INTERNATIONAL MONETARY FUND

IMF Country Report No. 17/10

REPUBLIC OF ESTONIA

SELECTED ISSUES

January 2017

This paper on Republic of Estonia was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed on December 21, 2016.

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International Monetary Fund
Washington, D.C.

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SELECTED ISSUES

December 21, 2016

Approved By
European Department

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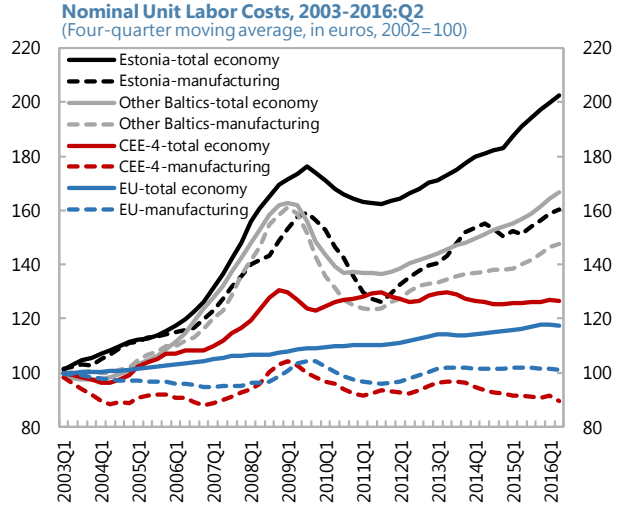
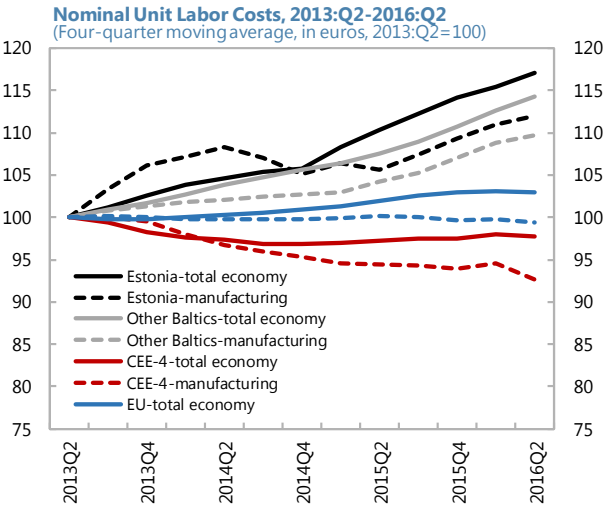
HOW WORRIED SHOULD WE BE ABOUT FAST ULC GROWTH IN ESTONIA?[1]

In recent years, wages in Estonia have been rising rapidly despite stagnating labor productivity, pushing up unit labor costs (ULCs) over time and relative to peers. This is prima facie evidence for a loss of competitiveness, but because ULCs are a crude indicator that can be misleading, they need to be explored in conjunction with other metrics to get a clearer picture. While somewhat less alarming, they broadly corroborate that ULCs have now reached a level where further unmitigated wage growth risks doing material damage to competitiveness and income convergence prospects with Western Europe. This highlights the importance of making Estonia's pro-productivity policies a success, but in the nearer term the onus is on mitigating excessive wage growth because this is where Estonia, together with the other Baltics, distinguishes itself from the rest of Central and Eastern Europe (CEE). Tax policy can provide short-term relief.

1. ULC developments in Estonia look alarming at first sight. ULCs, as well as the closely related concept of the real effective exchange rate, are key indicators in the assessment of countries' external competitiveness. They are widely used in IMF country reports, the IMF's internal vulnerability exercise, OECD economic surveys, and the EC's macroeconomic imbalance procedure (European Commission, 2016). According to this metric, developments in Estonia are out of line with those in the EU overall and in the largest four economies in CEE, with ULCs double their 2002 levels and 17 percent higher than in 2013:Q2.[2] For the EU as a whole, ULCs grew by only 2 percent—a 15 percent gap with Estonia, which exceeds the European Commission's 9 percent threshold for ULC growth by a large margin and raises a red flag in the IMF's vulnerability exercise for emerging market economies based on the assessment of the real effective exchange rate. Focusing more



Sources: Eurostat; and IMF staff calculations.
CEE-4 comprises the Czech Republic, Poland, Slovakia, and Hungary.



Sources: Eurostat; and IMF staff calculations.
CEE-4 comprises the Czech Republic, Poland, Slovakia, and Hungary.

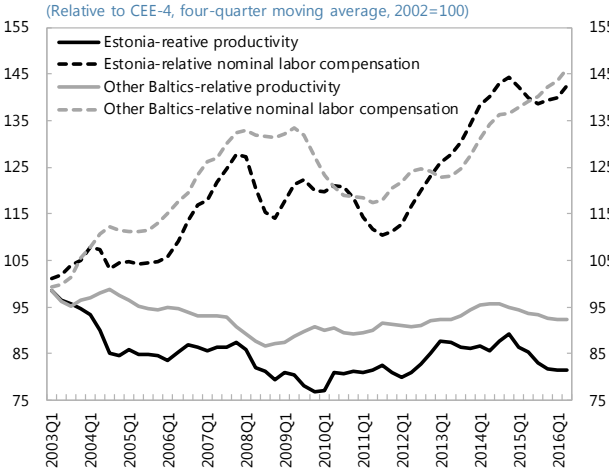
[1] Prepared by Christoph Klingen.

[2] The four largest CEE economies comprise the Czech Republic, Poland, Slovakia, and Hungary. They are referred to as the CEE-4.

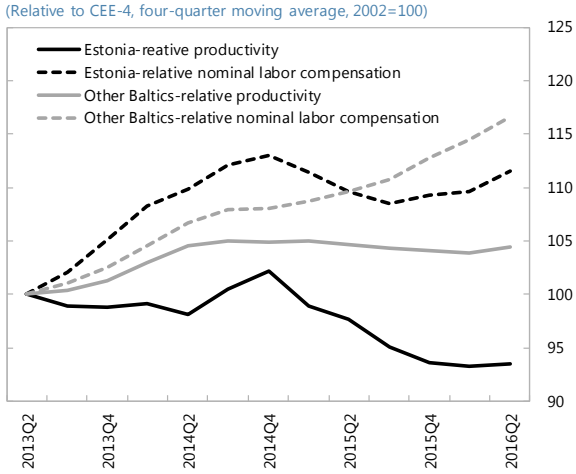
narrowly on the manufacturing sector, which is particularly exposed to foreign competition, shows a similar picture. How alarmed should we be?

2. Conceptual drawbacks of the ULC indicator may overstate the deterioration in Estonia's external competitiveness. Those are mostly related to the poor measurement of productivity, which is defined simply as the gross value added per employed person and does not correctly account for capital deepening, product quality improvements, changing human capital, composition effects from shifts between economic activities, etc. These shortcomings could potentially bias ULC-based assessments against Estonia. Moreover, limitations to every competitiveness indicator make it necessary to evaluate a host of them and come to an overall assessment in an eclectic approach (Lipschitz and McDonald, 1992). Other indicators include real ULCs—essentially the complement to profit shares, enterprise profitability, export market shares, the current account, and survey results. They may paint a less worrisome picture of Estonia's competitiveness.

3. The labor cost side of ULC developments deserves particular attention, because this is where Estonia differs most from the rest of CEE. Since 2002, labor costs in manufacturing grew by an extra 45 percent in Estonia relative to CEE, while the shortfall in productivity gains was a much smaller 6 percent. In the more recent period since mid-2003, labor costs also accounted for close to two thirds of Estonia's ULC increase relative to that in CEE. Estonia broadly shares this feature with Latvia and Lithuania. What is so different in the Baltic labor markets?



Sources: Eurostat; and IMF staff calculations.
CEE-4 comprises the Czech Republic, Poland, Slovakia, and Hungary.



Sources: Eurostat; and IMF staff calculations.
CEE-4 comprises the Czech Republic, Poland, Slovakia, and Hungary.

4. The rest of this chapter is organized as follows: The next section explores whether the various conceptual drawbacks of ULCs as competitiveness indicator bias results against Estonia and, if so, by how much. It finds that most do not, but that income convergence might explain a substantial part of Estonia's rapid ULC growth relative to the EU. Attention shifts to real ULCs, a concept akin to the labor share of national income, in the section B. Here developments are not as alarming as in ULCs, but nonetheless are now entering the territory where they could do material damage to growth and income convergence prospects. Section C explores various other

competitiveness indicators, including export market shares, enterprise profitability as per company accounts, survey results, and the current account. They broadly corroborate concerns about competitiveness developments. Section D goes on to delve deeper into why wage growth seems to have decoupled from productivity in Estonia, but not elsewhere in the region. It finds a significant role of government and minimum wage policies, and some evidence of unwarranted momentum, while Estonia's particularly unfavorable demographics appear to be only of second order importance. Section E concludes. An appendix compares the explanatory powers of ULCs and real ULCs. If finds that real ULCs are more closely associated with export developments and therefore deserve heightened attention in competitiveness assessments.

A. Potential Bias in ULC-based Competitiveness Assessments

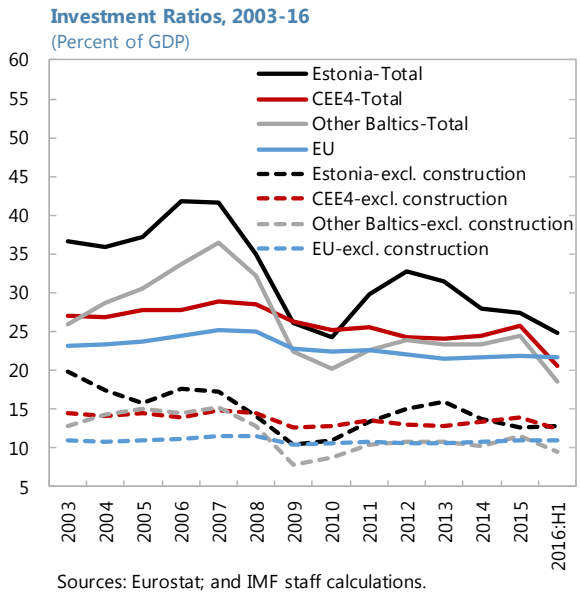
5. Drawbacks to ULCs as competitiveness indicators are undisputed, but the real question is whether they bias results against Estonia. Changes in the production structure, business cycle positions, capital deepening, the presence of a nontradable sector, non-cost competitiveness factors, demographics, and the speed of income convergence can all affect ULCs unrelated to competitiveness. But this will only overstate Estonia's loss of competitiveness as measured by ULC developments relative to trading partners if these drawbacks push up Estonia's ULCs more than those elsewhere. If so, it would mitigate concerns about Estonia's relatively sharp ULC increase.

6. Shifts between economic activities had little bearing on ULC developments. When the structure of an economy shifts toward labor intensive activities, ULCs tend to rise, but this would not necessarily signal a deterioration in competitiveness. In the case of Estonia, using constant industry shares to calculate ULCs makes little difference. When using the average shares of 39 activities during 2003–14, or the activity weights of the EU, the cumulative ULC increase actually ends up being a marginal 5-10 percent higher. Hence, composition effects do not inflate Estonia's ULC growth and do not exaggerate the competitiveness decline.

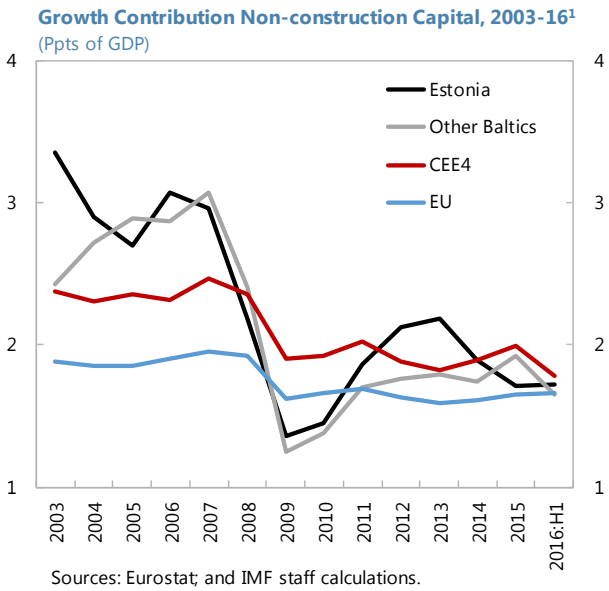
7. Estonia's relative business cycle position has not been a driver of ULC growth either. ULCs are strongly influenced by the business cycle, as Estonia's boom-bust cycle in the 2000s clearly demonstrates (Bakker and Klingen, 2012). In the boom phase until 2007, overheating pushed wages and ULCs up. The economic slump in 2008–09 led to further increase as labor productivity collapsed. But when companies subsequently reduced employment and wages started to fall, ULCs came down sharply. However, in the time periods analyzed here—2003 to 2016:Q2 and 2013:Q2–2016:Q2—Estonia's output gap as estimated for the IMF's World Economic Outlook changed little and by about the same as in the EU on average. For the longer period since 2003, the output gap widened by 0.5 percent of potential GDP for both, and in the more recent period it declined by 1.2 and 1.4 percent of GDP, respectively. Again, hardly enough of a difference to distort the ULC-based competitiveness assessment.

8. Capital deepening biased the ULC-based competitiveness assessment for Estonia only marginally. High investment and a high rate of capital accumulation tend to increase labor productivity and mitigate ULC growth without affecting competitiveness. Investment in Estonia has been much higher than in peers, averaging 33 percent of GDP during 2003–2016:H1 and 27 percent

of GDP in the last three years, compared to 27 percent and 24 percent of GDP in CEE, respectively. Investment excl. construction, which is arguably more indicative of the buildup of productive capacity, was about the same in Estonia and in peers. Growth contributions from capital were accordingly very similar. Hence, peers' ULCs were not biased down by less than in Estonia—if anything if was the other way around.



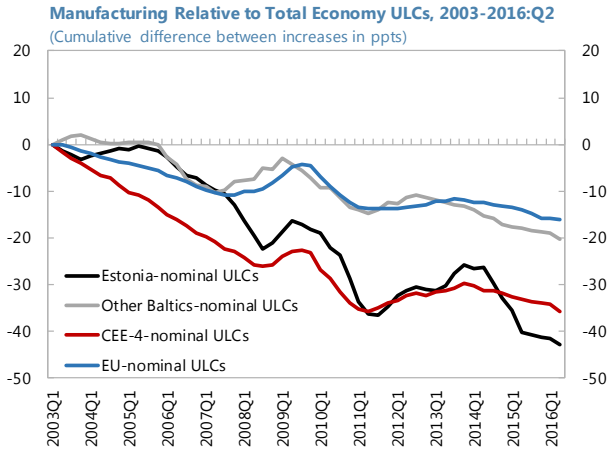
Sources: Eurostat; and IMF staff calculations.



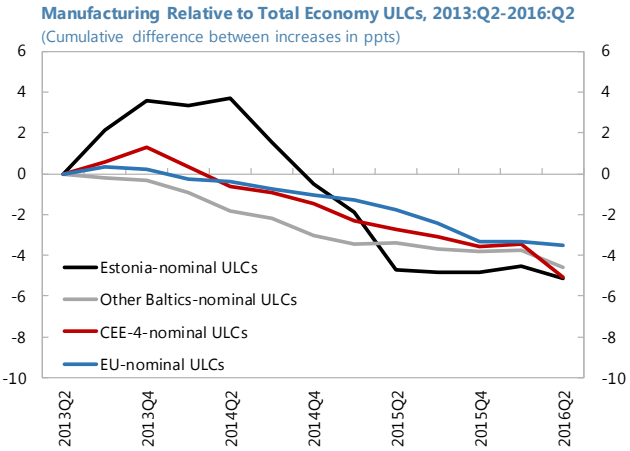
Sources: Eurostat; and IMF staff calculations.

1\ Assumes capital-output ratio of 110 percent of GDP in 2000, depreciation over 15 years, and a non-construction income share of capital of 20 percent for all countries.

9. Economy-wide ULC developments overstate Estonia's competitiveness loss relative to the EU average, but not relative to CEE. ULCs calculated from all economic activity also capture developments in the nontradable sector, which is largely irrelevant for competitiveness because it does not compete much externally. In catching-up economies productivity tends to grow more slowly in the nontradable sector than in the tradable sector while wages typically rise at about the same rate in both. As a result, the more relevant ULC growth in manufacturing is typically slower than economy-wide ULC growth, a phenomenon referred to as the Balassa-Samuelson effect. This



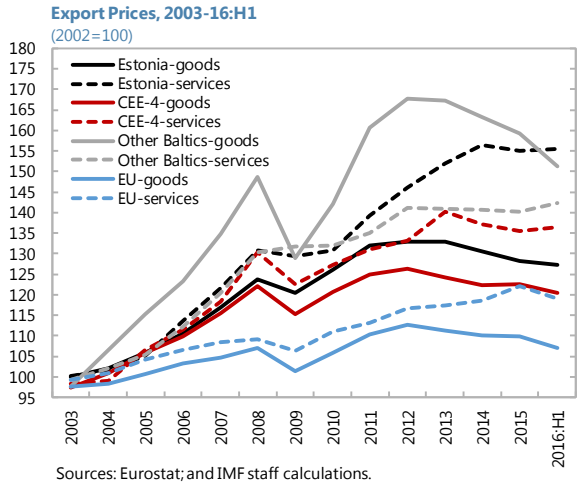
Sources: Eurostat; and IMF staff calculations.



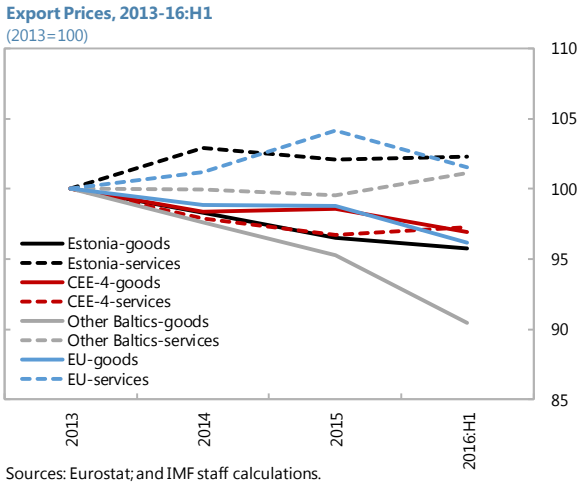
Sources: Eurostat; and IMF staff calculations.

effect is clearly visible in the case of Estonia over the long horizon since 2003, but also to a similar extent in CEE. Moreover, since mid-2013 the effect has largely disappeared and relative ULC developments were in line with those in the EU. To eliminate distortions introduced by the nontradable sector, one can also simply base the competitiveness assessment on ULC developments in the manufacturing sector, as a proxy for the nontradable sector. On this metric, Estonia's increase still exceeds that of CEE and the EU by a very wide margin.

10. Omission of non-price aspects of competitiveness biases results somewhat against Estonia, though not in the more recent period. The most important element of non-price competitiveness are product quality improvements. In principle, they should be captured in real gross value added figures that enter ULC calculations, but in practice it rarely is because of the limited use of hedonic price indices. As a result, productivity growth is understated and ULCs growth overstated. To see whether this effect played more strongly in Estonia than in peers, and therefore distorted the comparison of ULC developments against Estonia, one can examine export prices—a commonly used proxy for quality.[3] Over the long horizon of 2003–2016:H1, Estonia's export prices indeed grew somewhat faster than those of CEE. But this would only potentially explain 15 ppts out of Estonia's extra 65 percent increase of manufacturing ULCs over this period. Moreover, in the last three years, there was no material difference between export price developments in Estonia and CEE any more.



Sources: Eurostat; and IMF staff calculations.



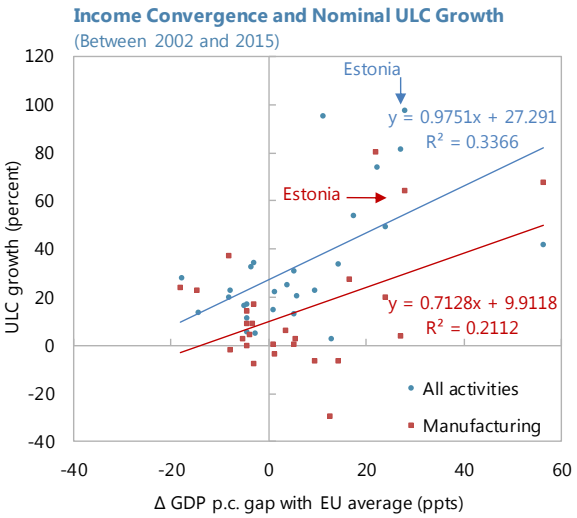
Sources: Eurostat; and IMF staff calculations.

11. Demographic effects on ULC developments have been negligible. Demographics can influence ULCs through labor hording effects. If labor market entries are set to decline, as is the case in Estonia, as well as to some extent in CEE more generally, firms may be especially reluctant to lay off workers and especially eager to secure labor resources as soon as they become available. This behavior results in labor hording where employment is somewhat higher than currently warranted in anticipation of future needs. Labor productivity is accordingly lower and ULCs are higher. Labor

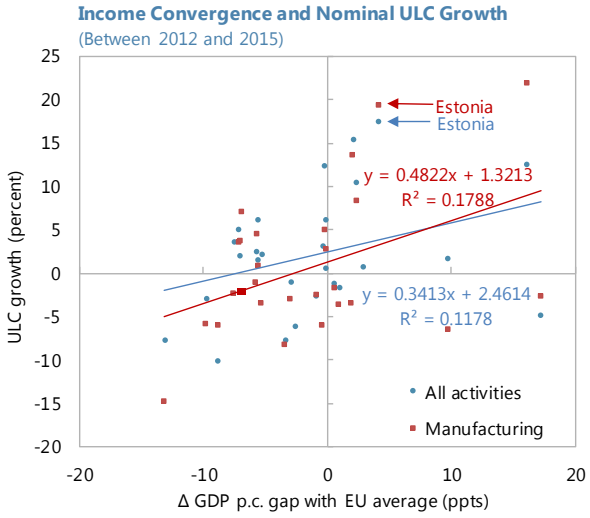
[3] More sophisticated approaches to estimating product quality have been developed more recently. They introduce micro-foundations and estimate quality, and consumer taste from relative unit values and real market shares. However, an application to Latvia still shows an unrealistic surge in product quality in the boom years and a steep decline in the subsequent recession (Benkovskis and Rimgailaite, 2011).

hording should be reflected in hours worked per employee. They have been declining throughout Europe for a long time, with Estonia in line with this general trend. Over the last three years, Estonia's decline was somewhat larger than in CEE, but at a differential of less than 2 ppts, this had no material impact on relative ULC developments.

12. Income convergence helps justify almost half of Estonia's extra long-run ULC growth vis-à-vis the EU, but only a small fraction of the differential with CEE. The positive association of income convergence and ULC growth is an empirical regularity and a catch-all for the various particularities of catching-up economies such as Estonia. As such, it captures some of the factors already discussed above, e.g. those related to product quality improvements, as well as Balassa-Samuel effects for economy-wide ULCs, but goes potentially further. Focusing on manufacturing ULCs, Estonia has seen an increase of around 65 percent since 2003 with some 30 percent explained by income convergence according to estimates for a sample of European countries. However, the comparison with CEE is less benign. Since CEE converged by almost as much as Estonia, Estonia's extra income convergence only explains 15 ppts of Estonia's extra ULC growth. This happens to be on the same order of magnitude as the product quality effect. Moreover, because income convergence toward the EU average has been very muted for Estonia and CEE since mid-2013 it plays only a marginal role in explaining more recent relative ULC developments.



Sources: Eurostat; and IMF staff calculations.



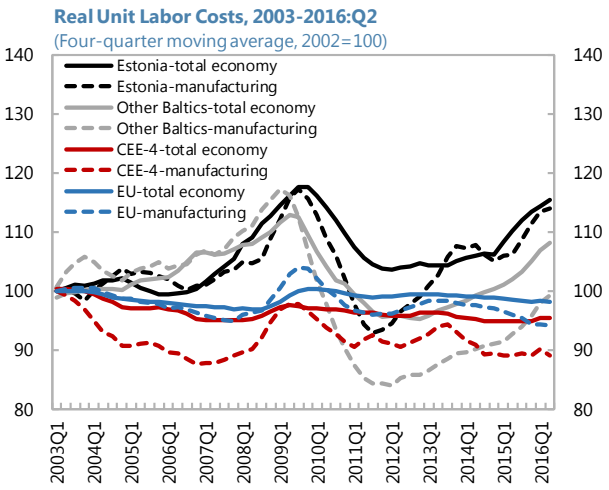
Sources: Eurostat; and IMF staff calculations.

B. Assessment Based on Real Unit Labor Costs

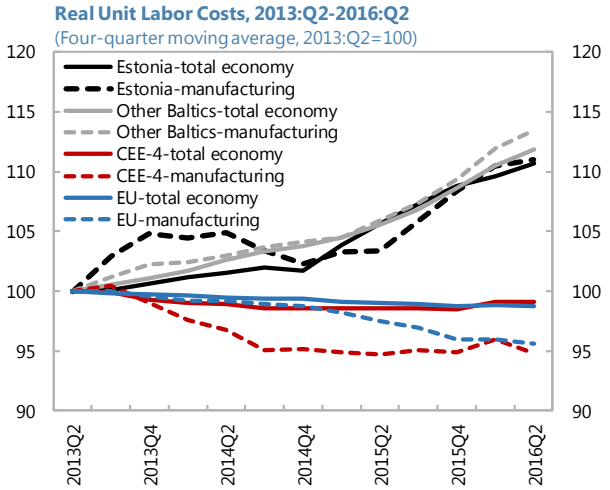
13. Real ULCs are a crucial indicator for competitiveness assessments, as well as for the allocation of resources between the tradable and non-tradable sectors. Unlike the nominal ULCs discussed above, they relate labor costs per employee to nominal rather than real output per employed person. They broadly track the labor share of income, and therefore also its complement, the profit share of income. While less commonly used than nominal ULCs, they have strong explanatory power for export performance (Annex 1). In addition, changes in the ratio of real ULCs in manufacturing and economy-wide ULCs are closely associated with resource shifts between the tradable and non-tradable sectors. This could be another concern related to rapid real ULC growth:

when it is driven by excessive wage developments, real ULCs in manufacturing could rise faster than economy-wide ULCs, because firms exposed to international competition are more constrained in passing higher costs through to prices, giving rise to incentives for moving economic activity to the nontradable sector, where the potential for productivity gains may be lower. Long-term growth and income convergence may weaken as a result.

14. Estonia's real ULC growth over the past three years also looks rather worrisome. Since 2003, real ULCs in manufacturing have risen by a cumulative 15 percent, compared to declines of 10 percent in CEE and 6 percent for the EU. About two-thirds of the gap with CEE has emerged since mid-2013. While there are no established thresholds to gauge when real ULC growth becomes problematic, the examples of Korea and Italy are nonetheless instructive (Annex 1). Pro-rating the rise of real manufacturing ULCs in these countries to match the length of the 2003–2016:H1 period in Estonia, shows a comparable increase of 8 percent in Korea, which was unproblematic, and an increase of 19 percent in Italy, which was associated with the economy falling back. This suggests that Estonia's 15 percent increase cannot be taken lightly.



Sources: Eurostat; and IMF staff calculations.

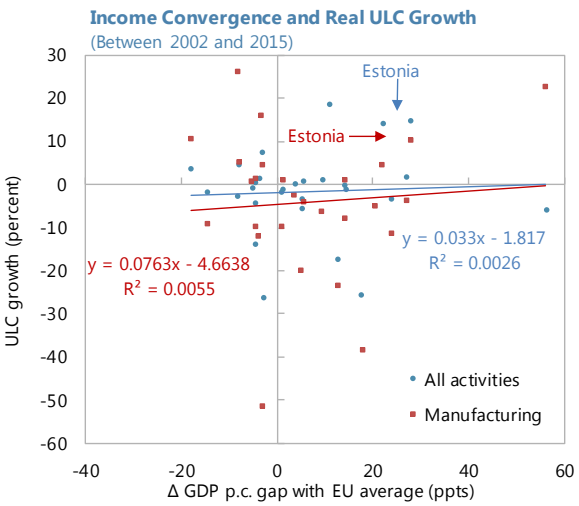


Sources: Eurostat; and IMF staff calculations.

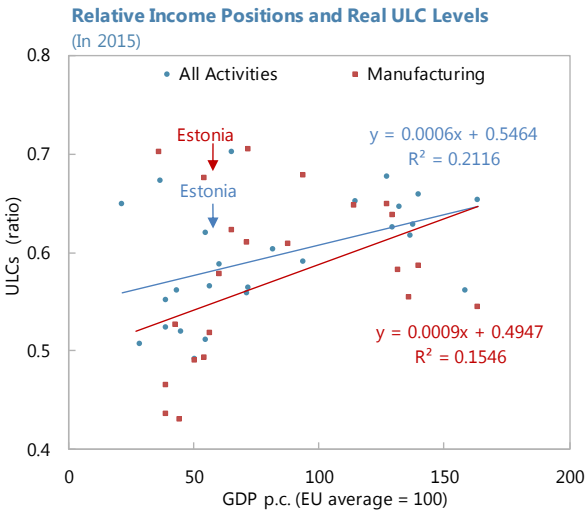
15. Another concern is the development of real ULCs in manufacturing relative to ULCs for all economic activities. With real ULCs moving inversely with profitability, a fall in relative manufacturing real ULCs generates incentives for firms to move into the nontradable sector, which may have less potential for productivity gains, thereby undermining long-term growth prospects. Over the period since 2003, manufacturing real ULCs grew significantly less in CEE, the EU and the other Baltic countries. But in Estonia they grew by about the same. This generated pull into the manufacturing sector in peers, but not in Estonia.

16. Income convergence is not a convincing mitigating factor in evaluating real ULC growth and neither is Estonia's current level of real ULCs. Unlike nominal ULCs, real ULCs are not systematically associated with income convergence. Estonia's particularly rapid real ULC growth can therefore not be partly attributed to especially strong income convergence. It can also not be excused by coming off a low base and therefore maybe not being problematic yet in terms of levels.

Indeed, if anything, overall and manufacturing real ULCs are already at higher levels than one would expect for an economy of Estonia's income level.[4]



Sources: Eurostat; and IMF staff calculations.



Sources: Eurostat; and IMF staff calculations.

C. Supplementary Competitiveness Indicators

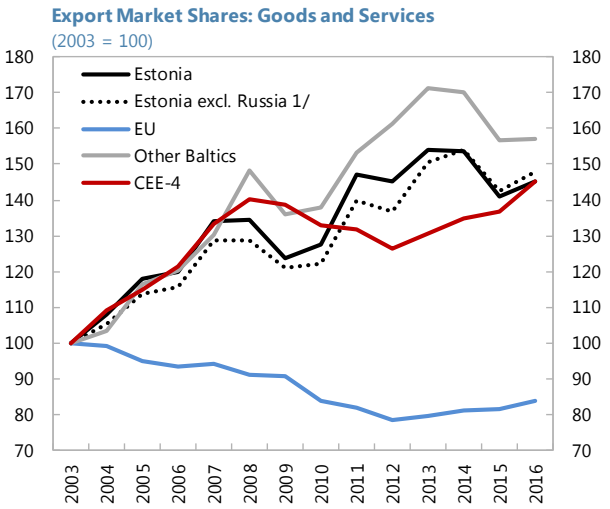
17. Competitiveness assessments cannot rely on ULCs alone. Any single indicator has drawbacks and can send misleading signals. This section looks at supplementary metrics—export market shares, profitability, survey results, and the current account balance—to corroborate the ULC-based readings.

Export Market Share Developments

18. Export market share developments have become less favorable than in the past. Estonia's export growth used to consistently outpace the expansion of global trade. The global financial crisis was a setback from which Estonia swiftly recovered. But after the rebound had run its course around 2013 and in contrast to developments in CEE, export market shares started to slip. Trade with Russia, which suffered from sanctions and ruble depreciation in the wake of the Russia-Ukraine conflict in the spring of 2014, played a role, but excluding it does not materially alter the picture. A more likely culprit is Estonia's weak overall growth, with GDP growth falling behind global developments almost as much as export growth did. Considering that not all countries can constantly gain market share or become more open to trade faster than the rest of the world, the developments in Estonia since 2013 are not necessarily of serious concern. But they are still somewhat disappointing for an economy that seeks to catch up with living standards in Western

[4] The lack of an association between real ULC growth and income convergence on the one hand and the existence of an association between ULC levels and relative income levels on the other hand is not inconsistent. It arises because it was the richer Western European economies that started out with higher real ULCs and maintained that lead over the period 2003–15 when CEE narrowed the income gap.

Europe. It is too early to tell whether they reflect deteriorating competitiveness, especially as export market shares tend to be affected with a lag. Close monitoring is called for.

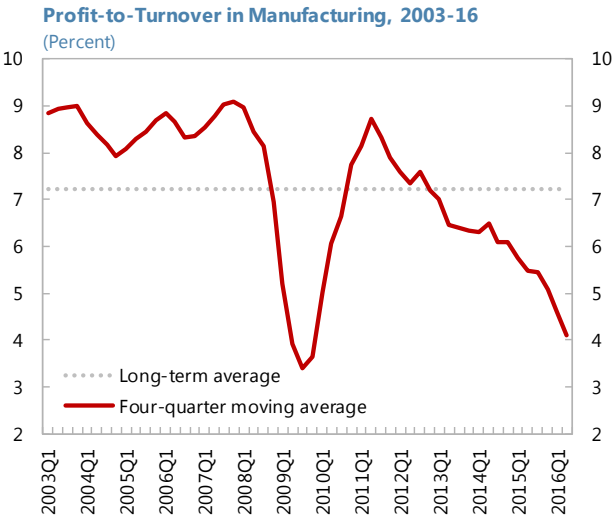


Sources: IMF, WEO; Statistics Estonia; and IMF staff calculations.
1/ Excludes exports to Russia from Estonian exports and Russian imports from global exports.

Sources: IMF, WEO; Statistics Estonia; and IMF staff calculations.
2/ Excludes exports to Russia from Estonian exports, Russian imports from global exports, and Russian GDP from global GDP.

Enterprise Profitability

19. Enterprise data fully confirm pressures on profits in the tradable sector. Profit margins in the manufacturing sector are down to little more than half their historical average and nearing the all-time low seen at the height of the global financial crisis. In other parts of the tradable sector profitability is also down, but closer to historical norms. The big contrast is with the nontradable sector, where profit margins are in line with their long-term averages. This picture is consistent with diminished competitiveness, which typically manifests itself initially in compressed profit margins in sectors that compete externally before it starts affecting export market shares.

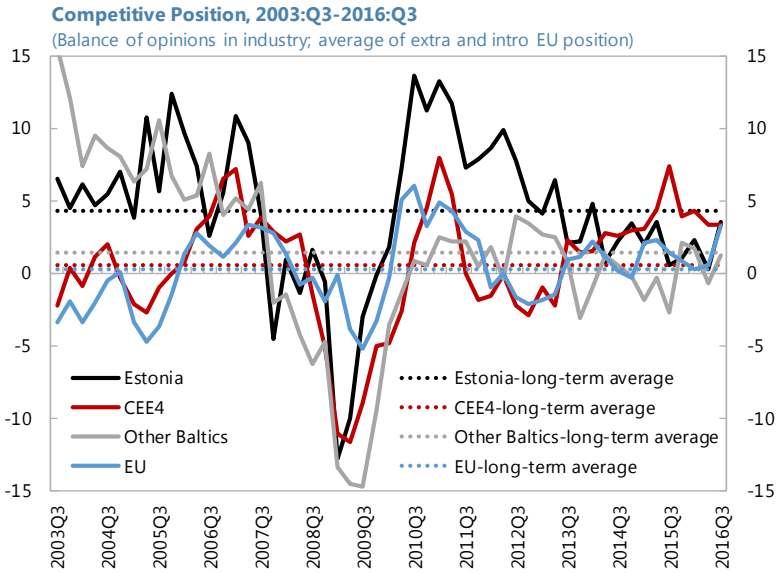


Sources: Statistics Estonia; and IMF staff calculations.

Sources: Statistics Estonia; and IMF staff calculations.

Survey Results

20. European Commission industry surveys also show an erosion in the external competitive position. The balance of opinion has been declining for several years, falling below its long-term average in mid-2013. Its pattern closely mirrors that of profit margins in manufacturing, although in terms of levels the lows reached during the global financial crisis are still a long way off and there was a slight uptick in 2016:Q3. Again, this self-assessment is very different in CEE, where industrial firms report improving and above-average competitiveness. In the other Baltic economies and the EU as a whole industry's assessments have been hovering around their long-term averages in the past few years.

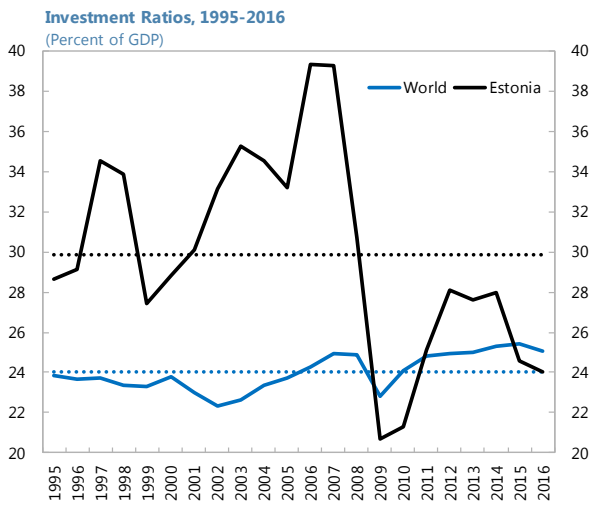


Sources: European Commission; and IMF staff calculations.

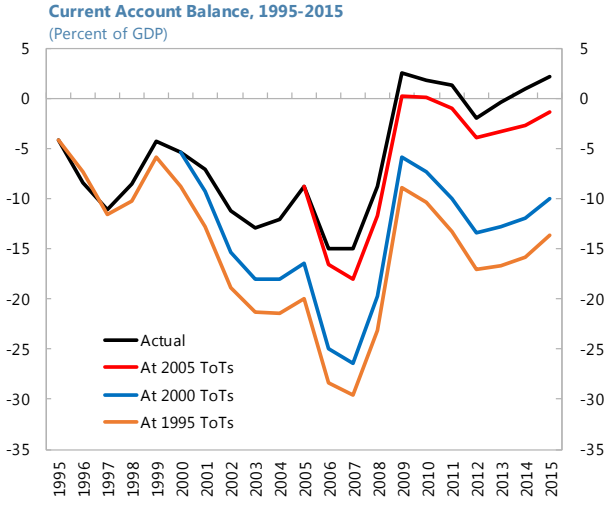
The Current Account Balance

21. Estonia's current account does not currently raise any red flags regarding external competiveness. While it had been in deficit for most of the period since reestablishment of independence and ballooned to a record of -15 percent of GDP at the height of the economic boom in 2007, it corrected very quickly in the ensuing recession and remained in broad balance through the recovery. In 2015 it recorded a surplus of 2.2 percent of GDP. This hardy suggests underperforming exports and domestic suppliers that are struggling to compete with imports.

22. However, developments of Estonia's current account balance are dominated by movements in saving-investment balances rather than changes in competitiveness. Any gains or losses in competitiveness have been swamped by swings in investment. In 2015, the investment-to-GDP ratio was some 6 ppts below its long-term average. In addition, terms-of-trade gains since 2005 have had a favorable impact on the current account balance of an estimated 3.6 percent of GDP. EU funds and fiscal surpluses were further boons to the external position. If these items were to revert to previous norms, Estonia would need to improve its competitive position to ensure current account sustainability.



Sources: IMF, WEO; and IMF staff calculations.



Sources: Haver; and IMF staff calculations.

D. The Root Causes of Estonia's Rapid Wage Growth

23. The strength of the economy, along with public sector wage polices, are the key drivers of wage growth (Table 1). A panel regression for 21 European countries over the period 2000–15 explores the issue. Real wage growth is clearly associated with real GDP growth and the output gap—higher GDP growth and less slack in the economy mean faster growth of real wages. Government wages also play an important role. Broadly in line with other studies, a 1 percent increase of real government wages is associated with a 0.306 percent increase of overall real wages (IMF, 2016). Minimum wages also seem to pass through to general wages with a coefficient of 6.3 percent, again in line with findings in the literature (e.g., Raei, Sodsriwiboon, and Sour, 2016). There may also be an influence from migration, with more outward migration going together with higher wage growth, presumably because it reduces labor supply. Furthermore, there seems to be some evidence that inflation reduces real wage growth, at least in the manufacturing sector. Contrary to popular perception, the declining number of labor market entries, proxied as the population share of the 18–25 year olds or the change thereof, does not turns out to be a significant determinant of wage growth. The wage gap with the EU average seems not to play a role either, suggesting that there is no evidence of wage convergence over and above what is due to differentials in real GDP growth.

Table 1. Real Wage Growth

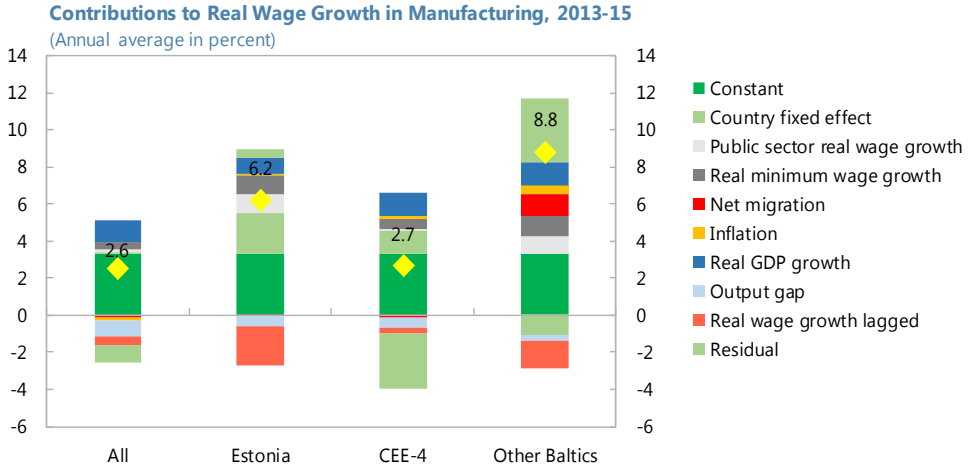
Dependent Variable: **Real Wage Growth in Manufacturing**
Method: Panel Least Squares
Sample (adjusted): 2001 2015
Periods included: 15
Cross-sections included: 19
Total panel (unbalanced) observations: 267

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	2.644	0.504	5.248	0.000
Output gap	0.212	0.111	1.910	0.057
Real GDP growth	0.366	0.101	3.632	0.000
Real minimum wage growth	0.175	0.062	2.812	0.005
Real public sector wage growth	0.230	0.087	2.631	0.009
Lagged real wage growth	-0.227	0.062	-3.643	0.000
Effects Specification: Cross-section fixed (dummy variables)				

Dependent Variable: **Real Wage Growth All Economic Activity**
Method: Panel Least Squares
Sample (adjusted): 2001 2015
Periods included: 15
Cross-sections included: 21
Total panel (unbalanced) observations: 302

Variable	Coefficien	Std. Error	t-Statistic	Prob.
Constant	0.695	0.228	3.044	0.003
Output gap	0.130	0.046	2.843	0.005
Real GDP growth	0.187	0.039	4.867	0.000
Labor market entries	1.285	0.753	1.705	0.089
Real minimum wage growth	0.077	0.024	3.202	0.002
Real public sector wage growth	0.292	0.030	9.606	0.000
Migration	-0.963	0.354	-2.722	0.007
Lagged real wage growth	0.072	0.045	1.591	0.113
Effects Specification: Cross-section fixed (dummy variables)				

24. Estonia's strong wage growth in manufacturing reflects wage policies and other country idiosyncrasies. During 2013–15, manufacturing wages grew by 6.2 percent per year in real terms, significantly more than in CEE and the EU, although the other Baltic economies saw even larger increases. According to the estimates, public sector wages and minimum wages contributed 1 percentage point each. CEE had much lower such contributions. Estonia's country fixed effect, which captures all other unspecified country idiosyncrasies, also adds 1 percentage point more than in CEE and 2 percentage points more than in the EU. Emigration and inflation did not play a quantitatively important role. Growth and output gap made very similar contributions to elsewhere.

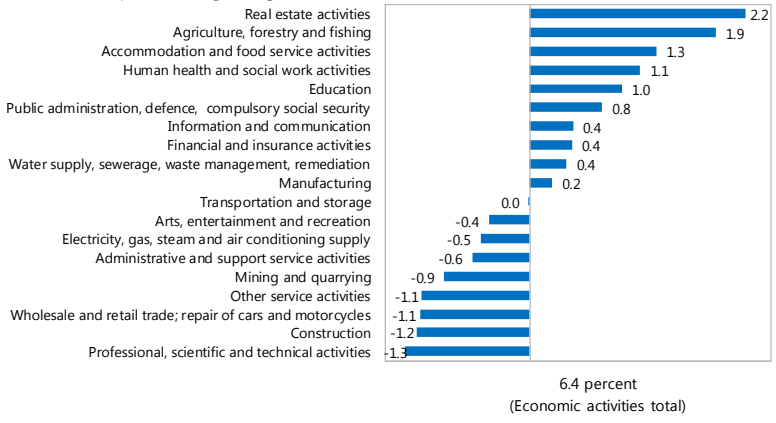


Source: IMF staff estimates.

25. Evidence from sectoral data suggests that wage developments in Estonia are not entirely a reflection of labor market tightness and that other non-economic factors, such a wage policies and momentum, may be at play. In recent years, sectors that did very well often saw lower-than-average wage increases and sectors that did poorly saw above-average wage increases. For example, wages rose relatively slowly in wholesale and retail trade, despite very strong consumption growth. The ICT sector, where employers have a particularly hard time finding suitable workers, registered wage growth not much above the average. Conversely, real estate activities have

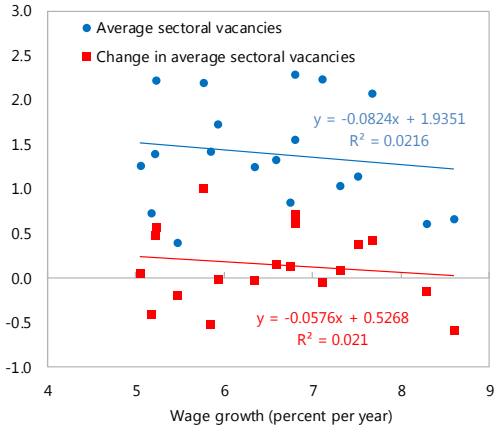
done poorly as of late, yet wages in this sector grew the most. There is also no statistically significant association between sectoral wage growth and sectoral vacancy rates, or the change of sectoral vacancy rates.

Wage Growth by Sector: Deviations from Average, 2012:Q1-2016:Q1
(Percent, four-quarter moving average)



Sources: Statistics Estonia; and IMF staff calculations.

Sectoral Wage Growth and Vacancies, 2012:Q1-2016:Q1



Sources: Statistics Estonia; and IMF staff calculations.

E. Conclusions and Policy Implications

26. ULC developments in Estonia raise important red flags about competitiveness. The divergence between rapid wage growth and stagnant productivity is certainly not sustainable. The pace of ULC growth relative to trading partners and the associated appreciation of the real effective exchange rate exceed conventional prudent thresholds. Unlike in the past, Estonia's relative rise in ULCs is no longer accompanied by a rise in relative export prices, suggesting that non-cost competitiveness factors ceased to sufficiently offset declining cost competitiveness. Whether ULCs have already reached a level that materially compromises competitiveness is harder to tell, but overall the evidence suggests that ULCs are close to this point. Real ULCs, which emerge as a particularly good indicator, are not only growing rapidly, but are also high by standards of a country at Estonia's income level. Company profitability in the tradable sector well below long-term averages and slipping export market shares are corroborating evidence.

27. Fast ULC growth is unlikely to become an issue for the external balance anytime soon, but risks undermining growth and income convergence. Estonia's current account has been broadly in balance in recent years compared to sizable historical deficits, largely on account of lower investment. With Estonia's investment ratio still considerably higher than in European peers, notwithstanding the decline in recent years, a return to large current account deficits is unlikely even if competitiveness continued to suffer. But unmitigated ULC growth would likely undermine the economy's growth potential as the tradable sector struggles and as resources shift to the nontradable sector where the scope for productivity gains is likely more limited.

28. Policies should adopt a three-pronged approach to tackle excessive ULC growth. Raising productivity growth is the most attractive track, because it provides the underpinnings for higher living standards at the same time. But policies to boost productivity growth will take time to

come to fruition and are unlikely to bring it all the way up to the current pace of real wage growth even in the medium term. Hence policies to cool excessive wage growth are highly relevant. As a third track, tax policy could provide immediate relief from wage pressures on profitability.

- **Boosting productivity.** Estonia already has many commendable programs to promote innovation and upgrading human capital in place. But they could be scaled up and broadened to more applied innovations, incentives for their take-up could be strengthened, and their effectiveness could be lifted by high-profile coordination and oversight through a productivity unit housed in the Prime Ministry. Higher public investment to close infrastructure gaps would also be helpful and there is some room to further improve Estonia's already favorable business environment.

- **Cooling excessive wage growth.** Policies have contributed to rapid wage growth through five consecutive minimum wage hikes of 10 percent per year and government wage increases that averaged over 8 percent annually in the last three years. A more cautious approach going forward would be helpful. The authorities should also clearly communicate that current wage growth is unsustainable in order to lean against the growing detachment from economic fundamentals. Moreover, efforts to boost labor supply for the private sector should be intensified: the release of labor resources from Estonia's relatively large government sector could be stepped up; tight limits on immigration from non-EU countries could be loosened; and there is room to further raise labor participation, especially for younger women.

- **Providing tax relief.** A cut in social security contribution rates would provide immediate relief from pressures of wages on profitability. At over 30 percent, they are high and the previous government had planned to gradually reduce them. These plans could be reinstated and accelerated. Since social taxes are mostly employer-paid, cuts would benefit profits in the first instance. In the longer run and as wage contracts are renegotiated, the benefits from the cut would be shared by employers and employees.

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Annex I. Nominal vs. Real Exchange Rates

1. Nominal and real ULCs are conceptually very different even though the formulas to calculate them are almost identical.

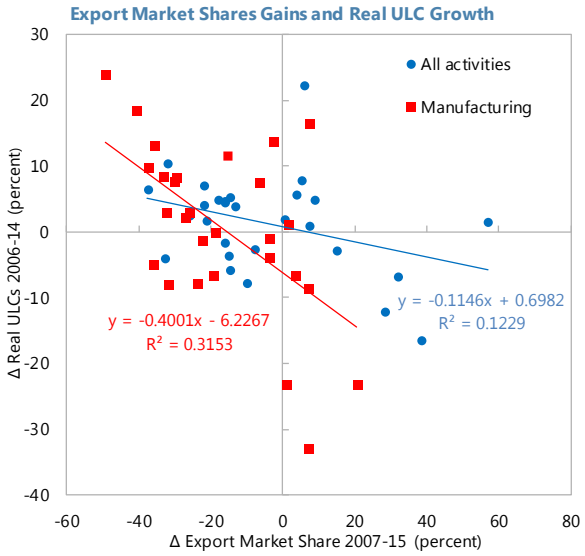
- Nominal ULCs are calculated as the ratio of labor compensation per employee and real value-added per employed person. They are a nominal index that increases over time as wages rise in an inflationary environment. When expressed in a common currency and compared to trading partners, they are equivalent to the real effective exchange rate. Because they compare labor costs adjusted for productivity differentials across country, they are routinely the starting point for an assessment of exchange rates and external price competitiveness.
- Real unit labor costs are calculated as the ratio of labor compensation per employee and nominal value-added per employed person and are a unitless indicator that does not systematically change in an inflationary environment. If the split of the employed between employees and the self-employed remains roughly constant over time, it broadly tracks the labor share of income, the complement to the share of profits and mixed income in gross value added. Hence, rising real ULCs point to a compression of profits, which in turn points to a loss of competitiveness if it occurs in the tradable sector.

2. Nominal and real ULCs have their conceptual drawbacks, but there are more issues with nominal ULCs. Both are affected by developments unrelated to competitiveness, such as the business cycle position, capital deepening, and shifts between sectors with different labor intensity. But in addition, nominal ULCs suffer from the fundamental problem that their increase may be the cause as well as the result of changes in competitiveness: an increase due to an autonomous rise in wages is a loss of competitiveness, but an increase due to an autonomous increase in product quality, export prices, and wages is a competitiveness gain. Moreover, nominal ULCs are an index number without meaningful interpretation to their levels, making it difficult to say whether an increase has already compromised competitiveness because it might have come off a low base.

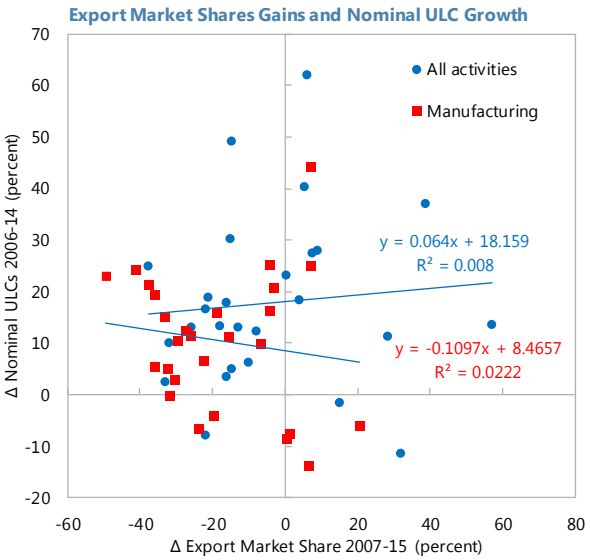
3. The relative performance of nominal and real ULCs is ultimately an empirical question. With regard to export performance, which indicator is more closely associated with gains and losses of market shares? With regard to growth in the tradable sector compared to the nontradable sector, which indicator has the better predictive power? With regards to income convergence, which indicator is more relevant? Regardless of the outcome of this performance comparison, a thorough competitiveness assessment should retain both indicators, but the exercise still conveys a sense of how much relative importance to attach to nominal and real ULCs in coming to an overall judgement.

4. Real ULCs appear more closely associated with export performance than nominal ULCs. A sample of 28 European countries shows a strong relationship between changes in real ULCs and changes in export market shares. Long periods of 12 years are considered for these changes to smooth out business cycle effects and other shocks. The association is even closer for the manufacturing sector, which is more exposed to trade. Export market shares for manufacturing

goods are calculated from SITC Revision 4 data provided through the World Integrated Trade Solutions portal, which allow a close matching of exports by type of good to the associated manufacturing activity. In contrast, there is only a weak correlation between exports and nominal ULCs in manufacturing and none with economy-wide nominal ULCs.

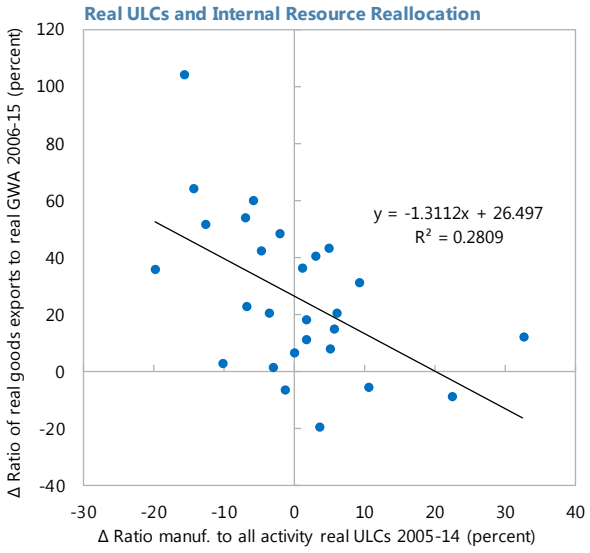


Sources: Eurostat; WITS; IMF, WEO; and IMF staff calculations.

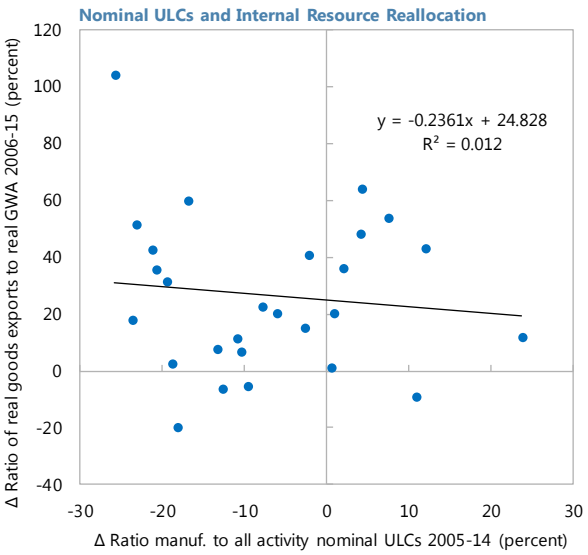


Sources: Eurostat; WITS; IMF, WEO; and IMF staff calculations.

5. Real ULCs developments are also better aligned with changes in internal resource allocation. When ULCs in the manufacturing sector, which is most active in exporting, rise relative to those for all activities, one would expect activity to shift away from exports, because in exporting it becomes relatively more difficult to make sales and profits. There is indeed a close association between changes in relative real ULCs and changes in the share of export-oriented activity in the economy. Relative profitability between activity in the tradable and nontradable sectors seems to



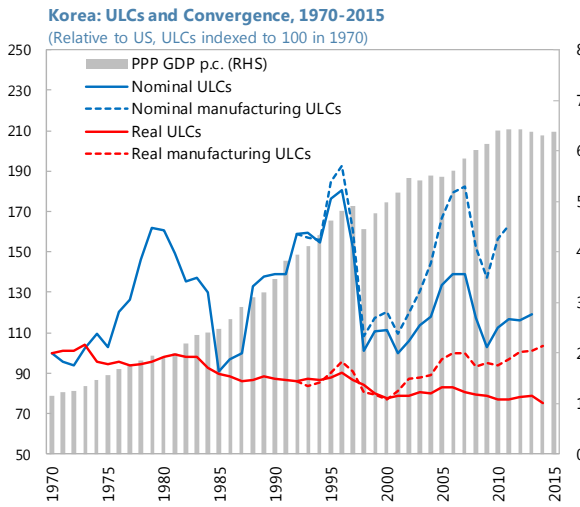
Sources: Eurostat; WITS; IMF, WEO; and IMF staff calculations.



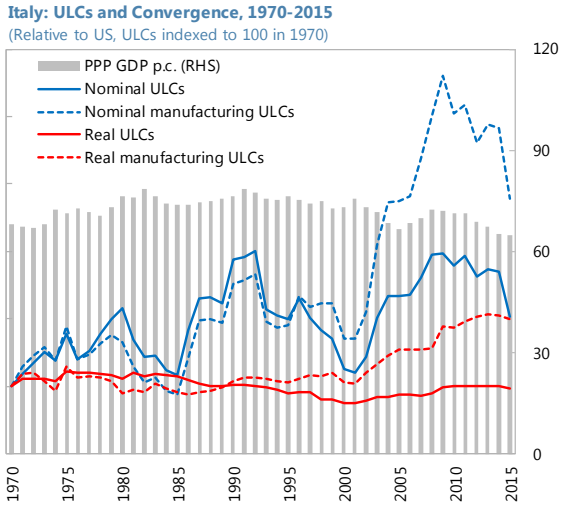
Sources: Eurostat; WITS; IMF, WEO; and IMF staff calculations.

matter for internal resource allocation. In contrast, relative nominal ULCs fail to show much relation to internal resource allocation.

6. A case study suggests that income convergence prospects are more strongly influenced by real rather than nominal ULC developments. Korea and Italy are a case in point. Korea exhibits a largely uninterrupted stretch of income convergence with the U.S. over many decades, measured as relative GDP per capita in purchasing power parity U.S. dollars. In contrast, Italy's relative income level remained broadly constant until the late 1990s and subsequently declined substantially. Nominal ULCs relative to those in the U.S. exhibit large gyration, partly related to exchange rate movements: a large increase up until the oil crises in the late 1970s and early 1980s followed by a correction, a large increase in the run-up to the Asian crisis in the second half of the 1990s followed by a sharp decline thereafter, and again a pronounced boom-bust cycle around the global financial crisis in 2008. These outsized fluctuations make it difficult to interpret nominal ULCs, even if some of these episodes left a mark on income convergence. Real ULCs in manufacturing paint a clearer picture. Korea's moderate and gentle increase by around 20 percent over the past three decades did not harm income convergence. But Italy's 50 percent increase over the same period did, especially the sharp rise after the launch of the euro at the turn of the century.



Sources: EC, AMECO; US BEA; Bank of Korea; and IMF staff calculations.



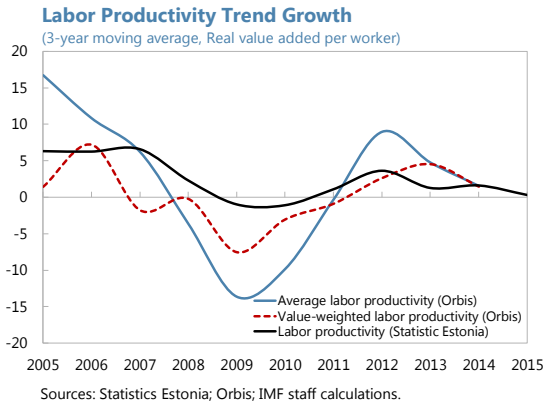
Sources: EC, AMECO; US BEA; Bank of Korea; and IMF staff calculations.

PRODUCTIVITY DEVELOPMENTS IN ESTONIA: EVIDENCE FROM FIRM LEVEL DATA[1]

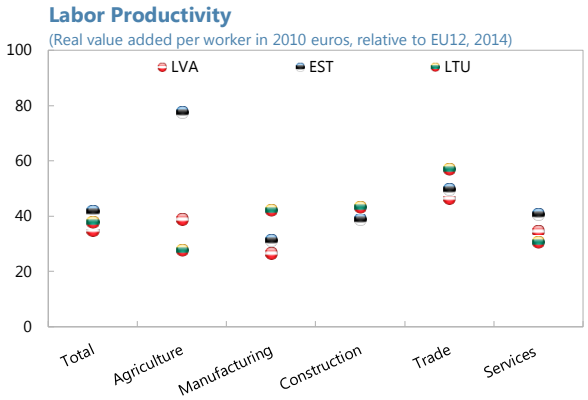
Labor productivity growth has been weak in recent years. Firm-level data can help shed light on where in the economy productivity growth was strong and where it lacked. Moreover, they reveal which firm-level characteristics were critical for productivity performance. It turns out that the bulk of productivity growth in Estonia can be attributed to the more traditional firms, that there was a strong catching-up effect of firms with initially below-average performance, and that the superior performance of younger firms disappeared in the period after the global financial crisis, suggesting reduced dynamism in the economy. Firm characteristics that were associated with strong productivity growth were also associated with weak employment generation, suggesting a pronounced labor rationalization element in productivity growth. There is tentative evidence that this effect might have been stronger in Estonia than elsewhere in Europe.

1. Since 2005, labor productivity trends in Estonia have flattened significantly. Real labor productivity, measured as the ratio of real gross domestic product in 2010 prices over total employment, registered a modest cumulative increase of 14 percent since 2005—an annualized growth rate of only around 1 percent. Value weighted labor productivity, calculated from firm level data was more volatile, but showed a similar trend.[2]

2. Like in most countries, productivity growth slowed down markedly following the 2008/09 crisis, but the extent is surprising, considering the still very sizeable productivity gap with Western Europe. Measured in real terms (2010 euros), the value added per worker in Estonia is a mere 40 percent of the EU12 average.[3] There is however significant variation across sectors—with workers in agriculture only a quarter less productive; while manufacturing productivity in Estonia is less than a third of the EU12 average. On average, productivity gaps are larger in high-technology sectors, both in manufacturing and in services. The gap shrinks when measuring



Sources: Statistics Estonia; Orbis; IMF staff calculations.



Sources: Eurostat; and IMF staff calculatons.

[1] Prepared by Pragyan Deb with contributions from Andreas Tudyka.

[2] The unweighted average of labor productivity across firms declined over the period.

[3] EU12 refers to the 12 countries that made up the European Union prior to the eastward expansion starting from 2004.

productivity in purchasing power standards, but it remains at a considerable one-third vis-à-vis the EU12 average.

3. Which segments of the economy drove aggregate productivity developments and what kind of firms were successful in boosting their productivity? This chapter uses firm-level data from Orbis, a worldwide database of primarily private company information, to shed light on these questions. Orbis provides firm-level balance sheet data over the period 2005–14 covering around 50–60 percent of the employed and 40 percent of total value added in the case of Estonia (Table A1).[4] Coverage varies across sectors, but even after dropping observations with missing values for key variables such as value added, there is sufficient data from 2005 onward for a meaningful analysis.[5] The data can be used to calculate labor productivity, total factor productivity (TFP), employment generation, and value added growth at the firm level. Section A dissects the economy along different dimensions to analyzes which segments are responsible for productivity, employment, and value-added growth. Sections B and C look at which firm characteristics are relevant for productivity and employment growth, respectively. Section D concludes.

A. The Distribution of Productivity, Employment, and Value-added Trends Across the Main Segments of the Economy

4. Dissecting the economy along different dimensions helps identify the locus of productivity growth in the economy and gauge the importance of composition effects on aggregate productivity growth. Five different stratifications of firms operating in Estonia are considered: (i) by economic activity, i.e. agriculture, manufacturing, construction, trade, market services, and basic services; (ii) by level of technological sophistication, i.e. high-tech manufacturing, other manufacturing, high-tech services, and other market services;[6] (iii) by firm size, i.e. micro enterprises with less than 10 persons employed, small enterprises with 10–49 persons employed, medium enterprises with 50–249 persons employed, and large enterprises with 250 or more persons employed; and (iv) by degree of involvement in external trade. Did these segments fare differently in terms of productivity, employment, and value-added growth? How much did they contribute to economy-wide trends? Did shifts in the relative importance of these segments materially affect aggregate developments through composition effects?

5. In the dissection by economic activity, agriculture and manufacturing stood out with the largest productivity gains (Figure 1). During 2005–14, labor productivity of an average firm in the agricultural sector nearly doubled and it increased by close to 22½ percent in manufacturing

[4] Since Orbis data is in nominal terms, real values are obtained using industry level value added and investment deflators available from Eurostat. As a robustness check, the deflators were also de-trended using the Christiano-Fitzgerald time-series filter (at 2 years), which yielded very similar results.

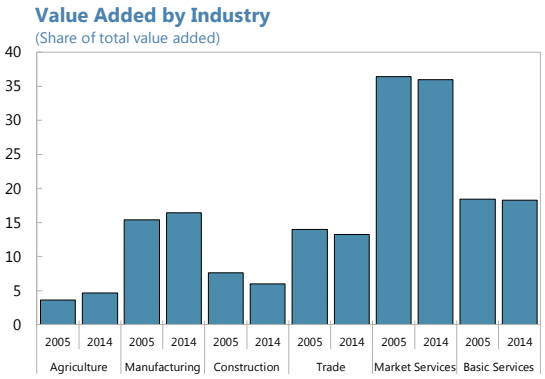
[5] Following Gal (2013) some of the variables are imputed when missing. Specifically, when data on value added is missing, it is imputed using EBITDA and cost of employees. In addition, total asset is used as a proxy when data on (tangible) fixed asset is not available.

[6] Basic services cover public administration, education and health services, and other administrative and support services. Market services include transportation, accommodation, professional, ICT, and financial and real estate services.

firms. In contrast, labor productivity declined by over 22 percent in market services and 19 percent in basic services, respectively. Much of this divergence likely reflects differences in capital deepening, as changes in TFP, while in the same direction, were considerably less pronounced. Productivity gains pushed up the share of value added in the economy generated by agriculture and mining, and manufacturing with a corresponding decline in other economic activities. Yet, the expansion of value added shares was not sufficient to generate much additional employment. Agriculture and manufacturing saw their shares in employment decline.

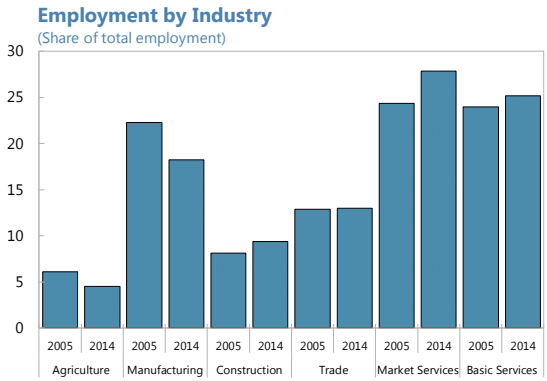
Figure 1. Estonia: Trends by Economic Activity

While the services sector remains dominant, the share of agriculture and manufacturing in value added increased, at the expense of construction, trade and market services…



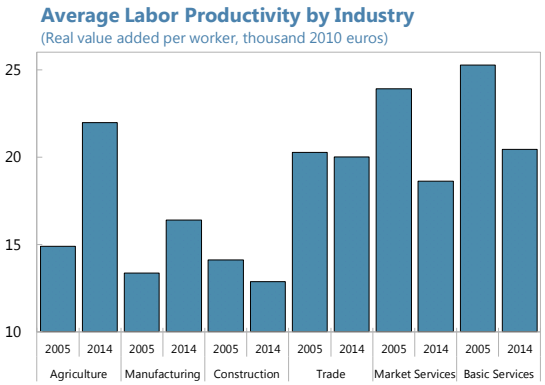
Sources: Statistics Estonia; and IMF staff calculations.

…but the opposite was true for employment – which fell for agriculture and manufacturing and increased for construction and services.



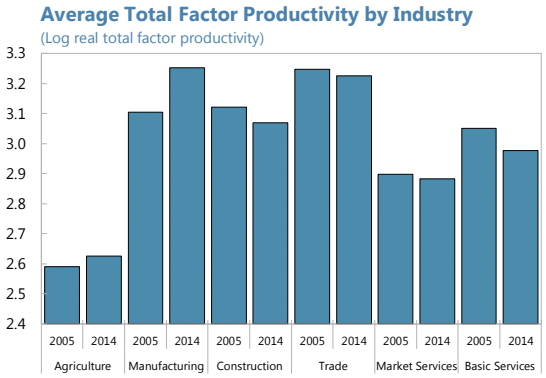
Sources: Statistics Estonia; and IMF staff calculations.

This was reflected in the strong increase in labor productivity in agriculture and manufacturing and a decline in all other sectors, especially services.



Sources: Orbis; and IMF staff calculations.

TFP developments showed a similar, but less pronounced trend.



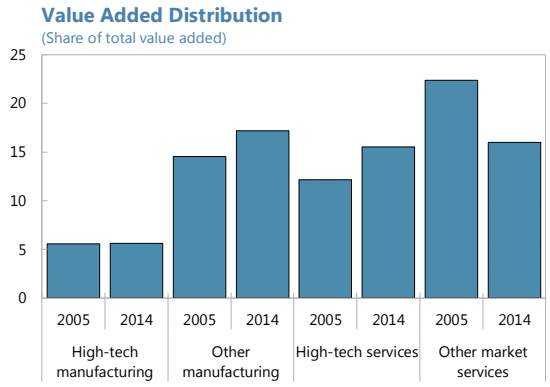
Sources: Orbis; and IMF staff calculations.

6. In the dissection by economic sophistication, high-technology sectors were not particularly strong drivers of productivity and more traditional manufacturing witnessed impressive gains (Figure 2). Labor productivity and TFP growth was similar for both high-tech and more traditional manufacturing. In services, productivity was flat in high-tech firms, and declined in

other services. The value added share of high-technology manufacturing was flat at around 5 percent, while the share of other manufacturing increased 18 percent, from 14 percent of value added to 17 percent. The employment shares of both declined, but the decline was stronger in high-technology manufacturing. In the services sector, high-technology services increased its share in both value added and employment, which was offset by declines in other market services.

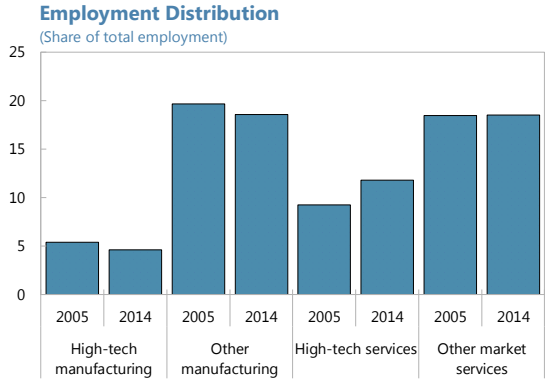
Figure 2. Estonia: Trends by Level of Technological Sophistication

Value added share of high-tech manufacturing was flat, while the share of other manufacturing increased; the share of high-tech services increased while other services fell.



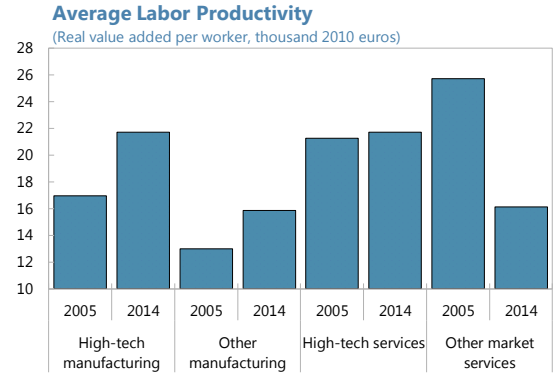
Sources: Orbis; and IMF staff calculations.

Employment share of manufacturing declined, particularly high-technology manufacturing, while the share of high-tech services increased.



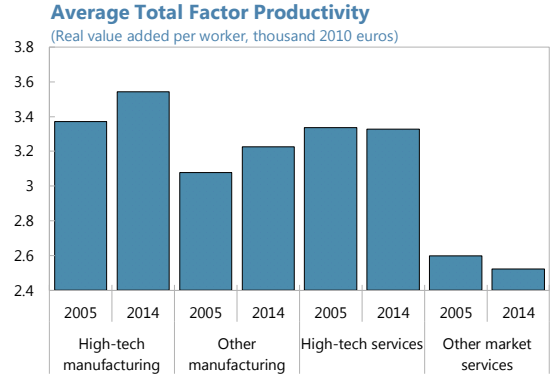
Sources: Orbis; and IMF staff calculations.

Labor productivity increased strongly for manufacturing, while it was flat for high-tech services and fell sharply for other services.



Sources: Orbis; and IMF staff calculations.

TFP showed similar trends for manufacturing, but was flat for high tech-services while declining for other services.



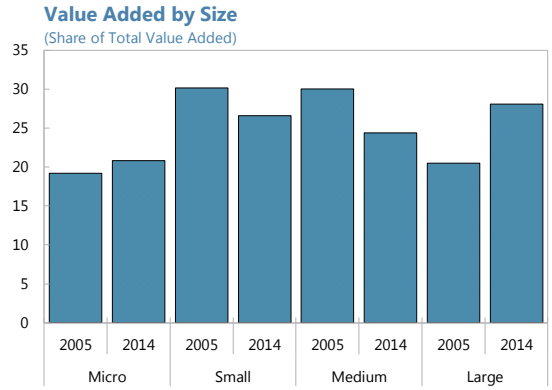
Sources: Orbis; and IMF staff calculations.

7. In the dissection by firm size, productivity increased in all size categories, except for micro enterprises where it declined (Figure 3). While labor productivity decreased by about 14 percent for micro firms, it increased for all other size classes, led by large enterprises where productivity more than doubled. TFP exhibits the same pattern, but variability is smaller and, in particular, the superior performance of large enterprises is much less pronounced. The categories with the strongest and weakest productivity performance expanded their shares in values added—

micro firms on account of expanding employment and large firms on account of productivity gains and despite a declining employment share.

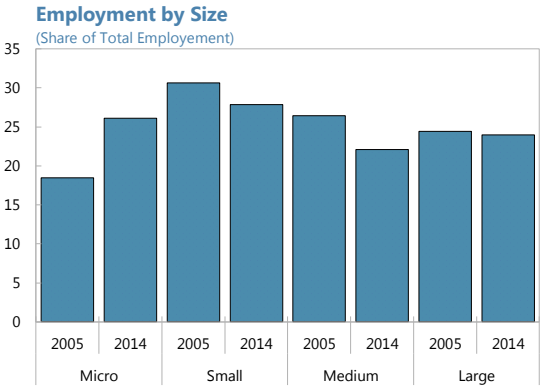
Figure 3. Estonia: Trends by Firm Size

Value added share of large and micro firms increased, while those of small and medium enterprises fell,...



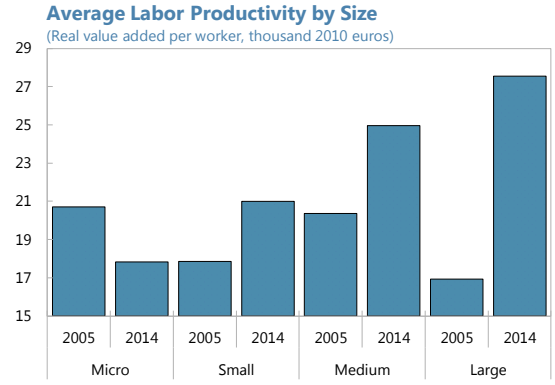
Sources: Orbis; and IMF staff calculations.

...but only micro enterprises increased their share in employment.



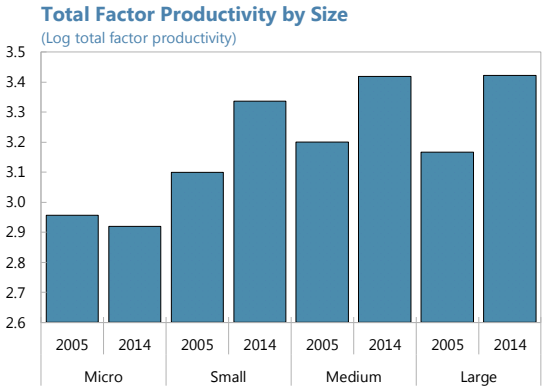
Sources: Orbis; and IMF staff calculations.

Labor productivity increased in all, but the micro firms...



Sources: Orbis; and IMF staff calculations.

...and the same trend was observed for TFP.



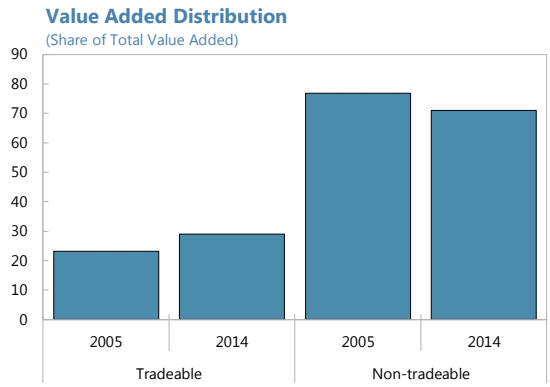
Sources: Orbis; and IMF staff calculations.

8. The dissection by degree of involvement in international trade yields only weak evidence of positive effects on productivity.

- **On the one hand, labor productivity and TFP increased in the tradeable sector, but declined in the non-tradeable sector,** suggesting a positive impact of international trade on productivity growth (Figure 4). The tradeable sector is generally defined as agriculture and allied activities, mining and manufacturing, with the non-tradeable comprising primarily services, along with construction and trade. The tradeable sector also increased its value-added share in the economy, but this expansion was not enough to prevent a fall of its employment share.

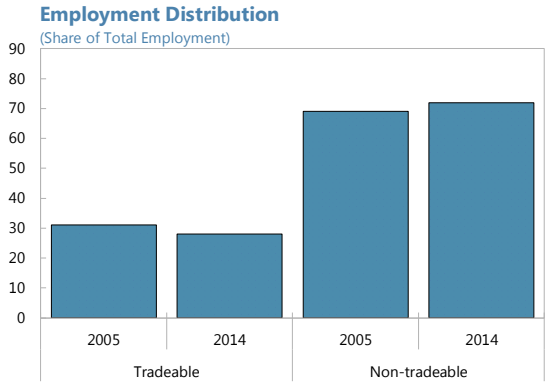
Figure 4. Estonia: Trends by Sectors' Tradability

Value added shares of the tradeable sector increased…



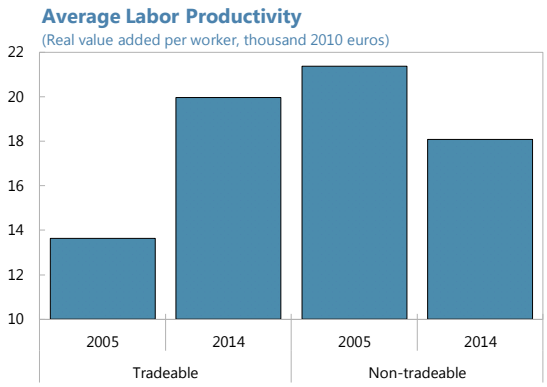
Sources: Orbis; and IMF staff calculations.

…although its share in employment registered a decline.



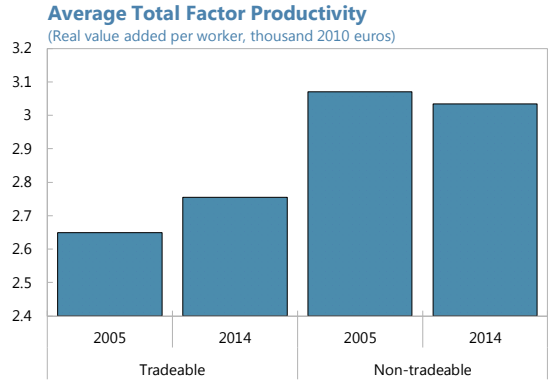
Sources: Orbis; and IMF staff calculations.

Labor productivity increased for tradeable, although on average tradeable were less productive…



Sources: Orbis; and IMF staff calculations.

…and the same trend was seen in the case of TFP.



Sources: Orbis; and IMF staff calculations.

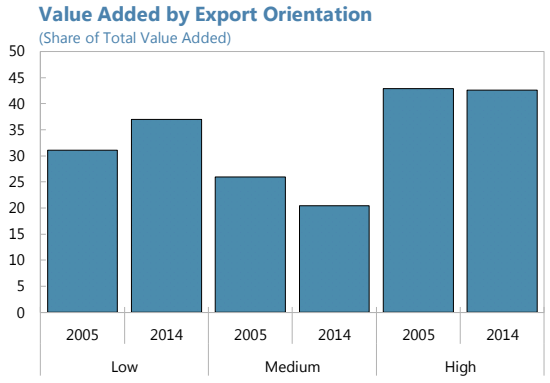
- **On the other hand, there is no close link between how much firms sell abroad and how much their productivity grows** (Figure 5). Using sectoral data on export shares, which is available at the 4-digit NACE industry level from Statistics Estonia, each firm is placed into one of three buckets according to the export orientation of the industry it belongs to: low, medium, and high share of sales to non-residents in total turnover.[7] Average labor productivity declined in all three categories: the decline was 19 percent for firms with low export orientation, 2 percent for firms with medium export orientation, and 1 percent for highly export-oriented firms. This

[7] When data is not available at the 4-digit NACE level, the 2-digit NACE is used as a fallback. Export orientation, while an improvement over the tradeable and non-tradeable breakdown, is still a crude proxy. A majority of the export orientation data was only available at the two-digit industry level and therefore does not pick up differences in export orientation within a particular (two-digit) industrial sector. Therefore, it is possible that within a particular sector, firms actually involved in exports performed better. In addition, this data does not capture the role of warehousing. A firm selling its products to a domestic warehousing company, which in turn exports the product, will be picked up as a domestic sale in our data. Therefore, some of the firms and sectors may be misclassified in the low export orientation category.

would suggest a boon of export orientation for productivity growth. However, TFP increased for both low and high export oriented firms, but declined for medium export oriented firms, suggesting not systematic link between export orientation and productivity. Value-added and employment shares increased for firms with low-export orientation, fell for those in the medium category, and did not change much in those with high export orientation.

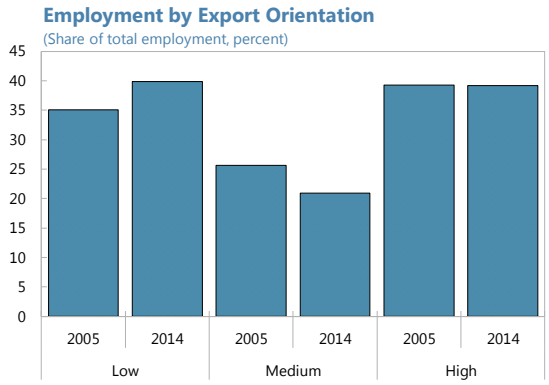
Figure 5. Estonia: Trends by Export Orientation

Value added shares of low export oriented firms increased…



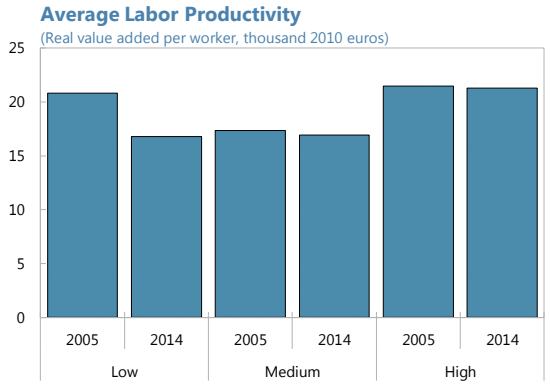
Sources: Orbis; and IMF staff calculations.

….as did the employment share.



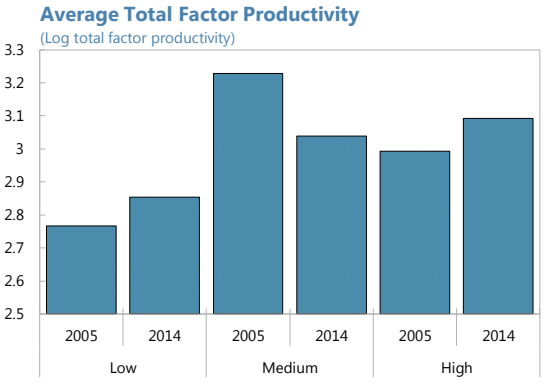
Sources: Orbis; and IMF staff calculations.

Labor productivity decreased less for more export oriented firms…



Sources: Orbis; and IMF staff calculations.

…and TFP increased for both low and high export oriented firms.



Sources: Orbis; and IMF staff calculations.

- **The lack of clear-cut evidence for superior productivity performance of exporters may reflect a variety of factors.** It may not show in the exercise based on foreign sales, because it might not be the amount of actual foreign sales, but exposure to foreign competition that disciplines firms into constantly working on productivity improvements. Moreover, it may be exaggerated in the exercise based on belonging to the tradeable or nontradable sector. It might be the nature of the activity of a firm rather than the exposure to stiff foreign competition that is the crucial factor, e.g. manufacturing may generally be more conducive to productivity gains than services. This highlights the more general problem of not controlling for common factors in this analysis.

9. Composition effects played only a small role in aggregate productivity developments. Had the employment distribution across firms with different degrees of technological sophistication remained the same as in 2005, aggregate labor productivity and TFP would have been around 2.4 percent and 1.1 percent lower in 2014, respectively. A stable employment distribution across firms of different sizes would have raised labor productivity and TFP by 2 percent and 1.1 percent, respectively. Composition effects are even smaller for the dissections according to economic activity and degree of involvement in international trade.

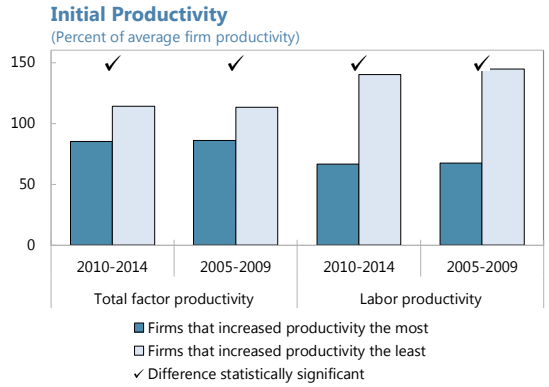
B. Firm Characteristics and Productivity Growth

10. A difference-in-means approach is used to assess the relationship between TFP developments and firm characteristics. Firms are ranked according to their growth in productivity and divided into three buckets. The averages of the top and bottom buckets are then used to explore the differences in firm characteristics for firms belonging to the different groups, i.e. firms that saw the highest increase in TFP vis-à-vis firms that saw the least. The following firm characteristics are examined: initial productivity and performance metrics; firm size and age; and worker skill level, capital intensity, and export orientation. Two periods are considered that roughly correspond to the boom years 2005–09 and the crisis and recovery years 2010–14. The results below are presented in terms of the percentage of the average value (across all firms) of the firm characteristic. The differences are also examined for statistical significance at the 5 percent level.

11. There is evidence of a "catching-up" effect (Figure 6). Firms belonging to the group with higher productivity growth, in both periods, had on average 25 percent lower TFP in the beginning of the period relative to the firms that saw a relatively smaller increase in productivity. The figure was even larger at over 50 percent for labor productivity. The differences are statistically significant. This implies that there was an element of "catching-up," with firms that had low initial productivity improving their performance relatively more than firms that were already more productive. This "catching-up" hypothesis is also borne out by other performance metrics, such as return on assets and profit margins. The return on assets of firms that showed the greatest increase in productivity was around 70 percent lower in the 2010–14 period, while it was around 40 percent lower in the 2005–09 period. Similar results hold for profit margin—in the 2010–14 period, the profit margin of firms belonging to the group showing higher increases in TFP was only about a fourth, and around half in the 2005–09 period. It should be cautioned however that this analysis relies on firms that stayed in business through the crisis and reported balance sheet data over the entire period under consideration, introducing an unavoidable survivorship bias.

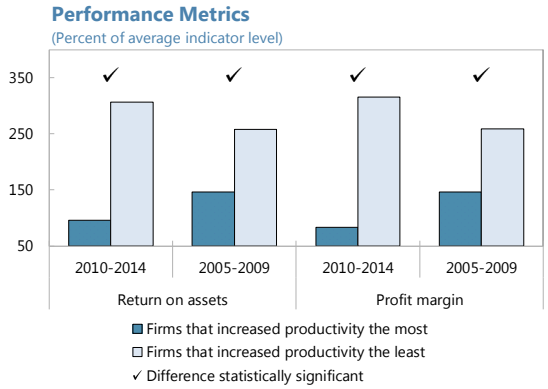
Figure 6. Estonia: Drivers of Productivity

Firms that increased productivity most were on average less productive…



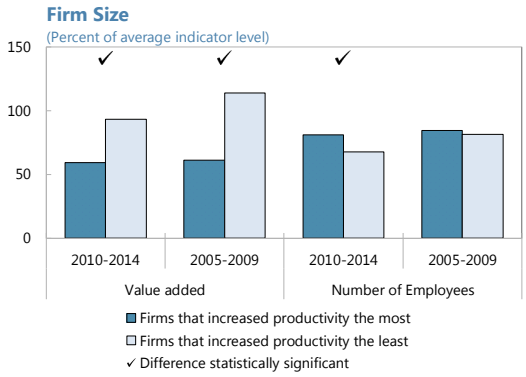
Sources: Orbis; and IMF staff calculations.

….and had significantly weaker performance metrics suggesting an element of "catching-up".



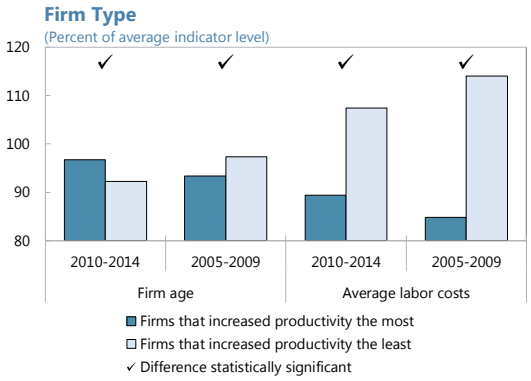
Sources: Orbis; and IMF staff calculations.

12. Evidence on the relationship between firm size and productivity growth is mixed. Firms that increased productivity most were smaller in value-added terms compared with firms that saw smaller increases in productivity. In the 2010–14 period, firms that did well in terms of TFP growth were around a third smaller, while in the 2005–09 period they were almost half as large. However, the opposite was true when size is measured in terms of employment. Firms that increased productivity most were around 20 percent larger in terms of number of employees in the 2010–14 period. However, the difference was not statistically significant in the 2005-09 sample. Moreover, both groups of firms were smaller than average, i.e. the largest of the firms, in terms of employment, were not part of either the group of firms that had the highest TFP growth nor the group with the lowest TFP growth.



Sources: Orbis; and IMF staff calculations.

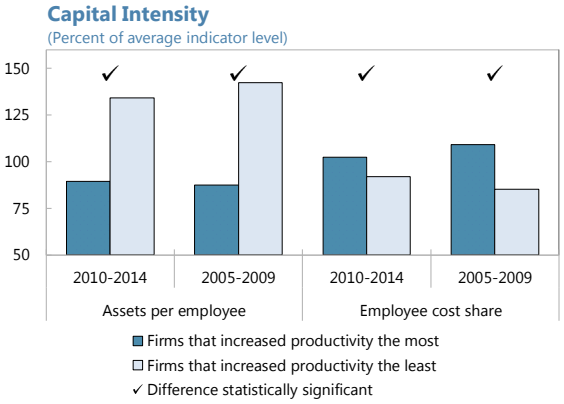
13. The role of firm age changed over time and firms with lower average labor costs saw larger productivity gains. The average firm that belonged to the high TFP growth group was older in the 2010–14 period, but was younger in the 2005–09 period. The difference in firm age is statistically significant. While younger firms are typically expected to be more dynamic, innovative, and faster growing, as seen in the 2005–09 sample, it is possible that in the environment of relatively higher uncertainty in the post crisis period, firm maturity and track record were assets that the older firms were able to exploit. This could be interpreted as reduced economic dynamism. Interestingly, average labor costs—a proxy for worker



Sources: Orbis; and IMF staff calculations.

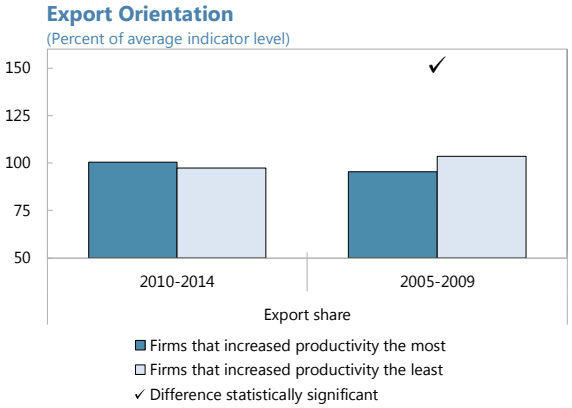
skill level—was lower for firms belonging to the high productivity growth group. It appears that firms that did well relied more on lower-skilled labor.

14. Firms that witnessed greater TFP growth were more labor intensive. In both periods, firms that increased productivity most had smaller assets per employee—roughly 2/3—compared with firms that saw the least increase in productivity. This result is reinforced by the employee cost shares, which was higher in firms with higher TFP growth. These, taken together with the earlier result of lower skill level in firms that belonged to the high TFP growth group, suggests that TFP growth was probably primarily driven by the more traditional industries.



Sources: Orbis; and IMF staff calculations.

15. In line with the above findings, export orientation appears to have played a limited role. Export orientation, measured again at the 4-digit NACE industry level, did not play a major role. The difference in export orientation between firms that increased productivity most compared to firms that saw the smallest increase in productivity was statistically insignificant in the 2010–14 period, while in the 2005–09 period, more export-orientated firms saw a smaller increase in productivity.



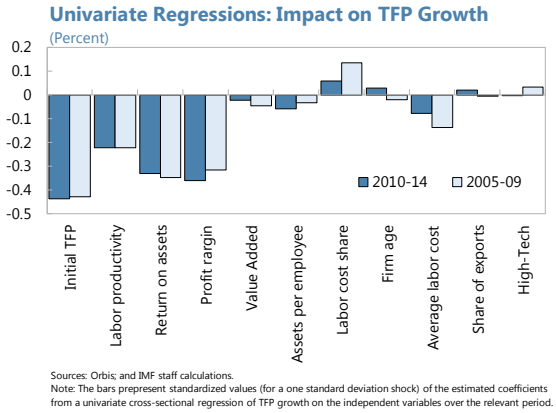
Sources: Orbis; and IMF staff calculations.

16. Regression analysis generally confirms the above results of the difference-in-means approach (Figure 7). Results continue to hold in univariate regressions, where the drivers of TPF growth are introduced one at a time. The results also go through in a multivariate setting, which controls for other included variables. Initial productivity and performance metrics have the largest impact, followed by average labor cost and capital intensity. Younger firms tend to be more productive, but this effect is weaker in the 2010–14 period. Belonging to the high-tech category and export orientation, albeit the latter with a small magnitude, were positively associated with productivity growth in the multiple regression setting (see Annex for detailed results).[8] In the multivariate setting, export orientation has a slightly positive association with productivity growth.

[8] The multivariate specification addresses the question whether being classified as high-tech has an impact on productivity growth compared to all other firms in the sample, while the approach in section B investigates the effect of being high-tech within manufacturing and services.

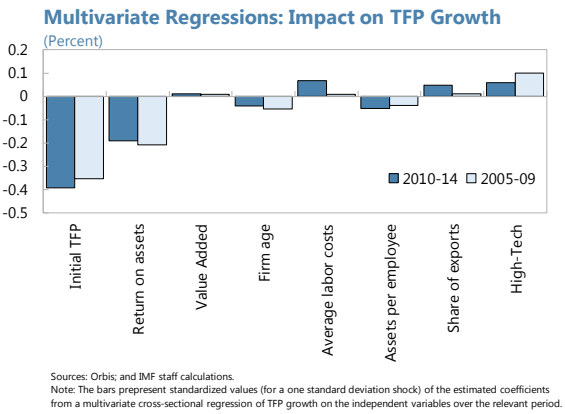
Figure 7. Estonia: Drivers of Productivity: Regression Analysis

Univariate regressions confirm difference in mean results…



Sources: Orbis; and IMF staff calculations.
Note: The bars prepresent standardized values (for a one standard deviation shock) of the estimated coefficients from a univariate cross-sectional regression of TFP growth on the independent variables over the relevant period.

…which largely go through in a multiple regression model.



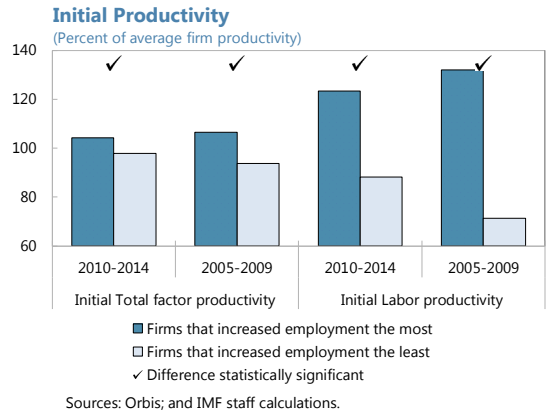
Sources: Orbis; and IMF staff calculations.
Note: The bars prepresent standardized values (for a one standard deviation shock) of the estimated coefficients from a multivariate cross-sectional regression of TFP growth on the independent variables over the relevant period.

C. Firm Characteristics and Employment Growth

17. A difference-in-means analysis is again employed in assessing which firm characteristics are conducive to employment generation. Again, firms are ranked and grouped into three buckets, but this time based on their change in employment. Thus in this section, the average characteristics of firms in the top and bottom buckets in terms of employment generation are compared to identify firm-level drivers of employment trends.

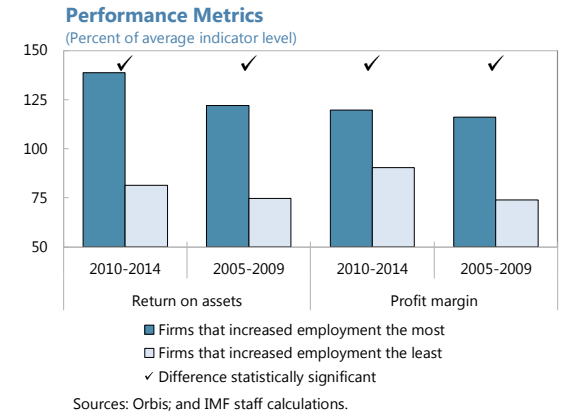
Figure 8. Estonia: Drivers of Employment

Firms that increased employment the most were on average more productive…



Sources: Orbis; and IMF staff calculations.

….and had significantly stronger performance metrics.



Sources: Orbis; and IMF staff calculations.

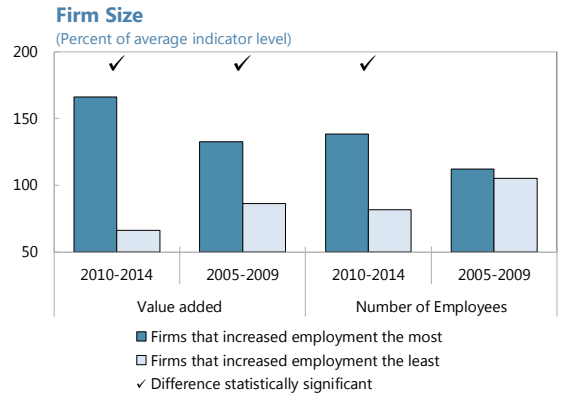
18. More productive firms saw greater increases in employment. In contrast to productivity growth, which was higher in firms that had low initial productivity, firms that increased employment the most were more productive—labor productivity of such firms was around 40 percent higher in the 2010–14 period and they were nearly twice as productive in the 2005–09 period when compared with firms that increased employment the least. The same holds true for other performance metrics, like return on assets, return on equity, and profit margins—firms that generated the most employment were significantly stronger (Figure 8).

19. Firms that increased employment more were larger and younger (Figure 9). The size of firms witnessing the greatest increase in employment was larger—around 2.5 times, in terms of value added, and around 70 percent, in terms of employment in the 2010–14 period. Such firms were also younger on average, and the difference in age was statistically significant. Compared with the results for TFP growth, it appears that although the larger and younger firms were increasing employment most, they were nevertheless amongst the group of firms that were at the bottom from regarding TFP growth.

20. Firms that employed higher-skilled labor, were more capital intensive, and more export oriented, increases employment more. Once again in contrast to the TFP growth results, firms that increased employment more had higher average labor costs, implying that they relied on higher-skilled labor. In the 2010–14 period, the average labor cost of the group of firms showing the greatest increase in employment was roughly a quarter higher than those that saw the smallest increase in employment. The difference was even larger, at close to 50 percent, in the 2005–09 period. Firms increasing employment most were also more capital intensive, with significantly higher assets per employee and a lower (close to 25 percent, both before and after the crisis) employee cost share. Finally, firms with larger employment increases were more export oriented.

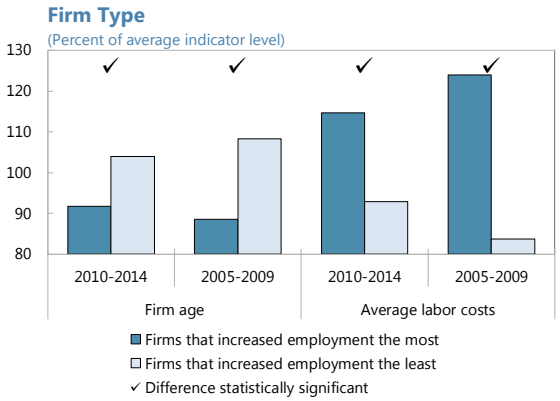
Figure 9. Estonia: Characteristics of Employment Generators

Larger firms increased employment more…



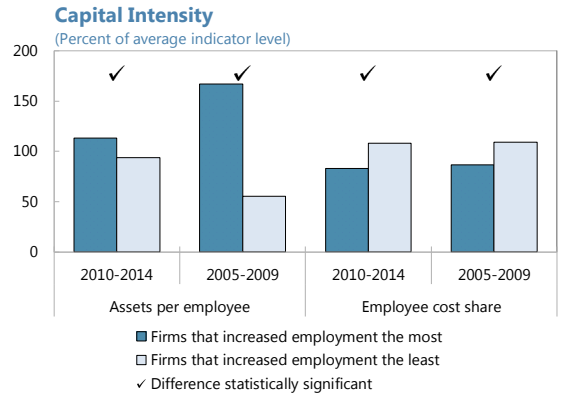
Sources: Orbis; and IMF staff calculations.

….as did younger firms and those reliant on higher skilled labor.



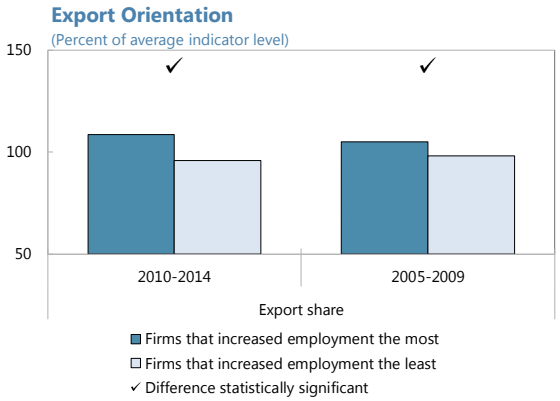
Sources: Orbis; and IMF staff calculations.

Firms generating employment were more capital intensive…



Sources: Orbis; and IMF staff calculations.

…as well as more export oriented.

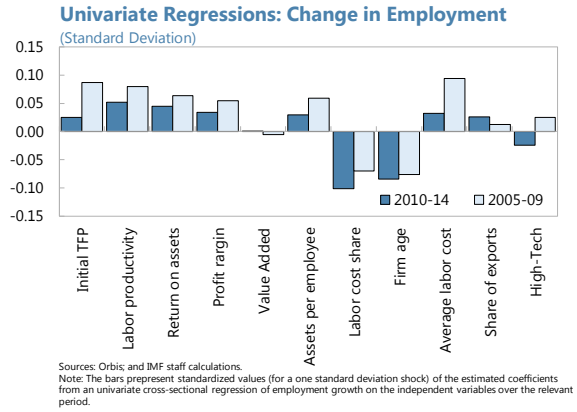


Sources: Orbis; and IMF staff calculations.

21. Regression analysis again broadly confirms the findings of the difference-in-means approach (Figure 10). Firms that increased employment, in order of importance, were younger, had higher average labor costs, were more capital intensive and had better performance ratios. Employment growth was also significantly lower in the 2010–14 period for high-tech firms.

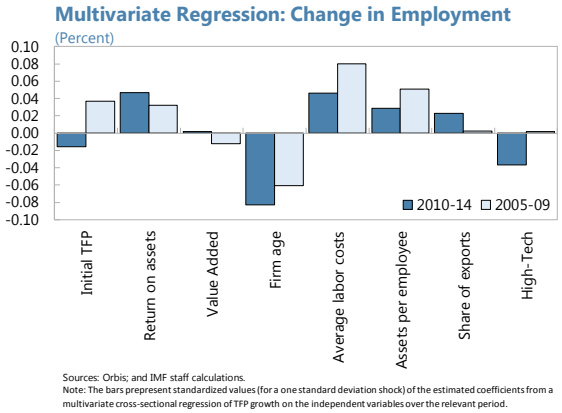
Figure 10. Estonia: Drivers of Employment: Regression Analysis

Regression results consistent with difference-in-means…



Sources: Orbis; and IMF staff calculations.
Note: The bars prepresent standardized values (for a one standard deviation shock) of the estimated coefficients from an univariate cross-sectional regression of employment growth on the independent variables over the relevant period.

….and multivariate regressions confirm findings.



Sources: Orbis; and IMF staff calculations.
Note: The bars prepresent standardized values (for a one standard deviation shock) of the estimated coefficients from a multivariate cross-sectional regression of TFP growth on the independent variables over the relevant period.

22. The effects of firm characteristics on employment growth and productivity growth were diametrically opposed in most cases. Firm characteristics that were associated with superior productivity performance were also associated with relatively low employment generation. This is true for all firm characteristics, except perhaps for firm age, where the effect on productivity is inconclusive.

Summary: Firm level drivers of productivity and employment growth

Firm characteristics	*Productivity Growth*	*Employment Growth*
Initial productivity	▼	▲
Performance metrics	▼	▲
Firm size	▼	▲
Firm age	▬	▼
Average labor costs	▼	▲
Capital intensity	▼	▲

D. Conclusions

23. Overall, catching-up and improvements in traditional firms were the main drivers of productivity growth. Catching-up, reflected in the important role played by initial productivity and performance metrics, was the main determinant of productivity growth. There is also evidence of strong productivity gains in the more traditional manufacturing sectors that was the backbone of aggregate productivity trends. Furthermore, TFP growth was generally not particularly driven by high-technology firms.

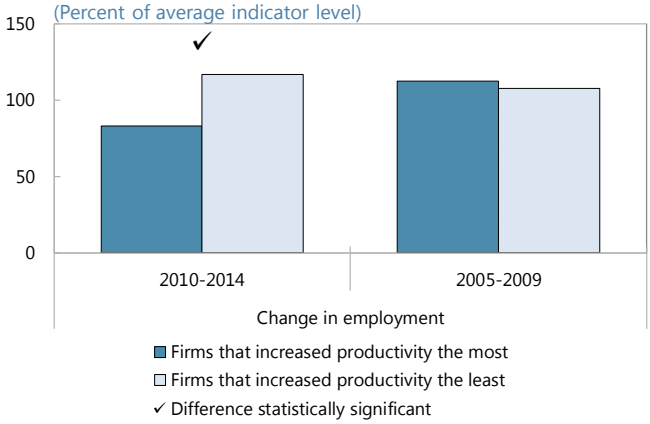
24. There are tentative signs of reduced firm dynamism. Firm age, which can be thought of as a proxy for firm dynamism, became less important for TFP growth in the period since 2010. While younger firms are typically expected to be more dynamic, innovative, and faster growing, as seen in the 2005–09 sample, it is possible that in the environment of relatively higher uncertainty in the post crisis period, firm maturity and track record was an asset that the older firms were able to exploit.

25. Labor rationalization, which seems to be particularly relevant in the case of Estonia, was a main source for productivity growth.

- Firms, which increased productivity the most, saw a lower increase in employment via-a-vis firms that increased productivity the least in the period 2010–14.
- The labor productivity-to-employment share elasticity, calculated using Eurostat macro-level data for the years 2005 and 2015 for EA12 and Estonia, indicates that for a given percentage change in the employment share, the relative change in labor productivity in the opposite direction is larger in every sector for Estonia. In line with the results above, the sectors displaying the strongest co-movements are the more traditional ones.
- Further research is needed to confirm these results and understand better why Estonia stands out.

Employment Change

(Percent of average indicator level)



Sources: Orbis; and IMF staff calculations.

Labor Productivity to Employment share elasticity, 2005–15

	EA12	EST
	(percent change)	
Agriculture	-1.6	-6.3
Manufacturing	-2.0	-3.9
Construction	0.0	-2.4
Trade	0.6	-3.2

Sources: Eurostat; and IMF staff calculations.

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Gilhooly, Bob, 2009, "Firm-level Estimates of Capital Stock and Productivity," *Economic and Labor Market Review*, Vol. 3, No. 5, pp. 36–41.

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Annex I. Data Sources and Regression Results

Table A1. Estonia: Orbis Data Coverage

Sector	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
					Percentage of Employment					
Agriculture	61.4	67.0	63.4	69.1	69.5	58.8	56.1	57.8	78.8	77.7
Manufacturing	43.4	45.5	47.0	48.9	46.6	50.0	51.8	48.4	53.2	52.4
Construction	32.7	36.2	37.3	33.2	30.0	36.4	40.5	44.5	45.2	41.6
Trade	47.9	57.2	60.1	55.4	47.5	50.6	49.8	50.0	51.1	49.0
Market Services	31.4	42.4	35.2	24.6	23.0	26.5	28.0	27.5	30.6	33.1
Basic Services	9.3	9.9	10.7	9.7	8.5	10.1	10.3	10.8	11.6	10.5
Total	**33.1**	**40.7**	**38.4**	**32.7**	**29.8**	**33.0**	**35.0**	**35.1**	**38.2**	**37.7**
					Percentage of Value Added					
Agriculture	91.6	90.4	78.9	95.5	91.0	82.0	83.9	85.0	98.3	107.4
Manufacturing	64.5	68.8	72.0	69.4	67.2	73.6	68.8	72.7	75.7	76.8
Construction	59.5	53.0	48.4	48.4	57.2	61.4	53.7	59.9	63.6	59.0
Trade	71.4	73.4	83.0	78.3	76.7	77.8	78.3	82.8	83.8	77.3
Market Services	58.9	67.5	66.0	64.1	59.5	68.3	68.9	64.2	66.5	66.4
Basic Services	12.9	15.0	16.8	18.0	15.0	15.4	16.1	15.6	15.9	15.5
Total	**52.7**	**56.2**	**57.0**	**56.8**	**53.9**	**57.0**	**56.4**	**56.1**	**58.8**	**57.8**

Sources: Orbis; Statistics Estonia; and IMF staff calculations.

Table A2. Orbis: Number of Estonian Firms with Useable Data

Sector	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
					Number of firms with data on Employees					
Agriculture	2,115	2,284	2,521	2,809	2,751	3,393	3,673	4,016	4,254	4,200
Manufacturing	2,789	3,020	3,305	3,536	3,288	4,051	4,295	4,606	4,763	4,538
Construction	2,413	3,016	3,854	4,306	3,956	5,039	5,554	6,115	6,400	6,042
Trade	5,491	5,879	6,352	6,899	6,424	8,035	8,494	9,100	9,319	8,824
Market Services	9,436	10,559	11,848	13,305	12,596	15,911	17,179	18,891	19,836	19,036
Basic Services	1,091	1,215	1,423	1,595	1,498	2,006	2,193	2,343	2,420	2,208
Total	**23,335**	**25,973**	**29,303**	**32,450**	**30,513**	**38,435**	**41,388**	**45,071**	**46,992**	**44,848**
					Number of firms with data on Value Added and Labor Productivity					
Agriculture	1,566	1,673	1,838	2,037	1,977	2,369	2,553	2,820	2,973	2,954
Manufacturing	2,018	2,217	2,411	2,574	2,345	2,857	3,007	3,203	3,309	3,149
Construction	1,685	2,146	2,736	3,054	2,681	3,312	3,634	3,991	4,238	4,055
Trade	3,814	4,081	4,377	4,680	4,285	5,129	5,294	5,602	5,610	5,295
Market Services	6,796	7,500	8,370	9,037	8,391	10,350	10,854	11,831	12,331	11,829
Basic Services	786	872	1,016	1,119	997	1,285	1,384	1,478	1,526	1,430
Total	**16,665**	**18,489**	**20,748**	**22,501**	**20,676**	**25,302**	**26,726**	**28,925**	**29,987**	**28,712**
					Number of firms with data on Total Factor Productivity					
Agriculture	1,511	1,625	1,786	1,950	1,884	2,277	2,462	2,718	2,870	2,849
Manufacturing	1,963	2,164	2,345	2,480	2,212	2,715	2,891	3,066	3,166	3,023
Construction	1,644	2,095	2,640	2,869	2,358	2,965	3,417	3,756	4,008	3,820
Trade	3,654	3,937	4,167	4,337	3,820	4,663	4,905	5,204	5,256	4,955
Market Services	6,479	7,193	7,920	8,383	7,520	9,481	10,135	11,043	11,465	11,072
Basic Services	750	838	966	1,031	883	1,179	1,283	1,381	1,424	1,326
Total	**16,001**	**17,852**	**19,824**	**21,050**	**18,677**	**23,280**	**25,093**	**27,168**	**28,189**	**27,045**

Sources: Orbis; and IMF staff calculations.

Table A3. Estonia: Difference-in-Means Results: Change in TFP

Average Firm Characteristic	Change in Total Factor Productivity							
	2010-2014				2005-2009			
	Top third	Bottom third	Difference	t-stat	Top third	Bottom third	Difference	t-stat
Total factor productivity	2.54	3.41	-0.87	-37.89	2.64	3.48	-0.83	-32.89
Labor productivity	126.88	266.68	-139.80	-19.20	135.81	291.68	-155.87	-14.87
Return on equity	-12.48	26.73	-39.20	-23.59	7.53	34.86	-27.34	-18.04
Return on assets	-0.31	16.46	-16.77	-36.35	6.32	21.39	-15.07	-30.09
Profit rargin	-0.96	12.18	-13.14	-35.96	4.04	13.82	-9.78	-25.13
Size (Value Added)	1245.56	1955.05	-709.48	-4.46	1715.02	3191.32	-1476.30	-5.90
Size (Number of employees)	8.77	7.31	1.45	2.63	13.37	12.92	0.45	0.32
Assets per employee	75.82	113.76	-37.94	-2.74	49.12	79.99	-30.87	-2.52
Employee cost share	24.31	21.81	2.50	6.93	23.08	18.02	5.06	12.90
Firm age	9.17	8.74	0.43	3.36	7.47	7.79	-0.32	-2.43
Average cost of employees	8.18	9.83	-1.65	-7.94	5.63	7.57	-1.94	-11.07
Current ratio	4.06	5.32	-1.26	-7.01	3.08	4.33	-1.25	-7.57
Liquidity ratio	3.42	4.62	-1.20	-7.10	2.51	3.69	-1.18	-7.33
Solvency ratio	51.28	60.73	-9.45	-15.14	48.47	59.68	-11.21	-16.80
Gearing	78.05	48.27	29.78	10.20	85.94	44.55	41.40	12.80

Table A4. Estonia: Difference-in-Means Results: Change in Employment

Average Firm Characteristic	Change in Employment							
	2010-2014				2005-2009			
	Top	Bottom	Difference	t-stat	Top	Bottom	Difference	t-stat
Total factor productivity	3.12	2.92	0.19	10.36	3.26	2.87	0.39	15.93
Labor productivity	210.27	150.40	59.87	10.51	270.64	146.47	124.17	12.32
Return on equity	11.10	0.29	10.81	9.23	27.33	11.46	15.87	11.24
Return on assets	9.06	5.31	3.76	11.15	15.30	9.36	5.93	13.55
Profit rargin	5.51	4.16	1.35	4.72	9.62	6.13	3.49	10.20
Size (Value Added)	2978.75	1190.75	1788.01	10.69	3428.06	2235.26	1192.80	4.47
Size (Number of employees)	13.34	7.85	5.49	6.31	16.50	15.46	1.03	0.83
Assets per employee	134.97	111.79	23.18	1.94	142.44	47.09	95.34	7.56
Employee cost share	20.32	26.51	-6.19	-21.97	18.27	23.05	-4.78	-13.09
Firm age	8.38	9.50	-1.12	-12.78	6.82	8.35	-1.53	-13.09
Average cost of employees	9.67	7.83	1.84	14.12	7.77	5.25	2.52	19.24
Current ratio	4.20	5.89	-1.69	-12.26	3.44	3.70	-0.26	-1.87
Liquidity ratio	3.48	5.07	-1.59	-12.20	2.77	2.91	-0.14	-1.09
Solvency ratio	51.83	59.53	-7.70	-18.15	50.58	52.13	-1.56	-2.76
Gearing	73.52	54.95	18.58	9.66	71.55	68.21	3.34	1.22

Table A5. Estonia: Regression Results

	TFP Growth		Change in Employment	
	2010-2014	2005-2009	2010-2014	2005-2009
		Univariate Regressions1		
Total factor productivity	-0.3889***	-0.4012***	0.0213***	0.0791***
	(0.0067)	(0.0091)	(0.0037)	(0.0054)
Labor productivity	-0.0007***	-0.0006***	0.0001***	0.0002***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Return on assets	-0.0146***	-0.0166***	0.0018***	0.0027***
	(0.0004)	(0.0005)	(0.0001)	(0.0002)
Return on equity	-0.0030***	-0.0036***	0.0004***	0.0007***
	(0.0001)	(0.0002)	(0.0000)	(0.0001)
Profit rargin	-0.0205***	-0.0199***	0.0016***	0.0030***
	(0.0004)	(0.0006)	(0.0002)	(0.0003)
Value Added	-0.0184**	-0.0402***	0.0004	-0.0045
	(0.0072)	(0.0095)	(0.0039)	(0.0053)
Number of employees	0.0002	0.0003*	-0.0002***	-0.0005***
	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Assets per employee	-0.0097***	-0.0074***	0.0032***	0.0099***
	(0.0014)	(0.0025)	(0.0004)	(0.0009)
Labor cost share	0.0033***	0.0081***	-0.0052***	-0.0040***
	(0.0005)	(0.0006)	(0.0002)	(0.0003)
Firm age	0.0044***	-0.0029*	-0.0125***	-0.0123***
	(0.0012)	(0.0016)	(0.0005)	(0.0008)
Average cost of employees	-0.0081***	-0.0201***	0.0036***	0.0142***
	(0.0009)	(0.0015)	(0.0004)	(0.0008)
Share of exports	0.0931**	-0.0194	0.1194***	0.0662**
	(0.0383)	(0.0547)	(0.0163)	(0.0268)
High-Tech	-0.0021	0.0892***	-0.0610***	0.0670***
	(0.0219)	(0.0283)	(0.0090)	(0.0138)
		Multivariate Regression		
Total factor productivity	-0.3506***	-0.3331***	-0.0134***	0.0339***
	(0.0078)	(0.0110)	(0.0043)	(0.0065)
Return on assets	-0.0085***	-0.0099***	0.0020***	0.0015***
	(0.0004)	(0.0005)	(0.0002)	(0.0003)
Value Added	0.0087	0.0073	0.0015	-0.0113**
	(0.0064)	(0.0088)	(0.0039)	(0.0057)
Firm age	-0.0060***	-0.0081***	-0.0121***	-0.0096***
	(0.0011)	(0.0015)	(0.0006)	(0.0009)
Average labor cost	0.0070***	0.0012	0.0050***	0.0121***
	(0.0009)	(0.0016)	(0.0005)	(0.0010)
Assets per employee	-0.0089***	-0.0155***	0.0050***	0.0166***
	(0.0013)	(0.0039)	(0.0008)	(0.0019)
Share of exports	0.2166***	0.0605	0.1060***	0.0115
	(0.0343)	(0.0495)	(0.0198)	(0.0309)
High-Tech	0.1542***	0.2719***	-0.0954***	0.0047
	(0.0199)	(0.0263)	(0.0113)	(0.0162)
Number of obs.	14767	10543	16896	12321
R-squared	0.221	0.192	0.043	0.046

Source: Orbis; and IMF staff calculations
Note: Standard deviation in parenthesis. *, **, *** denotes statistical significance at 10 percent, 5 percent and 1 percent level respectively