\left(P_s Y_s\right)^{\frac{1}{1-\sigma_s}}}{P_s} \qquad (12)$$

where κ_s is an industry-specific constant and can be ignored. The real output of firm is assessed from its nominal output ($P_{si}Y_{si}$) and industry-specific elasticity of substitution by deriving the demand function for individual firm's output. Similar to Hsieh and Klenow (2009), I use the firm's wage bill (w_sL_{si}) rather than employment, which allows capturing the difference in human capital per worker and hours worked.[2] The latter is of special importance for Latvia, since the share of part-time employment notably increased during the crisis period.[3]

[1] $\overline{MRPX_s} = \left(\sum_{i=1}^{N_s} MRPX_{si}^{-1}\theta_s\right)^{-1}$, where *MRPX* denotes *MRPK*, *MRPL*, or *MRPM*.

[2] Thus, w_s refers to skill-adjusted hourly wage assumed to be equal for all firms within industry *s*.

[3] Braukša and Fadejeva (2013) analyse micro data from the Labour Force Survey and conclude that part-time employment and temporary contracts were actively used in Latvia during 2009–2010.

Although the logic behind distortion equations (13)–(15) is the same as in Hsieh and Klenow (2009), the form of equations in Dias et al. (2014) differs due to the additional production factor. Capital distortion faced by individual firm is derived as

$$1+\tau_{Ksi}=\frac{\alpha_s}{1-\alpha_s-\beta_s}\frac{P_s^M M_{si}}{R_s K_{si}} \qquad (13).$$

Specifically, lower-than-usual use of capital is a sign of capital restrictions. Similar logic is applied to (14), where the high ratio of intermediate inputs to labour costs implies high labour distortions:

$$1+\tau_{Lsi}=\frac{\beta_s}{1-\alpha_s-\beta_s}\frac{P_s^M M_{si}}{w_s L_{si}} \qquad (14).$$

Finally, the size (output) distortion is detected as a case of abnormally low share of intermediate inputs in total output:

$$1-\tau_{Ysi}=\frac{\sigma_s}{\sigma_s-1}\frac{P_s^M M_{si}}{(1-\alpha_s-\beta_s)P_{si}Y_{si}} \qquad (15).$$

The interpretation of τ_{Ysi} is more complex in comparison with capital and labour distortions, since a large size distortion could be a sign of restrictions to total output (e.g. higher taxes after passing some threshold) or the consequence of restrictions to intermediate inputs (e.g. due to limited access to short-term loans).

2. DATA

2.1 Latvia's firm-level database

I use a firm-level database that contains information on a representative sample of Latvian enterprises in 2006–2013, with the number of firms in the dataset varying between 61 159 in 2006 and 93 895 in 2013. The dataset includes commercial enterprises in all areas of activities, excluding credit institutions and insurance companies.

The data are provided by the Central Statistical Bureau of Latvia (CSB) and Latvijas Banka, and come from various sources. First, the dataset contains detailed information on firm balance sheets, profit and loss statements, value added, number of employees, personnel costs, production value and intermediate inputs. Data are collected on the basis of CSB annual statistical reports "1-annual", "Complex report on activities", and also are provided by the State Revenue Service.

Second, the dataset includes information on firm-level external trade in goods provided by the CSB. The source of the external trade database is twofold, since the information on Latvia's trade with the EU countries comes from INTRASTAT surveys, while that on trade with other countries comes from custom declarations. Third, data on external trade in goods are supplemented with the dataset on external trade in services provided by Latvijas Banka (quarterly survey, forms "3-MB" and "4-MB"). Finally, Latvijas Banka also provides information on external assets and liabilities of firms (annual and quarterly surveys, form "1-MB").

In this paper, I have excluded several sectors from the empirical analysis due to the lack of data or specific nature of the sector, namely, agriculture, forestry and fishing (A), financial and insurance activities (K), public administration and defence (O), education (P), health (Q), arts, entertainment and recreation (R), and other services activities (S).

Table 1 compares the size distribution of firms in Latvia's firm-level database with distribution from the Structural Business Statistics in 2013. In both cases, the numbers represent NACE sectors B–J and L–N. Overall, the distribution by size is similar and the coverage of firm-level database is rather high.

Table 1

Distribution of firms by size according to Structural Business Statistics and firm-level database (2013)

Number of employed	Number of firms		Turnover		Value added		Employed	
	number	% of total	millions of euro	% of total	millions of euro	% of total	thousands of persons	% of total
Structural Business Indicators								
0–9	86 829	90.4	14 444.6	27.7	1 946.2	20.3	167.5	28.8
10–19	4 680	4.9	4 557.0	8.7	819.3	8.5	63.0	10.8
20–49	2 887	3.0	8 359.4	16.0	1 375.9	14.3	86.4	14.8
50–249	1 454	1.5	12 992.7	24.9	2 447.7	25.5	138.9	23.8
250–..	194	0.2	11 247.2	21.6	2 749.1	28.6	126.5	21.7
Total	96 046	100.0	52 142.5	100.0	9 608.6	100.0	582.2	100.0
Total sample of firm-level database								
0–9	74 955	92.8	16 764.2	31.2	1 845.5	20.6	145.8	29.2
10–19	2 291	2.8	3 606.7	6.7	562.9	6.3	31.0	6.2
20–49	1 916	2.4	7 721.9	14.4	1 129.3	12.6	58.5	11.7
50–249	1 373	1.7	13 427.9	25.0	2 546.8	28.5	134.2	26.8
250–..	200	0.2	12 179.8	22.7	2 865.2	32.0	130.5	26.1
Total	80 735	100.0	53 700.6	100.0	8 949.7	100.0	500.0	100.0
Final sample of firm-level database (firms that satisfy minimum data requirement, excluding outliers)								
0–9	23 011	84.0	6 670.4	21.0	795.7	14.9	74.0	23.4
10–19	1 700	6.2	2 803.4	8.8	435.9	8.2	23.1	7.3
20–49	1 456	5.3	5 198.2	16.4	824.2	15.4	44.6	14.1
50–249	1 093	4.0	10 931.9	34.4	1 934.3	36.2	107.1	33.8
250–..	127	0.5	6 146.6	19.4	1 351.9	25.3	67.7	21.4
Total	27 387	100.0	31 750.5	100.0	5 342.0	100.0	316.4	100.0

Sources: Eurostat, Latvia's firm-level database and author's calculations.
Notes. Includes data on commercial enterprises in NACE sectors B–J and L–N. Turnover and value added do not sum up by size categories for Structural Business Statistics, since statistics for some industries/size classes is not reported for confidentiality reasons.

The dataset contains all necessary information for empirical evaluation of the theoretical model described above. However, some important variables are missing (due to non-reports) for many firms. All firms with missing/zero values for output, fixed capital (at the end of current and previous year), employment, intermediate inputs, wage bill and assets were excluded from the dataset for a particular year. Also, following the usual approach of resource allocation papers, I excluded outlying firms with too high or too low TFP, distortions of capital, labour and size.[4] Finally, I excluded several 4-digit sectors of activities due to the small number of observations: the threshold was set to 100 observations during 2007–2013, after the exclusion of outliers.

The last part of Table 1 shows that the problem of missing variables and outliers is substantial, since only 34% of enterprises satisfied the abovementioned criteria in 2013. As expected, the problem of missing variables persists for small firms and is less relevant for large enterprises. Losses of information are not so large in terms of turnover or employment: the final sample covers 59% and 63% of initial full sample respectively.

Major variables used in the empirical analysis are firm's industry (4-digit NACE), output[5], capital (average of the stock at the beginning and end of the year), number of employees, wage bill, and intermediate inputs. I deflate intermediate inputs by industry-specific deflator for intermediate inputs reported by the CSB. Capital is deflated by an industry-specific investment deflator, which is constructed taking into account the composition of capital in each corresponding industry.[6] Finally, nominal capital costs are derived as the real interest rate plus depreciation rate, multiplied by the price of capital.[7]

2.2 Evaluation of industry-specific parameters

I define industry as a 4-digit NACE sector. The evaluation of substitution elasticity and production function parameters is straightforward. Although the firm-level distortions are unobserved, I assume that average distortions within a specific industry equal zero. This leads to simple and intuitive expressions for the parameters of interest.

Unlike Hsieh and Klenow (2009), Dias et al. (2014), or García-Santana et al. (2015) who assumed $\sigma = 3$ for all industries, I evaluate the elasticity from the actual firm-level data. First, it is not relevant to use the value of $\sigma = 3$ for the current setup of the model, since Hsieh and Klenow (2009) model firm's value added. Elasticity of substitution of 3 corresponds to a 50% mark-up, which is realistic for profits over value added, but definitely overestimates profits over the turnover (output). Second,

[4] Usually, researchers eliminate observations that fall into top 1 and 99 percentile of the distribution for abovementioned variables (see Hsieh and Klenow (2009), Dias et al. (2014), García-Santana et al. (2015)). I use a more conservative approach, removing observations below Q_1 – 1.5 IQR and above Q_3 + 1.5 IQR, where Q_1 and Q_3 denote the 1st and the 3rd quartiles, and IQR stands for interquartile range. I check the role of alternative outlier detection procedures in the Subsection 3.2 "Robustness check".

[5] Defined as turnover net of change in stocks and purchases of goods and services for resale plus capitalised production and other operating income from the economic activity.

[6] Fixed capital and investment deflators are split into four categories: intellectual capital, dwelling and other buildings, machinery and equipment as well as other capital. Investment deflators are provided by the CSB (deflator for total investment used for other capital). Since deflators for dwelling and other buildings as well as total investment were highly volatile during 2007–2010, I filter them by the Christiano–Fitzgerald filter (leaving oscillations above 2 years). This allows excluding the short-term (speculative) component of real estate prices.

[7] Industry-specific depreciation rate is set according to industry capital structure, assuming 8% depreciation rate for intellectual capital, 5% for dwelling and other buildings, 13% for machinery and equipment, and 10% for other capital. Real interest rate is defined as the long-term credit rate minus change in the price of investment.

Broda and Weinstein (2006) demonstrate that elasticity of substitution between varieties of a product can vary over a very wide range; therefore, the assumption of equal elasticity for all industries is too strict.

Elasticity of substitution between products is related to the mark-up (μ_s) level, which could be derived by comparing nominal output to nominal costs at the industry level:[8]

$$\frac{\sigma_s}{\sigma_s - 1} = 1 + \mu_s = \frac{\sum_{i=1}^{N_s} P_{si} Y_{si}}{\sum_{i=1}^{N_s} \left(w_s L_{si} + P_s^M M_{si} + R_s K_{si} \right)} \quad (16).$$

The evaluated mark-ups and corresponding elasticities of substitution between products are reported in Figure A1. The elasticity of substitution for a typical Latvian industry is close to 6.5, i.e. roughly in line with the mark-up of 18%. The values of elasticity vary significantly across industries, pointing, however, to different market structures. The highest elasticities are in several subsectors of retail trade (sale of food, beverages and tobacco in specialised stores; sale via stalls and markets), as well as in the manufacture of furniture and articles of wood denoting a high degree of homogeneity for these services and products. In general, manufacturing industries tend to have higher elasticity of substitution and lower mark-ups, although there are some notable exceptions, like the manufacture of instruments and appliances for measuring, testing and navigation. I have observed the largest market power in wholesale of household goods, wholesale of information and communication equipment as well as telecommunications.

The evaluation of industry-specific production function parameters α_s and β_s is performed in a similar way. The coefficient of labour input (β_s) depends on industry-specific mark-up and the ratio of industry's wage bill to industry's output:

$$\beta_s = \frac{\sigma_s}{\sigma_s - 1} \frac{\sum_{i=1}^{N_s} w_s L_{si}}{\sum_{i=1}^{N_s} P_{si} Y_{si}} \quad (17).$$

The coefficient of capital input (α_s) is obtained as a remaining share from labour and intermediate inputs:

$$\alpha_s = 1 - \beta_s - \frac{\sigma_s}{\sigma_s - 1} \frac{\sum_{i=1}^{N_s} P_s^M M_{si}}{\sum_{i=1}^{N_s} P_{si} Y_{si}} \quad (18).$$

I report the shares of inputs in industry-specific production functions in Figure A2. The main conclusion is that the majority of production costs are due to intermediate inputs (around 75%). Intermediate inputs tend to be more important in

[8] There are two ways to evaluate industry's mark-up: by calculating the average of individual firm's mark-ups or by dividing industry's total output by total costs. I use the second approach, since it gives more weight to large firms that tend to provide better statistics.

manufacturing than in services. The dominating role of intermediate inputs in production process confirms the necessity for a three-factor production function.

Another interesting conclusion is that capital share tends to be higher in manufacturing, although there are some services industries with outstanding importance of the capital factor for production, accommodation and real estate activities (mostly buildings), rental and leasing activities, warehousing and support activities for transportation among them. Finally, the share of labour inputs is very high in employment activities, computer programming as well as postal and courier activities.

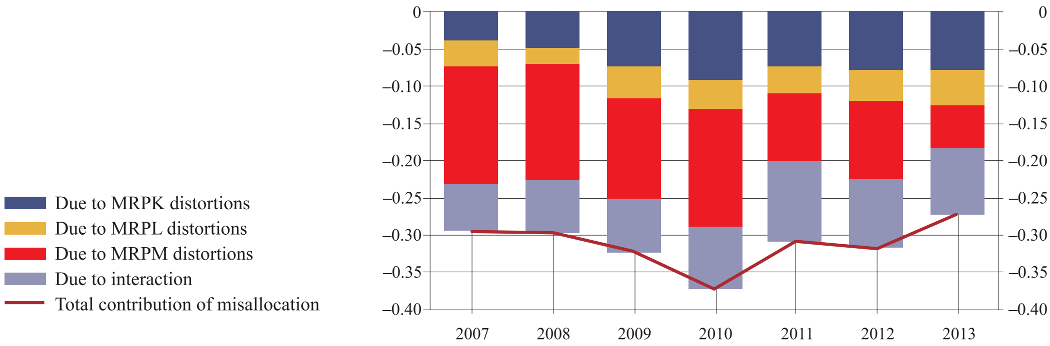
3. MISALLOCATION OF RESOURCES IN LATVIA

3.1 General trends

The application of the Dias et al. (2014) modification of Hsieh and Klenow (2009) methodology to Latvia's firm-level data leads to the conclusion that potential TFP (and output) gains from reallocation of resources were around 27% in 2013 (see Figure 1). This high indicator is in line with other empirical findings. Thus, Hsieh and Klenow (2009) argued that full liberalisation would boost aggregate manufacturing TFP by 86%–115% in China, 100%–128% in India, 30%–43% in the US. García-Santana et al. (2015) reported an impressive rise in misallocation of resources in the Spanish economy, with potential TFP gains from reallocation approaching 50% in 2007. Dias et al. (2014) showed that equalising TFPR within industries would lead to a 30% gain in output of Portugal in 2011. However, absolute numbers could be misleading. Hsieh and Klenow (2009) pointed to model and measurement errors as a possible source of bias. Moreover, I show that absolute results are not robust to alternative outlier detection procedures and model specifications. However, the methodology provides rather stable results in terms of changes in misallocation levels and decomposition.

There was no clear trend in misallocation level during 2007–2013 in Latvia. Rather, we can observe two different tendencies: growing misallocation of resources prior to and during the crisis (in 2007–2010) and improved allocation of resources after 2010. This result diverges from the findings by Dias et al. (2014) and García-Santana et al. (2015) who reported that misallocation increased over time for Portugal and Spain. It is interesting that despite huge external and internal shocks during the financial crisis in Latvia (real GDP dropped by 14.2% in 2009) there were no major shifts in allocation efficiency in that period. We can conclude that misallocation of resources was not the major driver of economic dynamics during the crisis; however, the contribution from declining misallocation to the economic growth in 2011–2013 was positive.

Figure 1
Contribution from misallocation of resources to total TFP



Sources: Latvia's firm-level database and author's calculations.
Notes. This figure represents the log of efficient output ratio in equation (11). Contributions due to distortions in MRPK are calculated assuming that MRPL and MPRM are the same across firms. Contributions due to distortions in MRPL and MRPM are evaluated similarly. The residual is attributed to interactions between marginal revenue products.

Figure A3 shows potential TFP gains by main economic sector. Misallocation of resources in services exceeds that in manufacturing and construction, which coincides with findings of Dias et al. (2014) for Portugal. One can also observe that the worsening of allocation efficiency during 2007–2010 mostly occurred in construction and transportation, while the improvement in allocation after 2010 was due to manufacturing, construction and trade.

For further analysis, I decompose the overall contribution from misallocation of resources into four parts: contributions to aggregate TFP due to misallocation of capital (MRPK), labour (MRPL), intermediate inputs (MRPM) and interaction of the three abovementioned factors. The analysis of contributions provides four additional observations.

According to the first observation, the largest contribution to potential TFP gains comes from misallocation of intermediate inputs (here I deliberately ignore the interaction term, which is hard to interpret). Thus, more productive firms tend to have higher marginal revenue product of intermediate inputs. Since MRPM is associated solely with τ_{Ysi}, we can conclude that size distortion contributes most to misallocation of resources in Latvia.

The second observation is also related to MRPM and size distortions, since improvements in allocation of intermediate inputs were the major factor behind the higher efficiency of total resource allocation after 2010. The improvement is observed in all economic sectors, especially in manufacturing and construction.

The third observation is related to misallocation of capital. Although the within-industry difference in MRPK was not amongst the most important drivers of misallocation in Latvia at the beginning of the sample period, the contribution due to MRPK increased over time and was similar in size to the contribution due to MRPM in 2013.

The fourth observation is about misallocation of labour. Overall, the contribution of misallocation due to different MRPL is small and does not exhibit a clear trend (in line with the conclusion about high flexibility of labour market by Braukša and

Fadejeva (2013)). However, Figure A3 shows some problems with misallocation of labour in the services sector, primarily information and communication services.

3.2 Robustness check

To perform the robustness check of abovementioned findings, I make six alternative calculations of potential TFP gains from reallocation. The results of total potential gains are reported in Figure A4.

The first robustness check is related to detection of outliers. I follow the conventional approach used in Hsieh and Klenow (2009) and trim the 1% tails of TFP and distortions for every year. This criterion is not as strict as the one applied to benchmark results, as it leaves 30.4 thousand observations in 2013 (compared with 27.4 thousand observations in the benchmark approach; see Table 1). The results in Figure A4(a) indicate that the absolute level of potential TFP gains is not robust to alternative outlier detection procedures: the effect of misallocation increases to almost 60% in 2013. The level of misallocation, although still containing two trends (downward before 2010 and upward afterwards), becomes more volatile, and the results for 2012 seem to be affected by the outliers. Nevertheless, the conclusions about contributions remain valid. The major contribution comes from distortion of intermediate inputs, the role of misallocation of capital increases over time, while misallocation of labour is minor.

The next robustness check is the exclusion of all observations when firms (indirectly) report negative value added. This brings us closer to the traditional approach of Hsieh and Klenow (2009) when such observations would be excluded by construction. According to Figure A4 (b), this does not affect the results much. In comparison with the benchmark approach, the efficiency of resource allocation slightly improved after 2008 (being especially pronounced in 2009–2010). Thus, firms with negative value added (and extremely low TFP) are responsible for some part of misallocation and should not be excluded from analysis.

Setting the same values of the elasticity of substitution between products for all industries may change the level of potential gains from reallocation (see Figure A4 (c) for $\sigma = 3$ and (d) for $\sigma = 6$), but does not change major conclusions.[9]

The fifth robustness check limits the sample to "stable" firms that were active during the whole period of 2007–2013. This modification moderately decreases potential gains from reallocation and results in a persistent upward trend in efficiency of allocation. We can conclude that allocation of resources is more efficient among "stable" firms, while growing misallocation during 2009–2010 was to a large extent driven by firms that did not survive the crisis.

Finally, I calculate the misallocation of resources in Latvia according to original Hsieh and Klenow (2009) methodology with two production factors – capital and labour. This includes the re-estimation of elasticity of substitution and production function parameters. Figure A4 (f) suggests a different story in comparison with the previous results. First, the potential TFP gains from reallocation are notably higher, at around 50% (which is not related to a different outlier detection procedure).

[9] Note that I still use industry specific σ while calculating coefficients of the production function in equations (16) and (17), since the use of alternative values led to negative values of α in many industries.

Second, misallocation gradually increases over time and is half-on-half driven by misallocation of capital and labour. This proves that adding intermediate inputs to the production function (and making it more realistic) may seriously alter the perception of misallocation and lead to different policy conclusions.

4. FOUR DIFFERENT STORIES BEHIND OBSERVED MISALLOCATION

The previous section evaluates the level of misallocation but does not reveal its driving forces. The current section contains four stories with potential explanations focusing on different aspects. The aspects in the first two stories about fragmentation of production and differences in competition levels are to some extent overlooked in the resource allocation literature. The third story is inspired by the creditless recovery after the financial crisis. The last story is specific for Latvia and provides an interesting example of legal framework effect.

4.1 Fragmentation of production

The original methodology by Hsieh and Klenow (2009) does not account for the fact that production process can be fragmented, i.e. split between different firms. In general, this is the weak point, obviously driven by the lack of necessary data, in most firm-level empirical studies. Although there are unique datasets containing some information on linkages between firms (e.g. Norwegian transaction-level custom data also identifying buyers, which were used by Bernard et al. (2014)), this is an exception. Despite data limitations, it is important to understand how fragmentation of production can affect estimations of misallocation.

Let us assume that the production process in industry s consists of two stages: production of intermediate inputs and final assembly. The second stage uses the output of the first stage as an intermediate input. Production functions and TFPs can differ between the stages. For example, the first stage can be more labour-intensive (bookkeeping services), or more capital-intensive (production of high-tech intermediate inputs). The production function is as follows:

$$Y_{si} = \tilde{\tilde{A}}_{si} \tilde{\tilde{K}}_{si}^{\tilde{\tilde{\alpha}}_s} \tilde{\tilde{L}}_{si}^{\tilde{\tilde{\beta}}_s} \left(\tilde{A}_{si} \tilde{K}_{si}^{\tilde{\alpha}_s} \tilde{L}_{si}^{\tilde{\beta}_s} \tilde{M}_{si}^{1-\tilde{\alpha}_s-\tilde{\beta}_s} \right)^{1-\tilde{\tilde{\alpha}}_s-\tilde{\tilde{\beta}}_s} \tag{19}$$

where variables and parameters with one tilde refer to the first stage of production and variables and parameters with double tilde to the second stage. If both stages of production occur within the same entity, the process described in equation (19) is observationally undistinguishable from the production process described in equation (3) where:

$$K_{si} = \tilde{K}_{si} + \tilde{\tilde{K}}_{si}\,;\; L_{si} = \tilde{L}_{si} + \tilde{\tilde{L}}_{si}\,;\; M_{si} = \tilde{M}_{si}\,,$$

$$\alpha_s = \tilde{\tilde{\alpha}}_s + \tilde{\alpha}_s \left(1 - \tilde{\tilde{\alpha}}_s - \tilde{\tilde{\beta}}_s \right);\; \beta_s = \tilde{\tilde{\beta}}_s + \tilde{\beta}_s \left(1 - \tilde{\tilde{\alpha}}_s - \tilde{\tilde{\beta}}_s \right),$$

$$A_{si} = \frac{Y_{si}}{K_{si}^{\alpha_s} L_{si}^{\beta_s} M_{si}^{1-\alpha_s-\beta_s}} = \tilde{\tilde{A}}_{si} \tilde{A}_{si}^{1-\tilde{\tilde{\alpha}}_s-\tilde{\tilde{\beta}}_s} \frac{\tilde{\tilde{K}}_{si}^{\tilde{\tilde{\alpha}}_s} \tilde{K}_{si}^{\tilde{\alpha}_s\left(1-\tilde{\tilde{\alpha}}_s-\tilde{\tilde{\beta}}_s\right)}}{\left(\tilde{\tilde{K}}_{si} + \tilde{K}_{si} \right)^{\tilde{\tilde{\alpha}}+\tilde{\alpha}_s\left(1-\tilde{\tilde{\alpha}}_s-\tilde{\tilde{\beta}}_s\right)}} \frac{\tilde{\tilde{L}}_{si}^{\tilde{\tilde{\alpha}}_s} \tilde{L}_{si}^{\tilde{\alpha}_s\left(1-\tilde{\tilde{\alpha}}_s-\tilde{\tilde{\beta}}_s\right)}}{\left(\tilde{\tilde{L}}_{si} + \tilde{L}_{si} \right)^{\tilde{\tilde{\alpha}}+\tilde{\alpha}_s\left(1-\tilde{\tilde{\alpha}}_s-\tilde{\tilde{\beta}}_s\right)}}.$$

Now we assume that a firm carries out production in two separate subsectors. Alternatively, the first stage can be outsourced to another enterprise. The entity responsible for the first-stage process, most probably, does not belong to industry s anymore.

As to the second stage, the current methodology systematically misperceives TFP and distortions of the final assembly firm. Since the intermediate input of final assembly equals the output of the first stage, the evaluation of capital, labour and size distortions according to equations (13)–(15) leads to the following outcome:

$$1+\hat{\tau}_{Ksi}=\frac{\alpha_s}{1-\alpha_s-\beta_s}\frac{R_s(1+\tau_{Ksi})\widetilde{K}_{si}+w_s(1+\tau_{Lsi})\widetilde{L}_{si}+P_s^M M_{si}}{R_s\widetilde{\widetilde{K}}_{si}} \quad (20),$$

$$1+\hat{\tau}_{Lsi}=\frac{\beta_s}{1-\alpha_s-\beta_s}\frac{R_s(1+\tau_{Ksi})\widetilde{K}_{si}+w_s(1+\tau_{Lsi})\widetilde{L}_{si}+P_s^M M_{si}}{w_s\widetilde{\widetilde{L}}_{si}} \quad (21),$$

$$1-\hat{\tau}_{Ysi}=\frac{\sigma_s}{\sigma_s-1}\frac{R_s(1+\tau_{Ksi})\widetilde{K}_{si}+w_s(1+\tau_{Lsi})\widetilde{L}_{si}+P_s^M M_{si}}{(1-\alpha_s-\beta_s)P_{si}Y_{si}} \quad (22).$$

Capital and labour distortions are overestimated ($\hat{\tau}_{Ksi}>\tau_{Ksi}$, $\hat{\tau}_{Lsi}>\tau_{Lsi}$), while size distortion is underestimated ($\hat{\tau}_{Ysi}<\tau_{Ysi}$). If there is no information about the outsourcing at the first stage, I interpret the lower share of capital and/or labour costs as a capital or labour distortion, while the larger share of expenses on intermediate inputs are treated as a negative size distortion.

The estimate of firm-specific TFP is also biased. If I assume that all profits are acquired at the second stage,[10] equation (12) leads to the following evaluation of TFP:

$$\hat{A}_{si}=\kappa_s\frac{(P_{si}Y_{si})^{\frac{\sigma_s}{\sigma_s-1}}}{\widetilde{\widetilde{K}}_{si}^{\alpha_s}\widetilde{\widetilde{L}}_{si}^{\beta_s}\widetilde{\widetilde{M}}_{si}^{(1-\alpha_s-\beta_s)}} \quad (23).$$

Since the composition of production factors differs from the optimal one, $\hat{A}_{si}>A_{si}$, so equation (23) overestimates the TFP of the final assembly firm.

Despite the fact that the original methodology of Hsieh and Klenow (2009) focuses on value added, it is subject to a similar bias. Capital distortion is upward biased, if the outsourced process is more capital-intensive than in the final assembly (e.g. the firm rents capital). Capital distortion is downward biased, if the outsourced process is more labour-intensive (e.g. the firm outsources bookkeeping services). Size distortion is undervalued while TFP is overvalued.

Ideally, one would need the data on transactions between individual firms (or, at least one may use a very detailed input–output data, like in Acemoglu et al. (2012)). This will allow restoring the whole production chain, estimating capital and labour costs of production at all stages, and using the original Hsieh and Klenow (2009)

[10] This assumption is made for simplicity. In the case of outsourcing, profits will be split between two firms. However, the assumption is realistic, if both firms belong to the same owner.

methodology with two factors of production. Such data are unavailable for Latvia, however.

Ignoring this phenomenon may bias overall conclusions, especially accounting for the growing role of outsourcing (see, e.g. Los et al. (2015) where the increasing international fragmentation of production is stressed). However, it is not easy to predict how the aggregated measure of misallocation would be affected. On the one hand, overvaluation of firm-specific TFPs as well as capital and labour distortions should boost the perception of misallocation (seemingly more productive firms are seemingly more distorted). On the other hand, growing fragmentation leads to underestimation of the size distortion and a better perception of the allocation efficiency. In any case, this drawback of the methodology should be kept in mind while interpreting the results.

4.2 Competition level

The importance of the size distortion in explaining misallocations may depend on different competition levels in domestic and external markets. The Hsieh and Klenow's (2009) framework assumes a closed economy. In an open economy, local producers can supply products to domestic and foreign consumers. If elasticities of substitution in domestic and foreign markets differ, exporters face higher size distortions than local-customer-oriented companies. Equation (15) shows that higher elasticity of substitution (and tighter competition level) means a higher size distortion, since a company faces more hurdles while expanding in a competitive environment. If we assume that Latvia's exporters are more productive than non-exporters, and competition level in international markets exceeds that in Latvia's market, the importance of size distortions for misallocation could be partly explained.

Regarding the first part of the above assumption, it is in line with international empirical evidence about productivity premia for exporting enterprises (see, e.g. Berthou et al. (2015)). In addition, I check this assumption econometrically in Section 5. As to the comparative level of competition, I refer to the most recent evidence obtained by Fadejeva and Krasnopjorovs (2015) from the Eurosystem's WDN survey in Latvia.

Table 2

Degree of competition in domestic and foreign markets for firms' main product in 2013

(%)

	Weak	Moderate	Severe	Very severe	Non applicable
Domestic market					
Manufacturing	2.2	40.1	34.0	18.1	5.5
Construction	7.1	22.4	33.5	35.5	1.5
Trade	3.7	22.8	30.0	43.5	0.0
Business services	0.0	18.2	22.0	59.8	0.0
Foreign market					
Manufacturing	0.9	29.6	47.5	21.2	0.8
Construction	0.0	27.0	45.6	27.4	0.0
Trade	5.2	26.1	27.9	35.8	5.0
Business services	1.3	24.0	35.9	38.5	0.2

Source: Fadejeva and Krasnopjorovs (2015), Tables A75 and A76.

Notes. Based on the sample of 557 Latvian firms. Results are weighted to represent firm population.

Table 2 reproduces the survey results with respect to firm perception about the competition level in Latvia and abroad. Answering the question about the degree of competition in domestic and foreign markets in 2013, the mode answer of manufacturing firms about the domestic market was "moderate" and "severe" about the foreign market. Similarly, one can see a lower degree of competition in the domestic market for construction companies. The situation is opposite for trade and business services. These facts are in line with the large misallocation of intermediate inputs in the manufacturing and construction sectors (see Figure A3) but cannot explain large size distortions for the trade sector.

The second finding of Section 3 is related to the declining contribution of size distortion to misallocation of resources after the crisis. The improvement could come from changes in the relative competition level in the domestic market. Table 3 contains another result from the WDN survey reported by Fadejeva and Krasnopjorovs (2015). It compares the perception of firms regarding variation of competition level in Latvia and abroad. While the relative competition level did not change much during 2008–2009 (the mode answer in both cases is "unchanged"), the responses indicate a substantial tightening of competition in the domestic market (38.5% of respondents answered "strong increase") and no changes in the foreign market (51.5% of respondents answered "unchanged") in 2010–2013. Combining these facts with the results in Table 2, we can conclude that the competition level in the domestic market was much lower than in the foreign market before 2010, while the gap narrowed in 2011–2013. Changes in the economic situation induced growing severity of domestic competition. During the boom period before 2008, the domestic market grew rapidly, and the behaviour of competitors was not binding. This reduced the size distortion for domestically-oriented (and less productive) firms. Lower growth rates after the crisis tightened competition in the domestic market, generating similar (or not so strong) size distortions for domestically-oriented enterprises.

Table 3

Change in competitive pressure on main product in domestic and foreign markets compared with situation before 2008

(%)

	Domestic market		Foreign market	
	2008–2009	2010–2013	2008–2009	2010–2013
Strong decrease	2.9	2.2	0.9	1.0
Moderate decrease	11.8	3.8	7.6	5.9
Unchanged	33.8	24.7	45.7	51.5
Moderate increase	30.0	28.1	25.2	19.7
Strong increase	18.7	38.5	11.2	8.8
Does not apply	2.8	2.8	9.4	13.1

Source: Fadejeva and Krasnopjorovs (2015), Table A.77.
Notes. Based on the sample of 557 Latvian firms. Results are weighted to represent firm population.

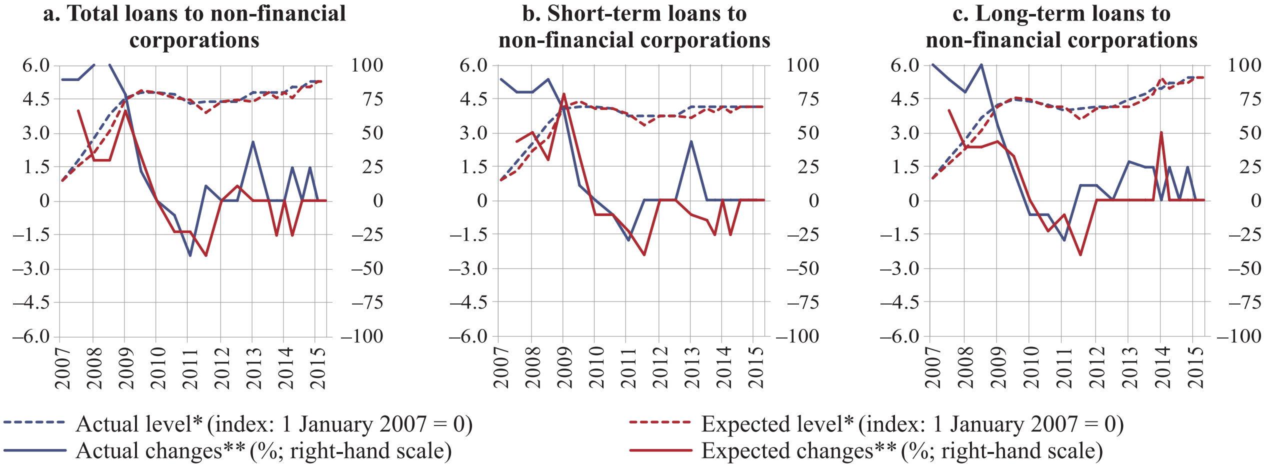
An alternative yet related explanation could be associated with an internal devaluation process which Latvia experienced in 2009–2010. High production costs (due to a rapid increase in wage rate outpacing productivity growth) did not allow Latvia's exporters to expand in external markets in the presence of tight competition.

The renewal of cost competition[11] because of internal devaluation restored exporters' ability to grow in foreign markets and reduced misallocation of resources.[12]

4.3 Supply of credits

The growing role of capital misallocation after the financial crisis calls for a closer look at credit availability. The tightening of credit standards in Latvia started in 2008; it is showed in Figure 2 which reports the results of the euro area bank lending survey for Latvia.

Figure 2
Credit standards in Latvia



Source: Latvijas Banka (2015).
Notes. * – net cumulative changes of credit institutions reporting tightening credit standards. ** – net percentage of credit institutions reporting tightening credit standards. Higher values refer to tighter credit standards.

Tightening of the supply side per se does not lead to misallocation of capital, however. The results in Figure 1 suggest that highly productive firms are more constrained in capital than other enterprises. According to Figure A3, it is mostly relevant for real estate and transportation industries. It could be a combination of both supply and demand factors. Perhaps, more productive firms have a higher demand for loans, which cannot be fully satisfied due to reduced loan supply, thus leading to positive capital distortions. As to low productive firms, the lack of supply may coincide with the lack of demand, thus, compared with highly productive enterprises, capital distortions are lower. While credit demand and credit supply cannot be observed from the data directly, I make an attempt to assess them by an econometric model in the next section.

[11] According to the abovementioned WDN survey results by Fadejeva and Krasnopjorovs (2015), wage reduction during the crisis was substantial. For instance, 32.4% of firms indicated that base wages or piece work rates were reduced during 2008–2009 (Table A.36).

[12] This contradicts the conclusions of Bems and di Giovanni (2014) who find that the main adjustment was due to the switch of Latvian consumers from expensive imports to cheap domestic products. However, the scanner-level dataset used by Bems and di Giovanni (2014) mostly consists of food products and beverages. Moreover, it does not cover exporting activities of Latvian enterprises.

4.4 Micro-enterprise tax

The misallocation of resources can be related to legal system of Latvia. The micro-enterprise tax is the most natural candidate for this analysis. The micro-enterprise tax was introduced in January 2011 (for existing firms, while newly-established firms have been subject to the micro-enterprise tax since September 2010). The micro-enterprise tax is a single tax payment, which includes mandatory state social insurance contributions, personal income tax, corporate income tax, and personal income tax of the micro-enterprise owner.[13] All abovementioned taxes are replaced by a single micro-enterprise tax of 9% from turnover. In 2011–2013, the right to choose to pay this tax existed, if the following criteria were complied with: a) turnover per calendar year did not exceed 70 000 lats (99 600 euro), b) number of employees at any time did not exceed five, and c) income of a micro-enterprise employee did not exceed 500 lats (711 euro) per month. The micro-enterprise tax is expected to discriminate large (and potentially more productive) firms. Yet, it cannot be held responsible for sizeable misallocations of resources before 2011.

5. ECONOMETRIC ANALYSIS OF MISALLOCATION

In this section, I conduct econometric analysis to uncover firm-specific characteristics that affect TFP, capital, labour and size distortions. I test the effect of 13 different variables available from Latvia's firm-level database. The first two variables are firm's age and total assets, since large and more experienced firms may face higher capital costs due to higher demand for credit. Alternatively, these firms may be subject to lesser credit constraints from banks (see, e.g. Lopez-Garcia et al. (2015) who analyse data from the ECB Survey on Access to Finance of Enterprises). Similarly, large and experienced firms may face different labour and size distortions, as well as have higher TFP than other firms. The outsourcing story should be also kept in mind.

The next block of five variables is related to financing conditions. I check three alternative options. First, the firm can borrow from the bank or another enterprise; thus I include the ratios of short-term debt and long-term debt to assets. Second, the firm may finance its needs from its own profits; hence the ratio of profits to turnover is included in the regression. All of these variables may affect firm-specific TFP, since better access to finance gives the firm an opportunity to introduce new technology. Manova (2013) shows that financial frictions restrict firm involvement in exporting operations that may influence TFP. Access to finance can also affect firm-level distortions: primarily capital distortion, as well as labour and size distortions via access to short-term credit. While interpreting the results one should remember that they can be driven both by the supply side and the demand side. For example, a higher debt to assets ratio may reflect higher demand for capital albeit lower supply of credit at the same time, since banks tend to tighten credit standards for firms with higher financial leverage (see Lopez-Garcia et al. (2015)).

Third, the presence of a foreign owner may affect the access to finance and productivity. Manova et al. (2011) use firm level data of China to show that foreign affiliates and joint ventures have additional funding from their parent companies

[13] See the State Revenue Service for more details at https://www.vid.gov.lv/default.aspx?tabid=8&id=5831&hl=2.

and/or access to foreign capital markets. Consequently, having a foreign owner helps overcome local financial frictions. I account for this factor by including the share of foreign capital in firm's total capital as an explanatory variable. Moreover, I split foreign capital owned by OECD residents away from the other foreign capital. The outsourcing story could be also essential for enterprises with foreign capital, since such firms are expected to engage in international fragmentation of production.

The next three variables describe firm's export activities. As discussed in Section 4, size distortions can be determined by different competition levels in domestic and foreign markets. I test this hypothesis by adding the share of domestically produced goods exports (exports of goods net of re-exports)[14] and the share of service exports in turnover. The share of exports can also affect firm-level TFP (similar to export premia reported by Berthou et al. (2015)) as well as capital and labour distortions. I also add the share of re-exports in turnover as an explanatory variable. This is the natural way to test whether fragmentation affects the evaluation of distortions and allocation of resources, since re-exporting is a clear case of international fragmentation of production.

Whereas the lack of data on inter-firm trade does not allow evaluating the degree of production fragmentation directly, I introduce two indicators that are associated with the outsourcing process. The first is the share of services in intermediate inputs. The second is the share of imports in intermediate inputs, which may capture the degree of involvement in international production chains. The last variable is micro-enterprise tax dummy, which equals 1 if a firm satisfies the requirements that are necessary to apply for the micro-enterprise tax after 2011 (annual turnover below 99 600 euro, number of employees does not exceed five, average wage does not exceed 711 euro per month).

The model explaining firm-specific TFP and distortions is as follows:

$$y_{i,t} = \beta \cdot x_{i,t} + \gamma_t + \eta_i + v_{i,t} \tag{24}$$

where $y_{i,t}$ denotes dependent variable, $x_{i,t}$ is the vector of explanatory variables, γ_t refers to time-fixed effects, η_i denotes entity-fixed effects, and $v_{i,t} = \rho v_{i,t-1} + e_{i,t}$. Therefore,

$$y_{i,t} = \rho y_{i,t-1} + \left(\beta \cdot x_{i,t} - \rho\beta \cdot x_{i,t-1}\right) + \left(\gamma_t - \rho\gamma_{t-1}\right) + \eta_i\left(1-\rho\right) + e_{i,t} \qquad (25).$$

I estimate equation (25) by system GMM (see Blundell and Bond (2000)). For stock variables (assets, debt, capital) I took the average of the values at the beginning and end of the year. All variables (except firm's age) are treated as endogenous variables.

The results reported in Table 4 support possible biases due to the fragmentation of production and outsourcing: this is clearly signalled by the coefficients before the re-exports variable. As predicted theoretically in Subsection 4.1, the fragmentation of production process (definitely present for re-exporting firms) leads to overestimation of capital and labour distortions, while the size distortion is underestimated. The presence of biases is also confirmed by the positive coefficient before the share of imports in intermediate inputs in the equation for capital distortions.

[14] Although hard data on re-export activities are not available, re-exports were evaluated using firm-level data in Beņkovskis et al. (2015).

Table 4
Determinants of firm-level TFP and distortions

Dependent variable	Relative TFP, ln(AisNs1/(σs – 1)/Ās)	Capital distortion, ln(1 + τKsi)	Labour distortion, ln(1 + τLsi)	Size distortion, ln(1 – τYsi)
Lagged dependent variable	0.209***	0.811***	0.539***	0.162***
Log of firm's age	–0.581***	–0.304	–0.218	–0.408**
its first lag	0.492***	0.268	–0.0852	0.454***
Log of assets (size)	0.471***	–0.918***	–1.074***	0.804***
its first lag	–0.354***	0.737***	0.974***	–0.749***
Short-term debt to assets ratio	0.0178**	–0.0363**	–0.0392***	0.0290***
its first lag	0.00631	0.0339*	0.0215*	–0.0229**
Long-term debt to assets ratio	0.00980	0.0208	–0.0180	–0.0136
its first lag	0.00658	–0.0284	0.00745	0.0234*
Profits to turnover ratio	0.0118***	–0.0125***	–0.00822**	0.0138***
its first lag	0.0581***	0.0238*	–0.0216**	0.0485***
Share of foreign capital (OECD countries)	0.372**	0.945***	0.405*	–0.0807
its first lag	–0.186	–0.514***	–0.357*	0.0509
Share of foreign capital (non-OECD countries)	–0.326*	–0.917***	–0.486*	0.0791
its first lag	0.241*	0.0696***	0.0446**	–0.0399
Share of goods exports in turnover	1.131***	1.942***	0.0698	0.0168
its first lag	–1.015***	–1.284**	–0.226	–0.169
Share of re-exports in turnover	0.687	4.966***	5.498***	–1.280**
its first lag	0.0464	–3.928***	–4.264***	1.312***
Share of services exports in turnover	0.430	0.954	–1.733*	–0.0461
its first lag	0.0691	–0.442	1.814**	0.181
Share of services in intermediate inputs	0.727***	–0.632*	–0.0108	0.199
its first lag	–0.320*	0.434	–0.131	–0.0270
Share of imports in intermediate inputs	0.249*	0.803***	0.272	0.0799
its first lag	–0.268**	–0.397**	–0.256	–0.186*
Micro-enterprise tax dummy	–0.0677***	0.124***	–0.0507*	–0.0784***
its first lag	0.0117	–0.271***	–0.133***	0.0896***
2010	0.0157	0.312***	0.0954***	0.0781***
2011	–0.0104	0.574***	0.286***	–0.0870***
2012	–0.0237**	0.672***	0.223***	–0.106***
2013	0.0202*	0.680***	0.269***	–0.122***
Firm's fixed effects	Yes	Yes	Yes	Yes
m1	–30.70***	–33.62***	–32.35***	–40.09***
m2	1.692*	–3.573***	–3.902***	–6.122***
Sargan	65.7	79.6	68.7	51.7
Number of observations	103 848	103 848	104 244	104 244
Number of firms	35 962	35 962	36 091	36 091

Sources: Latvia's firm-level database and author's calculations.
Note. *** – p-value < 0.01, ** – p-value < 0.05, * – p-value < 0.1.

Obviously, we should keep the effect of outsourcing in mind while interpreting the results. For example, the effect of assets on distortions could simply be related to the fact that larger firms perform all production stages in-house. Also, higher capital and labour distortions for firms owned by residents from the OECD countries could occur due to involvement of these enterprises in global value chains. Similar reasons may define higher capital distortions for exporters of goods.

Unfortunately, the lack of information on trade between firms complicates the economic interpretation of Table 4 in many cases. In particular, it is unclear whether we can interpret the positive impact of foreign capital from OECD countries on firm's TFP as the effect of technology transfers and spillover of knowledge. Higher TFP for exporters of goods raises similar doubts: is it related to better productivity or is it simply misperception because of the fragmentation of production? Let me list several conclusions that still can be scanned from Table 4.

It appears that large firms tend to have higher TFP.[15] I also find that new enterprises are expected to be more productive than the old ones. Firms with foreign capital from non-OECD countries are found to be less productive and less capital constrained (I have no reason to expect that these effects are due to smaller involvement of such firms in vertical integration). Therefore, investment from non-OECD countries does not increase productivity but provides an alternative way of enterprise financing.[16]

The hypothesis that exporters face higher competition leading to positive size distortions in external markets is neither rejected nor approved by Table 4. On the one hand, size distortions for exporters of goods and services do not differ significantly from those for non-exporters. On the other hand, fragmentation of production (arguably more pronounced for exporters) may conceal this effect.

The results in Table 4 claim that costs of capital are lower for large non-exporting firms with high profits and high short-term debt. This reflects the importance of profits as a source of financing capital for Latvian enterprises. Higher costs for exporters could be due to higher demand for capital (which banks do not fully satisfy), while larger firms face higher supply of loans. However, two latter effects may be subject to the fragmentation bias mentioned above. The negative coefficient before short-term debt is puzzling and contradicts the findings by Lopez-Garcia et al. (2015).

Finally, the micro-enterprise dummy significantly affects all three distortions and TFP. Taking into account that the micro-enterprise tax provides a strong incentive to splitting the enterprise (to optimise tax payments), these results are also strongly biased due to fragmentation. However, one can still observe that micro-enterprises are significantly less productive than the other firms (even after controlling for size). In addition, micro-enterprises face lower labour distortions. Despite legal restrictions on the number of employees, micro-enterprises pay lower price for labour (social and personal income taxes are replaced by micro-enterprise tax) which determines negative labour distortion.

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[15] The expected fragmentation bias for TFP is negative for large firms, thus the abovementioned conclusion is valid.

[16] This could be also driven by tax evasion in some cases, since many firms report foreign capital coming from Russia and Cyprus.

CONCLUSIONS

In this paper, I follow Dias et al. (2014) and analyse the misallocation of resources in Latvia, using a modified Hsieh and Klenow (2009) framework with three production factors: capital, labour and intermediate inputs. In addition, I assume that industries may have different competition levels. My empirical analysis is based on Latvia's firm-level data for 2007–2013, a representative dataset provided by the CSB and Latvijas Banka. The dataset covers the period that includes the financial crisis, thus it gives an opportunity to uncover changes in resource allocation in a period of large shocks.

I found that potential TFP gains from reallocation were close to 27% in 2013. The misallocation of resources is higher in the services sectors but significantly lower in manufacturing and construction. I observe growing misallocation of resources prior and during the financial crisis and improvement in the allocation of resources afterwards. The misallocation of resources was not the major driver of economic dynamics during the crisis; however, there was a positive contribution from declined misallocation to the economic growth in 2011–2013. The worsening of allocation efficiency during 2007–2010 mostly occurred in construction and transportation, while the improvement in allocation after 2010 was recorded in manufacturing, construction and trade.

Decomposition of potential TFP gains by source of misallocation together with the econometric analysis led to the following conclusions. First, the major source of potential TFP gains is the size distortion that affects the allocation of all three production factors across firms. One of the possible explanations behind higher size distortion for more productive firms in Latvia is the different competition level in domestic and foreign markets. According to a recent survey, exporting firms face a notably higher competition level than domestically-oriented enterprises, which results in misallocation of resources, since exporting firms tend to be more productive as proved by econometric estimates. The gap between the competition level in Latvia's market and foreign market narrowed after the crisis, which partially explains the improved allocation of resources after 2010. Another reason for better allocation could be related to the internal devaluation process which increased price competitiveness of Latvia's enterprises abroad and reduced obstacles for their further expansion in external markets.

My second conclusion is related to distortion of capital. Although misallocation of capital was small at the beginning of the sample, it increased over time and became an important source of TFP losses in 2013. The increased misallocation of capital can be related to tighter credit conditions of Latvia's banks. The econometric evidence is inconclusive due to fragmentation bias. However, there is some weak evidence that exporters of goods face higher capital costs due to restricted credit supply.

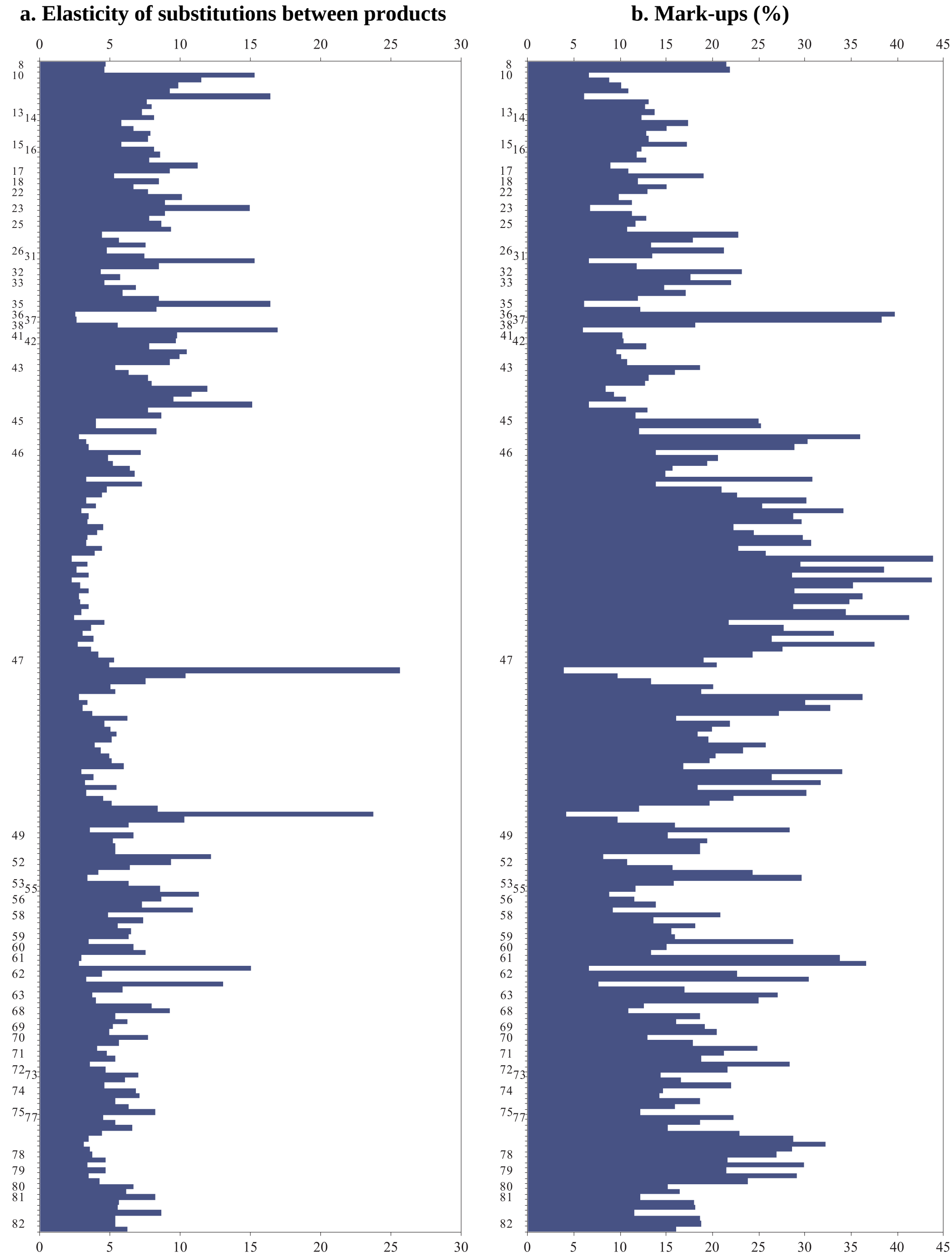
Third, currently labour distortion is not an important issue in Latvia, which is in line with an overall assessment of relatively high flexibility of Latvia's labour market. The only sector to face notable labour distortions is information and communication services. These findings could serve as a warning regarding the quality of labour force in the abovementioned sector.

Finally, the paper uncovers serious problems in drawing policy conclusions about allocation of resources using firm-level data. The Hsieh and Klenow (2009) framework does not account for the fact that the production process can be fragmented, i.e. split between different firms. In the absence of network data of inter-firm trade, it leads to biased estimates of firm-specific TFP and distortion. Namely, the methodology tends to overestimate TFP, capital and labour distortions, simultaneously underestimating size distortions of firms involved into outsourcing process. I prove this theoretically and empirically by analysing the estimated distortions for enterprises that intensively participate in international fragmentation of production (namely, for re-exporters). Although availability of data on transactions between different firms is rare, this is the direction to proceed with the empirical analysis of misallocation. Network data on trade between firms will allow restoring the whole production chain, estimating direct and indirect capital and labour costs of production at all stages. But for the moment, all the strong conclusions regarding misallocation of resources and its driving forces should be treated with some caution.

APPENDIX

Figure A1

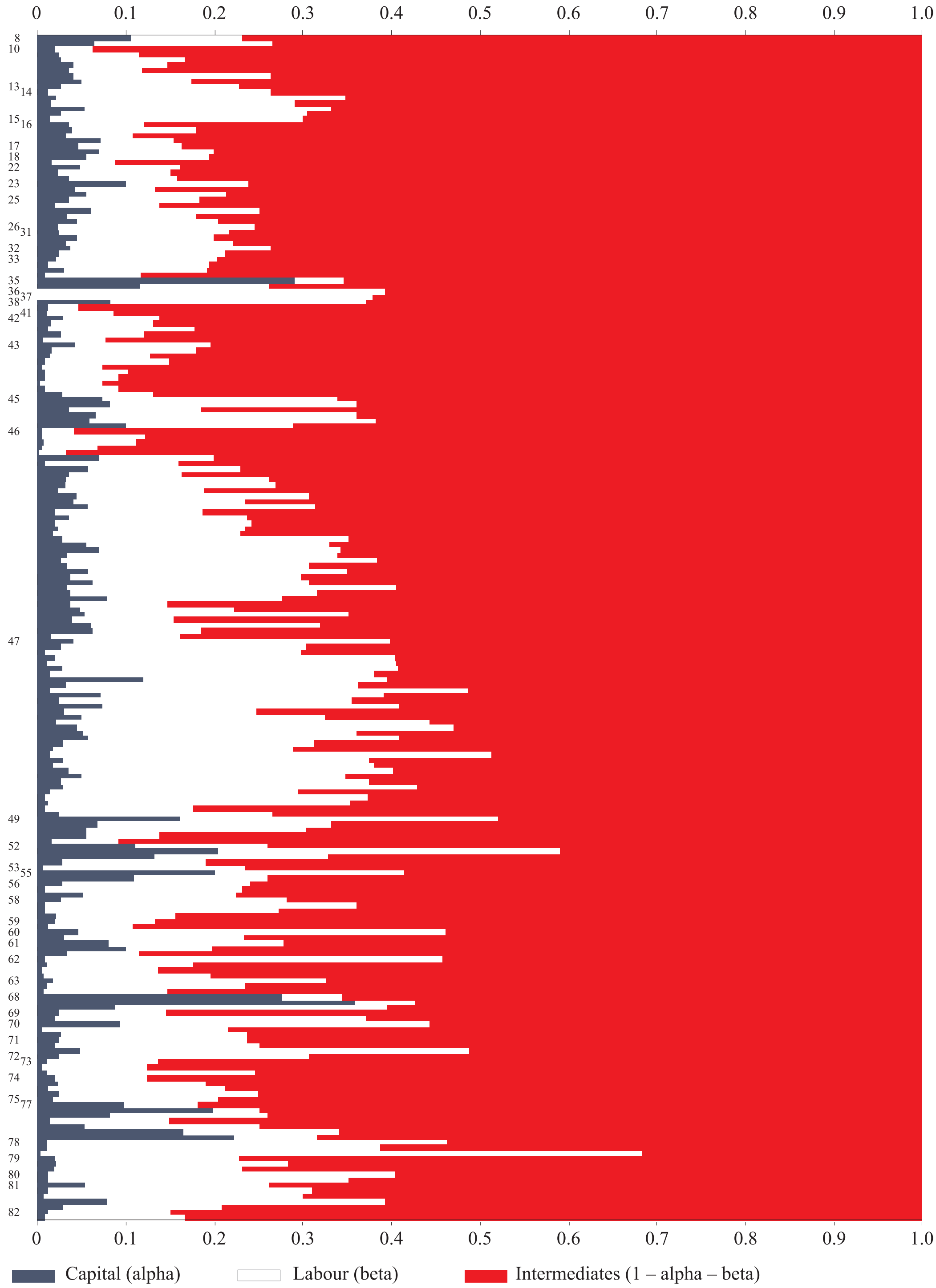
Elasticity of substitution between products and mark-ups by 2-digit NACE categories



Sources: Latvia's firm-level database and author's calculations.

Note. Elasticities of substitution and mark-ups are evaluated using equation (20) for the period of 2007–2013.

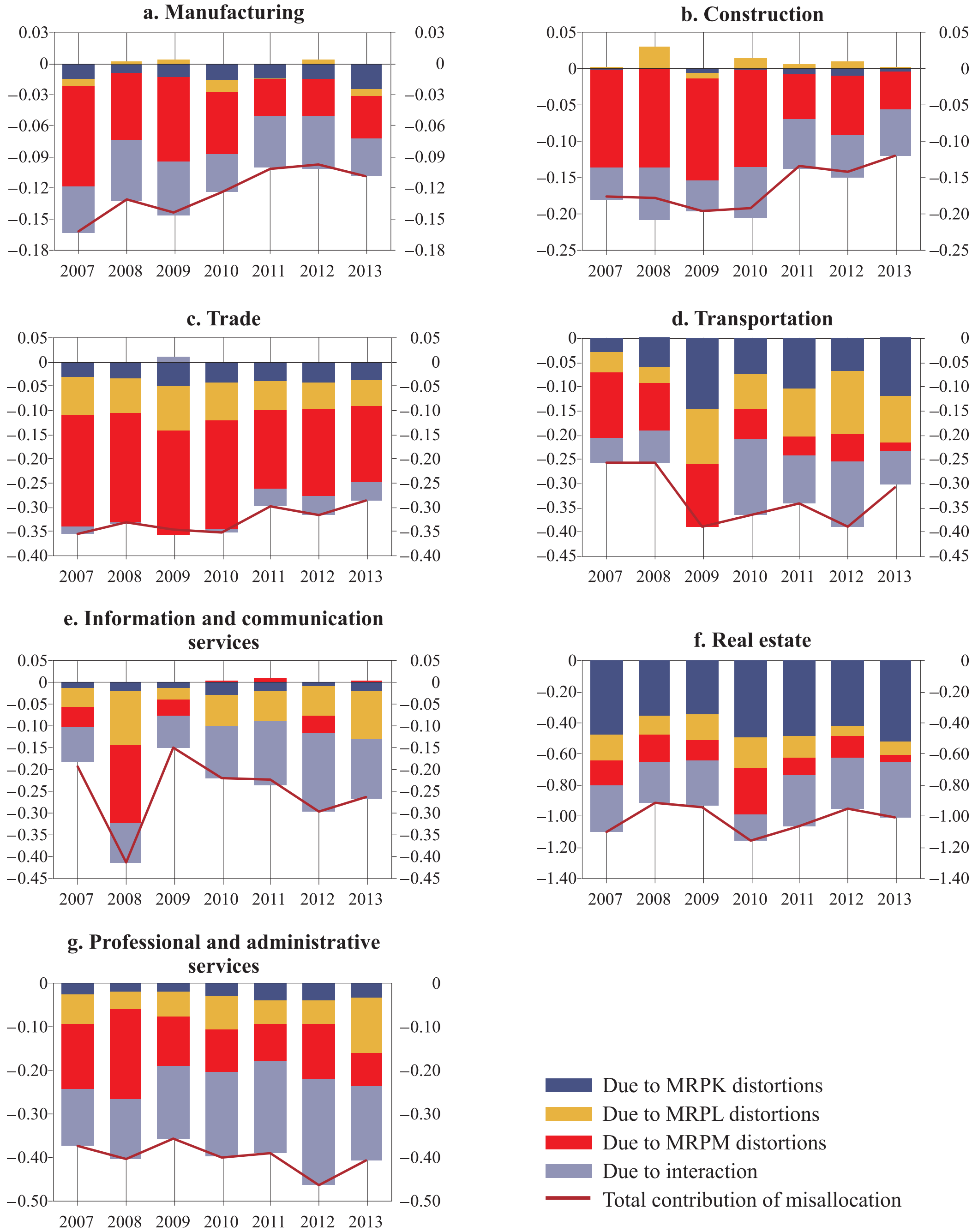
Figure A2
Production function coefficients by 2-digit NACE categories



Sources: Latvia's firm-level database and author's calculations.
Note. Parameters of productions function are evaluated using equations (21) and (22) for the period of 2007–2013.

Figure A3

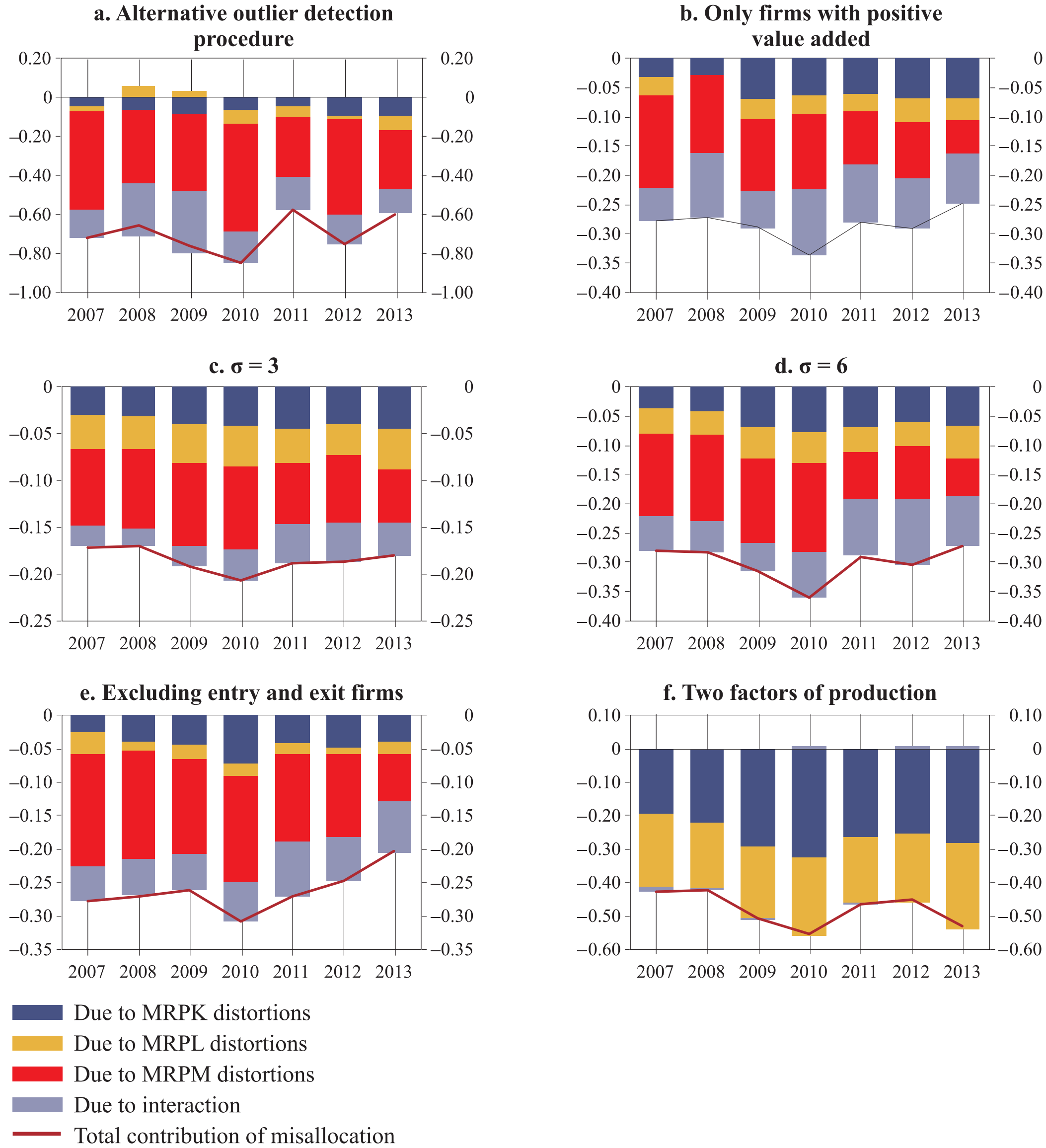
Contribution from misallocation of resources to TFP of main economic sectors



Sources: Latvia's firm-level database and author's calculations.

Notes. Figure represents the log of efficient output ratio in equation (11). Contributions due to distortions in MRPK are calculated assuming that MRPL and MPRM are the same across firms. Contributions due to distortions in MRPL and MRPM are evaluated similarly. The residual is attributed to interactions between marginal revenue products.

Figure A4
Alternative estimates of contribution from misallocation



Sources: Latvia's firm-level database and author's calculations.
Notes. Figure represents the log of efficient output ratio in equation (11). Contributions due to distortions in MRPK are calculated assuming that MRPL and MPRM are the same across firms. Contributions due to distortions in MRPL and MRPM are evaluated similarly. The residual is attributed to interactions between marginal revenue products.

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