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The European Construction Value Chain: Performance, Challenges and Role in the GVC

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The European Construction Value Chain: Performance, Challenges and Role in the GVC

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Abstract

Several years after the global slump, the construction industry and many countries and sectors with construction-related activities and firms tied to them still feel the impact of that financial and economic crisis. In contrast, several years prior to the crisis, there had been a major construction bubble. This report outlines the significance of the construction sector for the EU economy, given its potential in job creation in micro and small enterprises as well as its role as a major consumer of intermediate products and related services. Developments within the industry have wide-reaching implications for the nature of growth that can be achieved, not least in terms of achieving the ambition of smart, sustainable and inclusive growth that is at the heart of the Europe 2020 strategy. Furthermore, a modernisation of the sector and improvements in the efficiency of building construction are also key aspects for the transformation of the EU's energy system as pointed out in the 'Energy Roadmap 2050'. In this context, the Commission introduced its 'Strategy for the sustainable competitiveness of the construction sector and its enterprises' that contained a proposed Action Plan Construction 2020 aimed at addressing challenges within the 2020 time horizon. This Action Plan focuses on five thematic priorities which aim to address economic, skills, environmental, regulatory, and international challenges. This study provides an assessment of the role and dynamics of the construction industry in the European Union and its interlinkages with other industries over the last fifteen years. The report draws a picture of a sector in transformation, partly still suffering from the ramifications of the global crisis, and points to the new foundations from which the sector and the whole value chain can develop towards the future.

Keywords: construction industry, construction value chains, trade, qualitative scenarios

JEL classification: L1, L74

CONTENTS

TABLES AND FIGURES

ABBREVIATIONS AND ACRONYMS USED IN THIS REPORT:

Acronym	Description
AMNE	Activity of Multinational Enterprises
CPC	Central Product Classification
CVC	Construction Value Chain
EBOPS	Extended Balance of Payments Services
EC	European Commission
ESA	European System of Accounts
ESM	European Stability Mechanism
EU	European Union
EU 27	European Union *excluding* Croatia
FATS	Foreign Affiliate Trade Statistics
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GVC	Global Value Chain
HHI	Herfindahl-Hirschman Index
HS	Harmonised System
IO	Input-Output
ISIC	International Standard Industrial Classification
M&A	Mergers and Acquisitions
MS	Member State
NACE	Statistical classification of economic activities in the European Community (Nomenclature statistique des activités économiques dans la Communauté européenne)
OECD	Organisation of Economic Cooperation and Development
PE	Private Equity
R&D	Research and Development
RCA	Revealed Comparative Advantage
SITC	Standard International Trade Classification
STRI	Services Trade Restrictiveness Index
SUT	Supply and Use Table
ToR	Terms of reference / Request for Services
TRAINS	Trade Analysis Information System
TTBD	Temporary Trade Barriers Database
WIOD	World Input-Output Database
WIOT	World Input-Output Tables
WTO	World Trade Organisation

1. Introduction

1.1. THE EU POLICY CONTEXT

The European Commission has repeatedly acknowledged the significance of the construction sector for the EU economy[1], given its potential in job creation in micro and small enterprises as well as its role as major consumer of intermediate products and related services. Developments within the industry have wide-reaching implications for the nature of growth that can be achieved, not least in terms of achieving the ambition of smart, sustainable and inclusive growth that is at the heart of the Europe 2020 strategy.[2] Furthermore, a modernisation of the sector and improvement in the efficiency of building construction are also key aspects for the transformation of the EU's energy system as pointed out in the 'Energy Roadmap 2050'[3], having a significant impact on energy, climate change and the environment.

In this context, the Commission introduced its 'Strategy for the sustainable competitiveness of the construction sector and its enterprises' that contained a proposed Action Plan *Construction 2020* aimed at addressing challenges within the 2020 time horizon.[4] The Action Plan focuses on five thematic priorities which aim to address economic, skills, environmental, regulatory, and international challenges. These are explained in more detail below:

› **Action 1: Stimulating favourable investment conditions** – With a view to creating favourable investment conditions to enhance the sustainable competitiveness of the construction sector, a number of financial instruments are being aligned to meet the needs of industry while addressing key policy objectives (e.g. energy efficiency).

› **Action 2: Improving the human-capital basis of the construction sector** – The sector is characterised by (future) skills shortages and the need to equip workers with skills to meet a widening array of sustainable construction policy objectives. A strategic approach is required to identify skills needs, tailor training programmes, attract more students to the industry etc.

› **Action 3: Improving resource efficiency** – Given the high energy and resource use associated with the sector (as identified in the Roadmap to a Resource Efficient Europe)[5], there is strong recognition that construction activities should take account of all natural resources required during the life-cycle of buildings and infrastructure.

› **Action 4: Strengthening the Internal Market for construction** – The Commission is keen to ensure that the legal framework is as clear and predictable as possible and that administrative costs for

1 COM (2012) 433.
2 COM (2010) 2020.
3 COM (2011) 885/2.
4 COM (2012) 433.
5 COM (2011) 571.

construction firms are proportionate to the objectives pursued (e.g. with a view to reducing market access problems).

› **Action 5: International Competitiveness** – The thrust of EU policy in this area seeks to strengthen firms' capabilities to engage and participate at an international level and ensure a level playing field in international construction markets.

The construction sector also falls under the scope of the Circular Economy Package adopted in 2015[6] to stimulate Europe's transition towards a stronger and sustainability-oriented economy. The goal is to increase the re-using, recycling and recovering of construction and demolition waste by 2020. Established within the Waste Framework Directive[7] and reaffirmed under the Circular Economy Package, it represents a valuable business opportunity for the construction value chain. In addition, DG GROW set up and runs the European Construction Sector Observatory (ECSO), a 3-year initiative under COSME for the 2015-2017 period. The Observatory serves as a platform to inform policy-makers as well as stakeholders on the market conditions and developments in policy of the construction sector in the 28 EU countries. The ECSO provides analysis, for most countries, of key policies and comparative assessments.

This study provides an assessment of the role and dynamics of the construction industry and its interlinkages with other industries over the last fifteen years in the European Union. The study is an empirical study, based firmly and uniquely on quantitative analysis. The study covers the period 2000-2014[8], in the middle of which Europe was hit by a severe economic and financial crisis. Given the ramifications of the crisis and the interpretation of the results, the study considers 2008-2009 as the crisis years. However, even several years afterwards many sectors and countries, with construction-related activities and firms tied to them, still felt the impact of this financial and economic crisis (see chapter 3.2). In contrast, several years prior to the crisis, there has been a major construction bubble, which is evident in the production statistics. The combination of these market swings means that the period under study is rather dynamic. Nevertheless, rather than this being an issue, it is a fascinating opportunity to observe a sector in transformation, albeit hard at times, and give a chance to study the new foundations from which the sector and the whole value chain can develop towards the future.

1.2. DEFINING THE 'CONSTRUCTION VALUE CHAINS'

For the purposes of this report, a value chain can generally be understood as a description of all the relationships between economic actors that are involved in the delivery of a product or service to their end user.[9] Essentially, a value chain is a representation of the way that production activities are organised so as to create, capture and preserve value through the delivery of a product or service to their end user. The value created within the chain is ultimately derived from the benefit the final user obtains from the product or service and, in monetary terms, is reflected in the amount that the end user is willing to pay for the product or service (less its associated costs of production).

6 COM (2015) 614

7 DIR 2008/98/EC

8 This is the latest available data that can be considered as trustworthy for all data sources, indicators and level of detail necessary (NACE 3-digit).

9 Buildings Performance Institute Europe (BPIE), (2016), 'Driving Transformational Change in the Construction Value Chain: Reaching the Untapped Potential'.

Although the value chain is often closely allied to the supply chain of a product or service, they can be distinguished from each other. A supply chain represents the organisation of production inputs and processes that is required to produce and deliver a product or service to a customer. As such, the supply chain is primarily concerned with the downstream flow of goods and services from their source to the final customer. By contrast, since the customer (or end user) represents the source of value within the value chain, a value chain perspective looks at it as an upstream flow. In general, from a business model perspective, '*supply chains focus upstream on integrating supplier and producer processes, improving efficiency and reducing waste'*. By contrast, '*value chains focus downstream, on creating value in the eyes of the customer*'[10]. Typically, therefore, a value chain approach is concerned with improving their organisation of production activities within the chain so that the supply of product or services is (better) aligned to the demands of customer and, accordingly, is focused on activities such as innovation, product development, design and marketing etc. that enhance consumer value.

Construction value chain: overview

The construction sector is characterised by a complex value chain, which envelops on-site construction activities, together with raw materials supply and the manufacture of construction materials and products that contribute to the 'upstream' construction supply chain. It also covers a range of knowledge-intensive services provided by private enterprises and public knowledge organisations, including architectural and engineering consultancy services. More broadly, taking a 'life-cycle' view, which is not limited to the design and execution of construction works but also the 'user phase' and eventual renovation or demolition, a range of additional actors in the construction value chain come into play, including those connected to the operation and maintenance of buildings during their lifetime. Casting the net further, many other actors from sectors normally considered outside the scope of the construction sector may be more or less directly linked to construction (e.g. energy and utility suppliers, ICT suppliers, financial and professional services). To these we can add the various local, national and European authorities that set legal and regulatory frameworks for construction and influence the broader business and other framework conditions affecting construction activities.

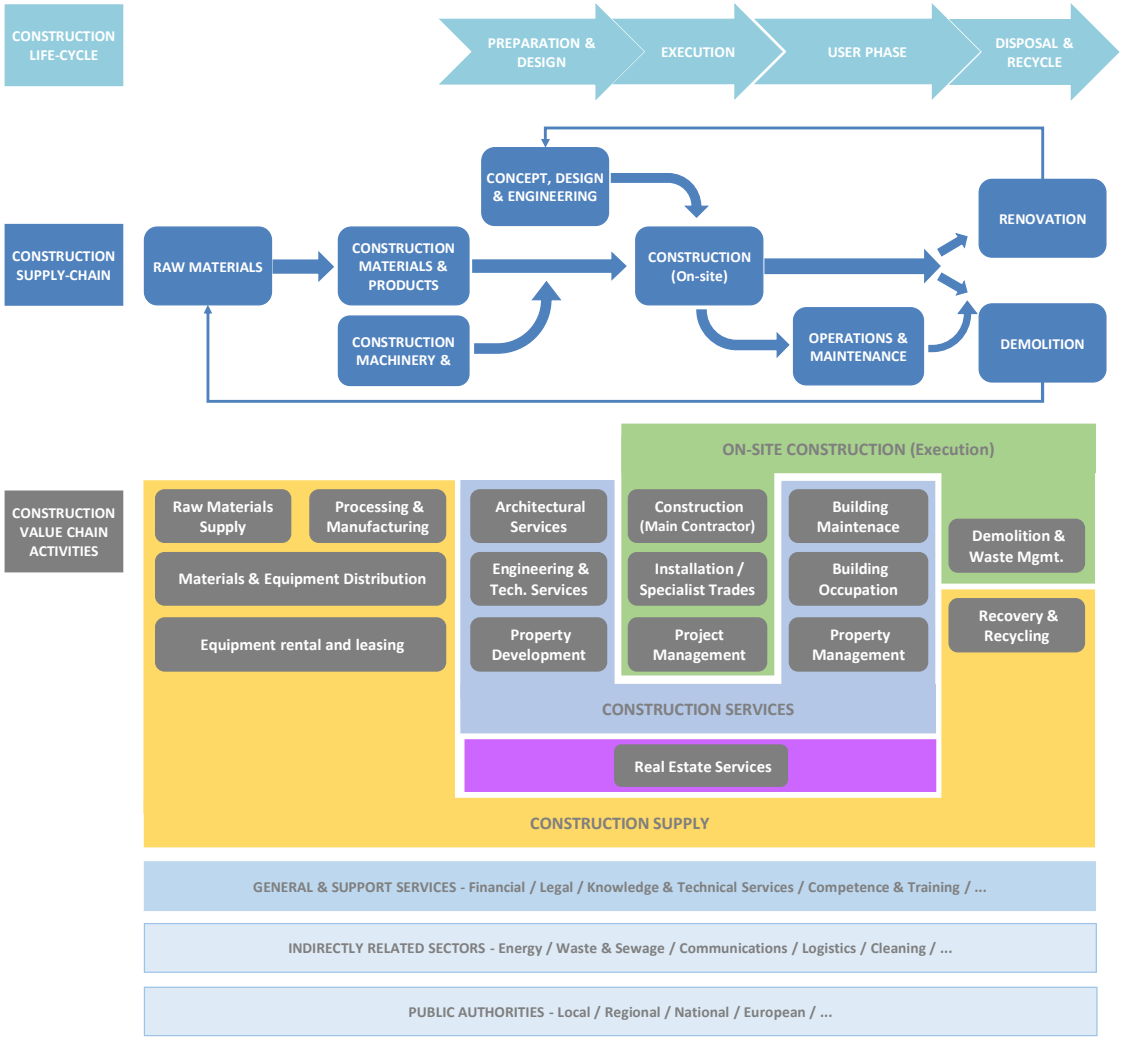
Drawing on Ecorys (2010)[11] and BPIE (2016)[12], Figure 1 provides a visualisation of the main elements of the construction value chain, linking a life-cycle perspective to a supply chain approach and illustrating activities that traditionally occupy a 'key' position within the chain.

[10] Feller, A., D. Shunk and T. Callarman (2006), 'Value chains versus supply chains*', BP Trends*, March 2006.

[11] Ecorys (2010), 'Sustainable Competitiveness of the Construction Sector', implemented under Framework Contract N° B1/ENTR/06/054.

[12] Buildings Performance Institute Europe (BPIE), (2016), 'Driving Transformational Change in the Construction Value Chain: Reaching the Untapped Potential'.

Figure 1 / The Construction Value Chain (CVC)



Source: Ecorys.

Within the above 'life-cycle' setting we can distinguish three core sets of activities within the construction value chain:

› **On-site Construction (execution)**: covering all aspects of the on-site execution of construction works, from site preparation to building completion for 'new-build' activities, together with any subsequent renovation (or retrofitting) activities, through to the ultimate demolition phase and possible site remediation activities;

› **Construction Services**: for which we can distinguish between:

- ***Professional construction services***: encompassing activities such as architectural, engineering (civil, structural and building services), building control, surveying, project management, etc., which primarily intervene in the preparation, design and execution phases of the construction life-cycle;

- ***Building operational services***: covering activities, such as building maintenance and property/facility management services, which are associated more closely to the 'use' phase of the construction life-cycle.

› **Construction Supply (materials and equipment)**: for which we can distinguish between:

- ***Construction materials and products***: which stretches backwards to include, for example, extractive industries providing raw materials, processing and manufacturing industries that turn raw materials into building products, and wholesale and retail chains that supply materials and products to the construction sector.
- ***Construction equipment***: covering the production and supply of construction machinery and equipment (e.g. earthmoving machines, road making equipment, construction site hoists / lifting equipment, and concrete equipment).

Furthermore, these core activities can be extended to include the **Real Estate** sector, which occupies a critical role in the functioning of markets for construction. This is evident from the sector's role in provision of management services for both commercial and residential properties and, also, its involvement in diverse activities throughout the construction life-cycle; e.g. planning, financing and investment, valuation, brokerage, facilities management, refurbishment and renovation, etc.

Looking beyond the above described main elements, a full mapping of the construction value chain may include a wide range of other supporting and related activities that, to a greater or lesser degree, contribute to construction activities and ultimately to the value of construction for users.

2. Construction sector and its value chain

This chapter describes what constitutes the Construction Value Chain (CVC), what are its main parts, what is its size and structure as well as the interdependencies that lie within it.

The construction sector itself is large and a significant part of the EU economy representing on its own around 3.5% of EU's GDP. However, the sector is a compiler of upstream goods and services, tying itself and others to a much larger eco-system called the 'construction value chain' (CVC). When considered in its entirety this represents around 8.2% of EU's GDP and employs around 23.2 million people (or around 10% of EU's total employment).

The CVC is complex, however, can be deconstructed and effectively analysed, with clear linkages and individual characteristics of different sectors. For example, although the construction sector does not really engage in extra-EU trade (only 3.3% of its inputs are imported), several of its input goods and services do, hence the importance to consider the CVC as a whole.

Main findings:

› The construction sector which stands at the core of the construction value chain (CVC)[13] *is a significant part of the EU economy.*

› It is a compiler of upstream products and services from its CVC, but 41% of its input structure is its value added.

› Around 30% of construction sector's intermediate inputs come from 'own supply' of construction company supplying another (such as sub-contracting).

› Over 70% of inputs to the construction sector consist either of materials and manufactured goods or are linked to their supply.

› *Computer, electronic and optical products* are imported in both large volumes as well as a share of inputs.

› The main upstream sectors are: Construction products, Mining and quarrying, Construction machinery, Intermediaries and Professional construction services.

› While the main downstream sector, the 'client' of the construction sector is: Real Estate

› The CVC, including major upstream and downstream economic activities, constitutes around 8% of EU GDP and 23 million jobs. Within these headline figures, the construction sector itself accounts for around half of the total.

[13] Unless stated otherwise, the construction sector is referred based on the classification in Annex I

› The size structure of the construction sector is relatively in line with the CVC as a whole (except for mining & quarrying and construction machinery, which are both highly concentrated sectors *of large firms).*

› Although the construction sector does not engage very much in extra-EU trade, upstream sectors do (e.g. for construction machinery, extra-EU trade represents 80% of total production).

› The majority of intra-EU trade takes place around northwest and central EU.

2.1. CONSTRUCTION SECTOR

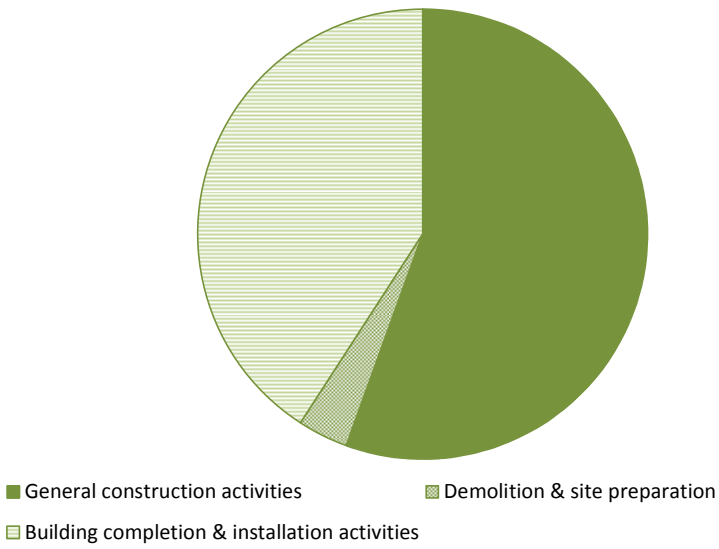
Main findings:

› The construction sector which stands at the core of the construction value chain (CVC)[14] *is a significant part of the EU economy.*

› It is a compiler of upstream products and services from its CVC, but 41% of its input structure is its value added.

The construction sector is a large part of the EU economy with annual value added of EUR 489 billion, or 3.5% of EU's GDP. In 2014 the sector employed 12.3 million people in 3.3 million companies across the EU.

Figure 2 / Composition of the construction sector by shares of value added



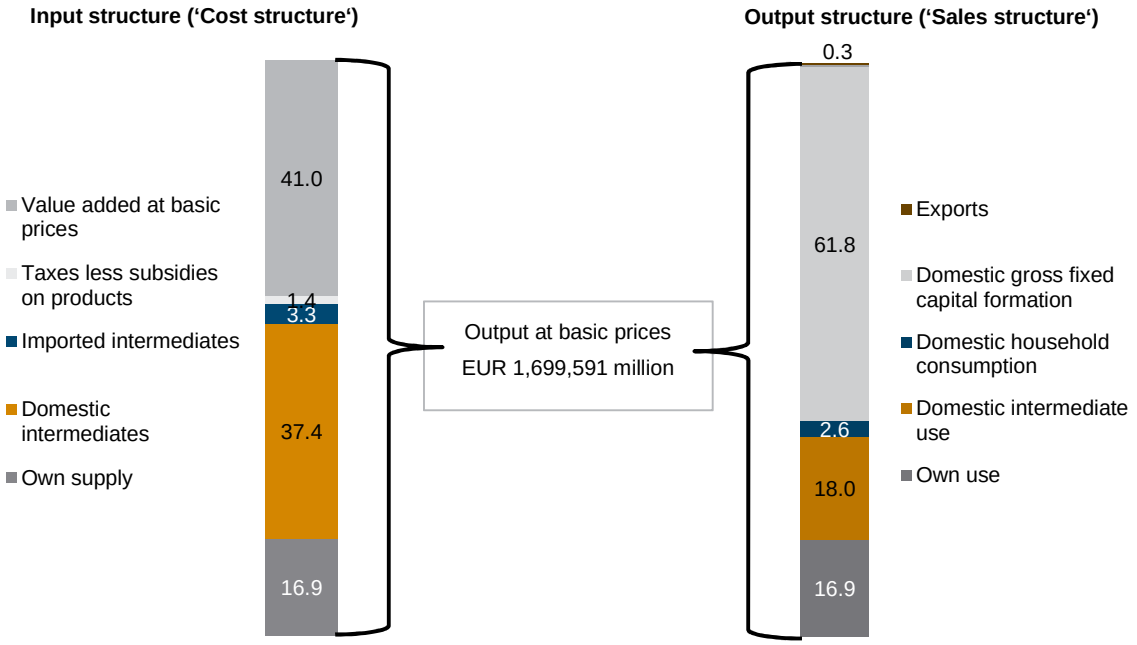
Source: Ecorys based on Eurostat Structural Business Statistics.

The construction sector is a compiler of upstream products and services. Almost 60% of the annual output of the construction sector is formed by inputs from other economic activities, with extra-EU input

[14] Unless stated otherwise, the construction sector is referred based on the classification in Annex I

imports playing a minimal part. Virtually all of the outputs of the construction sector are used domestically within the EU having only a negligible share of extra-EU exports by the construction sector.

Figure 3 / Inputs and outputs of the construction sector (in 2011[15])



Source: Eurostat; wiiw calculations.

2.2. STRUCTURE AND COMPOSITION OF CVC

The previous section provided an overview of the size of the construction sector and an overview of its input and output structures. In this section, a more detailed description of the composition of inputs used by the Construction sector is provided, including the extra-EU imported intermediaries. This is combined with an assessment of the sectorial breakdown of construction demand (the client of the construction sector).

At the end of the chapter the reader should have an overview of the complexity of the CVC and major upstream sectors are selected, that will be analysed throughout this study.

Main findings:

› Around 30% of construction sector's intermediate inputs come from 'own supply' of construction company supplying another (such as sub-contracting).

› Over 70% of inputs to the construction sector consist either of materials and manufactured goods or are linked to their supply.

[15] Although 2011 is the latest data, the analysis of the structure for previous years has revealed a very stable input & output division. In the absence of more recent data, it is assumed that structure revealed by the 2011 data is a reasonable approximation for the current structure.

› The main upstream sectors are: Construction products, Mining and quarrying, Construction machinery, Intermediaries and Professional construction services.

› The main downstream sector, the 'client' of the construction sector is: Real Estate

2.2.1. CVC upstream

The largest category of inputs used by the construction sector is 'own supply' of construction and construction works, which accounts for around 30% of total intermediate inputs (or 16.9% including value added in the total as presented in figure 3) used by the sector.[16] This consist of construction inputs that are supplied from one construction firm to another firm, referred to as 'own supply'. Such transactions may occur, for example, when a construction sub-contractor supplies goods or services to a main contractor.

Excluding this 'own supply' as well as 'value added'[17], Figure 4 shows the breakdown of the main non-construction goods and services inputs used by the EU construction sector. Over 70% of inputs to the construction sector consist either of materials and manufactured goods or are linked to their supply. Materials and manufactured goods make-up around half of construction inputs, for which the most important product categories are '*Other non-metallic mineral products*', which accounts for 13.1% of total value of 'intermediate' inputs, followed by '*Fabricated metal products, except machinery and equipment*' (9.5%), and '*Electrical equipment*', '*Rubber and plastic products*' and '*Wood and wood products*' each with a share of between 4 to 5%. Just under a fifth of inputs are accounted for by services linked to the supply and materials and equipment (e.g. transportation, distribution, and rental services), notably '*Wholesale trade services*'[18] (7.7%) and '*Rental and leasing services*' (3.7%). The most important services inputs are '*Architectural and engineering services; technical testing and analysis services*' (5.9%) and '*Real Estate services*' (4.3%).

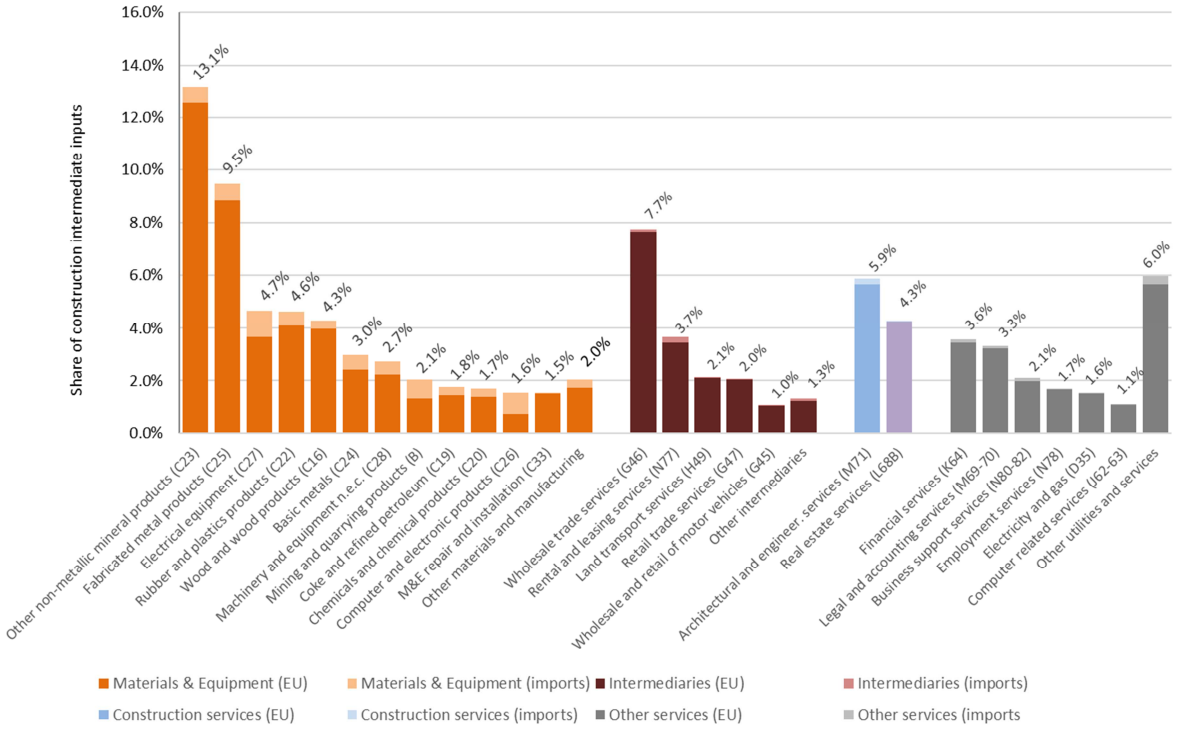
Although the overwhelming majority of inputs used by the EU construction sector are supplied from within the EU, with extra-EU imports accounting for less than 6% of the value of total inputs of products (again excluding value added from the calculation), imports are important for some specific product categories. For example, among the main input categories of goods and services used by the EU construction sector, the share of extra-EU imports is highest for '*Computer, electronic and optical products*' (56% imported), '*Mining and quarrying products*' (35%) and '*Electrical equipment*' (21%). By and large, however, high import intensities for these particular product categories are representative of high import levels across all economic activities rather than being specific to the construction sector.

[16] Total intermediate inputs equals the sum of 'own supply', 'domestic intermediates' and 'imported intermediates', as shown in Figure 2.

[17] That does not have inputs and largely constitutes of labour.

[18] The value for wholesale services is basically a measure of the trade margins earned by wholesalers on products sold to the construction sector.

Figure 4 / Composition of intermediate inputs used by the construction sector (2011)[19]



Source: Eurostat (Input-Output Tables), Ecorys calculations.

The previous analysis provides only a partial picture as it neglects second order effects whereby construction demand for a particular product has a 'knock-on' effect on the activities supplying inputs to the production of these products. For example, construction demand for non-metallic mineral products will have an impact on the demand for products from mining and quarrying that provide the raw products for non-metallic minerals production. Alternatively demand for fabricated metal products will impact on demand for basic metals. A more complete picture of the overall impact of construction demand is provided by the 'output multiplier'[20] which takes into account the direct and indirect (or secondary) impacts on demand from products.

The total output multiplier for the construction sector is estimated at 2.31 (in 2011), of which the largest component is the construction sector itself, with a value of 1.22.[21] Leaving aside this 'own supply' component, Figure 5 shows the other product categories whose output increases the most as a result of an increase in output (demand) of construction. These data indicate that the most important backward linkages are those to '*Non-metallic mineral products*', '*Fabricated metal products*' and '*Wholesale trade*

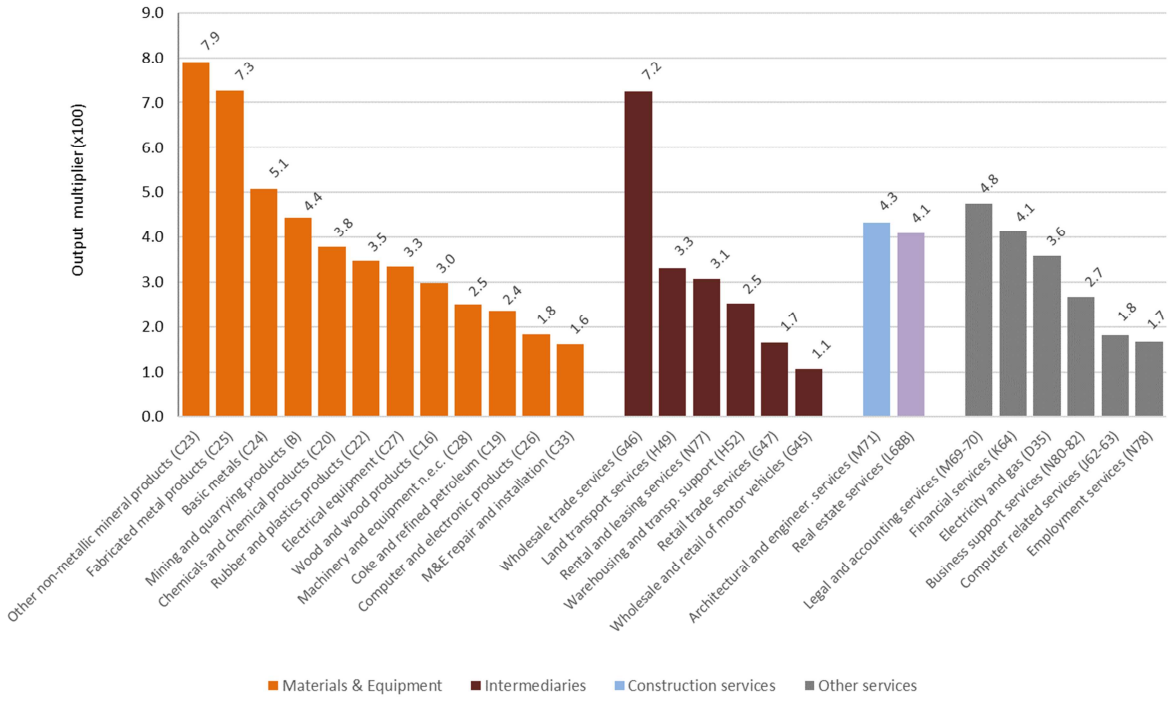
[19] Shares calculated on the basis of total intermediate inputs less 'own supply' of construction.

[20] The output multiplier is based on the Leontief-inverse, whereby the sum of column elements can be termed 'backward linkages'.

[21] The total output multiplier measures the total of all outputs (goods and services) required to produce one additional unit of output of a particular product. In the current case, construction is estimated to have a multiplier of 2.31, which implies that a EUR 1 increase in output of construction results in a total increase in outputs of products of EUR 2.31; of which EUR 1 is the final output of construction and EUR 1.31 is 'additional' output of other products and services. Part of this 'additional' output is generated within the construction sector itself (i.e. through 'own supply'), which accounts for why construction's contribution to the total multiplier is greater than 1.

services'. The broad pattern is similar to that seen in above. However, when comparing output multipliers with the input shares shown earlier, the backward linkages of construction to products such as '*Basic metals*', '*Mining and quarrying products*', '*Chemicals and chemical products*' and '*Land transport services*' appear relatively more important than indicated by their direct use as inputs into construction.

Figure 5 / Backward linkages of the construction sector – output multiplier (2011)



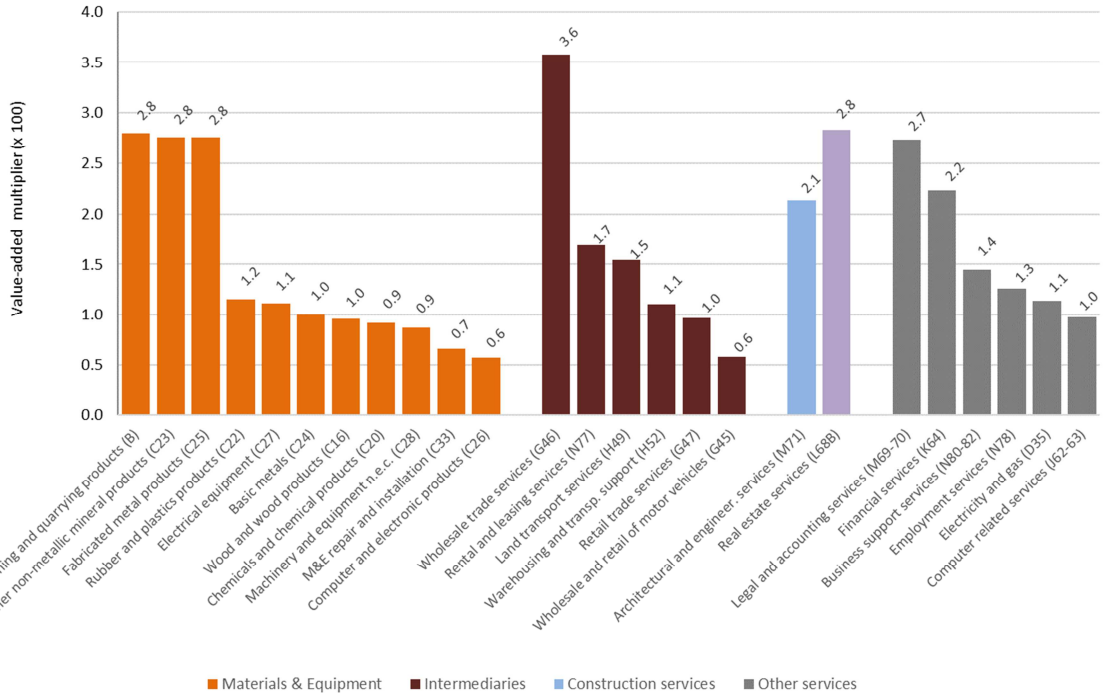
Source: Eurostat (Input-Output Tables), wiiw calculations.

As an alternative to the output multiplier, the impact of construction demand can also be examined in terms of value added. The overall total value added multiplier for the construction sector is estimated at 0.97, of which 0.5 is generated in construction and 0.47 from other goods and services.[22] Figure 6 depicts the main components of value added multiplier for these other goods and services. It is interesting is to compare the relative position of product categories shown in Figure 6, with previously shown data on shares in intermediate inputs and output multipliers. For example, additional demand from the construction sector creates marginally more value added in '*Mining and quarrying products*' than in '*Non-metallic mineral products*' and '*Fabricated metal products*'.

It is also noticeable that additional construction demand creates nearly as much value added in '*Legal and accounting services*' as it does in each of the three materials and equipment product categories just mentioned. Similarly, the value added generated in '*Financial services*' substantially exceeds that of products such as '*Rubber and plastics products*', *Electrical equipment*' and '*Basic metals*'.

[22] This implies that an additional EUR 1 of output (final demand) of construction generates (direct and indirect) domestic value added of EUR 0.97. Within this total, value added generated in construction itself amounts to EUR 0.50, while the value added generated in the other industries is EUR 0.47.

Figure 6 / Backward linkages of the construction sector – value added multiplier (2011)

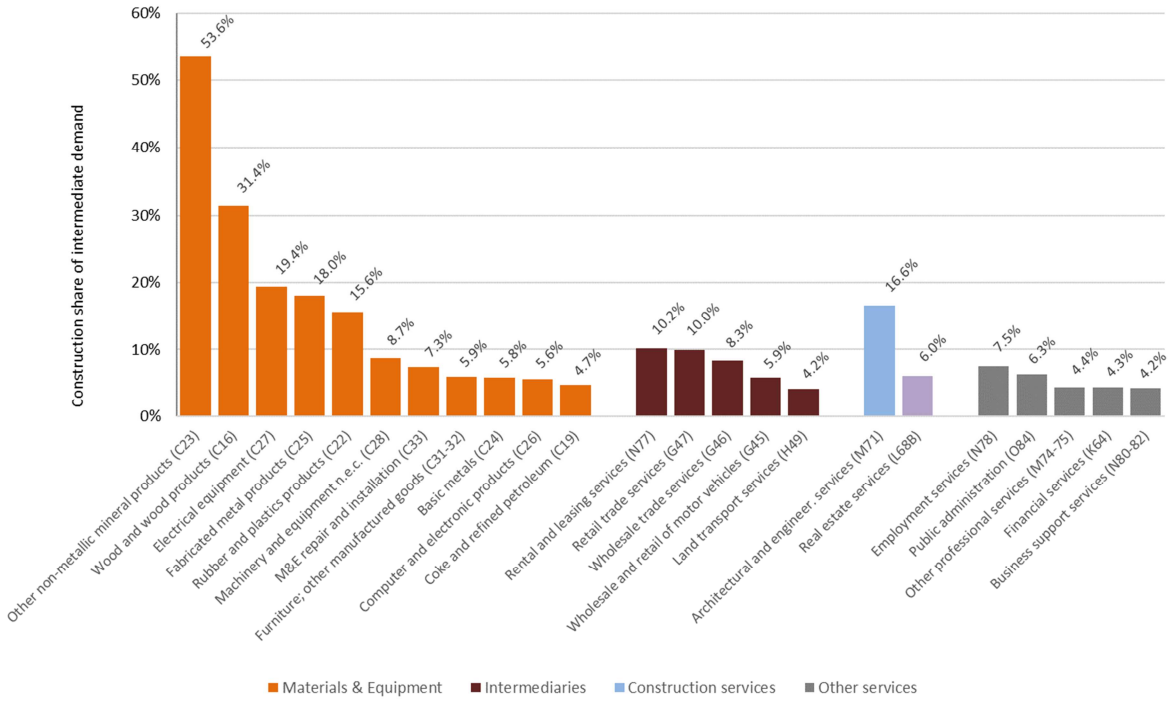


Source: Eurostat (Input-Output Tables), wiiw calculations.

Finally, the relationship between the construction sector and its input suppliers can also be considered from the perspective of the construction sector's share in total demand for particular types of goods and services; i.e. construction's importance as a source of demand for different products. Figure 7 shows the product categories for which the highest shares of total input demand coming from the construction sector.[23] It is clear that the construction sector represents a major outlet for many basic materials and manufactured goods. In particular, the construction sector accounts for more than half (53.6%) of intermediate demand for '*Other non-metallic mineral products*', nearly one-third (31.41%) of intermediate demand for '*Wood and of products of wood and cork*' and nearly one-fifth (19.4%) of intermediate demand for '*Electrical equipment*'. The sector also makes a major contribution to industry demand for '*Fabricated metals products*', and '*Rubber and plastics products*'.

[23] The estimated shares are calculated on the basis of total intermediate consumption use for each product category. Other use categories, such as final consumption use (e.g. by households or government), gross fixed capital formation or exports are not included in the calculation of total use. Therefore, the estimates do not measure the share of the construction sector in total demand but its share in total intermediate consumption demand from economic sectors (i.e. business and public sector production processes).

Figure 7 / Construction sector share in total demand for intermediate inputs (2011)[24]



Source: Eurostat (Input-Output Tables), Ecorys calculations.

2.2.2. CVC extra-EU import products

Focusing in greater detail on the 3.3% of extra-EU imports that constitute the inputs into the construction sector as presented in Figure 3, significant differences arise across product categories. Figure 8 reports the 17 most important products that are imported[25], namely those products accounting for more than 1% of total imported intermediates.

The different products are arranged both in terms of their size of the overall imported intermediaries (along the x-axis): meaning that *electrical equipment* is the most imported of all products, representing just over 12% of all the imported products that are inputs into the construction sector.

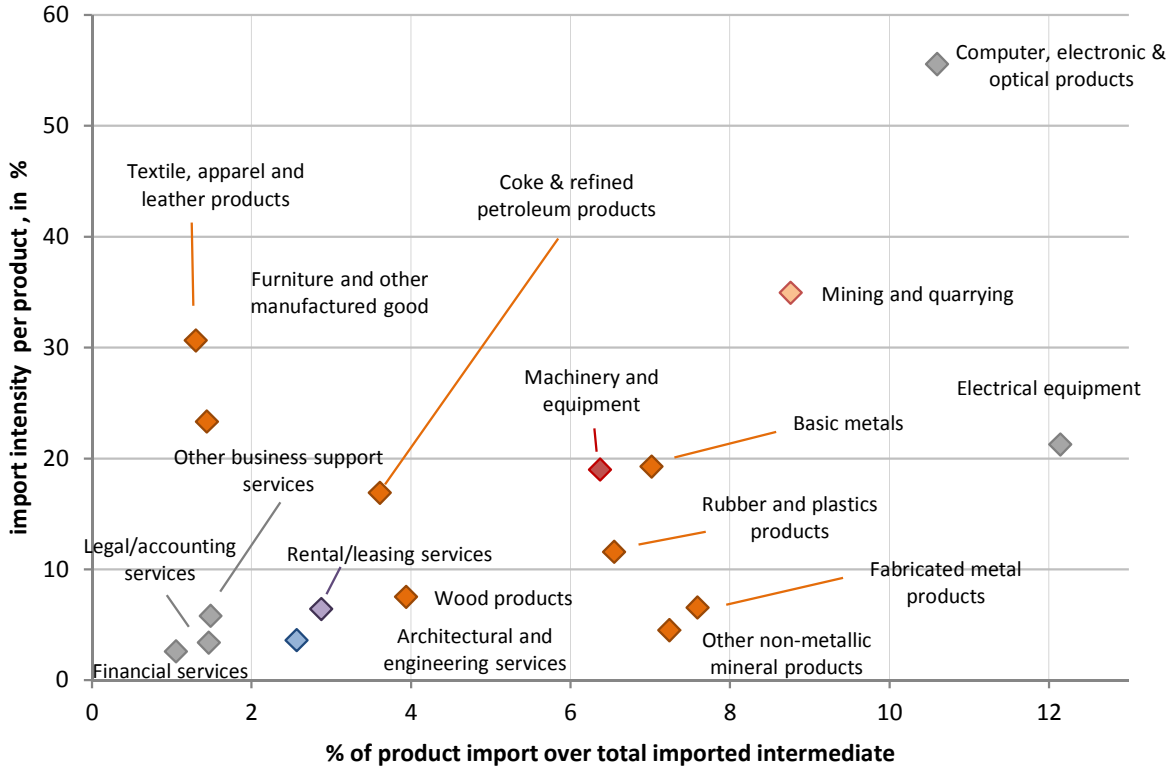
Secondly the products are also arranged by the share of product imports over the total intermediate consumption of that specific product (y-axis): meaning that although *textile, apparel and leather products* constitutes a relatively small share of the total imports that go into the construction sector (less than 2% along the x-axis), out of the EUR 2.4 billion that the sector inputs into the construction sector EUR 0.7 billion is imported (accounting for 30.6% along the y-axis).

[24] Shares calculated on the basis of total intermediate consumption of products. Final use (i.e. final consumption, capital formation (investment) and exports) is not included.

[25] As in the earlier analysis, the data is reported for 2011, but analysis conducted did not show major shift in the structure over time, thus warranting the use of 'older', yet more detailed data.

Considering the two aspects together helps in identifying exactly those areas in which the construction sector, through its inputs, is more dependent on imports (those higher on the y-axis), and those products where the volumes of imports are large (those to the right along the x-axis).

Figure 8 / Main imported intermediate inputs of the construction sector vis-à-vis the import intensities of each product category, in 2011



Source: Eurostat, Wiiw calculations.

2.2.3. CVC downstream

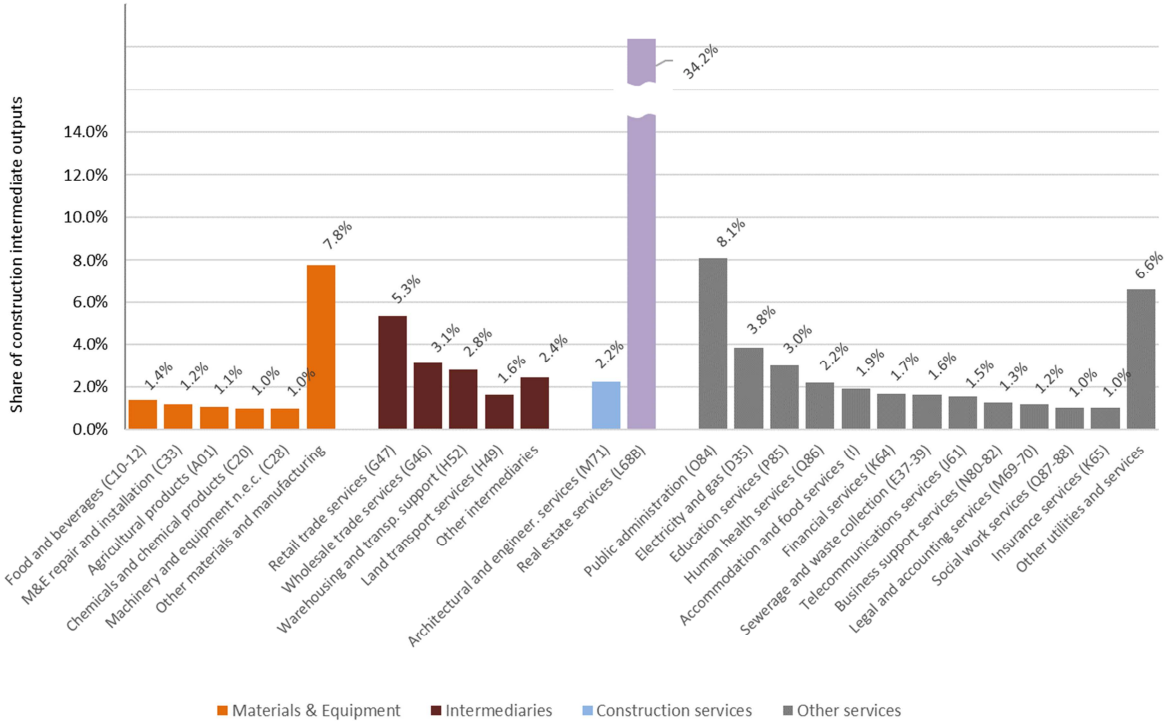
While the analysis of intermediate inputs described above offers the basis for a reasonable presentation of the upstream of the CVC, a similar approach is subject to important constraints for performing downstream analysis. In particular, as noted above, over 60% of construction output is categorised as (domestic) Gross Fixed Capital Formation (GFCF); essentially, investments in dwellings, other buildings and structures. Of the remaining output, a small proportion goes to final consumption and exports, while the remainder is split between 'own supply' (16.9% of total output) and intermediate inputs used by other economic sectors (18% of total output). Hence, focusing only intermediate input use captures only around a fifth of downstream use of construction.

With respect to GFCF in construction assets (i.e. dwellings, other buildings and structures), around two-thirds[26] is attributable to the '*Real Estate*' sector which, when combined with the sector's significant

[26] The Real Estate sector is estimated – at least from the national accounting perspective underlying available data – to account for over 95% of investment in dwellings and nearly 40% of investment in other buildings and construction, resulting in an overall share of 65% of total construction GFCF.

share of intermediate use of construction (see below), implies that the '*Real Estate*' sector accounts for well over half of total use (or acquisition) of construction outputs.[27] This highlights the role of the '*Real Estate*' sector, which acts as an important intermediary between the construction sector and 'downstream' demand for construction from other economic sectors (i.e. industries, the public sector and private households). Essentially, in the underlying accounting framework of the Input-Output data, the '*Real Estate*' sector makes investments in construction assets, on the basis of which it supplies 'real estate services'.[28] Therefore, so as to present an overall picture of the downstream of the CVC, the following analysis encompasses three main elements: intermediate input use of construction, intermediate input use of Real Estate, and GFCF in construction assets.

Figure 9 / Breakdown of intermediate consumption of construction outputs (2011)[29]



Source: Eurostat (Input-Output Tables), Ecorys calculations.

Starting with intermediate input use of construction by other economic sectors, Figure 9 shows that this component of demand for construction is dominated by '*Real Estate*', which accounts for over a third of demand. Other significant sectors are '*Public administrations*' (8.1%) and '*Retail trade services*' (5.3%) but, in general, intermediate demand for construction is widely and relatively thinly spread across sectors. A broadly similar sectorial pattern is revealed by the forward 'supply' multiplier(s)[30] for the

[27] Calculation excludes 'own supply' within the construction sector.

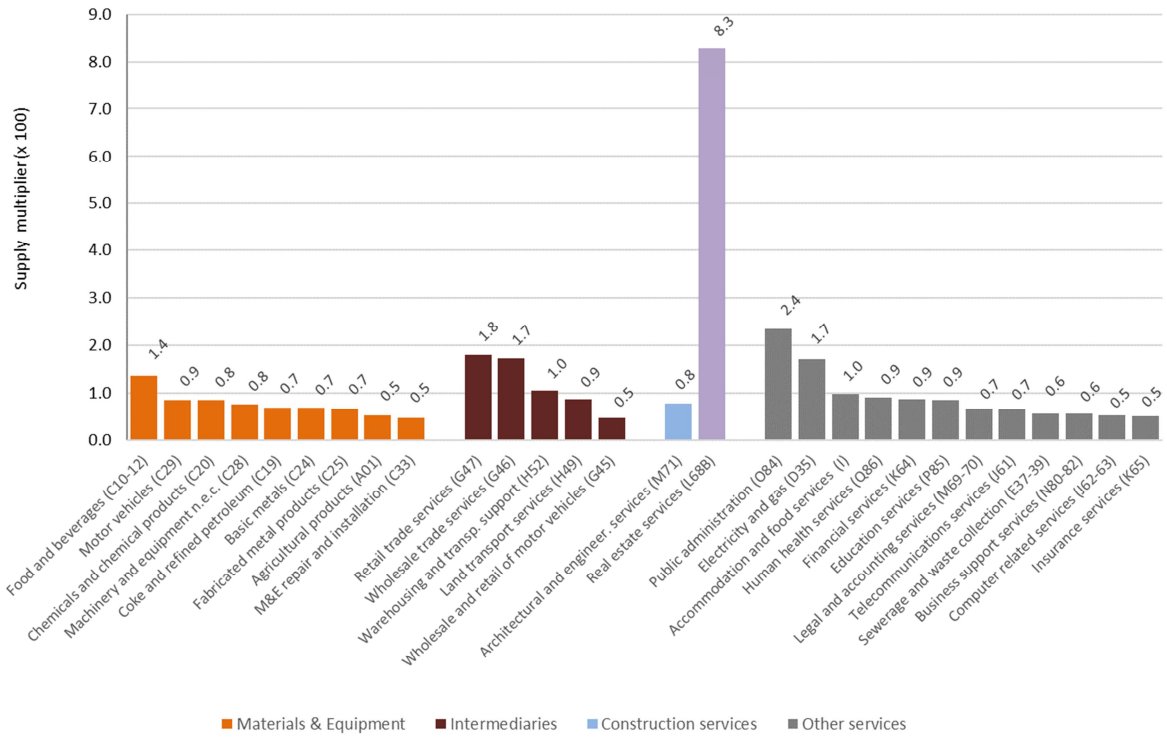
[28] Note: Real Estate activities include acting as a lessor, agent and/or broker in, for example, selling, buying or renting real estate. It also covers building of structures, combined with maintaining ownership or leasing of such structures.

[29] Excluding own supply.

[30] The 'supply' multiplier is based on the Ghosh-inverse, whereby the sum of row elements can be termed 'backward linkages'. This multiplier essentially provides an indication of the effect of the supply of output from one industry – in this case construction – on the production of those industries that are its customers and, in turn the effect of this production on that of their customers and so on and so on.

construction sector, shown in Figure 10. The total forward multiplier is estimated at 1.62[31] (in 2011) of which 1.22 is accounted for by 'own demand' (as with the backward multiplier) and 0.40 by other economic sectors, of which '*Real Estate*' dominates, again.[32]

Figure 10 / Forward linkages of the construction sector – supply multiplier (2011)



Source: Eurostat (Input-Output Tables), wiiw calculations.

Turning to '*Real Estate*', it should be first noted that just over half (52%) of the total use (demand) for Real Estate is attributed to '*Final consumption expenditure by households*'.[33] In terms of use of real estate in the rest of the economy, as shown in Figure 11, there is a reasonably even spread across economic sectors, although nearly a quarter of demand is accounted for by retail and wholesale distribution activities. These sectors also stand out on the basis of the estimated forward multipliers, although also noticeable is the relatively strong multiplier for 'Construction'; see Figure 12.[34]

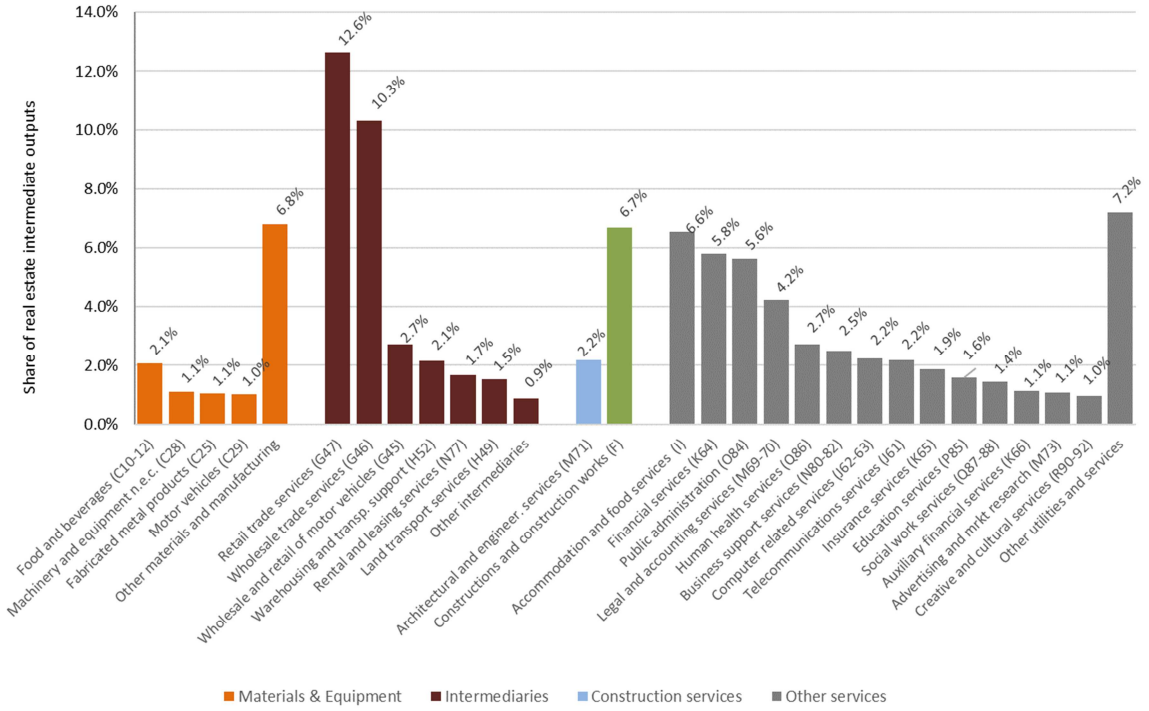
31 Taken at 'face value', a comparison of the 'forwards linkages' multipliers with the 'backwards' multipliers shown earlier would suggests that the construction sector has stronger linkages to upstream (suppliers) industries than to downstream (customer/users) industries. However, as already mentioned, this neglects the fact that over 60% of the output of the construction sector is counted as GFCF.

32 The reported values for 'Real Estate' cover the combined value for the 'Real Estate' (as defined in the Eurostat Input-Output Tables) and the fictitious accounting item of 'Imputed rents of owner-occupied dwellings'.

33 As an approximation, given that Real Estate accounts for a little above 50% of construction demand (intermediate use + GFCF) and households account for about half of Real Estate demand then this would suggest that households ultimately make up about a quarter of total demand for construction.

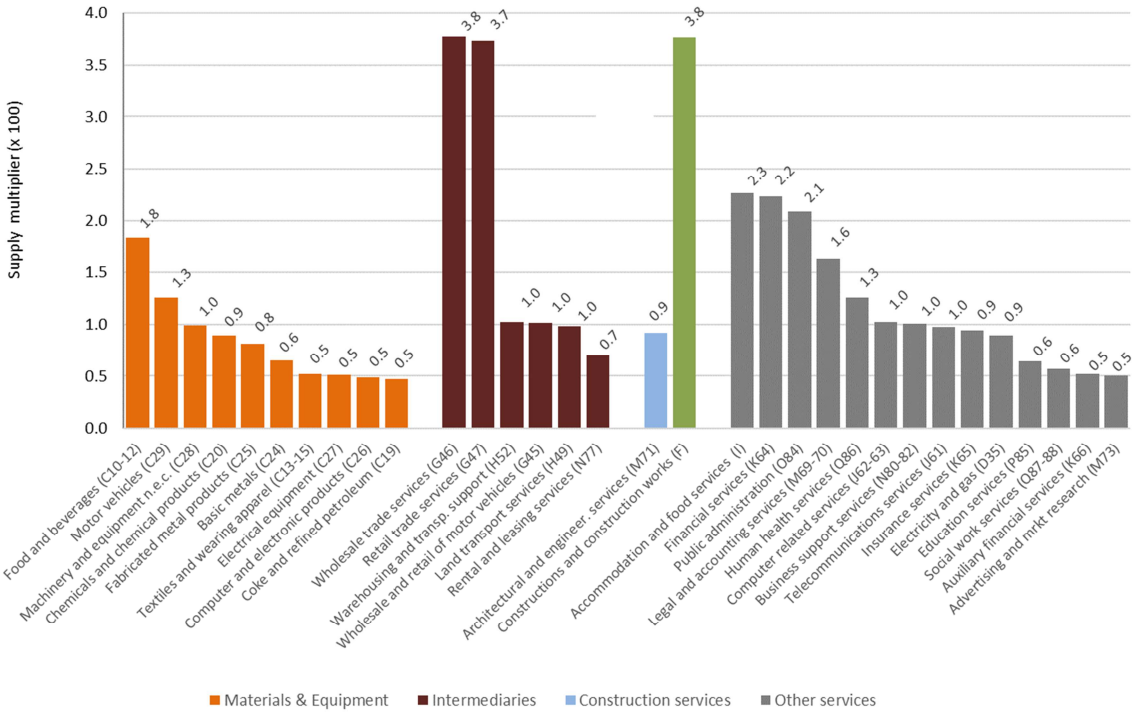
34 The total forward multiplier is estimated at 1.52 (in 2011) of which 1.04 is accounted for by 'own demand' and 0.48 by other economic sectors.

Figure 11 / Breakdown of intermediate consumption of real estate outputs (2011)[35]



Source: Eurostat (Input-Output Tables), Ecorys calculations.

Figure 12 / Forward linkages of the real estate sector – supply multiplier (2011)

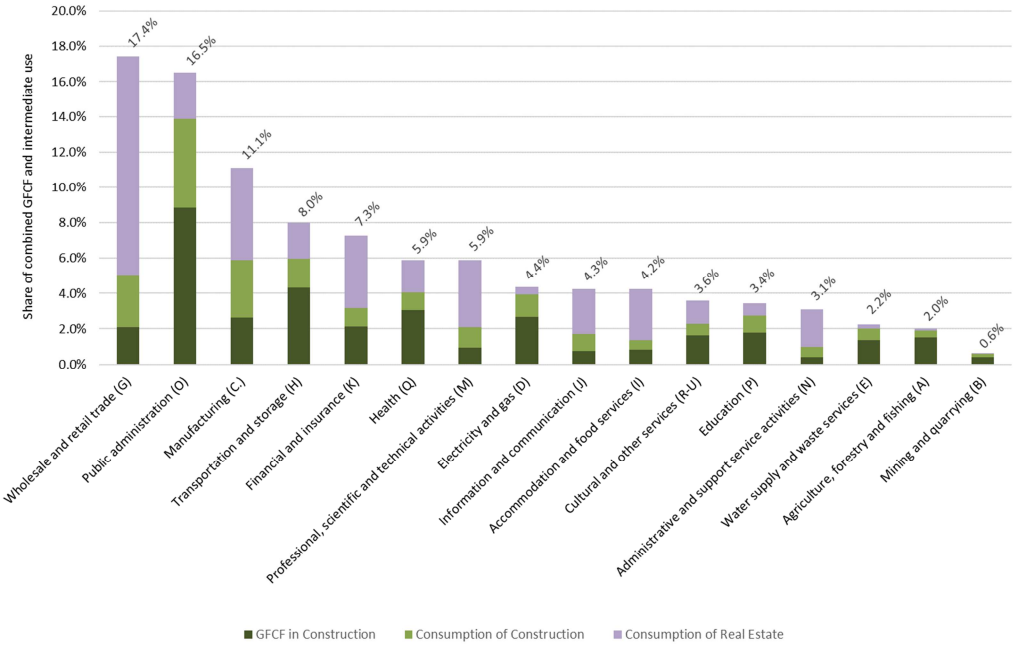


Source: Eurostat (Input-Output Tables), wiiw calculations.

[35] Excluding own supply.

Finally, turning to GFCF in construction assets (i.e. dwellings, other buildings and structures), as already noted, around two-thirds is attributable to the '*Real Estate*' sector. [36] For other economic sectors, in order to obtain an indication of their overall relative importance for construction, estimates of the value of their investment construction assets (i.e. GFCF) can be combined with data on their intermediate use of construction and real estate. This is shown in Figure 13, which gives an overall indication of breakdown of construction-related spending by businesses and the public sector (i.e. non-household expenditure).[37] Using this combined measure, the sector with the highest share is '*Wholesale and retail trade*' followed by '*Public administration*; we can see however that the former is derived mainly from the use of intermediate inputs from real estate, whereas the latter is driven by the substantial public sector investments (GFCF) in construction.

Figure 13 / Breakdown of combined construction-related spending (2011)



Source: Eurostat (Input-Output Tables), Ecorys calculations.

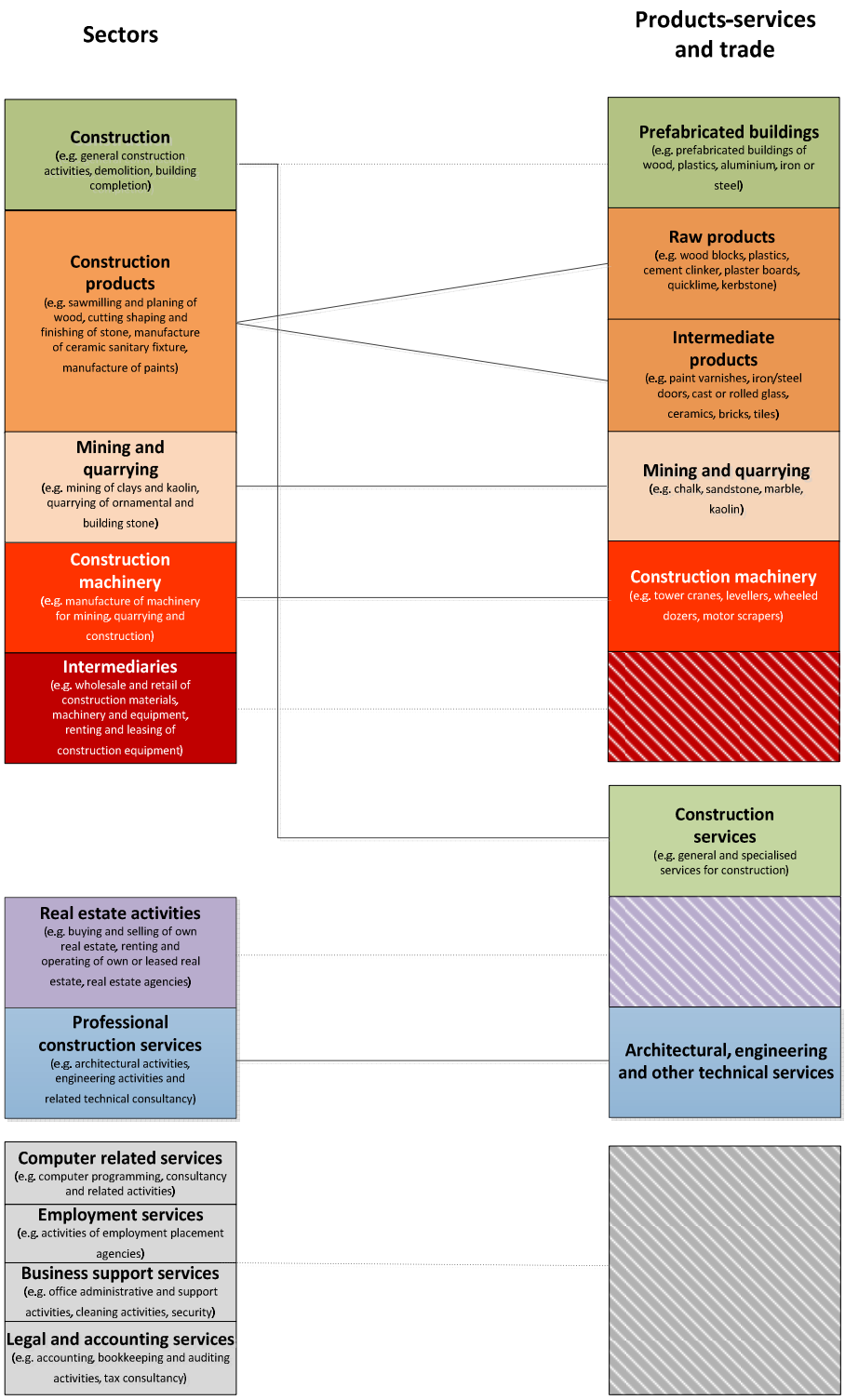
2.3. OVERVIEW OF MAIN CVC SUB-COMPONENTS

The previous sub-section has sought to provide a general description of the EU CVC based on an assessment of supply and use (input-output) linkages. Drawing on this description, the subsequent empirical analysis will focus on a selected group of economic sectors – and corresponding product and services – identified as strongly linked into the CVC. For the most part, the analysis will concentrate on the 'upstream' dimension of the CVC (i.e. the supply of materials and products to the construction sector) but will cover also real estate and professional construction services (e.g. architectural services, engineering consultants, etc.).

[36] Eurostat Input-Output data do not provide a breakdown of GFCF by economic sector. To obtain such a breakdown, Eurostat data on gross capital formation by economic sector have been used to estimate sector shares of total construction GFCF.

[37] The calculations exclude 'own supply' of construction and real estate and exclude, also, inter-industry supply between these two sectors.

Figure 14 / Correspondences among sectors and product-services and trade in the CVC
(consult the Annex for a more detailed explanation)



Source: Ecorys.

The sectors covered by the analysis can be grouped into 8 general categories, as illustrated in Figure 14 (left hand column). Also shown in the figure is the general categorisation that will be employed when

matching sectors to categories of products and services (right hand column).[38] A detailed description of the coverage and classification of activities and products is provided in Annex I. The colour coding shown in the figure helps to identify sectors and corresponding products and services throughout the report.

2.3.1. Combined size, structure and trade of the CVC

Disclaimer:

From this point we analyse the sectors that are considered as a major part of the CVC based on the above analysis. The selection was done on as detailed level to separate relevant sector activities (see Annex I for more details).

However, due to the nature of data available, exact proportional sector activities are not possible to be assigned. In other words: it is assumed (as Eurostat assumes), that all the firms under a certain sector perform only the sector activity to which they subscribe. For example a carmaker may also produce construction machinery as a minor part of its operation, however since this is not the firm's primary activity it would not be captured in Eurostat's nor other publicly available data sources.

Main findings:

› The CVC, including major upstream and downstream economic activities, constitutes around 8% of EU GDP and 23 million jobs. Within these headline figures, the construction sector itself accounts for around half of the total.

› The size structure of the construction sector is relatively in line with the CVC as a whole (except for mining & quarrying and construction machinery, which are both highly concentrated sectors *of large firms).*

› Although the construction sector does not engage very much in extra-EU trade, upstream sectors do (e.g. for construction machinery, extra-EU trade represents 80% of total production).

› The majority of intra-EU trade takes place around northwest and central EU.

2.3.2. Size of the CVC

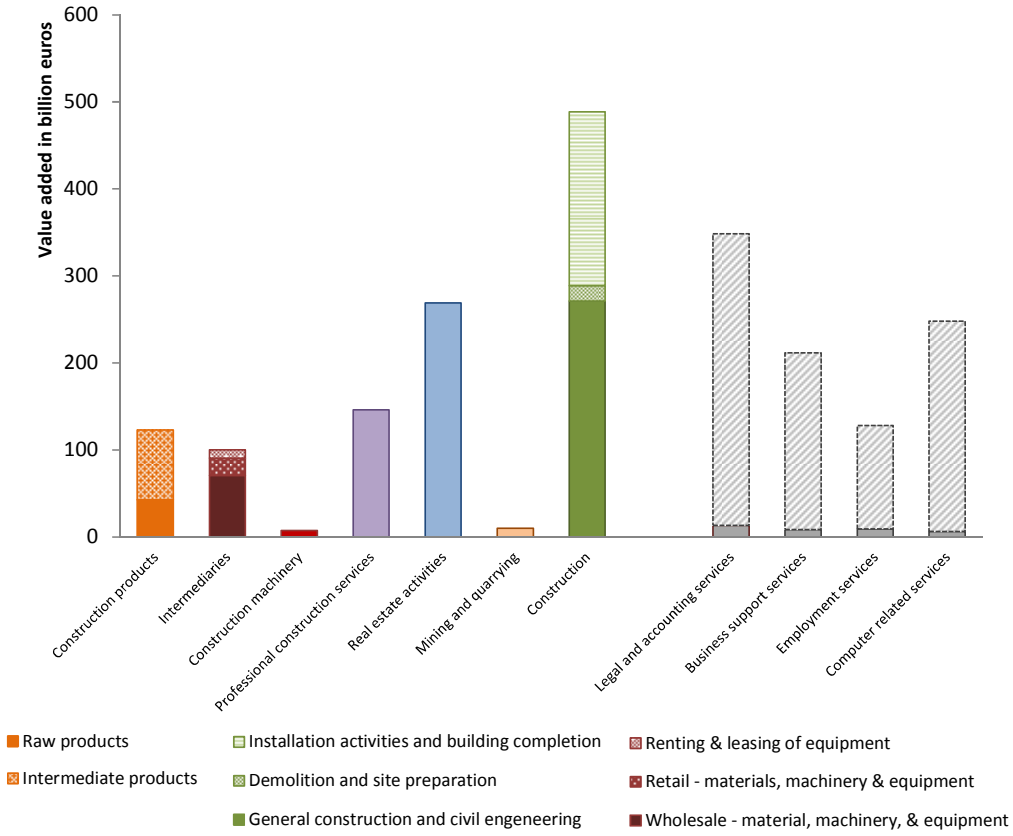
In measuring the whole CVC, including its upstream and downstream economic activities, it accounts for over 6.2 million companies and almost 23.2 million jobs (9.7% of total EU employment in 2014). The CVC accounts for around EUR 1.14 trillion of value added in 2014 or around 8.2% of EU's GDP for that year.

Within the CVC, the construction sector is the largest in size (see Figure 15). This is not only true in terms of value added, as shown in the figure, but also in terms of employment and number of firms.

[38] Differences in the breakdown across categorisations is mainly driven by differences in classifications used by different data sources; e.g. for economic activities (NACE) or for products and services (Prodcom) and products between the two.

The smallest sub-sector in terms of value added is construction machinery with a total value added of EUR 10 billion in 2014. This may seem small at first, but the reported figure appears to be in line with what reported by the Committee for European Construction Equipment (CECE), which indicates a total turnover for 2015 of EUR 25 billion.[39] The association collects data provided by 1,200 companies employing roughly 130,000 people, figures which correspond to our data, ensuring a good level of coverage of CECE data.

Figure 15 / Size of sectors and subsectors in the CVC, in terms of total value added in 2014



Source: Elaboration on Structural Business Statistics, Eurostat – Legends refers to sub-sectors decomposition[40]

To complete the overview several key service sectors were included: *legal and accounting services, business support services, employment services, computer-related services.* The data for those sectors are highly aggregated (dotted line); therefore, using the outcomes from chapter 2.2, an estimate for the size of the construction-relevant services was calculated[41].

[39] Committee for European Construction Equipment, Report for 2015

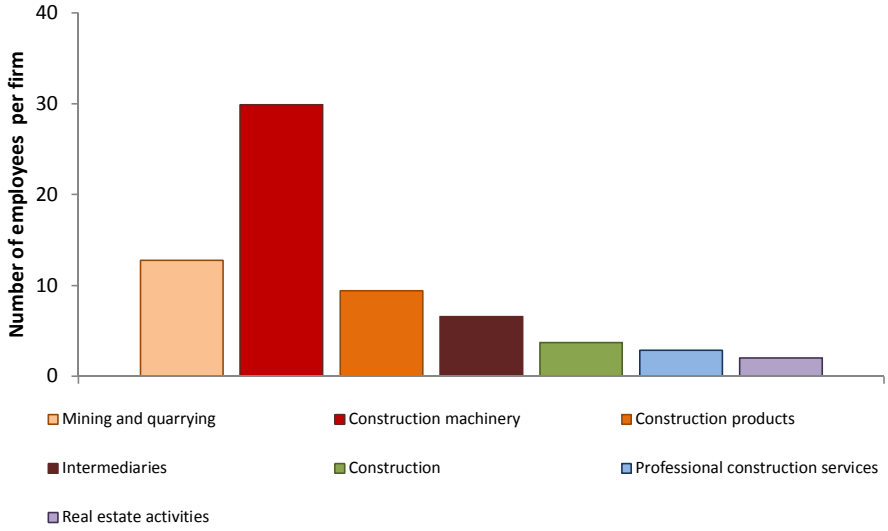
[40] In dotted lines is reported the total size of the four services sectors considered, in full grey the fraction of those sectors involved in the CVC. Discount factors were derived as the share of intermediate consumption related to the construction sector.

[41] This remains a rough estimate in light of lack of more detail data, which is available for the other sectors and the data limitations presented at the beginning of this chapter.

2.3.3. Structure of the CVC

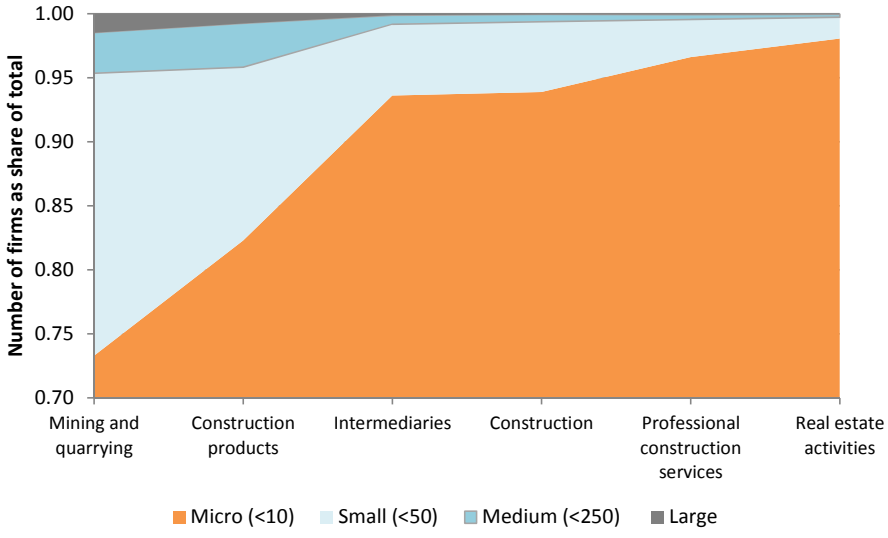
Figure 16 present the average size of firms for the most important CVC sectors. It becomes clear that there is a rather diverging average size over the different sector, with construction machinery and mining and quarrying having the largest average firm size.

Figure 16 / Average size of firm in the CVC



Source: Elaborations on Eurostat Structural Business Statistics.

Figure 17 / Sector composition per firm size



Source: Eurostat, data at sector level.

These two sectors with the largest average firm size are also those with the lowest share of micro firms as a share of total number of companies (Figure 17), which only confirms the dominance of larger firms in these sectors. The small shares of micro firms in mining and quarrying as well as construction

manufacturing can be explained by the significant amount of investment in assets necessary to operate in the sector and the economies of scale that go with it.

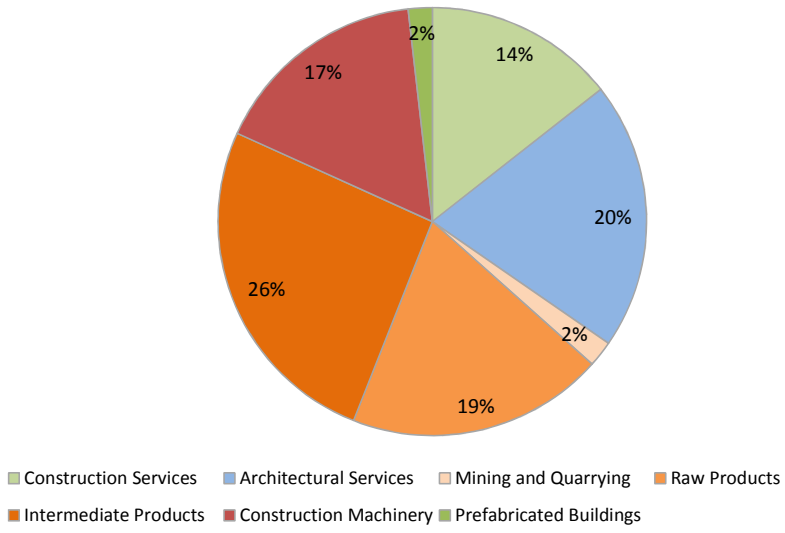
However both sectors still have a large share of small companies, which could indicate a level of subcontracting to specialist firms, or special parts of a more complex machine (in particularly for construction machinery, where lots of small firms produce components that are then assembled in large firms). Nevertheless large companies dominate these two sectors. For example, almost 50% of all turnover in the construction machinery sector can be assigned to the top 10 largest companies. For mining and quarrying this is 25%, for the rest of the CVC it is around 10%.

The service industry, both in real estate and professional construction services show the highest presence of micro firms and the lowest concentration of the sector.

2.3.4. Trade of the CVC

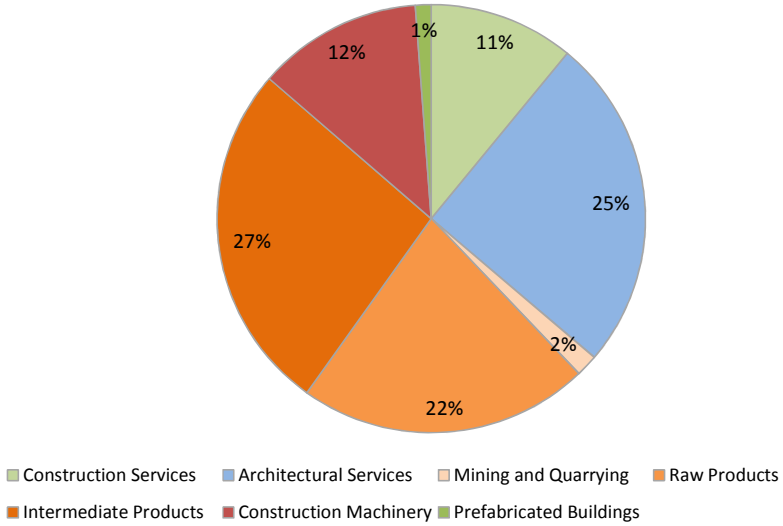
Trade is analysed by assessing trade product groups which can be linked back to the main CVC sectors as presented in Figure 14. The importance of the different CVC sectors in trade differs strongly, partly related to their overall size but also to their trade intensity. In terms of export values, the relative shares of each sub-component are displayed in Figure 18 for 2004 and Figure 19 for 2014. Roughly two-thirds of the total trade value in the CVC can be attributed to trade of goods, while the remaining 35% is trade in services. We first assess the trade in goods followed a further analysis of the trade in services and their barriers.

Figure 18 / Relative importance per CVC sector in total export value, 2004



Source: Eurostat Comext. Ecorys calculations.

Figure 19 / Relative importance per CVC sector in total export value, 2014

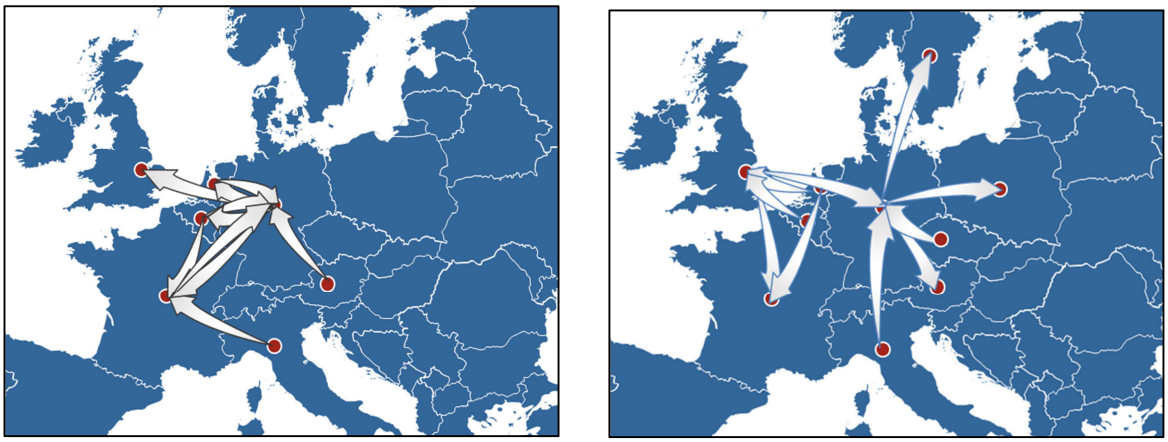


Source: Eurostat Comext. Ecorys calculations.

Largest trade flows

The largest intra-EU trade flows tend to be concentrated in Northwestern and Central Europe. For example, looking at the construction machinery sector, the 10 largest intra-EU trade flows (in absolute terms) occur between the pre-2004 Member States, whereas the next 10 largest are more central. This concentration in Northwestern and Central Europe is valid, in general, for all product groups in this study.

Figure 20 / 20 largest intra EU trade flows (in absolute terms) for construction machinery in 2014

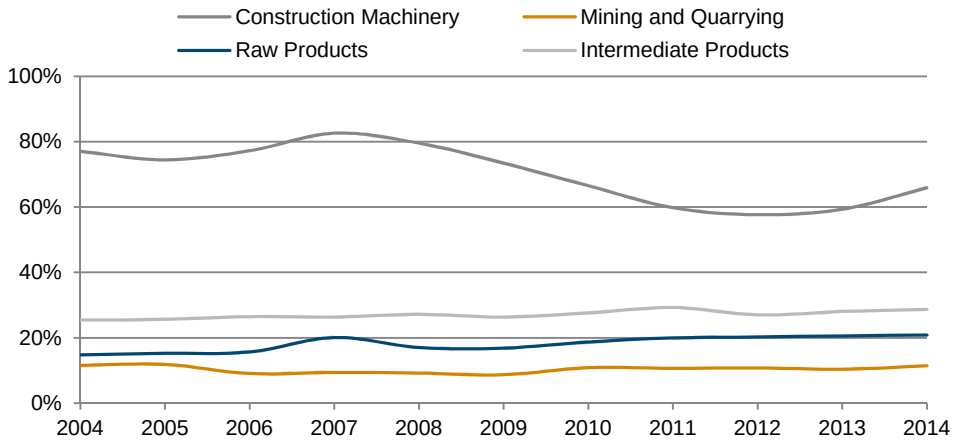


Source: Eurostat Comext. Ecorys calculations. The ten largest trade flows are depicted on the left panel, those flows ranked 11-20 are shown on the right. Annex III provides the ranking of these largest 20 trade flows in construction machinery.

Importance of cross-border activity per product group

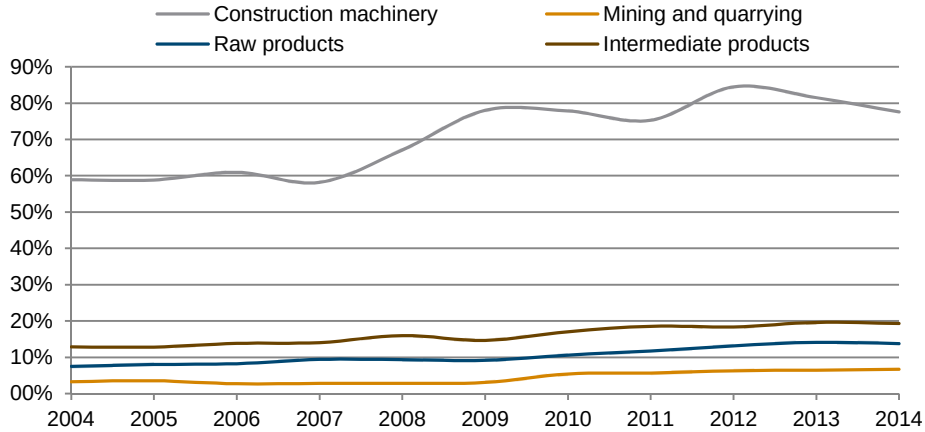
The product groups of the CVC are diverse in terms of their tradability within Europe. Figure 21 displays the value of intra-EU exports in the four product groups as a share of domestic EU28 production. The intra-EU trade value includes exports of domestically produced products by Member States as well as re-exports of products produced in other Member States or third countries. It is clear that construction machinery products tend to be exported more than any of the other three product groups indicating that it a more specialised product group with a stronger production focus.

Figure 21 / Upstream product groups: relevance of intra-EU trade in domestic production



Source: Eurostat Comext and Prodcom. Ecorys calculations.

Figure 22 / Upstream product groups: relevance of extra-EU exports in domestic production



Source: Eurostat Comext and Prodcom. Ecorys calculations.

Figure 22 shows the relative importance of extra-EU exports in each product group, once again expressed as share of domestic EU28 production. As with the intra-EU data, one product group stands out: construction machinery, where the value of exports is up to 80% of all domestic production in recent years. Since 2009, third countries are a more important export destination than other Member States in the case of construction machinery. This is also reflected in these two figures, as extra-EU construction

machinery exports as a share of domestic production are higher than for intra-EU. For the remaining three product groups, Member States remain a more important destination.

Even within an export intense sector such as construction machinery, it is a small number of products that drive the trade. The top 5 products in construction machinery (e.g. machinery parts, diggers, shovel loaders) account for just over 42% of intra-EU trade.

3. Economic and trade performance of the Construction Value Chain (CVC) since 2000

This chapter presents how economic performance and trade of the construction sector and CVC have developed since 2000. This chapter aims to present the evolution of the CVC. The subsequent chapter focuses on understanding of the underlying drivers of the changes and structure of the sector.

The attention is first focused on the core of the CVC, namely the construction sector itself (section 3.1), in terms of economic performance indicators. As trade is of only limited importance to the construction sector itself, but rather to the upstream economic activities this is not further elaborated. In section 3.2 we move to analysis of the CVC as a whole, again focusing on the same economic performance indicators (to allow comparison with the construction), but also trade performance (since parts of the CVC engage in extra-EU trade). Lastly, to illustrate economic and trade performance differences between Member States, a further analysis of two opposite examples, namely Poland and Spain, will be presented (section 3.3).

The crisis has impacted the construction sector in the EU in a significant way, resulting to a 25% fall in production and employment, which has yet to show full signs of recovery. Since 2000, the productivity in the construction sector has virtually remained stagnant, despite periods of growth and bust. This would suggest that the construction sector is in a poor shape, however, a further assessment of the CVC as a whole reveals a more positive and encouraging position of EU's CVC. This again indicates the importance of assessing the sector from a value chain rather than an isolated sector perspective.

When analysing the CVC, several sectors are more closely correlated with the construction sector and therefore show similar trends. Some sectors, such as several services sectors that are relevant in the CVC[42] as well as construction machinery, have showed more stable headline performance figures in comparison to the construction sector, or those closely correlated to it. All CVC sectors show higher productivity compared to the construction sector with most increasing their productivity after the crisis. Furthermore trade in all CVC sectors has overall been either growing or stable and the EU has a trade surplus in all the products and services analysed. Nevertheless, key differences remain between not only regions in the EU, but between MS as well.

Main findings:

› Production (the quantity) of the construction sector fell by one quarter during the economic and financial crisis and has yet to show clear signs of recovery.

› Similarly, construction sector's share of total employment reached 7.7% by the second half of 2007 but has subsequently fallen to 6.2%.

[42] These include: architectural activities, engineering activities, but also computer-related services, employment services, business support services and legal and accounting services. For more information see Annex I.

› Having peaked at around 5.8% in 2007-08, the EU construction sector's share of GDP fell to 3.5% in 2014

› The construction sector has struggled to raise its labour productivity performance, failing to achieve any sustained improvement over the past decade.

› Production and employment trends in several upstream CVC sectors have shown similar developments as in the construction sector which illustrates their correlation.

› Service sectors that are relevant in the CVC and construction machinery sectors are less correlated with the construction sector and display alternative, often more stable, trends.

› All CVC sectors have a higher productivity compared to the construction sector and most have increased their productivity after the crisis.

› Both intra-EU and extra-EU trade is stable in half of the analysed CVC sectors and increasing in the other half.

› In the CVC sectors analysed, the EU has a trade surplus (we export more than we import).

Differences between Member States in the EU:

› Countries under the ESM programme have, except for Portugal, experienced a pre-2008 growth and a sharp fall after the 2008. The construction price levels have rebalanced in several cases to around 80% of the EU average. While the productivity has been falling until 2012 after which an increase was registered.

› Eastern and Baltic countries have experienced a sharp pre 2008 growth and a fall, but not to the same extent as the ESM countries. Their productivity varies, but has been increasing since 2012. While their construction price levels are relatively constant around 40-50% of the EU average.

› Central and Western countries have a more stable construction sector. However, productivity has been consistently falling since 2008 and is not showing signs of a recovery. The construction price levels are also more stable with many of the old MS exhibiting above EU average price levels.

A more detailed assessment was carried out for Spain and Poland:

› Fall in productivity in Spain started a year after the onset of the crisis, but it has been falling ever since. While, despite two dips, Polish firms experienced a growth trend of productivity.

› The polish construction sector is flexible in terms of its profit margins and therefore has the ability to ride out harder periods by remaining price competitive. Spanish companies remained to operate at around 11% profit margin, despite large scale bankruptcies in the sector.

› Pre-crisis levels show the construction boom in Spain and upcoming Polish construction sector post-EU accession.

› After the onset of the 2008 crisis, cost levels in Poland and Spain have remained virtually flat, despite an overall EU increase.

› Partially as a result of its price competitiveness, the crisis in Poland did not leave a lasting mark on the exports of upstream products in the CVC.

› In comparison the Spanish exports mainly remained at pre-crisis level, further exasperating the sectors problems, since alternative markets were not an option for replacing collapsed domestic market.

3.1. ECONOMIC PERFORMANCE TRENDS IN THE CONSTRUCTION SECTOR

Since the construction sector is the 'core' of the CVC, specific attention is paid to its specific trends, since they form and shape large parts of the CVC.

Main findings:

› Production (the quantity) of the construction sector fell by one quarter during the economic and financial crisis and has yet to show clear signs of recovery.

› Similarly, construction's share of total employment reached 7.7% by the second half of 2007 but has subsequently fallen to 6.2%.

› Having peaked at around 5.8% in 2007-08, the EU construction sector's share of GDP fell to 3.5% in 2014

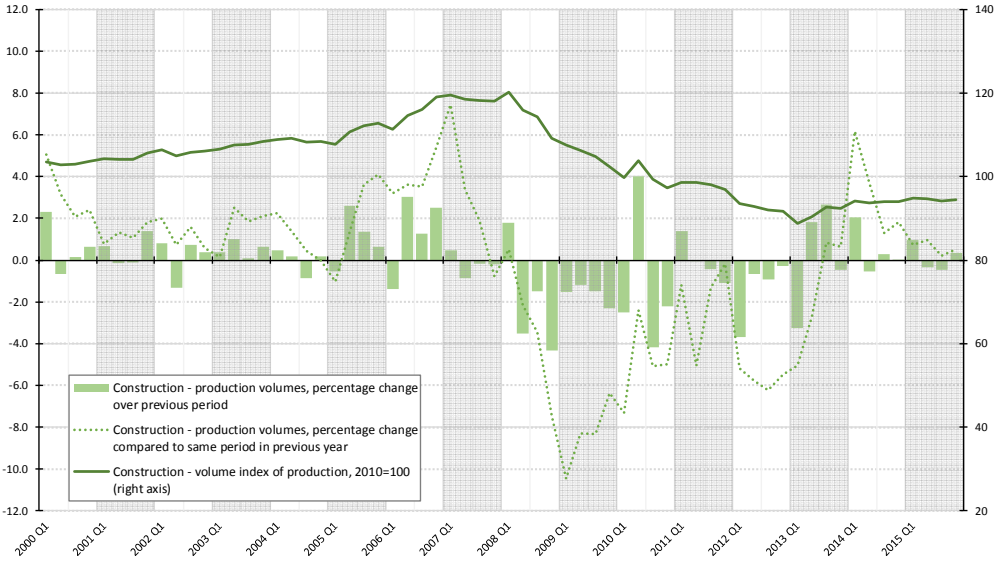
› The construction sector has struggled to raise its labour productivity performance, failing to achieve any sustained improvement over the past decade.

3.1.1. Production

Between 2000 and 2007, the volume of production in the construction sector increased by around 15%, reaching a peak in Q1 of 2008. Production fell dramatically thereafter, decreasing by 10% between 2008-Q1 and 2009-Q1 and continuing to slide almost unabated until 2013-Q1, by which time production had fallen by over a quarter compared to its 2008 peak. Although there was some recovery of activity in 2013 and 2014-Q1, production remained largely flat during the remainder of 2014 and through 2015 (see Figure 23).

The initial impact of the financial crisis of 2007-08 was less pronounced for construction than for other sectors, say manufacturing which fell by close to 20% between 2008-Q1 and 2009-Q1. But the adverse effects have lingered more persistently. At the end of 2015, the volume of manufacturing production stood at over 90% of its level at the start of 2008, compared to less than 80% for construction.

Figure 23 / EU28 Construction Sector (F): production volume level and growth; quarterly data, seasonally and calendar adjusted

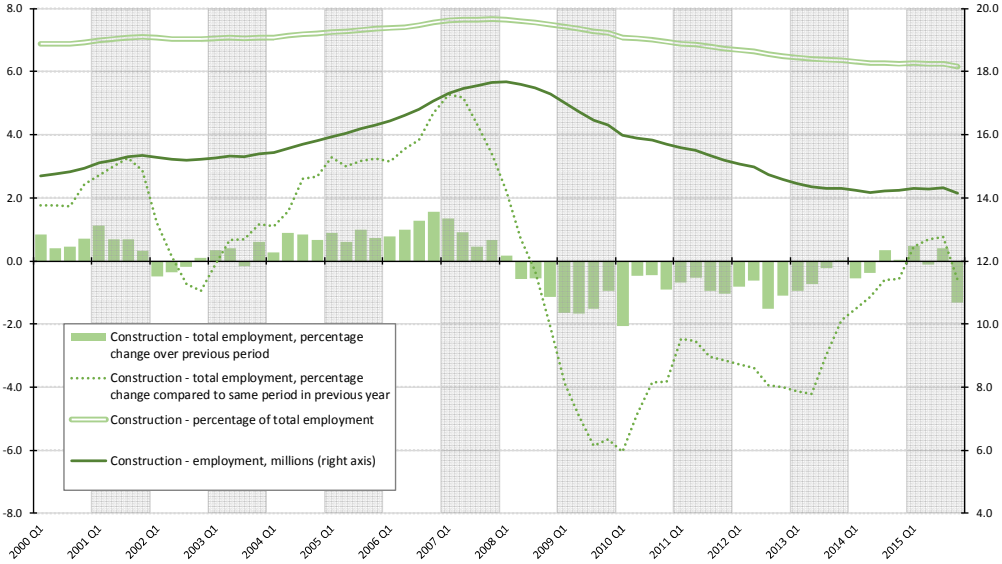


Source: Ecorys based on Eurostat (STS).

3.1.2. Employment

Between 2000-Q1 and 2008-Q1, employment in the construction sector increased from 14.7 to 17.7 million persons, an increase of over 20%. During the financial and economic crisis, construction sector employment shrank by 3.5 million, with the number employed falling to 12.3 in 2014 and has since continued to hover around this level (see Figure 24).

Figure 24 / EU28 Construction Sector (F): employment level and growth; quarterly data, seasonally and calendar adjusted

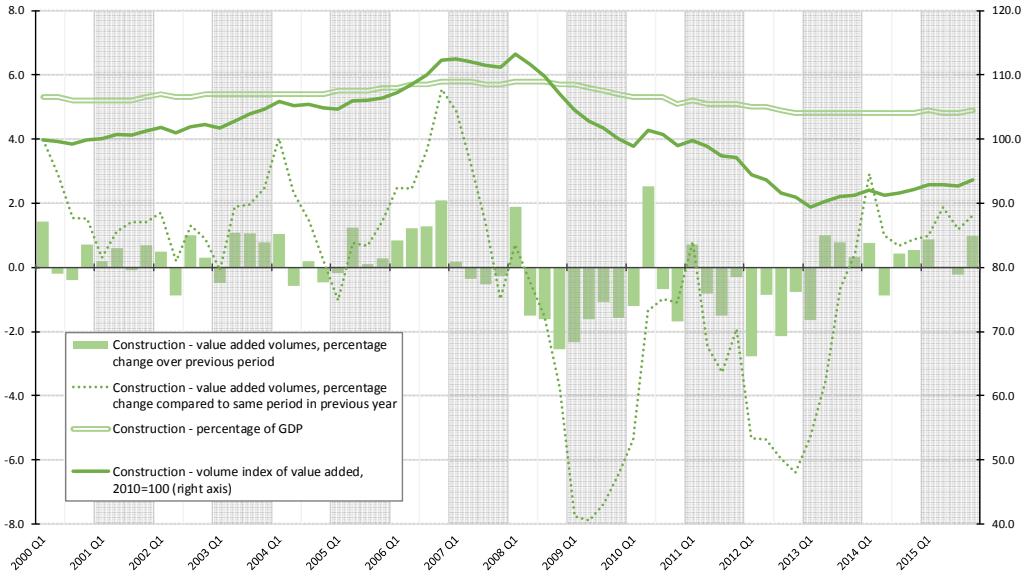


Source: Ecorys based on Eurostat (Quarterly national accounts).

3.1.3. Value added

The evolution of real value added in the construction sector has largely mirrored the development of production volumes (see above). From 2008-Q2 through to 2013-Q1, the sector only had two quarters in which it managed to achieve positive growth in value added (see Figure 25).

Figure 25 / EU28 Construction Sector (F): value added volume level, growth and share of GDP; quarterly data, seasonally and calendar adjusted



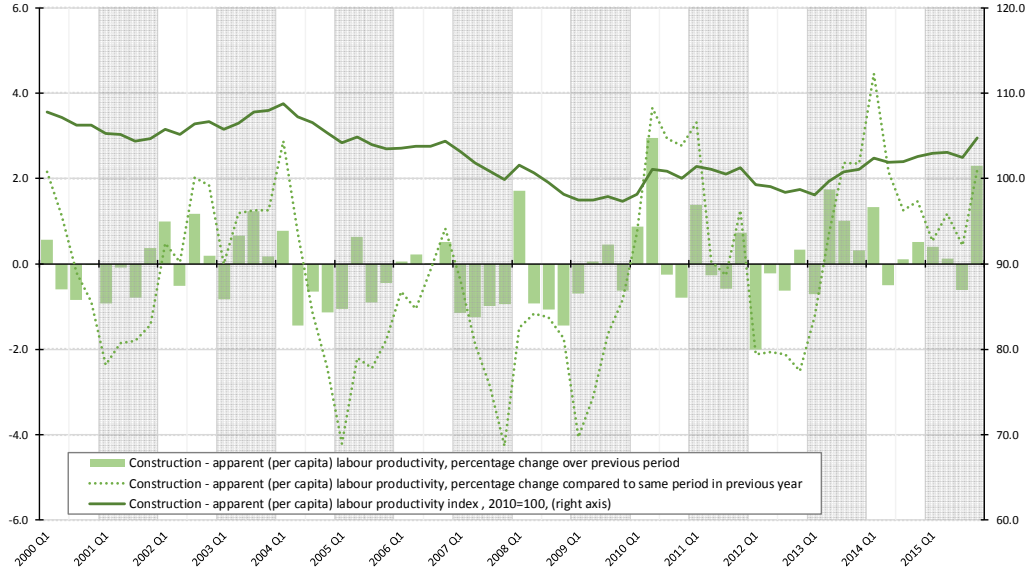
Source: Ecorys based on Eurostat (Quarterly national accounts)

3.1.4. Productivity

Although the onset of the financial and economic crisis appears to have contributed to negative growth, apparent labour productivity[43] in the construction sector had been on a downward path since 2004. Overall, from 2004-Q1 to 2009-Q4, apparent labour productivity fell by 8%. Following a relative stabilisation during 2010 to 2012, apparent labour productivity has seen some modest, albeit erratic, improvement from 2012 through to 2015. Nonetheless, apparent labour productivity is still below pre-crisis levels (see Figure 26).

[43] The apparent labour productivity measure is based on value added per person employed in construction (i.e. per capita basis). The labour productivity index has been estimated using the difference in growth rates of value added (volume index) and employment, using Eurostat data for EU28.

Figure 26 / EU28 Construction Sector (F): apparent labour productivity level and growth; quarterly data, seasonally and calendar adjusted



Source: Ecorys estimates based on Eurostat (Quarterly national accounts)

3.2. ECONOMIC AND TRADE PERFORMANCE TRENDS IN THE CVC

Moving from the 'core' of the CVC (the construction sector), to the main parts of the CVC, this section, focuses on the economic trade performance indicators as introduced in the previous section. In addition an analysis of trade performance is conducted, for the major parts of the CVC engaged in trade.

It should be noted that while the analysis on the construction sector was done on quarterly basis, in the interest of clarity and space the analysis in this section deals with data for every 4 years since 2000. This way trends are still visible, while graphs don't become too big.

Main findings:

› Production and employment trends in several upstream CVC sectors have shown similar developments as in the construction which reflects their correlation.

› Service sectors that are relevant in the CVC and construction machinery sectors are less correlated with the construction sector and display alternative, often more stable, trends.

› All CVC sectors have a higher productivity compared to the construction sector and most have increased their productivity after the crisis.

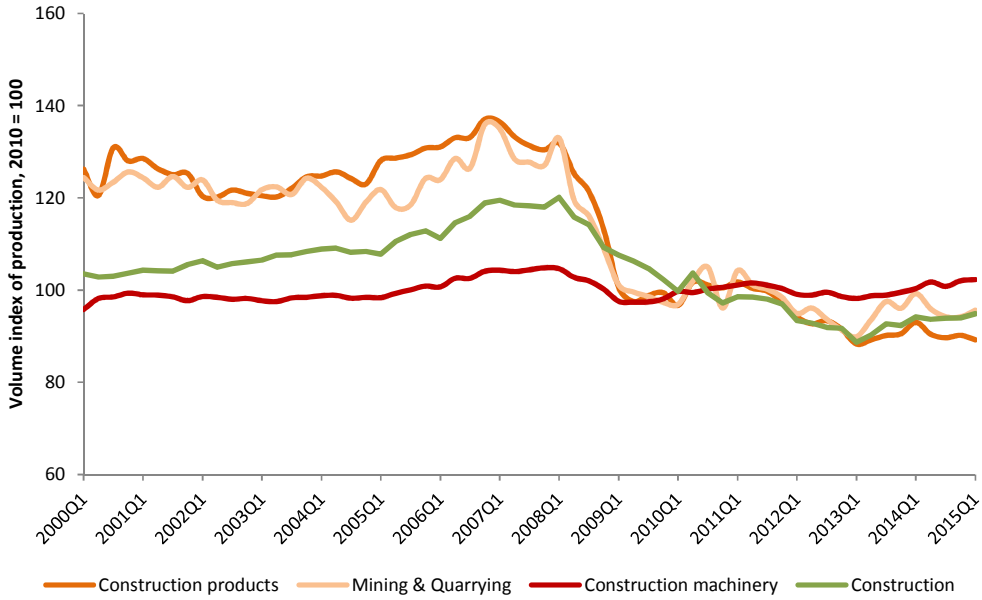
› Both intra-EU and extra-EU trade is stable in half of the analysed CVC sectors and increasing in the other half.

› In the CVC sectors analysed, the EU has a trade surplus (we export more than we import).

3.2.1. Production trends across the CVC

In comparison to the fall in production in the construction sector itself, which was presented in chapter 3.1.1., the fall in construction products and mining and quarrying has been much more dramatic. In particular construction products have seen almost a 30 index point fall from the peak in 2007, suggesting a boom and bust cycle. This is in comparison with construction machinery, whose production has remained very stable at the index year of 2010 showing that it is less tied to the performance of the construction sector (a notion which is further strengthened below with a relatively low correlation of the two sectors).

Figure 27 / Changes in the volume of production in the CVC[44] (index 100 = in 2010)



Source: Eurostat

To further explore possible linkages between production growth in construction and 'upstream' segments of the CVC, Table 1: Cross-correlation of quarterly production volume indices for construction and selected 'upstream' sectors (correlation coefficient), 2002 to 2015shows estimates of the strength of the correlation between the volume of production of the construction sector (by sub-segments of 'building' and 'civil engineering') and that for several specific sectors.[45] Although these data cannot be used to confer a causal link between the level of activity in one sector and that in another sector, a high correlation can 'signal' that there is a potential interrelationship between levels of activity in the two sectors, which could suggest a degree of interconnectedness or integration of activity in the respective sectors.

[44] Production values for the two service sectors are not available.

[45] The estimated correlations are calculated using Eurostat indices of the respective volume of production.

Table 1 / Cross-correlation of quarterly production volume indices for construction and selected 'upstream' sectors (correlation coefficient), 2002 to 2015

	Sector	Building (F-CC1)	Civil Eng. (F-CC2)
08	**Other mining and quarrying**	**0.92**	**0.70**
16	**Manufacture of wood and of products of wood and cork (except furniture); manufacture of articles of straw and plaiting materials**	**0.91**	**0.63**
16.2	Manufacture of products of wood, cork, straw and plaiting materials	0.90	0.69
23	**Manufacture of other non-metallic mineral products**	**0.94**	**0.72**
23.1	Manufacture of glass and glass products	0.83	0.55
23.2	Manufacture of refractory products	0.80	0.55
23.3	Manufacture of clay building materials	0.86	0.60
23.4	Manufacture of other porcelain and ceramic products	0.81	0.59
23.5	Manufacture of cement, lime and plaster	0.95	0.79
23.6	Manufacture of articles of concrete, cement and plaster	0.95	0.80
24	**Manufacture of basic metals**	**0.70**	**0.35**
24.1	Manufacture of basic iron and steel and of ferro-alloys	0.69	0.37
24.2	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel	0.85	0.58
24.3	Manufacture of other products of first processing of steel	0.79	0.47
24.4	Manufacture of basic precious and other non-ferrous metals	0.87	0.61
25	**Manufacture of fabricated metal products, except machinery and equipment**	**0.73**	**0.41**
25.1	Manufacture of structural metal products	0.97	0.81
25.2	Manufacture of tanks, reservoirs and containers of metal	0.95	0.74
25.6	Treatment and coating of metals; machining	0.60	0.24
25.9	Manufacture of other fabricated metal products	0.84	0.58
22	**Manufacture of rubber and plastic products**	**0.46**	**0.15**
22.1	Manufacture of rubber products	0.82	0.54
22.2	Manufacture of plastics products	0.62	0.28
20	**Manufacture of chemicals and chemical products**	**0.10**	**-0.10**
20.3	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	0.92	0.70
31	**Manufacture of furniture**	**0.95**	**0.75**
27	**Manufacture of electrical equipment**	**0.55**	**0.32**
27.4	Manufacture of electric lighting equipment	0.77	0.56
27.5	Manufacture of domestic appliances	0.86	0.66
27.9	Manufacture of other electrical equipment	0.82	0.55
28	**Manufacture of machinery and equipment n.e.c.**	**0.20**	**-0.04**
28.92	Manufacture of machinery for mining, quarrying and construction	0.67	0.49

In general, the analysis indicates higher correlation levels between 'upstream' sectors and the 'buildings' sub-sector of construction than for 'civil engineering' sub-sector, which is not surprising considering the relative size of the two sub-sectors.[46] Overall, the findings indicate a high correlation of growth rates in production between construction and many sectors that *a priori* may be expected to rely heavily on demand from the construction sector. These include, notably, '*Mining and quarrying*'[47] '*Wood and wood products*'[48] and a broad sweep on non-metallic mineral products and metal-based products. Even with sectors such as chemicals, analysis at a finer level reveals strong correlations between construction and '*Manufacture of paints, varnishes and similar coatings*', '*Manufacture of explosives*' and '*Manufacture of glues*'. In respect of construction machinery, the data point to a relatively strong positive correlation between production growth in the 'buildings' sub-sector and in '*Manufacture of domestic appliances*' and '*Manufacture of lifting and handling equipment*'.

The data also reveal positive correlations with the '*Manufacture of machinery for mining, quarrying and construction*', although the correlation appears relatively weak compared to many other sectors mentioned above. This latter finding may reflect the strong export orientation of the construction machinery sector.

3.2.2. Employment trends across the CVC

Given that the CVC provides around 23.2 million jobs (see chapter 2.4.1), the construction sector with its 14.1 million employees (see chapter 3.1.2) represents 61% of the CVC's employment which makes it the most important employment generator in the sector. Whereas section 3.1 addressed the employment trends in construction sector, in this chapter we address the remaining 39% of employees who are active in the related sectors.

The construction products sector has seen a 23% drop in terms of people employed from its peak of almost 3.9 million persons employed in 2008 and has showed little recovery. This is comparable to the 20% drop and the pattern of the construction sector a further suggestion of the inter-relationship described in the previous chapter. However, for all the other sectors in the CVC there have either seen a recovery from 2012, or as in the case of intermediaries a continuous growth due to changing business models in the CVC and growing demand for its services (see chapter 4.1).

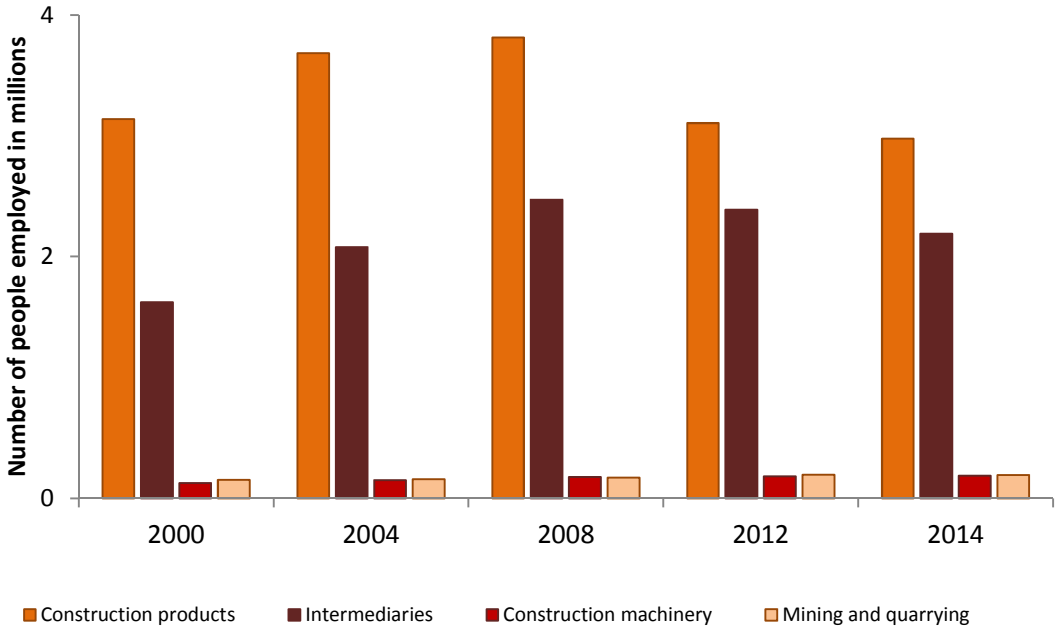
In comparison all service sectors that are relevant in the CVC have showed a stable employment and appear not to have been impacted significantly by the crisis (figure 29).

[46] As the overall evolution of production in the construction sector is driven by the 'buildings' sub-sector, the correlation coefficients shown with respect to buildings are essentially the same as those for the construction sector as a whole.

[47] Specifically, 'Quarrying of stone, sand and clay' (see annex)

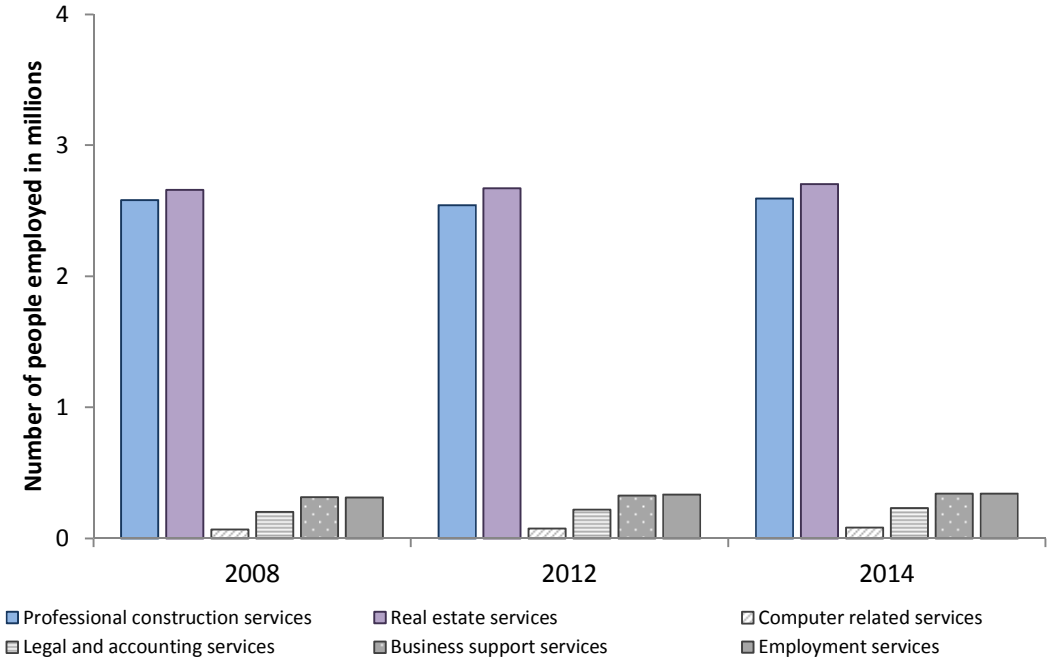
[48] Specifically 'Manufacture of other builders' carpentry and joinery' (see annex)

Figure 28 / Size of upstream sectors of the CVC, in terms of people employed



Source: Elaborations on Structural Business Statistics, Eurostat

Figure 29 / Size of service sectors that are relevant in the CVC, in terms of people employed



Source: Elaborations on Structural Business Statistics, Eurostat

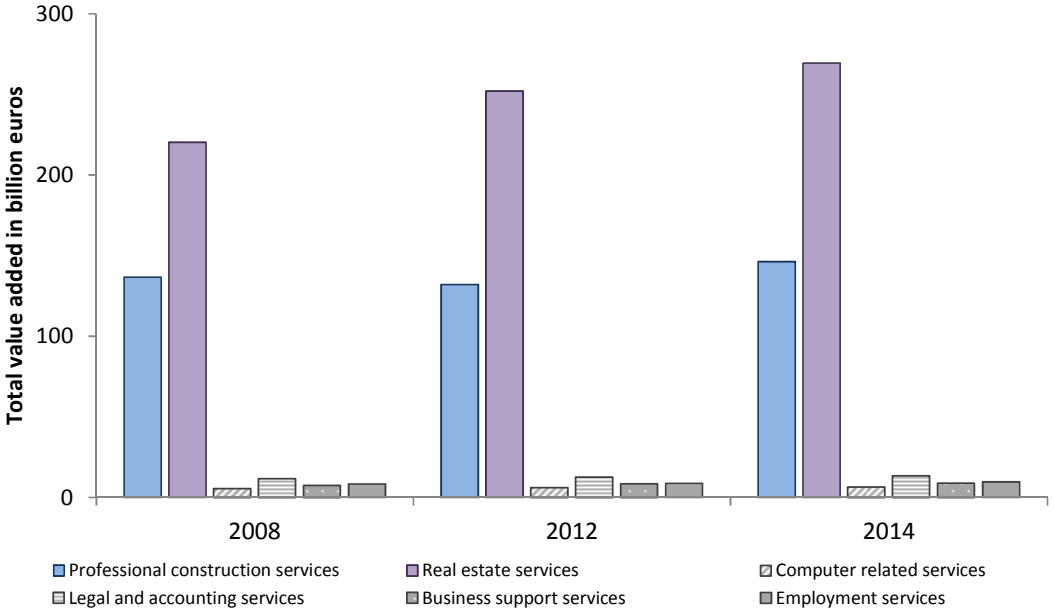
3.2.3. Value added trends across the CVC

The evolution of real value added in the CVC has been largely similar to that of employment and to some extent production (see above). The exception to this trend is real estate services, which have experienced significant growth, by EUR 49 billion of total value added, since 2008.

Figure 30 / Size of upstream sectors of the CVC, in terms of total value added

Source: Elaborations on Structural Business Statistics, Eurostat

Figure 31 / Size service sectors that are relevant in the CVC, in terms of total value added

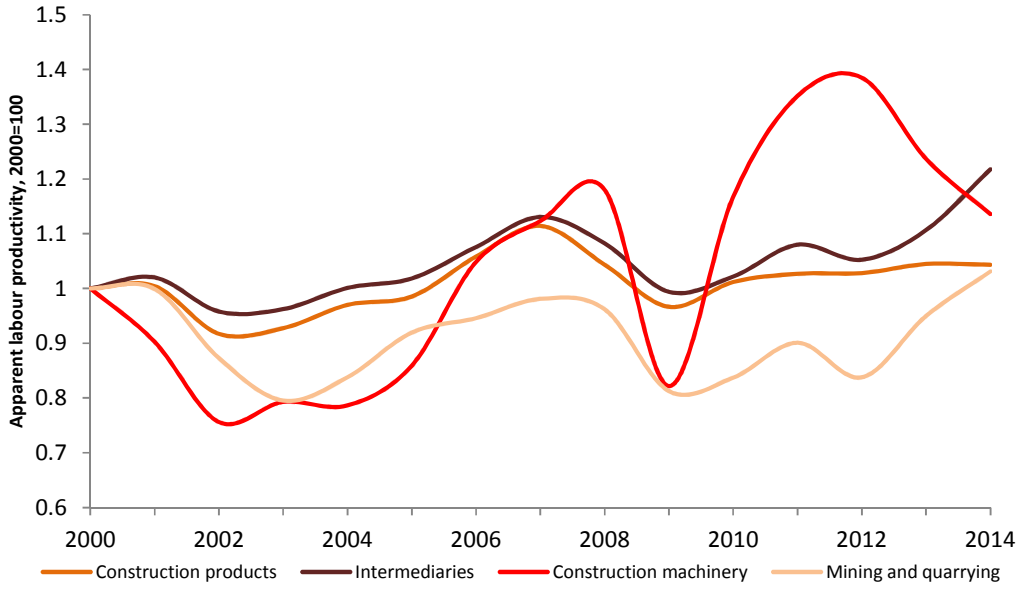


Source: Elaborations on Structural Business Statistics, Eurostat

3.2.4. Productivity trends across the CVC

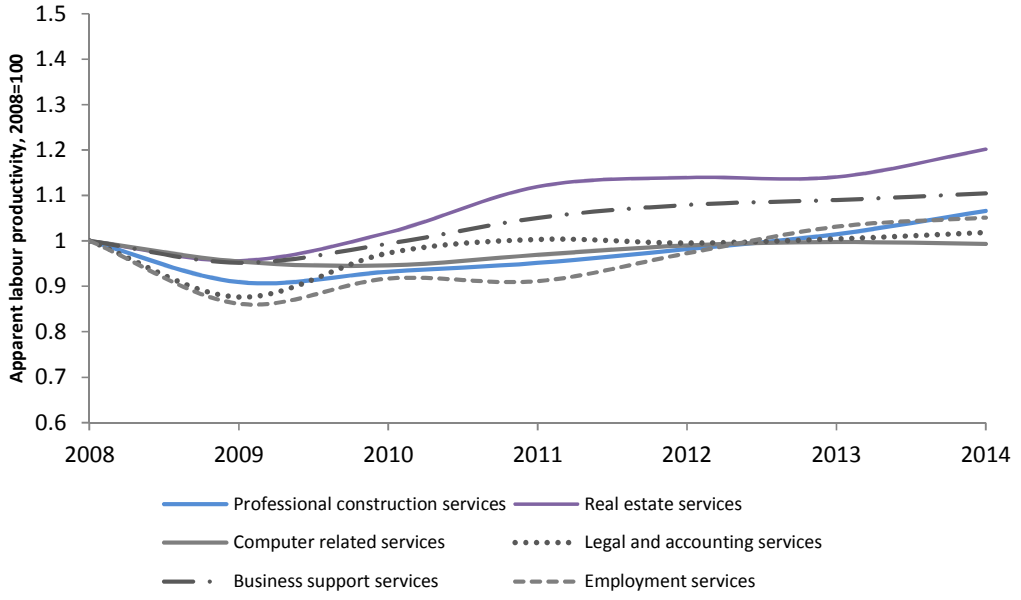
Similar to the declining productivity of the construction sector before the onset in 2008 of the crisis(see section 3.1.4) many of the other CVC have also experience lower productivity levels compared to their benchmark in 200.

Figure 32 / Apparent labour productivity in the CVC



Source: Elaborations on Structural Business Statistics, Eurostat

Figure 33 / Apparent labour productivity in the service sectors that are relevant in the CVC, since 2008



Source: Elaborations on Structural Business Statistics, Eurostat

After 2010, while the construction sector's productivity remained low and stagnant, its CVC reacted differently with the exception of construction machinery and computer-related services, other CVC sectors have increased their labour productivity.

Besides individual conclusion on CVC sectors, this illustrates, that although several trends are similar between the construction sector and its CVC, the internal reactions to shocks and internal sector performance are driven by other drivers. This is investigated further in chapter 4.1.

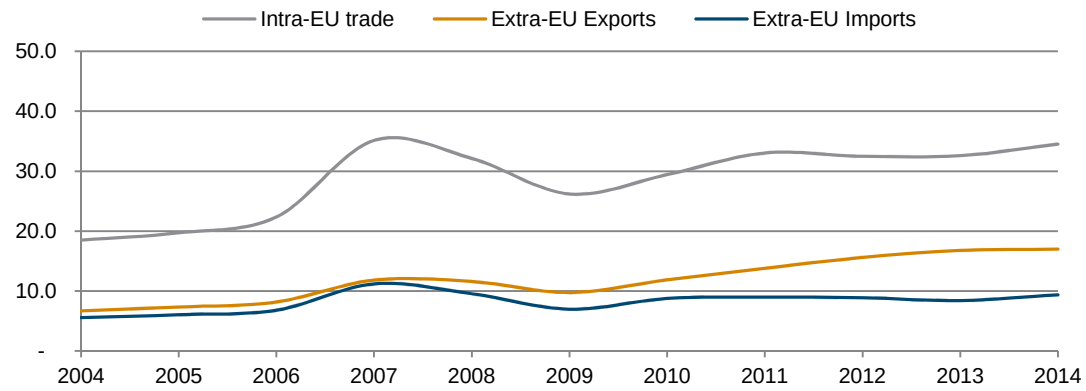
3.2.5. Trade performance trends in the CVC

The differences in trade flows and patterns are such, that each aggregated product group warrants individual attention. This section will present the headline trends in terms of trade flows for the EU28 and the trade balance for each Member State in 2004 and 2014 (pre- and post-crisis). More specifically, both intra-EU trade and extra-EU imports and exports are depicted for the EU28 as a total between 2004 and 2014. At the Member State level, normalised trade balances (e.g. net exports divided by total trade, defined as intra-EU + extra-EU trade), are depicted for the first and last year of the trade data time horizon.

Raw products

Intra-EU trade in 2014 has regained its pre-crisis levels, at EUR 35 billion. Vis-à-vis the rest of the world, the EU has had a trade surplus for the past decade, with extra-EU exports outpacing extra-EU imports since the crisis.

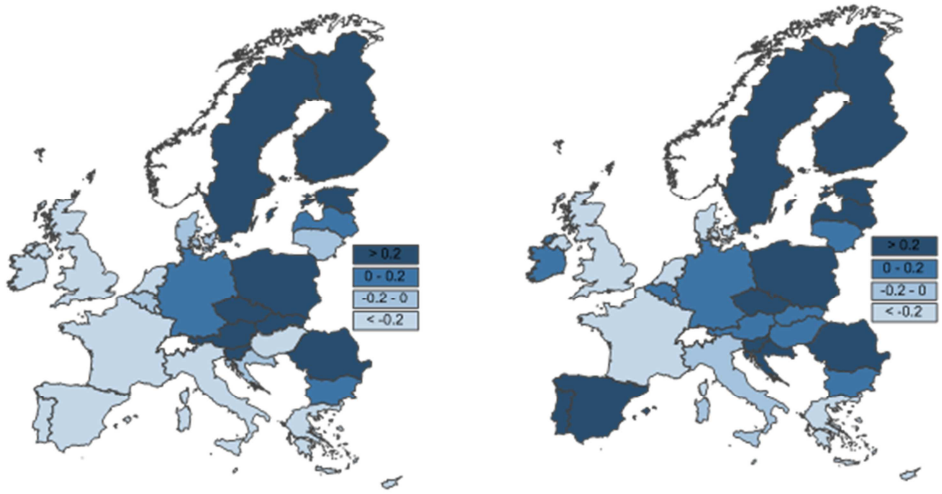
Figure 34 / Trade flows for raw products in billion EUR



Source: Eurostat Comext. Ecorys calculations.

As for the normalised trade balance, Member States that joined the EU in 1995 and 2004 tend to have the largest trade surpluses. Within the *raw products* product category, wood and wood products are the largest group, which may explain the large trade surplus of Austria, Sweden and Finland. Most Member States in the west tend to be net importers of these products, although in the decade between 2004 and 2014, Spain and Portugal became large net exporters as well.

Figure 35 / Normalised trade balance for raw products, 2004 and 2014

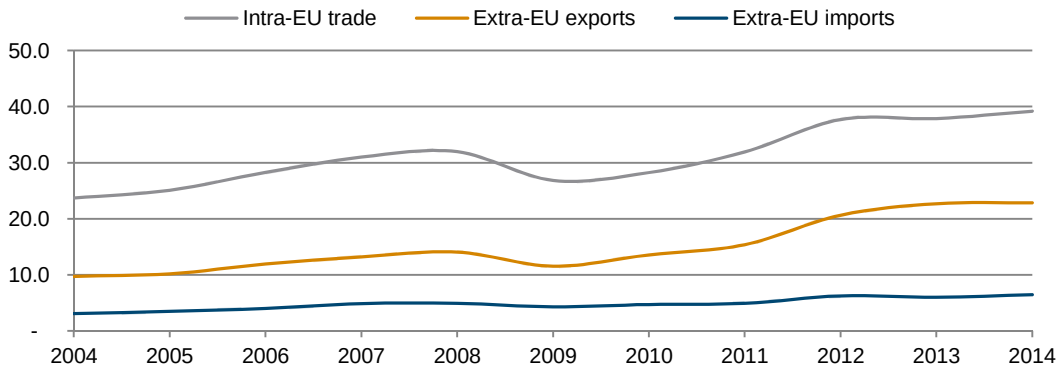


Source: Eurostat Comext. Ecorys calculations. Normalised trade balance is calculated as the trade balance divided by total trade, data for 2004 in the left panel, 2014 in the right panel. Darkest colour denotes normalised trade balance larger than 0.2.

Intermediate products

The trade flows for *intermediate products*[49] show that intra-EU trade has increased steadily over time, from EUR 23 billion in 2004 to EUR 39 billion in 2014. Similarly, extra-EU exports have more than doubled in value over that same time period, increasing the extra-EU trade surplus from EUR 6.5 billion to EUR 16.5 billion. This is a first indication that intermediate products are competitive in the world market, and that imports from outside the EU do not tend to crowd out domestic production.

Figure 36 / Trade flows for intermediate products in billion EUR

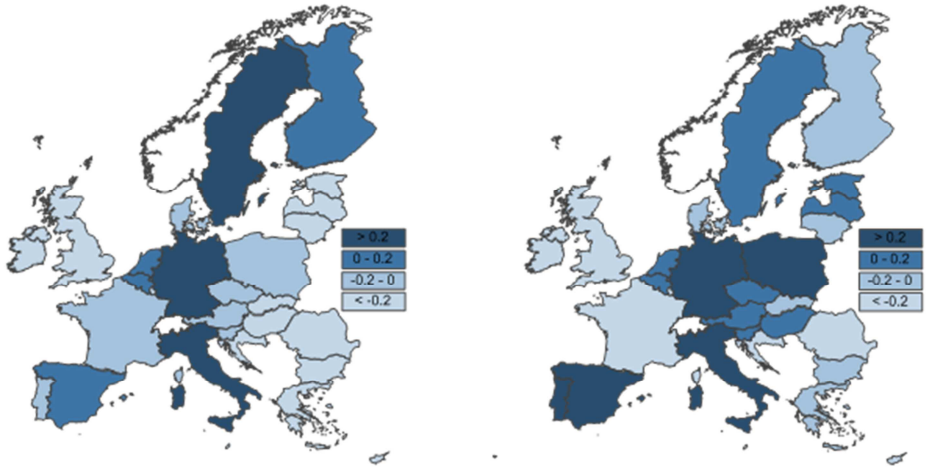


Source: Eurostat Comext. Ecorys calculations.

An interesting finding from a look at the normalised trade balances is that Eastern European Member States used to be net importers in 2004, but a decade later most of them are net exporters. This, too, shows that a wide variety of Member States is able to sell their goods to third countries, though some Member States have seen a deterioration vis-à-vis their normalised trade balance.

[49] Intermediate products include; chemical products, glass products, clay and ceramic products, and metal products.

Figure 37 / Normalised trade balance for intermediate products, 2004 and 2014



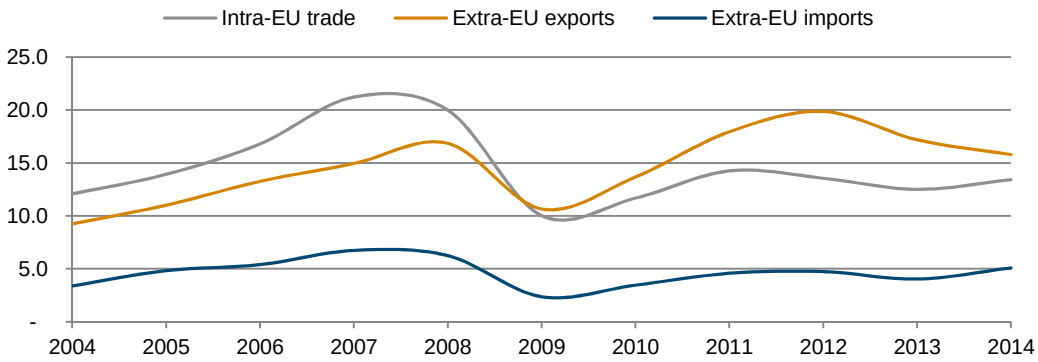
Source: Eurostat Comext. Ecorys calculations. Normalised trade balance is calculated as the trade balance divided by total trade, data for 2004 in the left panel, 2014 in the right panel. Darkest colour denotes normalised trade balance larger than 0.2.

Construction Machinery

Trade in machinery used in the construction sector tends to be somewhat smaller in absolute size than the other two product groups discussed above. It is noteworthy that since the crisis, third countries make up a larger share of the total exports than do intra-EU partners. This finding may point towards the competitive position of EU manufacturers in the global arena for construction machinery, although it is also likely that manufacturers will have more actively looked for other markets during the crisis. In 2013 and 2014 extra-EU exports are in decline while intra-EU trade slowly resumes.

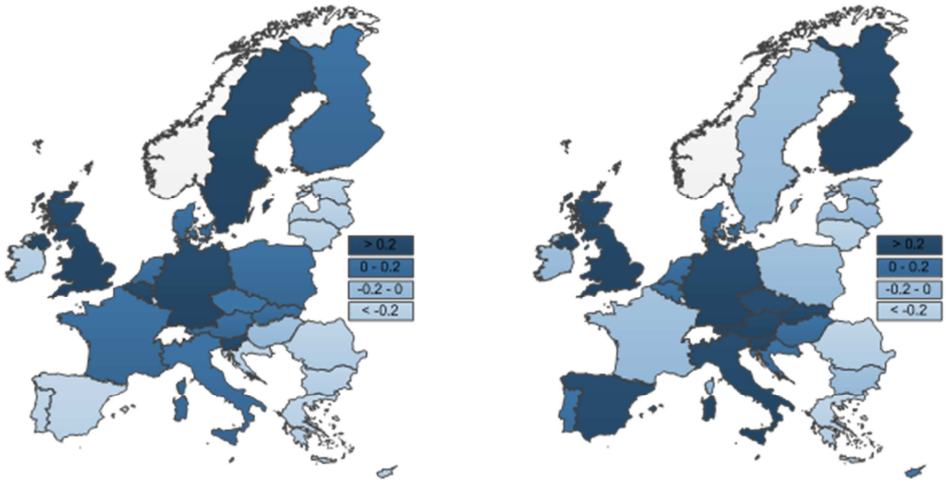
At the Member State level, the countries with an originally large manufacturing base tended to have the largest trade surplus in 2004 (such as Germany, UK, Belgium, and several Eastern EU MS). Since then, however, several Central European Member States and Spain have become more apparent net exporters of construction machinery, while a number of other countries (Sweden, France, Poland) have become net importers.

Figure 38 / Trade flows for construction machinery in billion EUR



Source: Eurostat Comext. Ecorys calculations.

Figure 39 / Normalised trade balance for construction machinery, 2004 and 2014

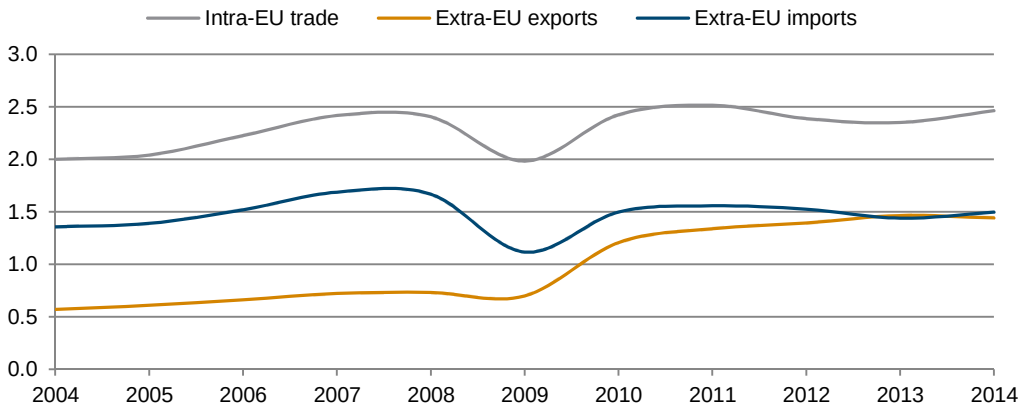


Source: Eurostat Comext. Ecorys calculations. Normalised trade balance is calculated as the trade balance divided by total trade, data for 2004 in the left panel, 2014 in the right panel. Darkest colour denotes normalised trade balance larger than 0.2.

Mining and Quarrying

Products such as sand and chalk naturally lend themselves less for cross-border trade as they are widely available and therefore transportation costs make the products more expensive than domestic ones. This is reflected in the trade flows depicted in Figure 26, which shows that intra-EU trade is a mere 2.5 billion annually. As opposed to the other product categories discussed above, the EU does not have a trade surplus *vis-à-vis* the rest of the world in these products, although the deficit has reduced in recent years and is now close to zero. While intra-EU trade is slightly above extra-EU trade, imports from third countries make up a signification part of the total trade in mining and quarrying. These imports are likely to consist of products that the EU does not possess.

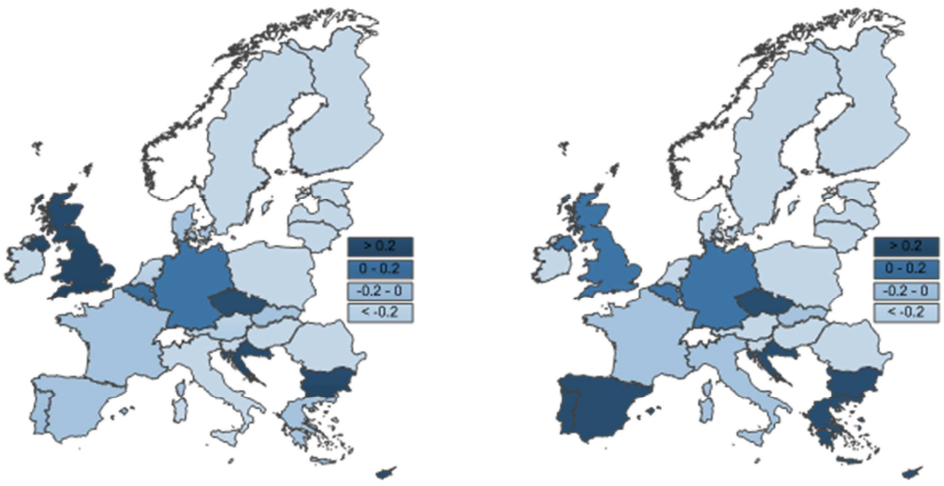
Figure 40 / Trade flows for mining and quarrying in billion EUR



Source: Eurostat Comext. Ecorys calculations.

In terms of Member State normalised trade balances, Bulgaria, the Czech Republic, Croatia and the UK had the largest trade surplus in 2004. Greece, Portugal and Spain went from being a net importer to a net exporter status in the decade under consideration. For these three countries, this can be attributed to a large drop in imports, so that this finding need not be a sign of strong performance in competitiveness of the manufacturing sector.

Figure 41 / Normalised trade balance for mining and quarrying, 2004 and 2014



Source: Eurostat Comext. Ecorys calculations. Normalised trade balance is calculated as the trade balance divided by total trade, data for 2004 in the left panel, 2014 in the right panel. Darkest colour denotes normalised trade balance larger than 0.2.

Construction and architectural, engineering services

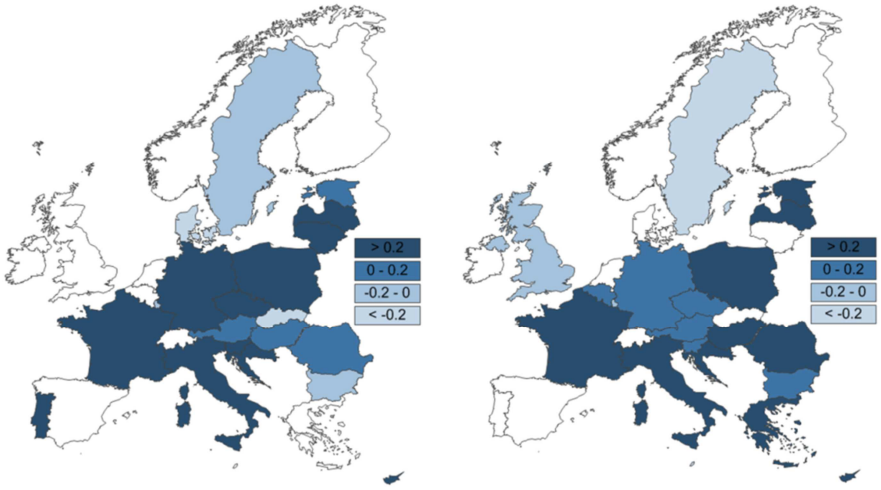
Data on trade in services are much more limited in terms of completeness and detail than data on trade in goods. We therefore only briefly touch upon this subject here, and avoid drawing strong conclusions as bad data may bias the observations. One other problem with the data is that the provision of construction services abroad can take more than a year, which often requires setting-up a local branch. Balance of payment statistics may, however, provide some rough indication as to the size of trade in services related to the construction sector. It is important to note that, especially in the case of the normalised trade balance, large changes may simply be a reflection of limited data availability.

For construction services as well as for architectural, engineering & technical services, exports to third countries are more important in terms of trade value than intra-EU trade. In the case of construction services, extra-EU exports have increased from 9.5 billion in 2004 to 18 billion in 2014, whereas intra-EU trade has stagnated at around EUR 13 billion since 2006. Due to limited data, the normalised trade balance can only be calculated for the years 2010-2013. In 2010, most EU Member States had a large and positive normalised trade balance, exporting more construction services than importing them and retained this position through 2013.

Figure 42 / Trade flows for construction services in billion EUR

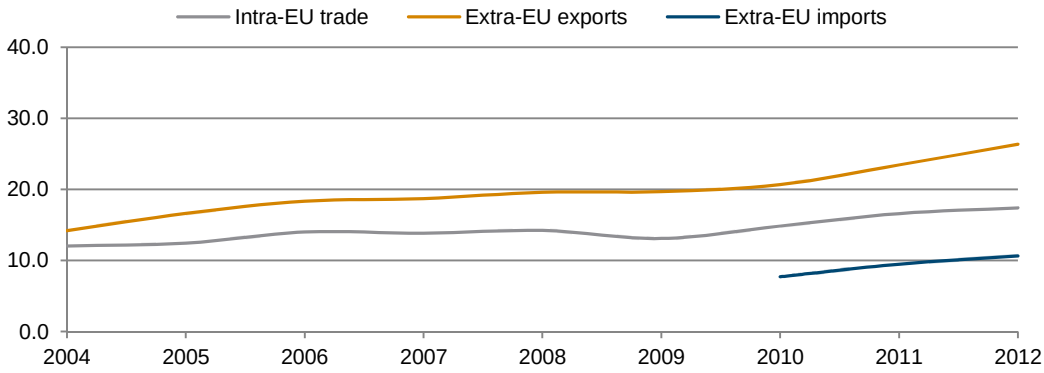
Source: Eurostat. Ecorys calculations. EBOPS code 249: Construction Services.

Figure 43 / Normalised trade balance for construction services, 2010 and 2013



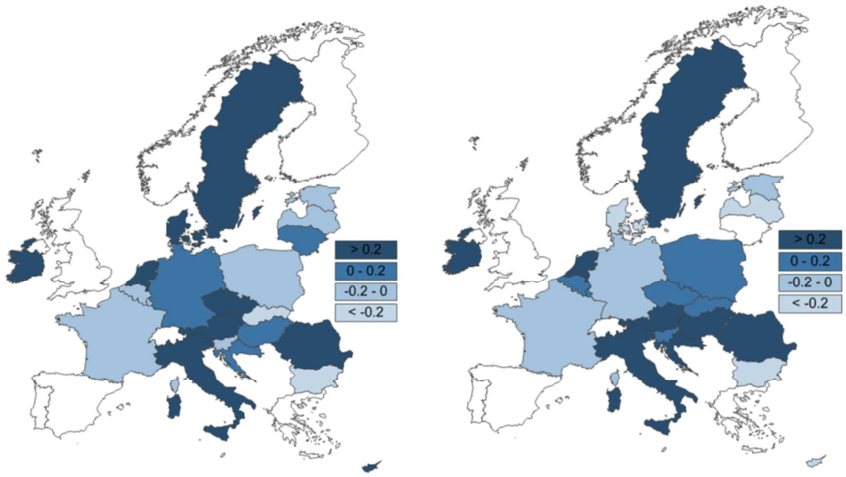
Source: Eurostat Comext. Ecorys calculations. Normalised trade balance is calculated as the trade balance divided by total trade, data for 2010 in the left panel, 2013 in the right panel. Darkest colour denotes normalised trade balance larger than 0.2.

Figure 44 / Trade flows for architectural, engineering and technical services in billion EUR



Source: Eurostat. Ecorys calculations. EBOPS code 280: Architectural, engineering, and other technical services.

Figure 45 / Normalised trade balance for architectural, engineering, technical services, 2010 and 2012

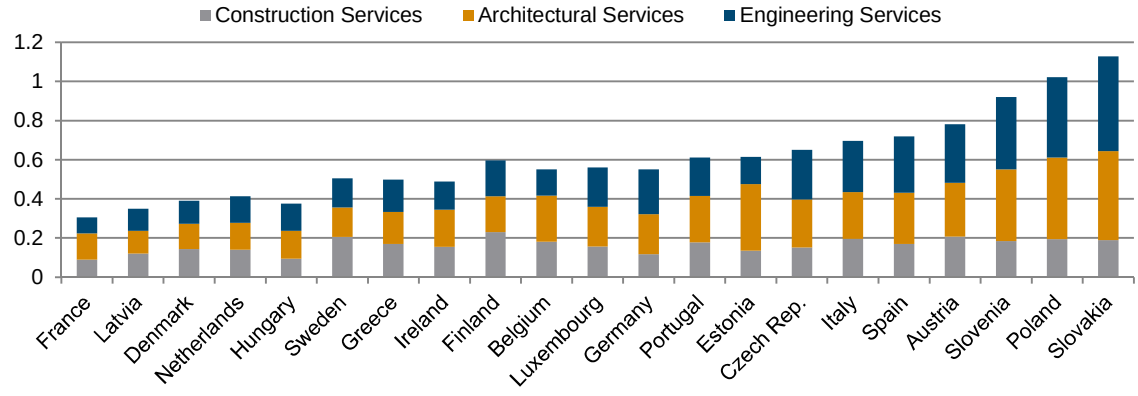


Source: Eurostat Comext. Ecorys calculations. Normalised trade balance is calculated as the trade balance divided by total trade, data for 2010 in the left panel, 2012 in the right panel. Darkest colour denotes normalised trade balance larger than 0.2.

Services trade barriers:

The Internal Market still contains barriers for cross-border activities of service providers. This is partly reflected in the OECD Services Trade Restrictiveness Index (STRI), where we should note that the STRI reflects barriers from a non-EU Member State perspective. Some barriers that exist for third country service providers are not relevant for intra-EU trade in services. While an analysis of the effect of these barriers on cross-border activity is beyond the scope of this report, the STRI index for construction, architectural, and engineering services may partly explain the relatively low intra-EU trade figures above. Figure 46 shows the overall restrictiveness per country, which is the sum of the trade restrictiveness indicators for the three related services. The most restrictive countries are Slovenia, Poland and Slovakia, whereas foreign services providers in France, Latvia and Denmark face the least barriers.

Figure 46 / Services Trade Restrictiveness for construction, architecture and engineering, 2015



Source: OECD STRI Database, Ecorys calculations.

Trade restriction and barriers:

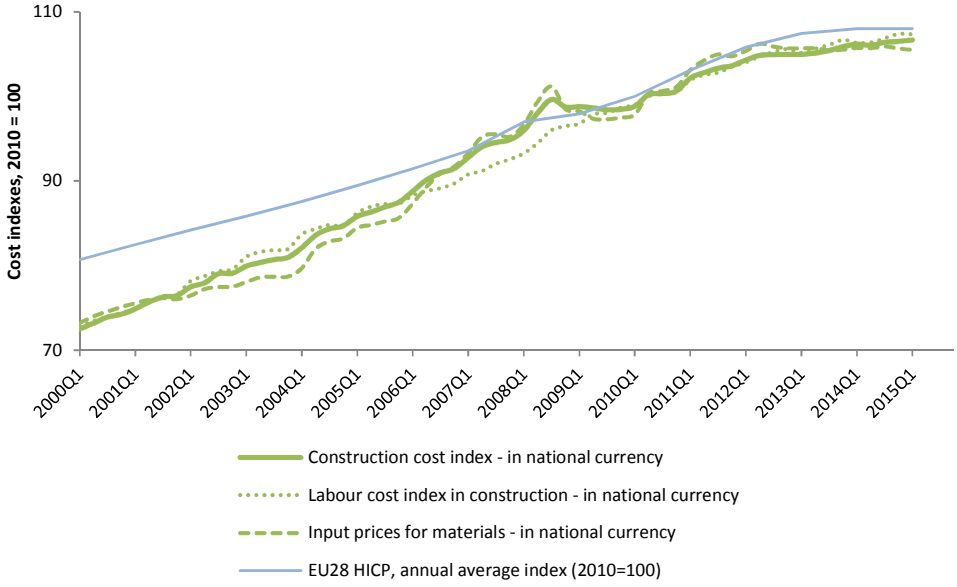
Of the five measures included in the STRI, restrictions to movement of people and restrictions to foreign entry are contributing most heavily to the results. Higher levels of restriction can partly be attributed to general measures that have an impact on all sectors of the economy. Examples of these types of measures are limitations on board members and managers of construction firms, investment screening, quotas and labour market tests, as well as impediments on acquiring land and real estate. The construction sector is notably affected by restrictions in public procurement as the government is an important source of demand for construction services. In some countries, there are content restrictions as well as requirements for residency and qualification of construction engineers. While engineering and architectural services are marginally more regulated than construction services, they can be regarded as relatively liberal. Compared to other accredited professional services, particularly legal and accounting services, engineering and architectural services are less restrictively regulated.[50]

3.2.6. Price levels

The overall EU construction cost index is relatively stable over time and in general under the overall inflation trends. However, during the construction boom period of 2004-2008, construction prices were increasing at a faster rate than inflation, usually suggesting a bubble. Furthermore in this period input prices have been increasing at a faster rate than labour cost in the period 2006-2008. The two trends have re-aligned after the crisis, again suggesting a temporary dimension of the bubble.

However, as we will see in the next section, when price developments are disentangled by different MS, different stories arise.

Figure 47 / Evolution of construction cost index and relative components



Source: Eurostat national accounts statistics + Ecorys calculations

[50] Massimo Geloso Grosso et al. (2014), Services Trade Restrictiveness Index (STRI): Construction, Architecture and Engineering Services. OECD.

3.3. COUNTRY COMPARISON OF ECONOMIC AND TRADE PERFORMANCE, IN PARTICULAR IN POLAND AND SPAIN

In the previous sub-chapters it was seen the difference of economic and trade performance in the different sectors of the CVC. In this sub-chapter we introduce an additional complexity in that there are differences even within the EU and in particular Poland and Spain. In particular the focus is on the construction sector as the changes in that sector are common knowledge to readers.

To demonstrate these differences we have selected indicators:

› *Value added growth: demonstrating the growth of the sector;*

› *Labour productivity: the most comprehensive and comparative driver of growth and performance outcomes;*

› *Price levels: showing differences across the EU as well as an alignment of the two comparable countries after Poland joined the EU in 2004;*

› *Profit margin: the show outcome of productivity increase as explained in 3.1.4. and therefore add a layer of explanation on the changes in the sector;*

› *Exports: as a demonstration of the difference in reaction to the changes by the sector;*

› *Trade in services & FATS: showing both the trade in services (where data are available) as well as activity of firms affiliated to domestic firms.*

At the end of this sub-chapter the reader should have an understanding of not only the complexity and performance of the CVC (from the two sub-chapters above), but also of the regional differences within the EU. This will become more important in the next chapter where the analysis dwells into new and in-depth findings about the functioning of the CVC and its integrations (both upstream as well across borders).

Main findings:

Differences between Member States in the EU:

› Countries under the ESM programme, except for Portugal, experienced growth prior to 2008 and a sharp fall thereafter. Construction price levels rebalanced in several cases to around 80% of the EU average, whereas productivity was falling until 2012 and increasing thereafter.

› Eastern and Baltic countries experienced strong growth prior to 2008 and some decline thereafter, but not to the same extent as the ESM countries. Their productivity varies, but has been increasing since 2012; construction price levels have been relatively constant around 40-50% of the EU average.

› Central and Western countries have a more stable construction sector. However, productivity has been consistently falling since 2008 and is not showing any signs of recovery. Construction price levels are also more stable, with several of the old MS exhibiting above EU average price levels.

A more detailed assessment was carried out for Spain and Poland:

› Fall in productivity in Spain started a year after the onset of the crisis, but it has been falling ever since. While, despite two dips, Polish firms experienced a growth trend of productivity.

› The polish construction sector is flexible in terms of its profit margins and therefore has the ability to ride out harder periods by remaining price competitive. Spanish companies remained to operate at around 11% profit margin, despite large scale bankruptcies in the sector.

› Pre-crisis levels show the construction boom in Spain and upcoming Polish construction sector post-EU accession.

› After the onset of the 2008 crisis, cost levels in Poland and Spain have remained virtually flat, despite an overall EU increase.

› Partially as a result of its price competitiveness, the crisis in Poland did not leave a lasting mark on the exports of upstream products in the CVC.

› In comparison the Spanish exports mainly remained at pre-crisis level, further exasperating the sectors problems, since alternative markets were not an option for replacing collapsed domestic market.

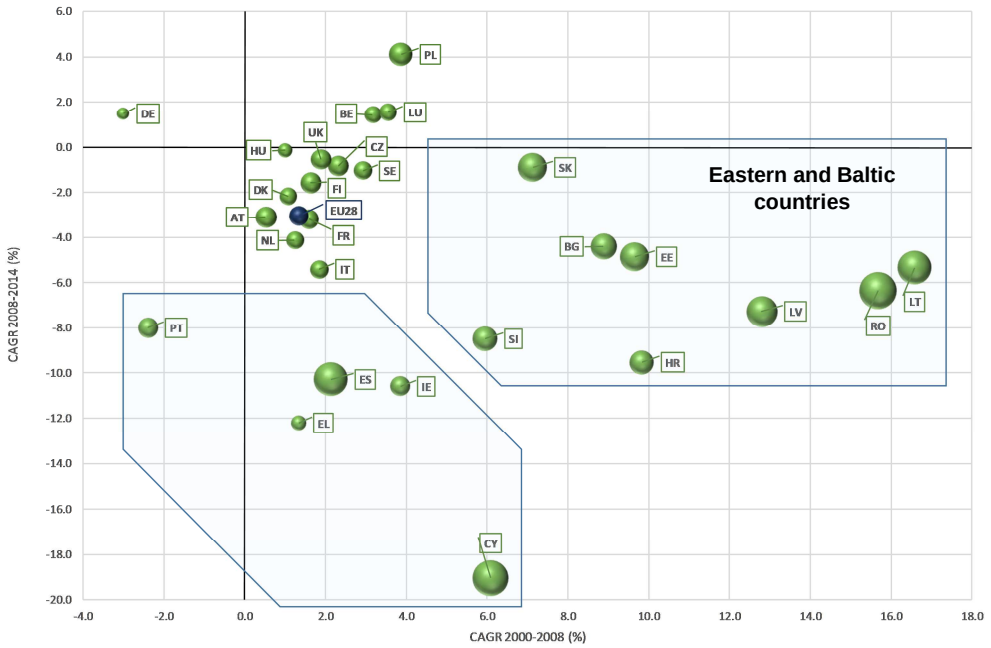
3.3.1. Differences in value added growth and productivity between parts of the EU

When comparing the growth of value added before and after 2008, the year marking the crisis, there are clear differences between the above-defined three main parts of the EU. The countries under the ESM programme (bottom box) have mostly experienced value added growth between 2000 and 2008 (positive on the x-axis), while all recorded a sharp decline from 2008-2014 (negative on the y-axis). In comparison, Eastern and Baltic countries (right box)[51] experience growth prior to 2008 as they started receiving pre-accession funds and then joined the EU, in most cases in 2004. Starting from 2008 they recorded a decline, but not as severe as in the case of the first group of countries. Finally, the Central and Western countries (the remainder not in boxes) have seen less volatility both before and after the crisis, showing a stable and mature construction sector.

The productivity for ESM countries has been decreasing since 2006 and only started to improve in 2012. In comparison, although productivity has been growing mildly for central and western countries up to the onset of the crisis in 2008, it fell by almost 20% and has yet to show signs of sustained recovery. The eastern and Baltic countries have showed signs of more volatile productivity, in much the same way as their economies have experienced larger swings.

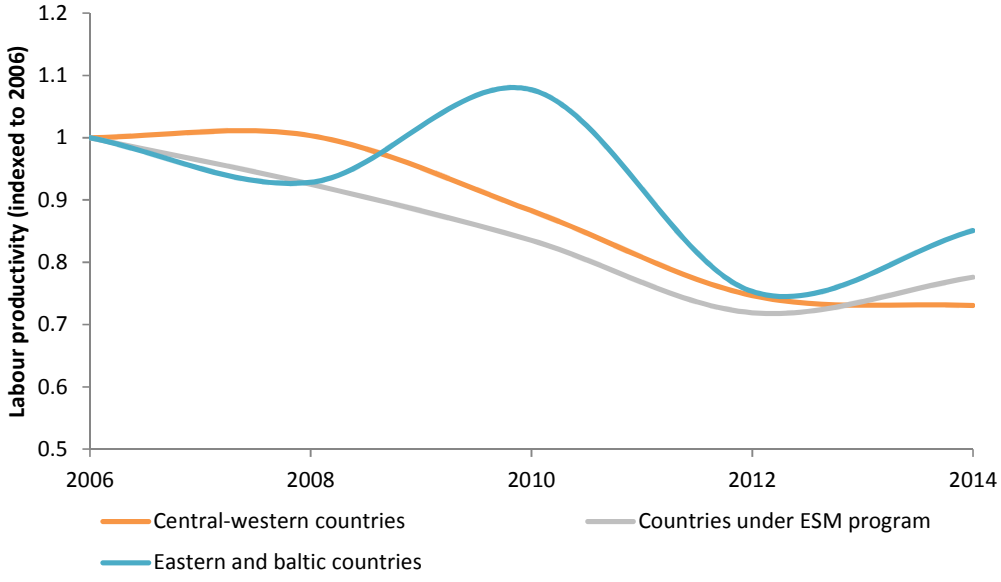
[51] PL, HU and CZ reported observations in line with those of the general group of countries. They have hence been excluded from the subgroup hereby considered and included in the residual '*Central and Western countries*'.

Figure 48 / Value added growth in the construction sector
2000-2008 (x-axis), 2008-2014 (y-axis)



Source: Eurostat.

Figure 49 / Evolution of apparent labour productivity[52] in the construction sector
(specifically onsite construction activities), decomposed by country-groups

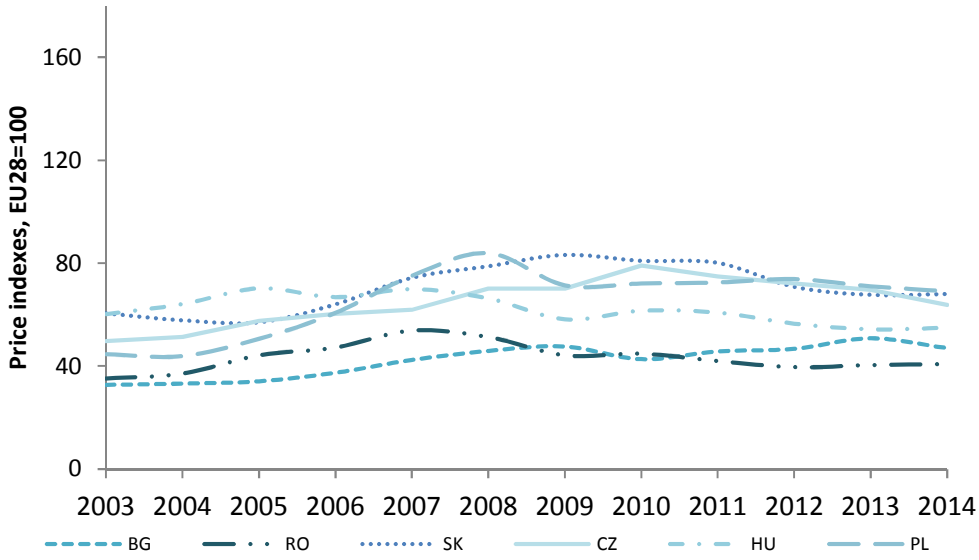


Source: Amadeus. Countries under the ESM programme include: ES, EL, PT, IE, CY; Eastern and Baltic countries include: BG, RO, HR, SI, SK, LT, LV, EE; Central-western countries include the remaining nations.

[52] Labour productivity is based on firm-level data from the Amadeus database and derived as value added over the number of employees. The aggregate value displayed is computed as the average over the specific regional subsets of total firm population.

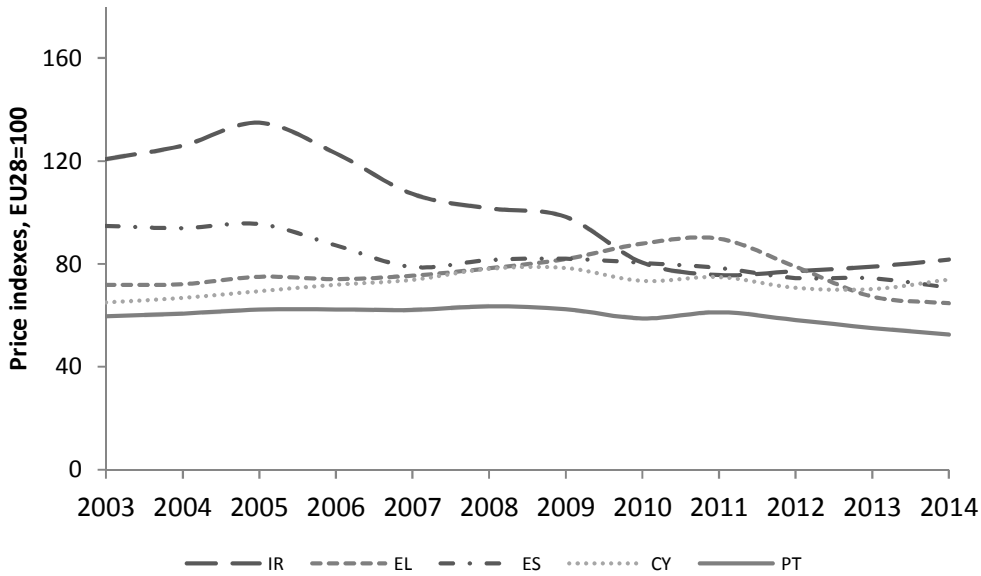
In terms of the differences in price levels, there are still significant differences across the EU. As expected the central and eastern countries remain below the EU average in terms of construction price index, while western countries show higher construction price index. Countries under the ESM programme oscillate between the two at just below the EU average. In particular, the price index for Ireland is noticeable as decreasing significantly since 2003, as well as the construction price index in Greece, where adjustment began to occur only in 2011, a couple of years into the crisis.

Figure 50 / Evolution of price levels vis-à-vis European average, central eastern countries



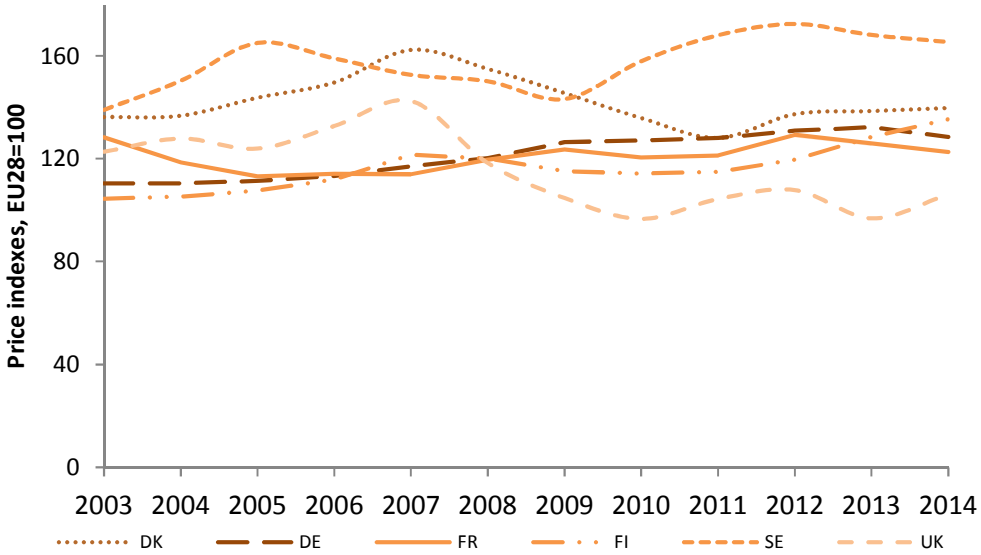
Source: Eurostat

Figure 51 / Evolution of price levels vis-à-vis European average, countries under ESM programme



Source: Eurostat.

Figure 52 / Evolution of price levels vis-à-vis European average, western countries



Source: Eurostat.

3.3.2. Poland and Spain

The two countries that stand out most in terms of extremes and typical representation of the different impact of the crisis are Poland and Spain. The crisis affected the Polish construction sector with a certain delay, and deepened in 2011-2013.[53] Quoting the analysis provided by the European Construction Observatory, internationally '*Polish construction companies fare well as sub-contractors in other EU countries, notably Germany*'.

In Spain the distress in the construction sector has put a large number of firms under strain, where 19% of operating companies was forced to exit the market in the period 2008-2012.[54] Signs of recovery can be envisioned, as business confidence has been improving, and less stringent credit conditions seem to improve access (and therefore demand) for housing. This factor, combined with declining housing prices is expected to push demand upwards. The house price index has decreased by 34.2% between 2008 and 2014, as registered by the European Construction Observatory[55]. Overall the Spanish construction industry is well positioned on the global value chain, with American markets as primary export destination[56]. The Spanish Construction Companies Association (SEOPAN) reported that 29% of the non-domestic turnover came from South and Central America in 2013, and 24% from North America.[57]

[53] European Construction Observatory, Country Profile for Poland, February 2016.

[54] European Construction Observatory, Country Profile for Spain, March 2016.

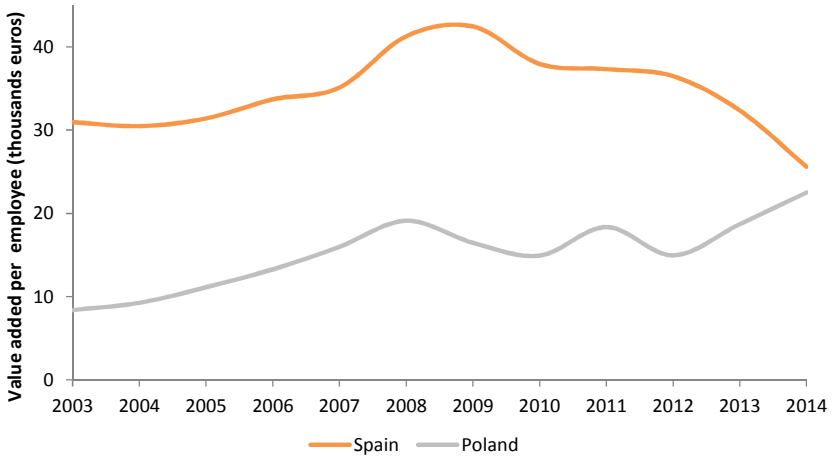
[55] Ibidem at 55.

[56] SEOPAN, Informe Economico 2014.

[57] The economic figures regarding the overseas activity should however be treated with caution. The European Construction Observatory raises concerns towards this trend. Experience from the past years indicates that the Latin America market *'can prove challenging from an execution or working capital standpoint'.* Spanish companies operating in Latin America have improved their business profiles but are exposed to the risks of significant capital losses, as it was the case for Isolux Corsan and Grupo Aldesa in Brazil and Mexico.

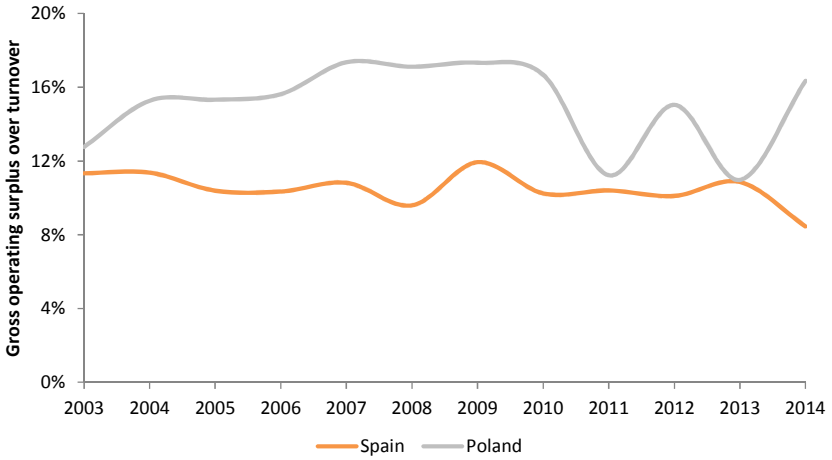
Productivity of Spanish firms in the construction sector has been increasing until 2009, and then started a decreasing trend after the burst of the real estate bubble. Polish firms instead have been improving their productivity levels since the star of 2003. And although the Polish construction sector has suffered two brief periods of declining productivity in 2008-2009 and 2011, overall the sector is on a steady growth path. Indeed, competitiveness is still low, but has been improving during the last years.

Figure 53 / Apparent labour productivity for Spanish and Polish firms in the construction sector



Source: Eurostat – Labour productivity as the total value added over total number of employees.

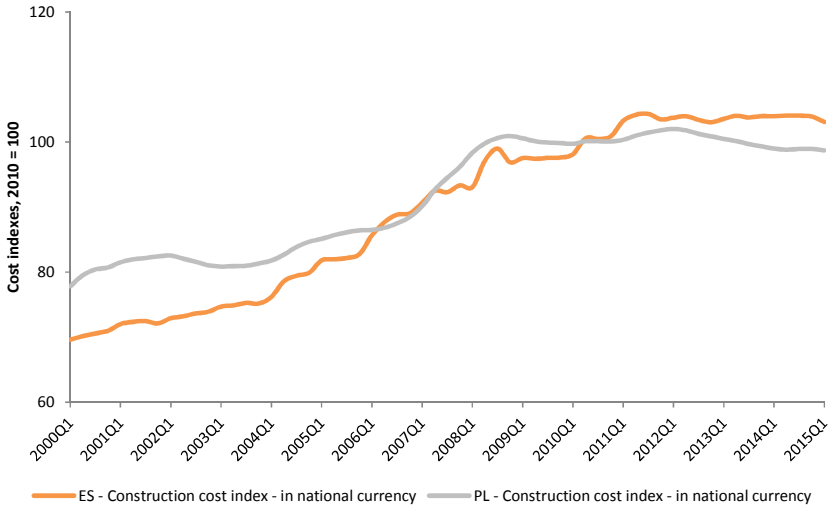
Figure 54 / Profit margins for Spanish and Polish firms in the construction sector



Source: Eurostat – Gross operating surplus over total turnover.

Typically sectors and countries that have price competition as their key asset will have a more fluctuating profit margin during periods of external shocks (such as an economic crisis, or intense price competition). This is the case for Poland, which during its two dips lowered its profit margins to react to remain price competitive. Spain on the other hand appears to have maintained a steady profit margin despite falling productivity and value added – indicating that a profit margin of around 11% was the minimal acceptable level, despite large-scale bankruptcies in the Spanish construction sector.

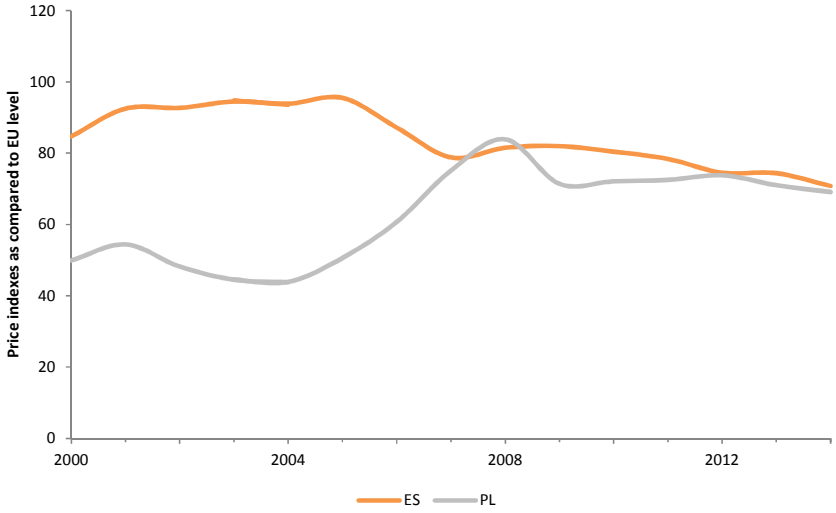
Figure 55 / Evolution of Construction Cost Index (CCI)



Source: Eurostat, Construction cost (or producer prices), new residential buildings – quarterly data.

Overall in the period 2004-2008 the construction cost prices in Spain were growing at a faster pace than in Poland, pointing towards the housing boom in Spain. From the onset of the crisis in 2008 the prices in both countries have essentially remained the same, in contrast to the EU overall trend of continuously increasing costs (section 3.3.1).

Figure 56 / Evolution of construction prices, as compared to the EU average



Source: Eurostat, Purchasing power parities (PPPs), price level indices and real expenditures.

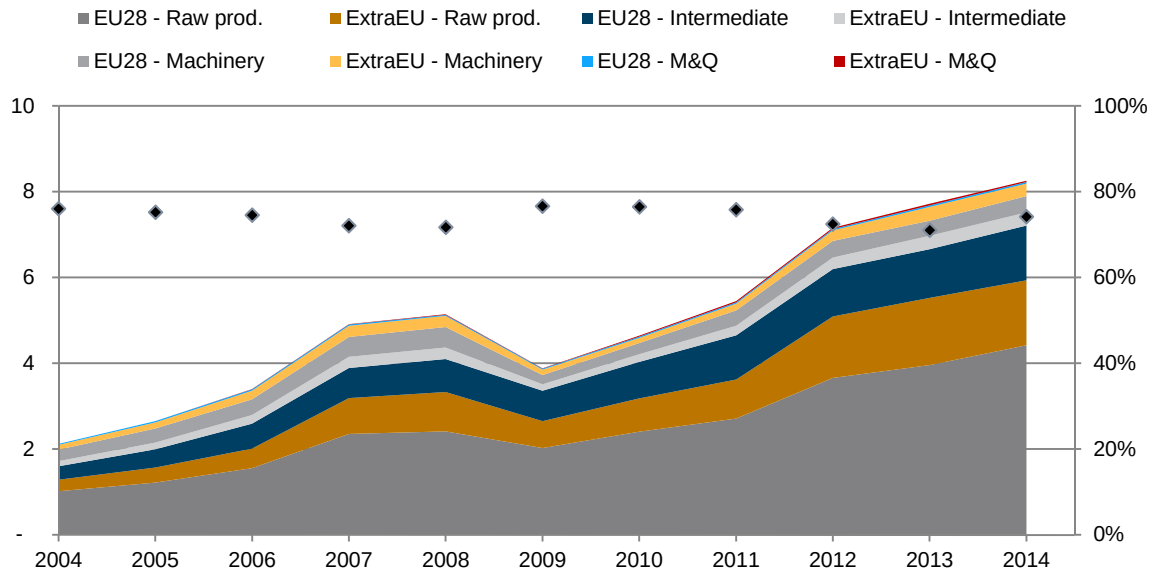
The Polish construction index has remained below its indexed level of 2010 for much of the last five years, indicating that, as mentioned above, in order to remain price competitive costs, emphasis was paid to keep cost prices down and more so than for example in Spain, where the construction sector has tried to rebalance.

When comparing the figures with the EU28 average we can see how the gap in price levels among the two countries has been steadily reducing. This suggests the above mentioned building boom in Spain and upcoming Polish construction sector post EU accession in 2004 up to the onset of the crisis in 2008.

Goods trade

As a result of the price competitiveness of Polish construction firms and their ability to maintain this during the difficult time has meant that the crisis in Poland did not leave a lasting mark on the exports of upstream products in the CVC. Over the last decade, Poland became a large exporter of raw products. Half of the total exports are raw products that are exported to other Member States, with extra-EU exports of raw products accounting for another 20% of the total exports. The market share of Poland in intra-EU trade of raw products increased from 5% in 2004 to 13% in 2014. Across all four sectors, the share of intra-EU partners in the total export portfolio of Poland is remarkably stable. EU MS account consistently for 72% to 77% of total trade.

Figure 57 / Development of exports in Poland (left axis) and share intra-EU in total (dotted line on the right axis), billion EUR



Source: Eurostat Comext. Ecorys calculations. The dotted line is the share of intra-EU exports in total exports. Raw prod. include wood products, plastic products, cement products, stone products and minerals. Intermediate include chemical products, glass products, clay and ceramic products, and metal products.

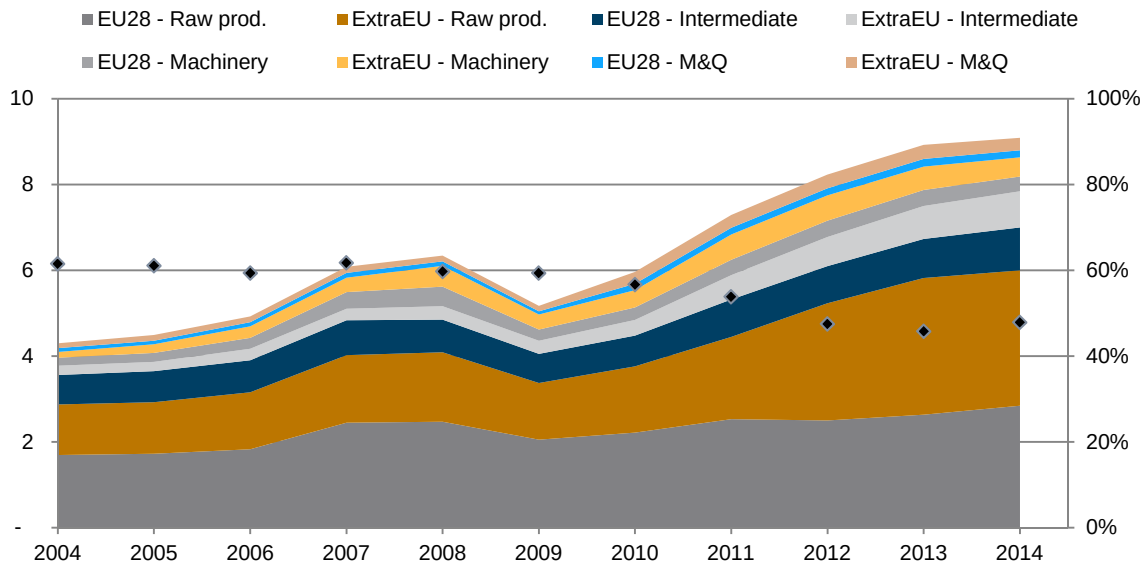
Germany is the main intra-EU export destination for Polish goods in all categories, both in 2004 and 2014. The results shown in Table 2 confirm the story that Poland is an important supplier to Germany, which seems to be the case in all product groups. Whereas the UK was an important destination for three of the four product groups in 2004, it was significantly less important in 2014. On the other hand, Eastern European Member States have entered the top 5 in many product groups.

Table 2 / Rank as intra-EU destination of Polish goods exports, 2004 and 2014

	Construction Machinery		MQ		Raw products		Intermediate products	
	2004	2014	2004	2014	2004	2014	2004	2014
Germany	1	1	1	1	1	1	1	1
UK	2	5			2		2	5
France	3	2			4			4
Sweden	4	4		5	5	5		3
Czech Republic			2	3		3	5	2
Lithuania				2		2	3	
Slovakia			3	4		4		
Belgium	5	3						
Romania			4					
Italy			5				4	
Denmark					3			

Source: Eurostat Comext. Ecorys calculations. Raw products include wood products, plastic products, cement products, stone products and minerals. Intermediate products include chemical products, glass products, clay and ceramic products, and metal products.

Figure 58 / Development of exports in Spain (left axis) and share intra-EU in total (dotted line on the right axis), billion EUR



Source: Eurostat Comext. Ecorys calculations. The dotted line is the share of intra-EU exports in total exports. Raw prod. include wood products, plastic products, cement products, stone products and minerals. Intermediate include chemical products, glass products, clay and ceramic products, and metal products.

In comparison, the crisis hit Spanish export flows in the upstream CVC product groups, without the increase in extra-EU exports of raw products, Spain's trade flows would still be around the pre-crisis levels. Data from the Observatory of Economic Complexity on trade flows indicate an increasing share of Latin American markets among the export destinations for Spanish cement, from 1.9% in 2006 to 13% in

2014[58]. The European Construction Observatory registered an increased in exports of cement of 88.6% between 2009 and 2013. Similarly, Eurostat data show that cement exports to Brazil increased from EUR 55 thousand in 2009 to almost EUR 40 million in 2012. Since the crisis, the EU has become a less important export destination of Spanish CVC products, as currently less than half of the total export find their way to EU partners. The stagnation of Spanish exports has exasperated the Spanish CVC as it has not been able to find alternative markets in light of falling domestic demand, aiding in the large business failures described earlier.

Compared to the export destinations of Polish goods, Spanish exports are much more concentrated in their destination. France, Portugal, the UK, Italy and Germany are the largest export destinations in almost all product groups. The first two countries are the main partner for Spanish exporting firms across the board.

Table 3 / Rank as intra-EU destination of Spanish goods exports, 2004 and 2014

	Construction Machinery		Mining and Quarrying		Raw products		Intermediate products	
	2004	2014	2004	2014	2004	2014	2004	2014
France	2	1	2	1	1	1	2	1
Portugal	1	3	3	2	2	2	1	2
UK	5	4	4	4	3	3	3	4
Italy	3		1	3	5	5	5	5
Germany	4	2	5	5	4	4	4	3
Netherlands		5						

Source: Eurostat Comext. Ecorys calculations. Raw products include wood products, plastic products, cement products, stone products and minerals. Intermediate products include chemical products, glass products, clay and ceramic products, and metal products.

Services trade

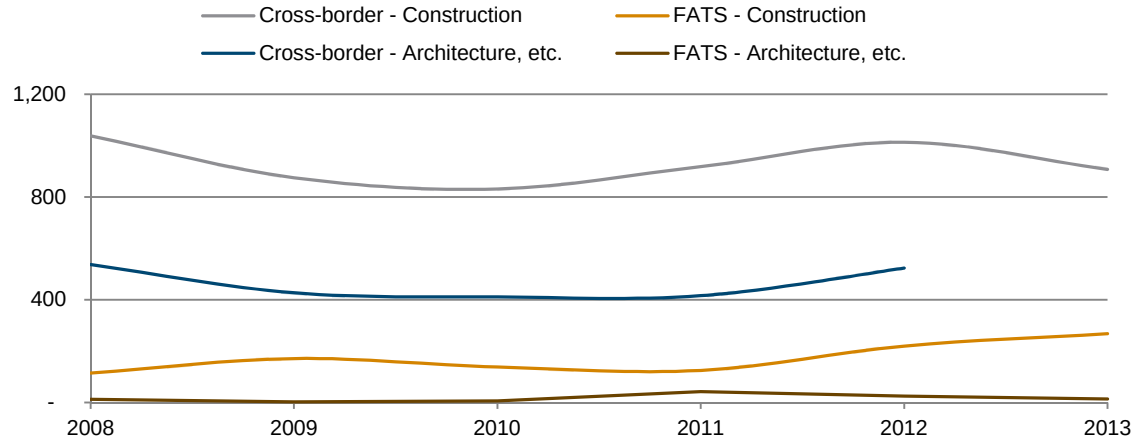
For Poland, data on cross-border trade in services, as well data on foreign affiliate sales of Polish companies[59] are available between 2008 and 2013. Temporary cross-border services provision is much larger than sales of Polish service providers through local affiliates. Cross-border trade of construction services hovers around EUR 1 billion annually, whereas architecture, engineering & technical services is about half that. Foreign affiliates sales of Polish controlled firms in other EU MS is on the rise, increasing from EUR 115 million in 2008 to EUR 265 million in 2013. FATS data on architecture, engineering & technical services show that this type of service provision is still very small[60]. Most of the foreign affiliate sales take place in Germany and the Czech Republic.

[58] Observatory of Economic Complexity.

[59] These are Polish companies that have been operating in other countries for a substantial amount of time and have therefore set up local subsidiaries.

[60] FATS data on real estate activities for Poland report values of around 1-3 million for 2011, 2012 and 2013 and are therefore not reported in this data. In general, Eurostat provides FATS data for each relevant NACE category, including Construction, Real estate activities and Architectural and engineering activities. However, upon closer inspection this dataset includes a large number of missing observations (years) and confidential entries. The provision of FATS data is voluntary, hence only a few Member States provide this data. FATS data for Poland and Spain should therefore be approached with caution.

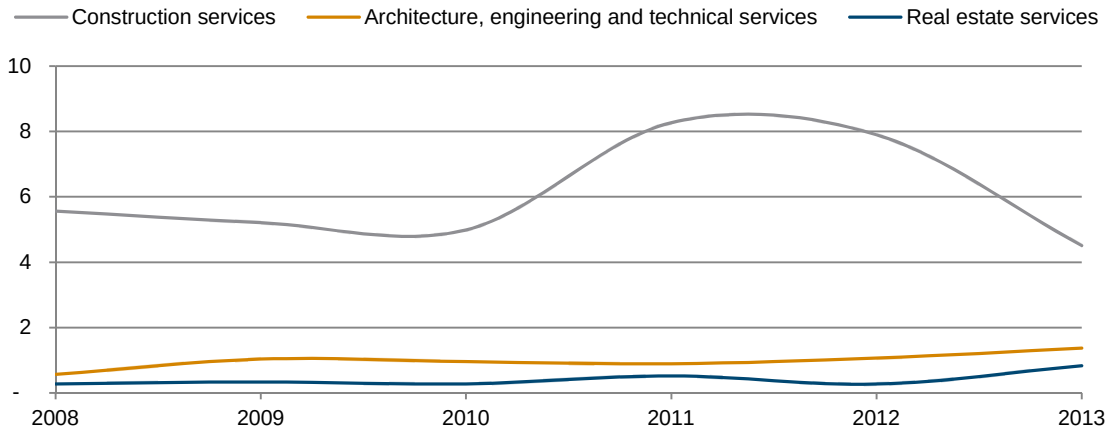
Figure 59 / Intra-EU cross-border sales of Polish service provider, million EUR



Source: Eurostat Comext. Ecorys calculations.

Data for Spain on cross-border trade in services are not reported. Therefore, Figure 60 only reflects data on foreign affiliate sales. The findings show an increase in construction services provided by Spanish owned companies in 2011. This finding may be explained by the attempt of Spanish services providers to escape their domestic downturn in 2010 and 2011, and to try to continue their work abroad. In the years after, following the decrease in apparent productivity in these years foreign affiliate sales dropped significantly.

Figure 60 / Foreign affiliate sales (intra-EU) of Spanish service providers



Source: Eurostat Comext. Ecorys calculations.

4. Functioning and fundamentals of the CVC

This chapter focuses on key findings about the core functioning and fundamentals of the CVC, by dwelling deeper into analyse some of the reasons behind the developments and structure of the CVC described in earlier chapters. The aim is to provide the reader with a more profound insight into the complex functioning of the CVC and present the principal understanding necessary for the future scenarios in the subsequent chapter.

The story is to look from the inside looking at the internal CVC functioning (chapter 4.1) and gradually spread outward to first the intra-EU CVC integration (4.2) and eventually to the global CVC and EU's position in it (4.3)

One way to look at the functioning and fundamentals of the CVC is to find out who is benefiting.

Within the CVC this appears to be the construction sector itself and professional construction services. Although in particular the construction sector has experienced a significant shakeout (companies going bankrupt), the financial health of the two sectors have improved after the crisis. And although profitability as well as investor returns are below 2006 levels, they have declined less than in other CVC sectors.

The financial health is partly due to the change in business models to become more flexible both in terms of employment as well as capital. Additionally one part of the construction sector (general construction) seems to have a strong negotiating power with suppliers and customers in the CVC to arrange more financially favourable payment schedules. Analyses also seem to indicate that the construction sector has an ability to benefit from productivity gains upstream in the CVC to increase its own profitability.

One way of assessing the status and future outlook of a sector is to see what private investors think. As a result of the developments, private equity has been buying up construction sector firms at an increasing pace, providing not only financing and efficiency gains, but also indicating a positive future outlook for the sector. However, this also indicates that the sector is far from reaching its full potential.

It should also be noted that due to the integrated nature of the CVC (as analysed in chapter 2), improvements in the construction sector mean that the whole CVC will benefit.

The CVC is becoming more cross-border and EU-wide integrated. This means that companies in small countries can increasingly benefit in being part of a wider CVC. For high value added products companies in larger countries benefit by become compilers and sourcing better and cheaper inputs. While lower value added products are usually traded intra-EU. This way all those participating in an EU wide CVC integration will benefit.

On the global level, EU's CVC is dominant, or at least has a strong competitive position, in some specialised parts of the CVC, namely the high value added products and services. There is a clear trend

towards more integration of the global CVC, with increasing specialisation. This is personified by the purchasing of other companies, which mainly focuses on new markets, rather than into the well-established and competitive EU CVC.

Main findings:

› Although the whole CVC was hit by the crisis and many companies have gone out of business, some sectors, such as the construction sector and professional construction services, are in better financial health than others.

› The crisis has accentuated a change in the business models throughout the CVC towards more flexible labour/contractors and less permanent employment. As well more flexible capital structures with more renting and leasing and less purchasing big capital items (e.g. large cranes, or diggers).

› General construction and machinery has been successful at increasing their net payment periods during the crisis, pointing towards a stronger negotiating position vis-à-vis its suppliers and consumers.

› The construction sector seems to be able to capture the productivity gains of upstream sectors and to transform them in its own higher profit margins.

› Global capital (in the shape of private equity funds) is increasingly interested and buying companies in EU's CVC. Responding to relative financial health of some companies and unrealised potential in the sector. Bringing in necessary efficiency gains and finance into the sectors.

› Overall the diversification of trade has increased, with new MS exporting to more EU countries and the old MS in turn sourcing more from other MS (new as well as old). This suggests that the single market has increased the cross-border integration of the CVC.

› Several smaller MS are more focused on intra-EU trade of products used in construction, suggesting a kind of integration of the CVC within the EU, where the final assembly and exports to third countries is taking place in some (the bigger) Member States.

› The CVC is competitive on a global scale with extra-EU exports of products used in construction and machinery exports accounting for a significant and growing share of total exports.

› There is a trend towards global specialisation, where the EU imports more of some products for domestic consumption and increasingly exports specialised in construction machinery. This points towards increased integration of the EU's CVC into the global CVC.

› The EU's CVC exports are diversified, with final clients in different geographic locations, while between 60% and 85% of import flow comes from five key trading partners. This suggests the nature of integration of the EU CVC in the global value chain.

› The EU tends to have a Revealed Comparative Advantage (RCA)[61] vis-à-vis most partners, with the exception of Turkey in almost all products used in construction and machinery sectors.

› For construction machinery, the EU is still the market leader, with a little over a quarter of the total market. While as for the intermediate products, the EU has lost its market leader position to China.

› EU CVC companies prefer to export than to acquire companies in non-EU markets (given the high value products they export), while non-EU companies focus on non-EU markets in acquiring firms to enter the markets.

4.1. INTERNAL CVC

This sub-chapter presents the evidence to the conclusions about the internal CVC functioning and fundamentals, mentioned in the summary of this chapter.

The attention is first focused on the analysis of relative financial health of the construction sector and professional services sector (4.1.1). Key drivers to this financial health of the construction sector (and the wider CVC) appear to be: changes in its business models to becoming more flexible (4.1.2), changes in payment periods and negotiating power (4.1.3) and the ability of the construction sector to benefit from productivity gains being made upstream in the CVC (4.1.4). The changes in the sectors as well as positive prospects and trends (identified in previous chapter) the construction sector is increasingly interesting to private equity (4.1.4).

Main findings:

› Although the whole CVC was hit by the crisis and many companies have gone out of business, some sectors, such as the construction sector and professional construction services, are in better financial health than others.

› The crisis has accentuated a change in the business models throughout the CVC towards more flexible labour/contractors and less permanent employment. As well more flexible capital structures with more renting and leasing and less purchasing big capital items (e.g. large cranes, or diggers).

› General construction and machinery has been successful at increasing their net payment periods during the crisis, pointing towards a stronger negotiating position vis-à-vis its suppliers and consumers.

› The construction sector seems to be able to capture the productivity gains of upstream sectors and to transform them in its own higher profit margins.

[61] The most frequently used proxy for international competitiveness is the revealed comparative advantage (RCA). It looks at the share of a certain sector in the total export basket of a country and compares that to the same indicator of another country (in this case the EU28).Values higher than one reflect a revealed comparative advantage.

› Global capital (in the shape of private equity funds) is increasingly interested in buying companies in the EU's CVC – responding to the relative financial health of some companies and unrealised potential in the sector, and bringing in necessary efficiency gains and finance into the sector.

4.1.1. Financial health

Financial health and Altman Z:

To measure financial health we have used the Altman Z indicator, which estimates the likelihood a company will go bankrupt within a year. The indicator compiles a series of financial ratios to get a picture of the overall financial health of a company. The model has been academically validated and updated since its first publication in 1968 and has gained wide acceptance as an overall analysis of financial health.

Many companies in the CVC went out of business during the crisis. According to a report by Deloitte and Creditreform, the annual insolvency in the construction sector has gone up from around 33 thousand companies per year in 2006 to around 54 thousand in 2013.

However, partially also due to this shakeout the remaining companies in construction sector and professional services, have come out of the crisis with better financial health[62]. And although their profit margins and investor returns[63] are below 2006 levels, they have declined less than the other sectors. However, these sectors show significant volatility between well and poorly performing companies, meaning that the sectors remain financially risky and requiring careful investment decisions into individual firms, rather than horizontal sector investments.

Construction sector and professional construction services have also reduced their indebtedness: the construction sector for example had an average level of indebtedness of 71.5% (of its equity) before the crisis and 64.5% after the crisis in 2014.

Table 4 / Financial performances of CVC in 2014

	Profit margin (2014)	Financial health (2014)	Investor returns (2014)
Construction sector	4.13	2.67	13.79
Construction machinery	2.01	2.29	5.93
Construction products	1.98	2.10	7.26
Mining and quarrying	3.00	1.86	6.38
Professional construction services	9.31	3.21	18.82
Real estate	9.12	2.17	9.35
Intermediaries	2.44	2.39	8.88

Source: Ecorys own calculations based on firm-level data.

On the other hand, the other sectors: construction machinery, construction products and mining & quarrying, remain very fragile in terms of profit margin and financial health, having experienced the

[62] Financial health is calculated using Altman Z, which is compilation of several financial ratios to give an indication of overall financial health.

[63] Measured by the ratio : Return on Equity (ROE)

largest falls as a result of the crisis. In addition, to survive the crisis these sectors have increased their indebtedness from on average 74.2% before the crisis to 79.2%.

Table 5 / Financial performances of CVC in 2006

	Profit margin (2006)	Financial health (2006)	Investor returns (2006)
Construction sector	5.63	2.59	21.82
Construction machinery	5.20	2.58	15.98
Construction products	4.37	2.20	15.30
Mining and quarrying	8.41	1.94	15.41
Professional construction services	12.07	3.21	31.16
Real estate	13.51	1.78	13.44
Intermediaries	3.99	2.47	17.85

Source: Ecorys own calculations based on firm-level data.

4.1.2. Business models have changed

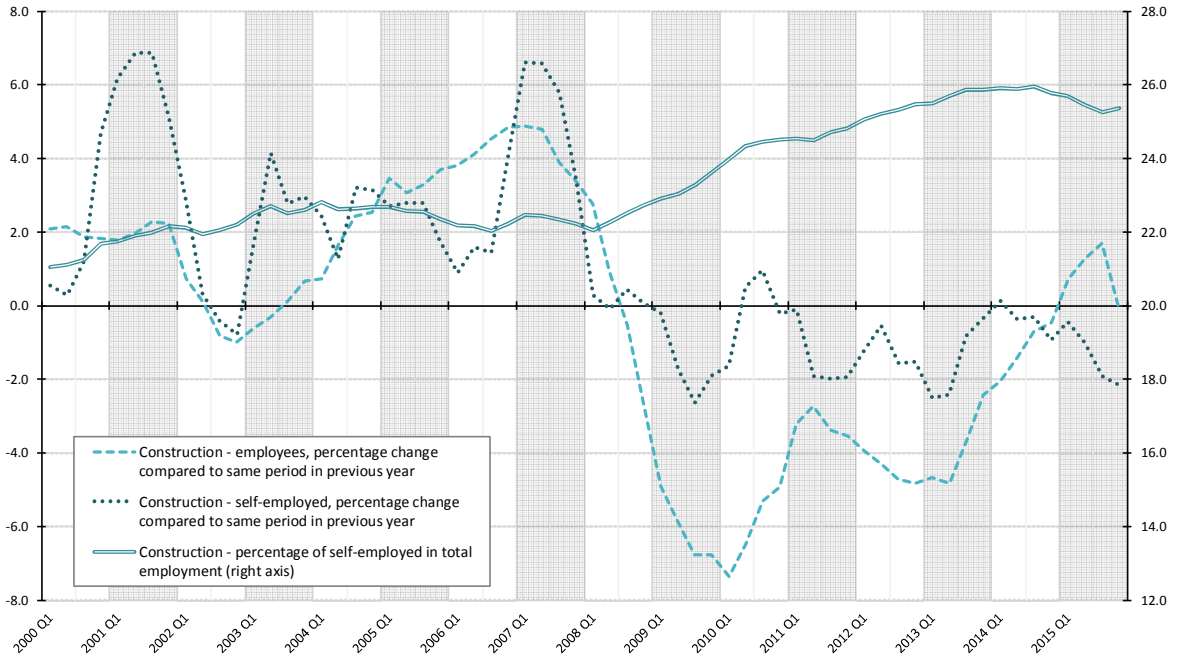
The crisis showed the urgency for firms in the construction sector to slim down activities and more efficient in terms of their permanent employees. This has resulted in the average number of employees per company to decline, a trend that already started at the onset of the crisis (Figure 61). The crisis has also illustrated the need for flexibility in terms of labour supply. As a result sub-contracting has dramatically increased, illustrated by the rise in the number of self-employed. This trend is observed also from the more aggregated Eurostat data and is further confirmed from modelling, which shows that as the number of sole traders increases, the average number of employees per company decreases.

Prior to the onset of the financial and economic crisis, growth in self-employment outstripped growth in the number of permanent employees, rising by 26% between 2000 (first quarter) and 2008 (first quarter) compared to 19% for permanent-employment. During the crisis period, employee numbers suffered consistently more negative growth rates than self-employment, resulting in the share of self-employed rising from 22% at the start of 2008 to 26% by mid-2014; however, this proportion slipped slightly in 2015.

When extending the focus to the broader scale of the CVC, differences in magnitude persist across sectors. Nevertheless, data outline the presence of an overall reduction in the size of firms and a rise in more flexible labour/contractors.

For companies in the construction sector investment into tangible goods were growing steadily in the pre-crisis years, fell in the two dips in 2008 and 2010, and never truly recovered to its pre-crisis trend. In comparison, renting and leasing of construction equipment has been investing significantly into tangible goods after the crisis (Figure 62). This indicates that the sector is meeting an increasing demand and thus investing more. The growth of the renting and leasing of construction equipment sector is further seen by its turnover growth of around 25% from 2009 to 2014. The combination of these two trends, give ground to the anecdotal evidence from sector participants, that the construction sector is switching to a more flexible capital structure, where it invests less tangible goods and rather rents/leases them from dedicated companies.

Figure 61 / EU28 Construction Sector (F): employment growth by employment status; quarterly data, seasonally and calendar adjusted



Source: Ecorys based on Eurostat (Quarterly national accounts)

Figure 62 / Dynamics of investment in tangible goods in construction sector and renting and leasing

Source: Elaboration on Structural Business Statistics, Eurostat.

4.1.3. Changes in payment periods and negotiating power

Payment period:

This is the time between receiving payment from customer and paying suppliers.

In terms of financial management, the longer the net payment period, the better in terms of the working capital management for the company. Payment period depends on both individual negotiations between suppliers and clients, with negotiating power playing a key role. As well as the position of the company, a company in financial distress might simply need a longer duration in order to stay in business and therefore honour its obligations.

The measure can be used as a proxy to tentatively hint at the negotiating power of firms: as companies are growing bigger and/or gaining in negotiating power, they will re-align their payment periods to better suit their own financial plans, rather than the conditions that are set by their suppliers and clients.

Given the difference in developments, the construction sector was analysed based on its three components as presented in chapter 2.1. General construction and construction machinery have seen their net payment periods increase on average by 4 to 7 days. This happened during a crisis when the whole CVC was under pressure and cash flows were important. This could point towards firms' strong negotiating position vis-à-vis their suppliers and customers in getting the terms most favourable to their financial plans.

This stands in direct contrast to intermediate products, demolition and wholesale, where firms seem to have a weaker negotiating position vis-à-vis their suppliers and customers since their net payment periods have increased by 4-6 days.

Table 6 / Credit cycle along sectors of CVC

		Net payment period (days, 2014)	Net payment period change (days, 2006-2014)
Construction sector	Demolition Site Preparation	43.10	-3.76
	General Construction	31.38	4.48
	Installation Activities Building Completion	37.18	-1.23
	Construction machinery	37.40	7.19
	Intermediate Products	38.62	-4.67
	Raw Products	28.30	-1.10
	Mining Quarrying	53.88	-2.39
	Professional Services	49.78	2.26
	Real Estate	22.84	2.16
	Wholesale	13.44	-6.10

Source: Ecorys own calculation of firm level data.

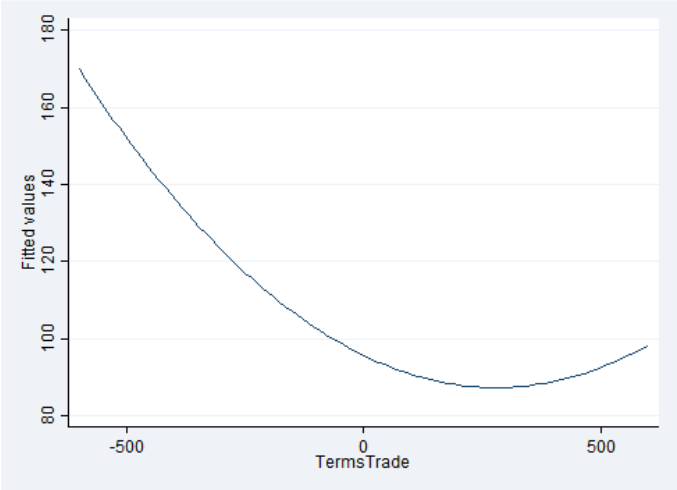
Firms that need to sustain an unfavourable or deteriorating payment period tend to increase their level of indebtedness to survive, which in turn has a negative impact on their financial health. This relationship gets worse the worse the payment period gets, illustrating a vicious cycle that firm can enter.

Modelling of company-level data provides evidence for this negative relation between the payment period and the indebtedness of firms. Firms which are not able to negotiate better repayment schedules (have to pay their suppliers more quickly, or even before they themselves get paid) face significant cash

low issues. To survive they take out debt to cover the period, increasing their indebtedness and putting pressure on their cash flow management.

Figure 63 portrays such a relation as inferred from data at firm level. It plots the results obtained by a regression in a non-linear quadratic form between the length of the payment period and the ratio of firm indebtedness. The figure suggests that the slope of the relation becomes even more negative, for those firms experiencing a particularly negative payment arrangement, namely those who have to pay their suppliers 180 days before they collect payments themselves. These firms tend to increase their leverage at even a higher speed than average firms. The opposite is true in the opposite direction, for firms having particularly positive arrangements tend to increase their indebtedness.

Figure 63 / Non-linear quadratic relation between credit cycle and level of indebtedness



Source: Elaborations on Amadeus. Payment period on x-axis, in days and fitted values of level of indebtedness on y-axis (derived as the ratio, in %, of debt over equity).

4.1.4. Productivity gains upstream financially benefit the construction sector

By employing a linear regression framework we find that firm performances indicators – e.g. productivity, return on investments, debt/equity ratio, and credit cycle – are significantly interrelated. We conducted individual sector OLS estimations, by controlling per year and country fixed effects. Results show how across sectors labour productivity is a significant explanatory factor for variations in profit margins. Conversely, levels of indebtedness appear to be negatively related to firms' profitability.

Profit margins in turns are significantly related to the financial health of firms, as captured by the Altman-Z indicator. Firms with higher profit margins tend to display more positive financial conditions. Altman-Z is significantly related to investor returns (ROE).

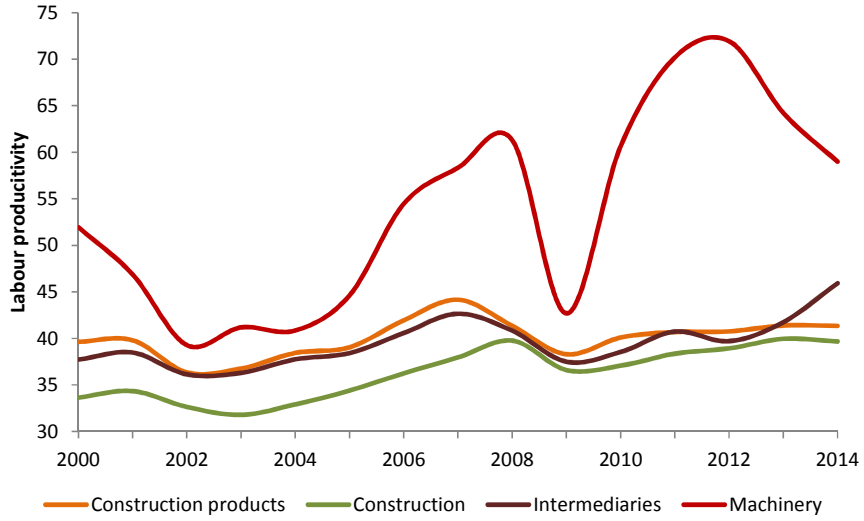
Data hence seem to suggest a chain of relation connecting the overall profitability of investment in a given sector with firm financial health, profit margins and, ultimately, productivity.[64]

[64] The previous statement does not necessarily imply the existence of a causal relation, but rather remark the interrelation of such performance indicators. Additional analysis would be required to robustly infer causality and to rule out other possible explanations.

While our modelling suggests that productivity could be a driver of profit margins (although causality cannot be proved), there appears to be a disparity in this relationship in the construction sector (Figure 64 & Figure 65), which has low productivity, but high profit margins. Subsequence analysis as well as sector insights by construction sector experts in the team, suggest that the construction sector is able to benefit from productivity gains upstream into increasing its own profits. This tentative relationship can visually also seen in the graphs below.

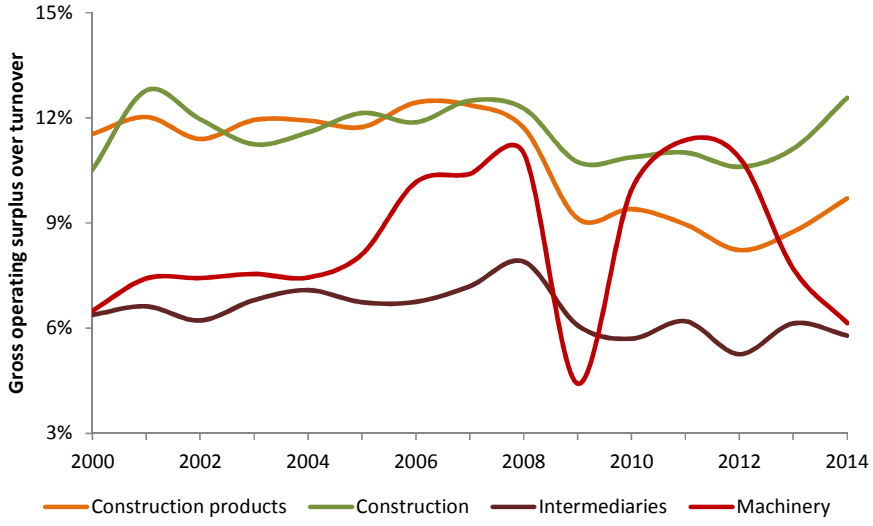
Such relationship hints that the inter-linkages within the CVC and the performance of upstream CVC are crucial to the performance of the construction sector itself.

Figure 64 / Labour productivity expressed in term of value added per employee – thousand EUR



Source: Elaboration on Eurostat Structural Business Statistics.

Figure 65 / Profit margins in terms of gross operational surplus over turnover – thousand EUR



Source: Elaboration on Eurostat Structural Business Statistics.

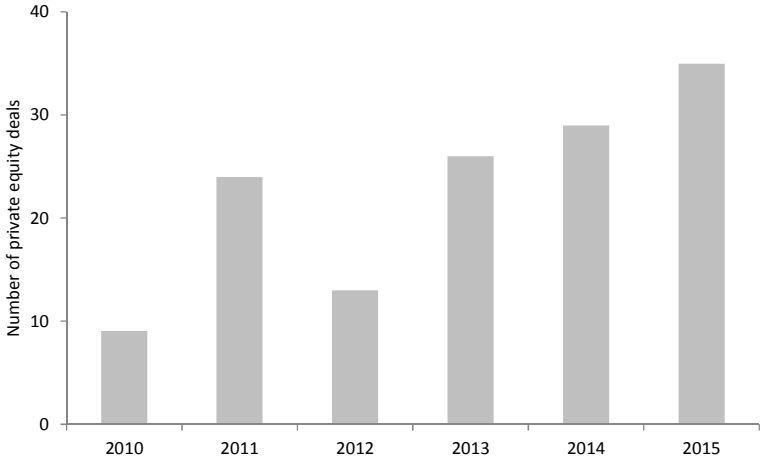
4.1.5. Private equity is increasingly buying into EU's CVC

Private equity (PE) are funds of usually large sums of money (EUR billions) from private individuals that seek out sectors and companies that have not reached their full potential, where there is a chance of improving in the short term. They then buy these companies, restructure them (cost cutting or new strategy) and sell them within 3-5 years. Given the strict financial pressures, PE's interest is a good indication about the positioning of construction sector, the CVC and its future potential.

A Deloitte study has shown that the number of deals by Private Equity (PE) into the construction sector and the CVC has increased from around 13% of all deals in 2009 to 23% of all deals in 2014. Given what positive financial situation, while high volatility of the sector it is not surprising in the entrance of PE since it seeks out financially stable, underperforming firms and sectors. However, PE tends to exit from sectors where volatility is decreasing and more correct valuation can be expected. This is because risk premiums decrease, as well as scope for arbitration, thus bringing down returns. In this sense it can be sense that PE's activity in sectors tend to be temporary during transition phases of a sector.

Nevertheless the interest by PE shows the position of the construction sector and the CVC. And given the inter-linkages within the CVC (as demonstrated in chapter 2), what is good for one part of the CVC, will have positive ramifications throughout the CVC.

Figure 66 / Share of private equity deals as a share of total annual deals



Source: Deloitte Real Estate – European Construction Monitor 2016, based on Mergermarket, 2015.

4.2. INTRA-EU INTEGRATION

As the second level of looking at the functioning and fundamentals of the CVC, this sub-chapter presents the evidence to the conclusions about the intra-EU integrations of the CVC, mentioned in the summary of this chapter.

The first analysis covers the extent to which different MS have seen their CVC companies integrate into the wider single market, both in terms of import diversity and export diversity (chapter 4.2.1). Finally the

focus of the intra-EU trade is analysed (chapter 4.2.2) in order see if some countries are more focused on intra-EU trade and why could that be.

Main findings:

› New MS have gained markets for products used in construction and machinery. Overall the diversification of trade has increased and suggests that the single market has increased the cross-border integration of the CVC.

› Several smaller MS are more focused on intra-EU trade of products used in construction, suggesting a level of integration of the CVC within the EU, where the final assembly and exports to third countries is taking place in some (the bigger) Member States.

4.2.1. Integration of CVC in the single market

One way to measure the changes in the source and supply structure of the CVC within the EU single market is the Herfindahl Index (HHI)[65]. More specifically, if the number of trading partners goes up (diversity increases), as a measure or market concentration, the HHI will decline. A more thorough explanation of this measure is provided in Annex III. Figure 67 displays the changes in intra-EU import diversity for each Member State between 2004 and 2014 for each of the product groups.[66] The darker shaded the country is, the more product groups have more diversified sources. Figure 67 displays the same, but for intra-EU export diversity, i.e. the number of countries supplying the import products has increased.

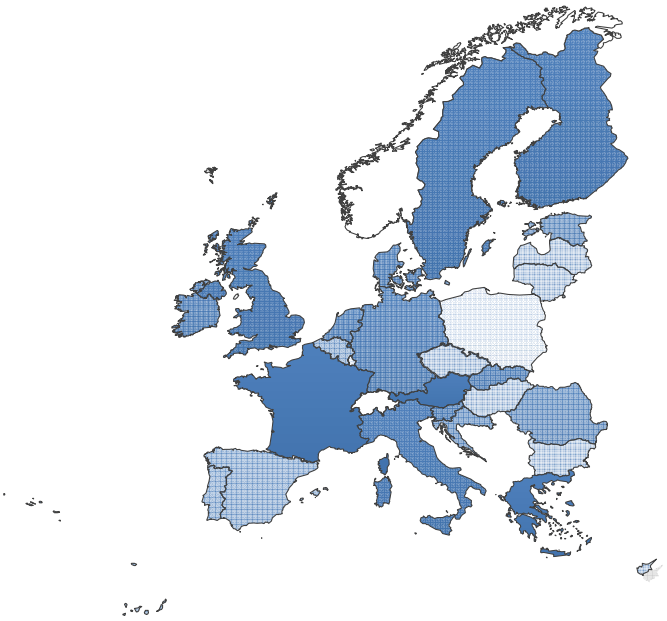
Most of the old, pre-2004 Member States, have seen their import sources become more diversified over time. This means that the old MS import from a wider variety of sources. The expansion of the EU and the integration of the newer MS is likely to be an important explanatory factor for this. For instance, Italian cement product imports originating in Slovenia increased from 3% to 15% between 2004 and 2014, or Finnish glass product imports from Estonia increased from 5% to 10% in that same period.[67] This is also reflected in the data for the newer MS, which show that for a significant number of these countries export to a wider variety of destinations in 2014 as compared to 2004; as is indicated by their increased export diversity. For the older MS, in contrast, the export diversity has decreased, which indicates that they tend to focus on a smaller number of destinations for most of their exports.

[65] In general, the HHI is a measure of market concentration. It can also be used to look at the number and importance of trading partners, as it captures changes in the number of trading partners over time, as well as when the relative sizes of the partners change.

[66] The product groups used for this analysis are; wood products, plastic products, cement products, stone products, mineral products, chemical products, glass products, clay and ceramic products, metal products, construction machinery, mining & quarrying, and prefabricated buildings.

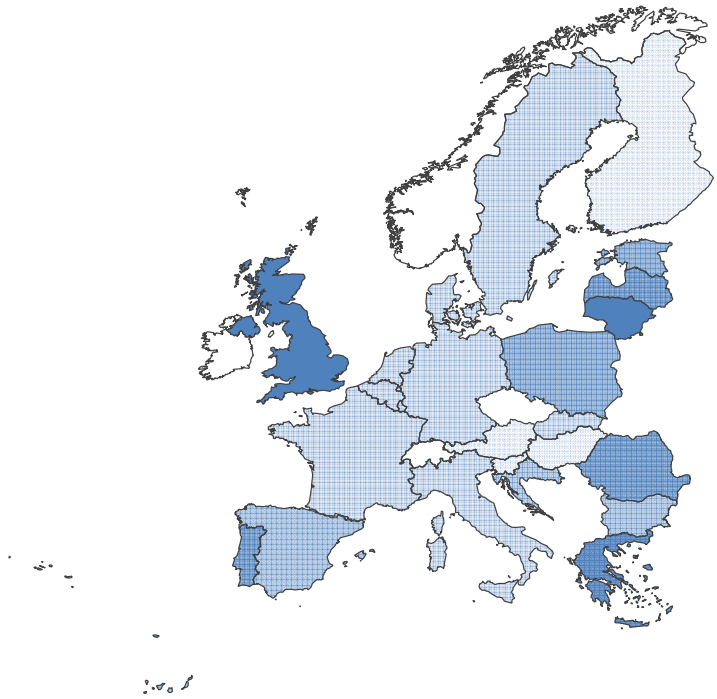
[67] The databases are created such that these trends can be easily identified, sheet ‘Bilateral Shares’.

Figure 67 / Upstream product groups – increasing import diversity between 2004 and 2014



Source: Eurostat Comext. Ecorys calculations. Note: The darker the colour, the more product groups have become more diversified in their import sourcing. See Annex II for explanation. See footnote 72 for an overview of the product groups that are included.

Figure 68 / Upstream product groups – increasing export diversity between 2004 and 2014



Source: Eurostat Comext. Ecorys calculations. Note: The darker the colour, the more product groups have become more diversified in their export destinations. See Annex II for explanation. See footnote 72 for an overview of the product groups that are included.

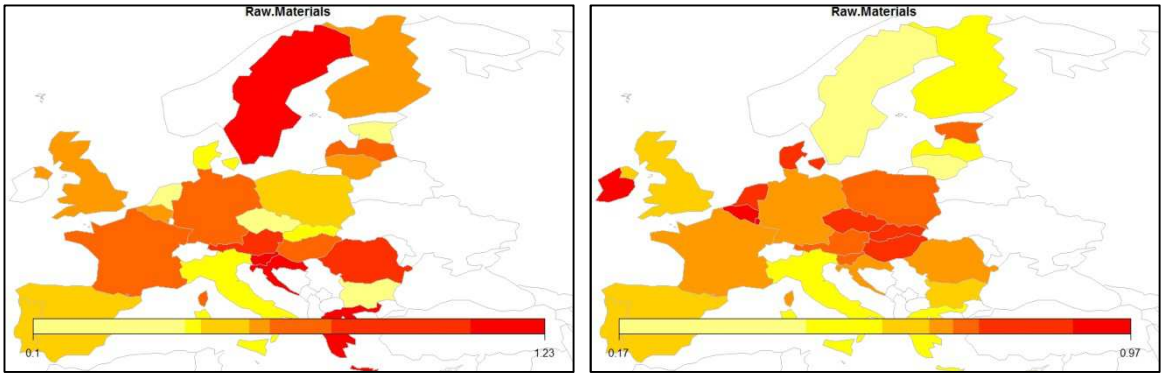
4.2.2. The focus on intra-EU trade

Not all Member States have the same trading patterns, and these patterns also vary according to the products traded. Some Member States export primarily intra-EU, which usually concerns low value added products, while other MS export extra-EU, mostly high value added products. This relationship becomes clear in the following chapter, where it becomes apparent that the EU has a global competitive advantage in exports of high value added construction products.

Raw products

The group *raw products* consists of low-value products that do not require much work before they can be exported. Countries with a high value added share in total production value are shaded in darker colours in the left panel of Figure 69. It appears that countries with a high value added tend to export most of the raw products to third countries. Countries for which the share of value added in total production is lower export most of their products within the EU.

Figure 69 / Share of raw product's value added in domestic production (left panel). The share of intra-EU exports in total exports (right panel) in 2014

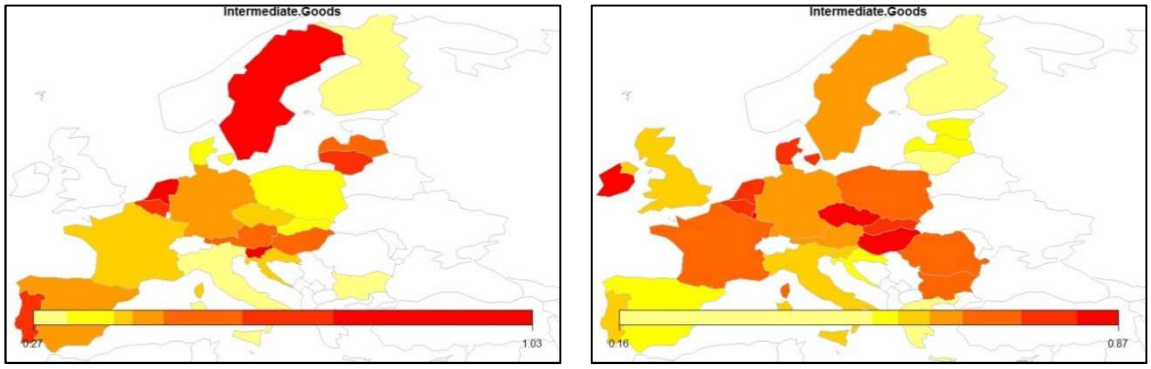


Source: Eurostat Comext. Ecorys calculations. Note: left panel shows the share of value added in domestic production. The right panel displays the share of intra-EU exports in total exports. Raw products include wood products, plastic products, cement products, stone products and minerals. Not all countries provided all data, therefore gaps in the figure may occur.

Intermediate products

A more telling example of the dynamics of intra-EU trade within the CVC can be found in the *intermediate products* group, as displayed in Figure 70. A similar story emerges, where the countries with high value added tend to have a larger extra-EU export focus, than countries with lower value added.

Figure 70 / Share of intermediate product's value added in domestic production (left panel). The share of intra-EU exports in total exports (right panel) in 2014

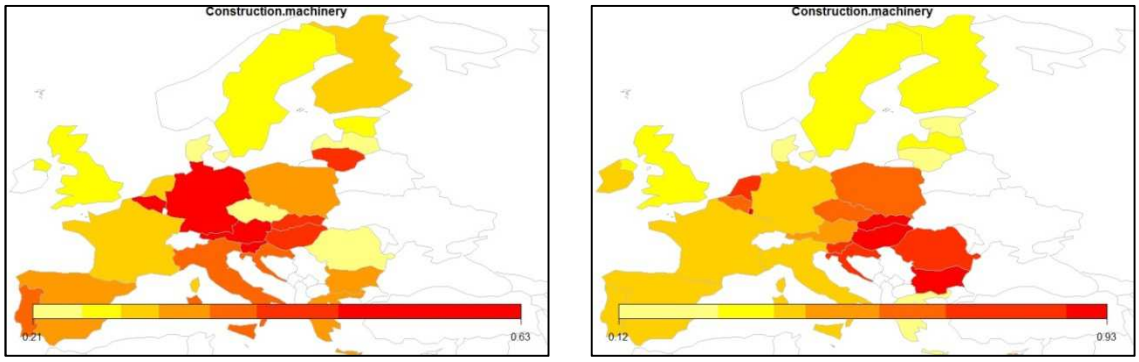


Source: Eurostat Comext. Ecorys calculations. Note: left panel shows the share of value added in domestic production. The right panel displays the share of intra-EU exports in total exports. Intermediate products include chemical products, glass products, clay and ceramic products, and metal products. Not all countries provided all data, therefore gaps in the figure may occur.

Construction Machinery

The *construction machinery* sector is the third product group that provides insights into the intra-EU integration of the CVC. Products that fall into this product group typically consist of multiple intermediate goods, so that it covers parts of, and assembled, construction machinery products. In case a country only exports parts of *machinery products*, value added as a share of total product value will be small. The real value is created in the assembling process of the machinery product. Once the product is assembled, it is ready for exporting to other Member States and third countries. Figure 71 shows that this is indeed what happens in the CVC. Countries with a low share of value added in the production value (e.g. in lighter shade in the left panel), tend to export more to other EU Member States (e.g. dark shade in the right panel). Countries in which the assembling process takes place, such as Germany, Belgium and Austria, add a lot of value added. These countries then export predominantly to third countries, so that the same of intra-EU exports for these countries is low.

Figure 71 / Share of construction machinery value added in domestic production (left panel). The share of intra-EU exports in total exports (right panel) in 2014



Source: Eurostat Comext. Ecorys calculations. Note: left panel shows the share of value added in domestic production. The right panel displays the share of intra-EU exports in total exports. Not all countries provided all data, therefore gaps in the figure may occur.

4.3. GLOBAL CVC POSITION

Lastly we turn our attention to the EU's CVC in a global perspective. First we focus on the growing extra-EU exports as a way of showing EU CVC's participation in the global CVC (chapter 4.3.1). Chapter 4.3.2 analyses the integration of EU's CVC in the global value chain suggesting EU's competitive position. This point is analysed to a closer level in chapter 4.3.3, where the EU CVC's global competitiveness is revealed quantitatively vis-à-vis its main trading partners. The sub-chapter closes at looking at the buying of companies (in terms of M&A), to see if extra-EU companies are buying into EU's CVC or vice versa (chapter 4.3.4).

Main findings:

› The CVC is competitive on a global scale with extra-EU exports of products used in construction and machinery exports as a significant and growing share of total exports.

› There is a trend towards global specialisation, where the EU imports more of some products for domestic consumption and increasingly exports specialised in construction machinery. All of this points towards increased integration of the EU's CVC into the global CVC.

› EU's CVC exports are diversified, with final clients in different geographic locations, while between 60% and 85% of import flow comes from five key trading partners. This suggests the nature of integration of the EU CVC in the global value chain.

› The EU tends to have a Revealed Comparative Advantage (RCA)[68] vis-à-vis most partners, with the exception of Turkey in almost all products used in construction and machinery sectors.

› For construction machinery, the EU is still the market leader, with a little over a quarter of the total market. While as for the intermediate products, the EU has lost its market leader position to China.

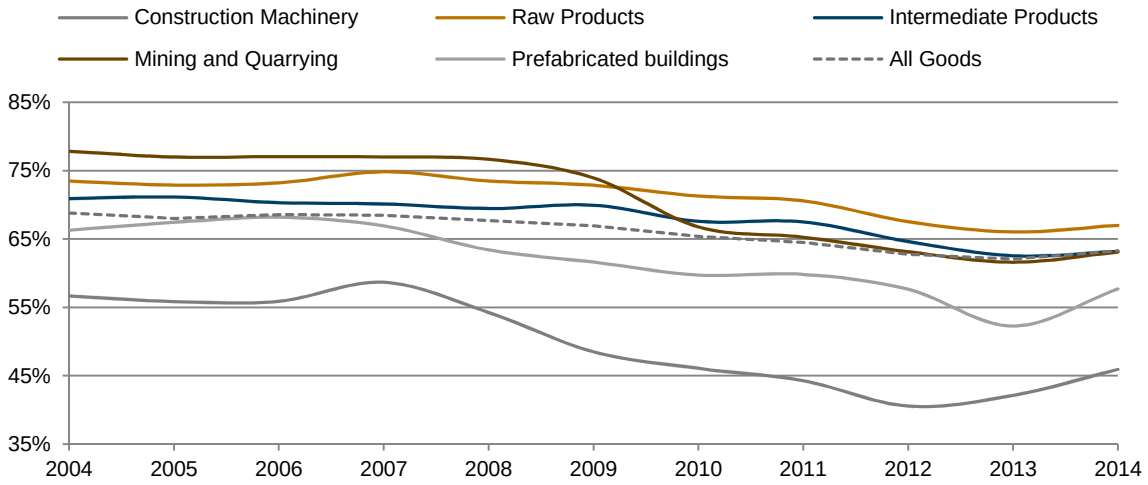
› EU CVC companies prefer to export than to acquire companies in non-EU markets (given the high value products they export), while non-EU companies focus on non-EU markets in acquiring firms to enter the markets.

4.3.1. Growing importance of extra-EU exports

Across all upstream construction machinery, extra-EU exports have increased more than intra-EU exports. Compared to the total export portfolio of the EU28, covering all goods, the decline has been more pronounced for most upstream product groups. In particular, exports to third countries in the construction machinery have a higher value than intra-EU trade, with intra-EU exports accounting for 46% of total exports in 2014, as opposed to 56% a decade before. These findings are a first indication of the competitiveness of the European construction machinery, which are able to compete at the global level. In the most recent year for which data are available, this decade-long trend seems to be reversing to some degree. This could, in part, be explained by the strengthening of the European economy.

[68] The most frequently used proxy for international competitiveness is the revealed comparative advantage (RCA). it looks at the share of a certain sector in the total export basket of a country and compares that to the same indicator of another country (in this case the EU28).Values higher than one reflect a revealed comparative advantage.

Figure 72 / Share of intra-EU exports in total exports, EU28

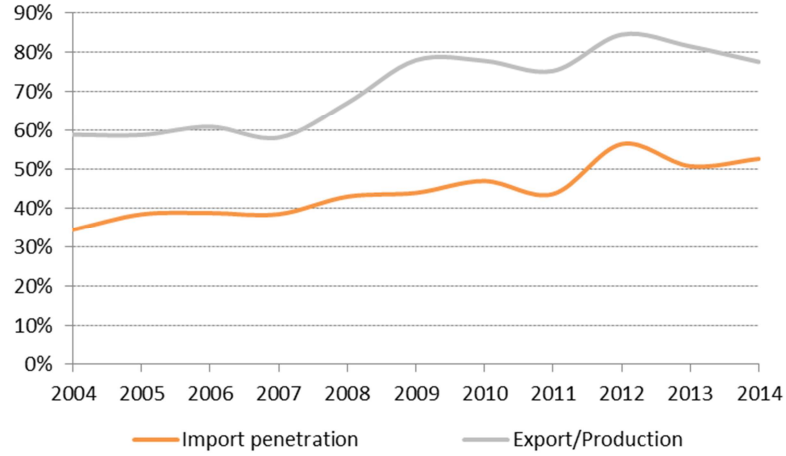


Source: Eurostat Comext. Ecorys calculations. Raw products include wood products, plastic products, cement products, stone products and minerals. Intermediate products include chemical products, glass products, clay and ceramic products, and metal products. 'All Goods' denote total trade activity of the EU28, non-construction-related activities included.

4.3.2. Integration of CVC in the Global Construction Value chain

There are several ways in which the integration of the CVC in the global value chain can be measured. In this section will start with the discussion of two main indicators; the first one, import penetration, measures the share extra-EU imports in apparent consumption. The second one looks at the value of extra-EU exports vis-à-vis EU28 production.

Figure 73 / Integration in global CVC of construction machinery products



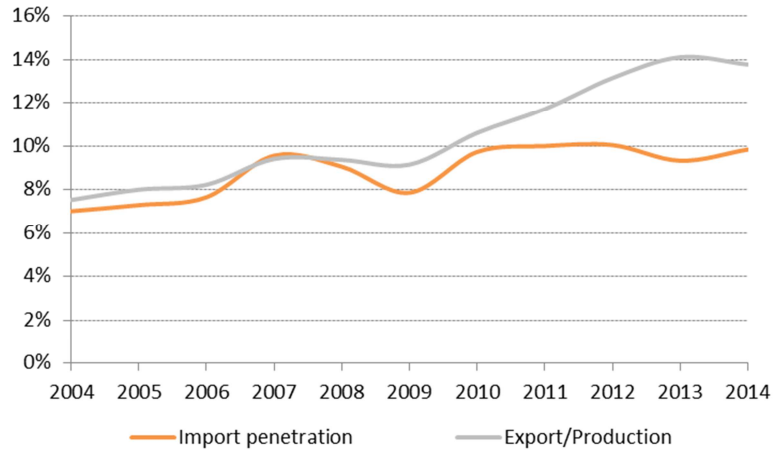
Source: Eurostat Comext. Ecorys calculations.

The results in Figure 73, Figure 74 and Figure 75 show that import penetration is increasing in all three aggregated product groups[69], while at the same time extra-EU exports also grow faster than domestic

[69] The analysis was done for upstream products only. This is since trade in construction sector essentially does not exist, while extra-EU services trade data was deemed unreliable.

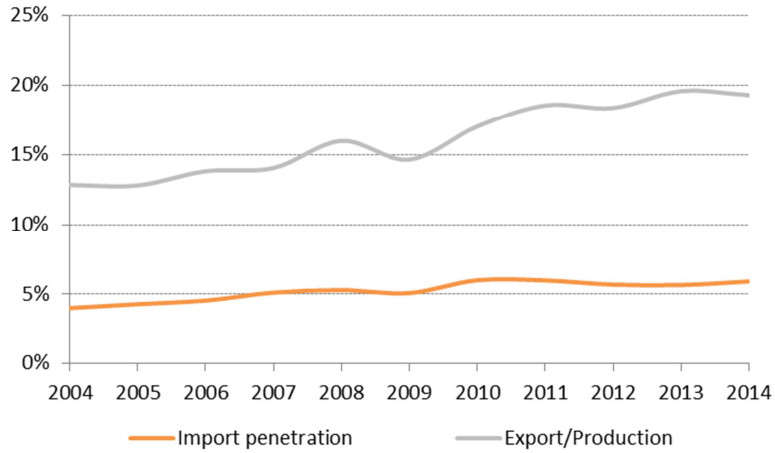
production.[70] Both these findings point in the direction of global specialisation, where imports become more important for apparent domestic consumption and a larger share of domestic production is exported (intra-industry trade). Within each of these aggregated product groups, the EU may specialise in the production and export of some products, and import others, with little overlap between the two types of goods. Such finding points towards greater integration of EUs CVC into global operations and the global CVC as a whole.

Figure 74 / Integration in global CVC of raw products



Source: Eurostat Comext. Ecorys calculations. Raw products include wood products, plastic products, cement products, stone products and minerals.

Figure 75 / Integration in global CVC of intermediate products



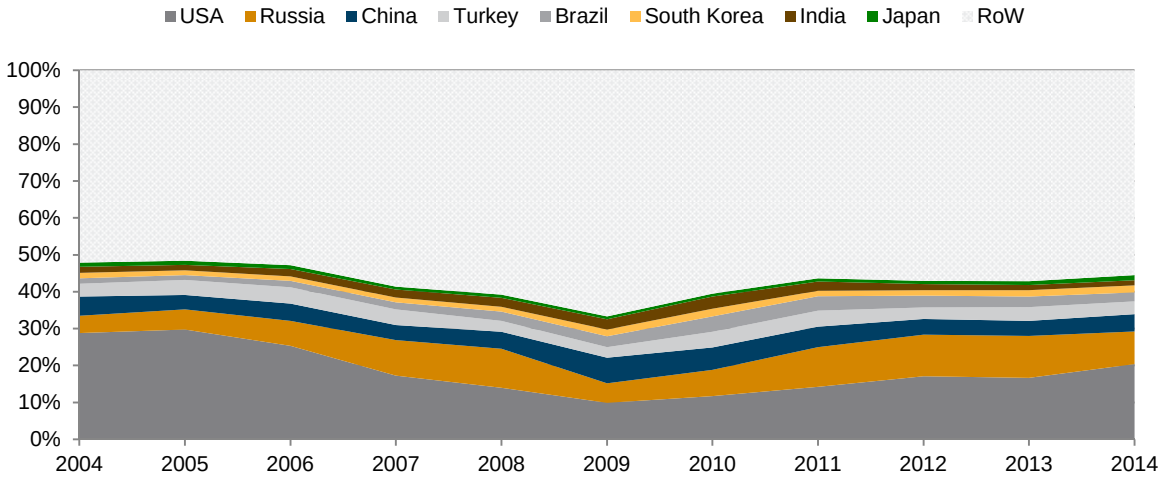
Source: Eurostat Comext. Ecorys calculations. Intermediate products include chemical products, glass products, clay and ceramic products, and metal products.

There are two different aspects that describe the relationship between the EU28 and its key partners. Looking at (extra-EU) export flows for all product categories, it appears that the share of the key partners identified for this study is roughly 40%. That means that the majority of the upstream goods that leave the EU are sold to other (third) countries. This finding holds for all four categories (construction

[70] A similar figure for mining and quarrying can be found in the Annex.

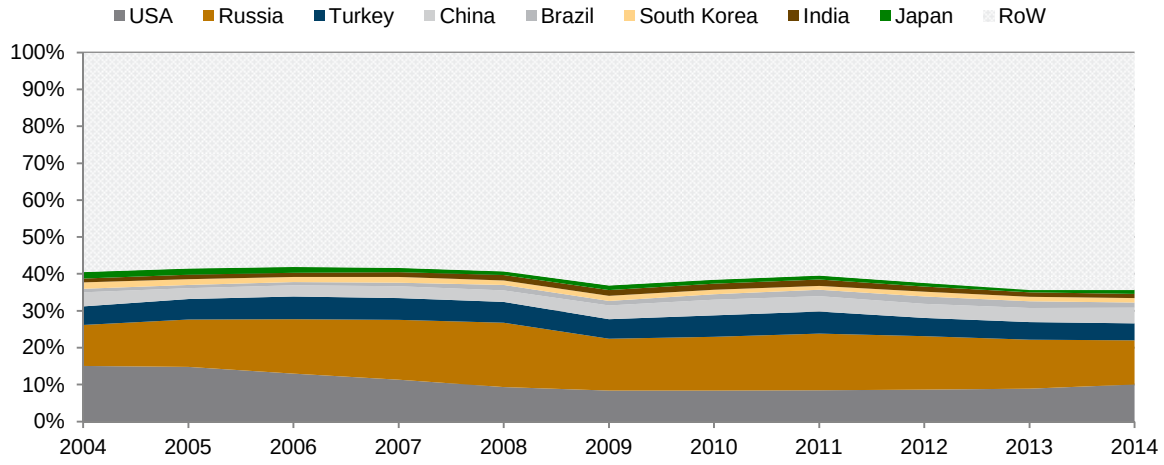
machinery, raw products, intermediate products, and mining & quarrying). European exports tend to be sold to other trading partners that are not included in the analysis. The area marked 'Rest of World' in Figure 76 is, for example, made up by Norway, Switzerland, Saudi Arabia and Australia amongst others.

Figure 76 / Share of extra-EU partners in total extra-EU exports (construction machinery)



Source: Eurostat Comext. Ecorys calculations.

Figure 77 / Share of extra-EU partners in total extra-EU exports (intermediate products)

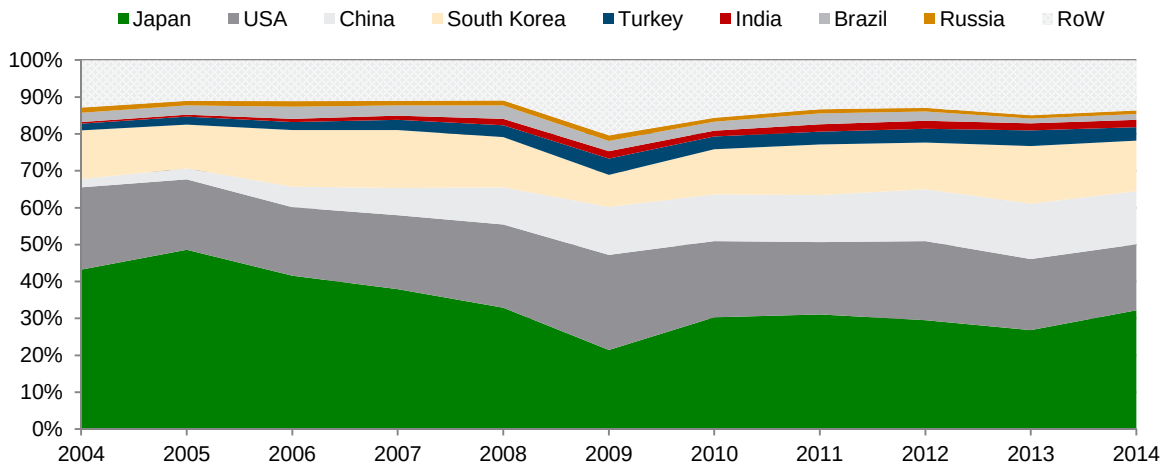


Source: Eurostat Comext. Ecorys calculations. Intermediate products include chemical products, glass products, clay and ceramic products, and metal products.

For import flows, another story emerges. The key partners for the EU28 identified for this study make up between 60% and 85% of the total import flows, sourced from outside the EU. For construction machinery, for example, the share of the key partners in extra-EU imports is consistently between 80% and 90%. While Japan is not a large export destination, it is the major import partner for EU Member States. Roughly a third of the total imports come from Japanese manufacturers, while the US takes second position with a market share of around 20%. The strength of the Japanese industry in this

product group also follows from the RCA analysis as discussed in the next section and shown in Figure 78.

Figure 78 / Share of extra-EU partners in total extra-EU imports (construction machinery)

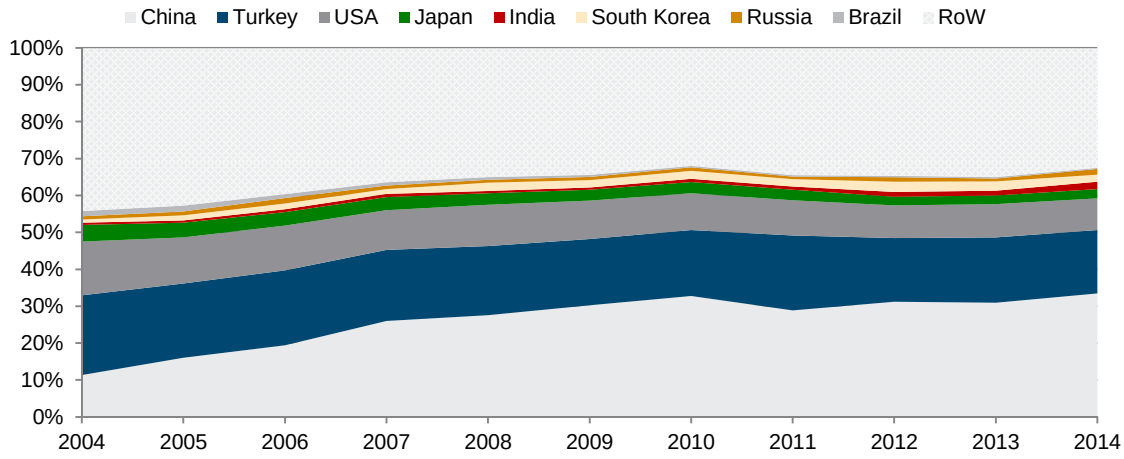


Source: Eurostat Comext. Ecorys calculations.

For non-machinery products, China is the main source of imports, but it has only recently taken up this position. Before the crisis, Turkey was the largest import partner. The increase in China's market share has mainly come at the expense of the market share of the *Rest of World* in total extra-EU imports.

Figure 79 shows the distribution across key partners for intermediate products, but for raw products a similar trend emerges.

Figure 79 / Share of extra-EU partners in total extra-EU imports (intermediate products)

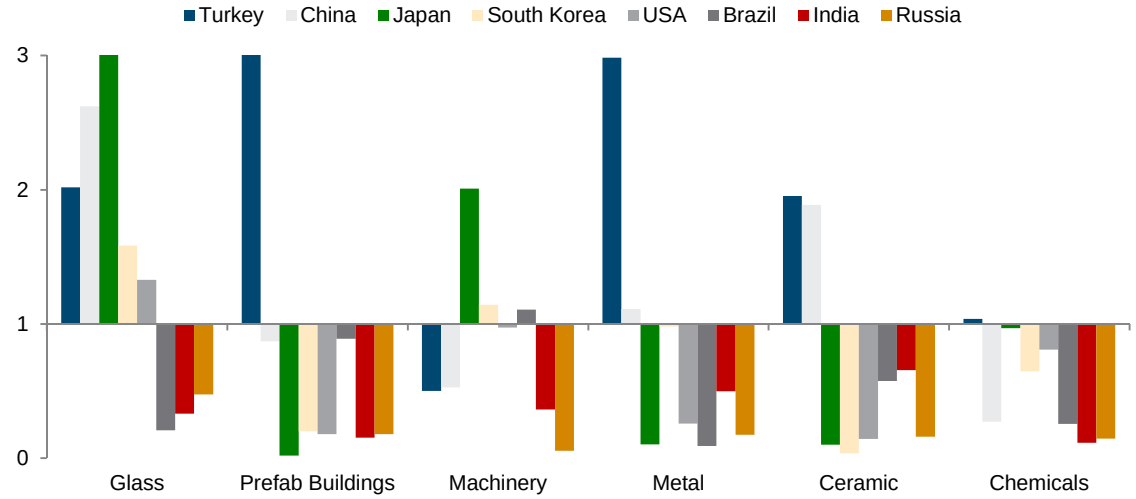


Source: Eurostat Comext. Ecorys calculations. Intermediate products include chemical products, glass products, clay and ceramic products, and metal products.

4.3.3. Global competitiveness of the EU CVC in non-raw products

Figure 80 shows the revealed comparative advantage (RCA) of the key partners identified for the study. If a country is below the line (RCA<1), this means that the EU has a better relative export performance in that product than the partner country. Although Turkey has a higher RCA than the EU in 5 out of 6 products, regarding all other key partners, the EU28 (as reference point) tends to be much better positioned. The only exceptions are the glass and machinery sectors, where exports from Japan, the US and South Korea make up a larger share of these countries' total export baskets than in the case of the EU28. On the world market, EU manufacturers therefore have to compete with competitors from these three countries in *glass products* and *construction machinery*.

Figure 80 / Revealed Comparative Advantage (RCA)[71] of key partners vis-à-vis EU28 of non-raw material product groups, 2014

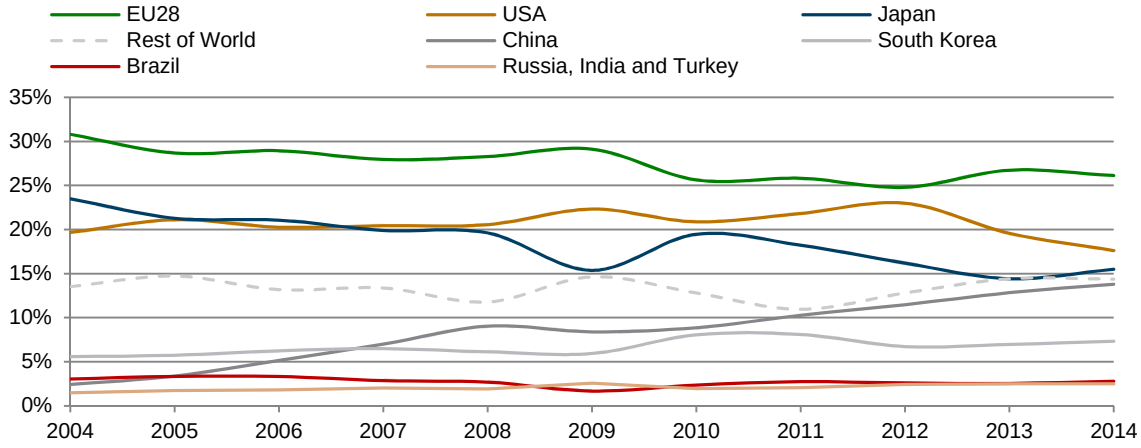


Source: UN Comtrade data, Ecorys calculations.

The US, Japan, China and *Rest of World* are all responsible for about 15% of total world exports. Even though the share of extra-EU exports has declined by roughly 5 percentage points over the last decade, this decrease is smaller than the decline of Japanese manufacturing in total world trade and similar to that of the US.

[71] The most frequently used proxy for international competitiveness is the revealed comparative advantage (RCA). it looks at the share of a certain sector in the total export basket of a country and compares that to the same indicator of another country (in this case the EU28).Values higher than one reflect a revealed comparative advantage. It should of course be noted that the RCA cannot distinguish between value added domestically or by third countries within the export values. A relatively 'good' RCA is therefore only a rough measure of competitiveness, as it may very well reflect simply passing through 'competitiveness' of third countries.

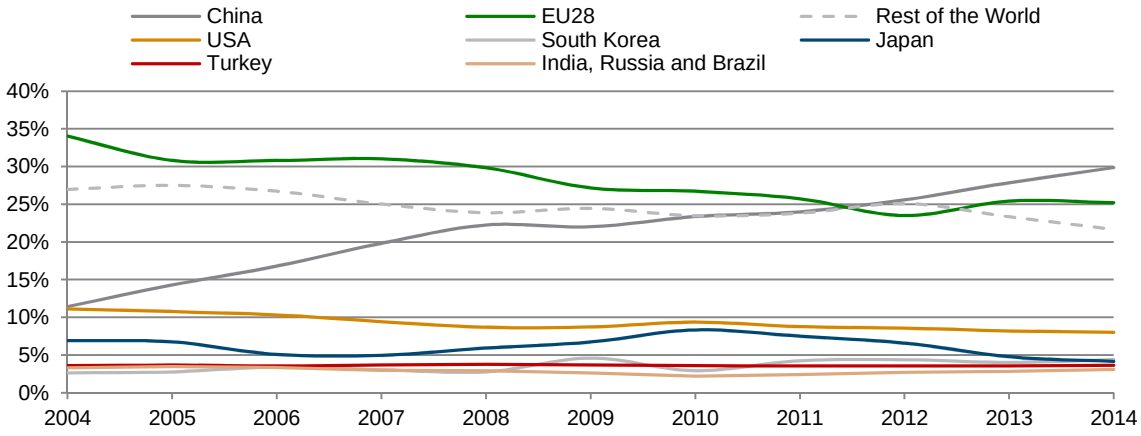
Figure 81 / Market shares of EU28 and key partners in construction machinery



Source: UN Comtrade data, Ecorys calculations. EU28 is extra-EU exports. Russia India and Turkey are grouped together due to their small individual market shares.

Extra-EU exports used to account for a third of the total world trade, but now accounts for a little over a quarter. For China, on the other hand, the market share has increased from 12% to 30% in about a decade. The US and Japan have also lost ground in this product category, see Figure 82. The market is clearly dominated by the EU and China; all other countries have much smaller shares in the global market.

Figure 82 / Market shares of EU28 and key partners in intermediate products



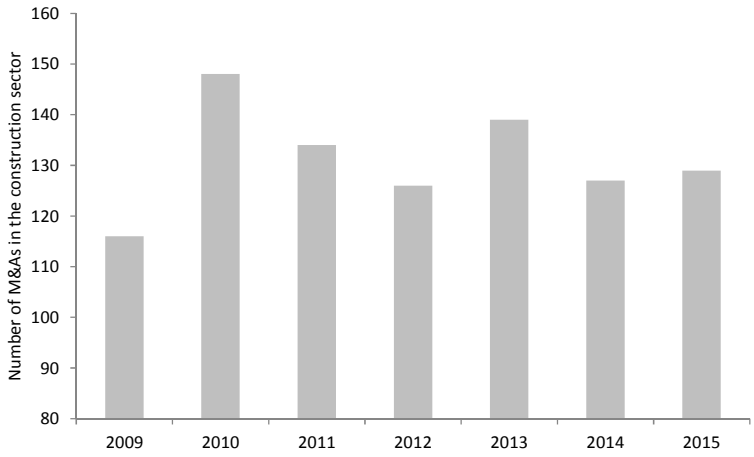
Source: UN Comtrade data, Ecorys calculations. EU28 is extra-EU exports. India, Russia and Brazil are grouped due to their small individual market shares.

4.3.4. International Mergers and acquisitions (M&A)

An alternative to involvement in the global CVC, besides exporting directly, is to acquire (buy) companies in these markets. This type of activity can be tracked by the activities of M&As.

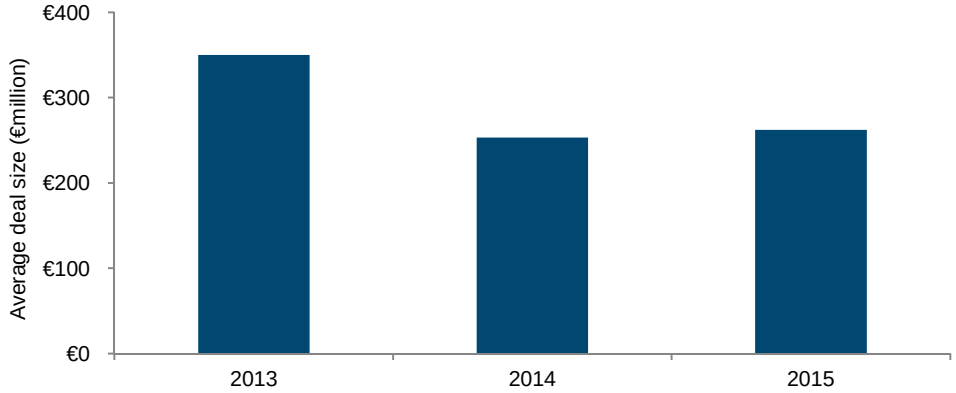
M&As in the European construction sector have shown a relatively stable trend along the last years, according to the *European Construction Monitor 2015-2016,* published by Deloitte. The number of deals appears to fluctuate, mirroring the trend in economic activity. Although the trend is expected to be similar for 2016, it may well be that a recovery in local construction markets drives upwards the number of deals.

Figure 83 / Mergers and acquisition involving European firms in the construction sector, evolution over time



Source: Ecorys elaborations 'European Construction Monitor', Deloitte, 2013, 2014 and 2016 editions.

Figure 84 / Average deal size of Mergers and acquisition involving European firms in the construction sector, evolution over time (million EUR)

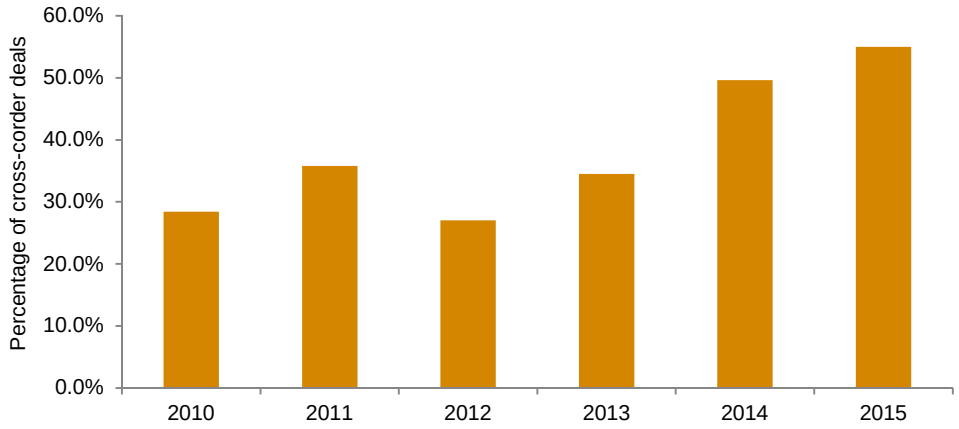


Source: Ecorys elaborations 'European Construction Monitor', Deloitte, 2013, 2014 and 2016 editions.

The average deal size of M&As decreased in 2014 to just over EUR 250 million, but in 2015 increased slightly to just over EUR 260 million. In comparison, the average size of strategic buys (M&As that have the objective to create synergies between companies and process) has decreased from almost EUR 390 million per deal in 2013 to around EUR 65 million in 2015[72].

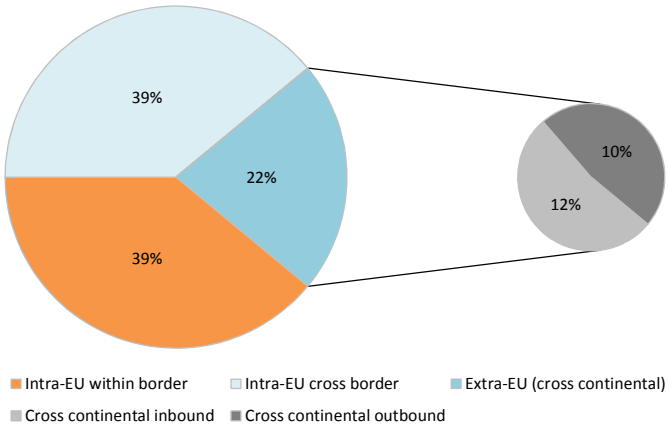
[72] 'European Construction Monitor', Deloitte, 2013, 2014 and 2016 editions.

Figure 85 / Percentage of cross-border deals as a share of the European annual total



Source: Ecorys elaborations 'European Construction Monitor', Deloitte, 2013, 2014 and 2016 editions, and Mergermarket, 2015.

Figure 86 / Mergers and acquisitions involving European firms in the construction sector in 2013



Source: Ecorys elaborations 'European Construction Monitor', Deloitte, 2013 and 2014 editions. 'Intra-EU' includes M&As involving two European companies, either within the same national market or cross-country. 'Extra-EU' includes cross continental M&As, which are further decomposed according to whether the newly created firm is European or non-European, labelled as 'inbound' and 'outbound' M&As, respectively.

European construction companies are increasingly looking for deals outside of their national borders (see Figure 86). This cross-border dimension of European construction companies is also relevant in terms of revenue. The Deloitte publication 'European Powers of Construction' (EPOC)[73] showed that the 50 largest listed European construction companies generated about 52% of their revenues abroad in 2014. The same report does not forecast this share to keep increasing, since expansion to international markets is usually as a reaction to declining domestic markets. Since the domestic markets are forecasted to increase by the same report, the international activity is unlikely to expand further and rather return to its longer term share.

[73] https://www2.deloitte.com/content/dam/Deloitte/at/Documents/real-estate/epoc-2015.pdf

Around 78% of annual M&As take place within the EU, while only 12% of the 139 M&As transacted in 2013 (involving EU companies) involved an EU construction company being bought by a non-EU company. Roughly the same proportion applied to EU companies acquiring non-EU companies.

Additionally according to a survey by KPMG[74], most non-EU companies in the CVC have other markets as their prime focus when considering new markets and almost non view the EU as the most attractive destination.

The combination of these findings suggest that the EU CVC market is a largely EU affair with, EU firms preferring to export directly, rather than acquiring local companies, which is understandable given the high value added products where the EU has a particular strong competitive position.

[74] KPMG Global construction survey 2013: 'Ready for the next big wave'.

5. Challenges and future scenarios

As we have seen in this report, the construction sector is characterised by historically poor productivity performance, with virtually stagnant labour productivity growth stretching back over many years, a phenomenon that is not limited to Europe.[75] While many other sectors have undergone radical transformation in production methods and work organisation, the construction sector is starting to embrace flexibility (both labour and capital) only as a result of the recent crisis (see chapter 4.1.2). The construction sector has experienced major shake-out, both in terms of employees, number of firms and volumes during the crisis (see chapter 3.1). However, its ability to benefit from productivity gains upstream in its value chain (chapter 4.1.4) and other internal changes has meant that many firms in the construction sector are now in good financial health (chapter 4.1.1).

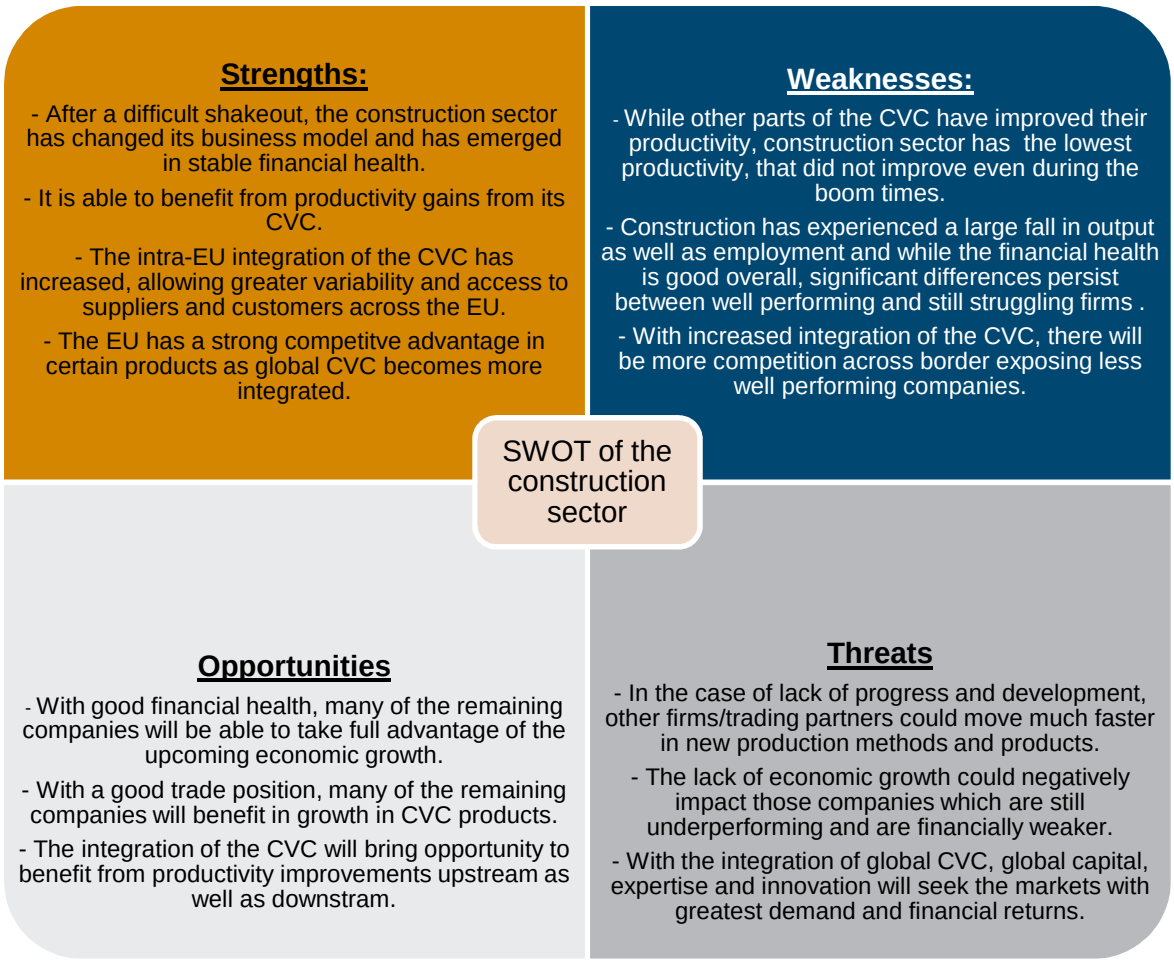
Simultaneously, the construction sector is faced by a host of 'external' challenges, most obviously in relation to the transition to a low carbon economy – including mitigating and adapting to the effects of climate change – but also from other 'mega trends' that will drive construction needs in the future: e.g. demographic and social change, disruptive technological breakthroughs, resource scarcity, shifting global economic power, urban redevelopment, migration etc. In this context, the construction sector will need to be better adapted and equipped to deliver the building and infrastructure solutions necessary to address future economic, environmental and societal challenges, while also meeting the technological requirements of buildings and infrastructure users.

Overall, the combination of these challenges points to the need for a profound transformation of the construction sector. Such a transformation would imply inter alia embracing new production methods (e.g. industrialisation), new technologies (e.g. digitalisation) and new business models (e.g. servitisation / product-service systems). Achieving such a transformation will require substantial efforts from within the construction sector but, equally, will depend on the attitudes and strategies of those clients, intermediaries and policy-makers that influence the business environment for construction activities. At the same time, the overall economic conditions will impact the level of construction demand which, in turn, will influence the degree of pressure and the scope of opportunities for implementing change within the sector.

[75] See, for example, OECD (2016), 'OECD Compendium of Productivity Indicators 2016', OECD Publishing, Paris.

This context is summarised below in a typical SWOT diagram:

Figure 87 / SWOT of the construction sector



Against the general context of industry transformation, the purpose of this chapter is to present alternative scenarios for the development of the construction sector, both at European and global level.

5.1. PRINCIPLE SCENARIO DRIVERS

Two principle dimensions ('drivers') for future conditions affecting the construction sector have been used to formulate potential scenarios for the construction sector:

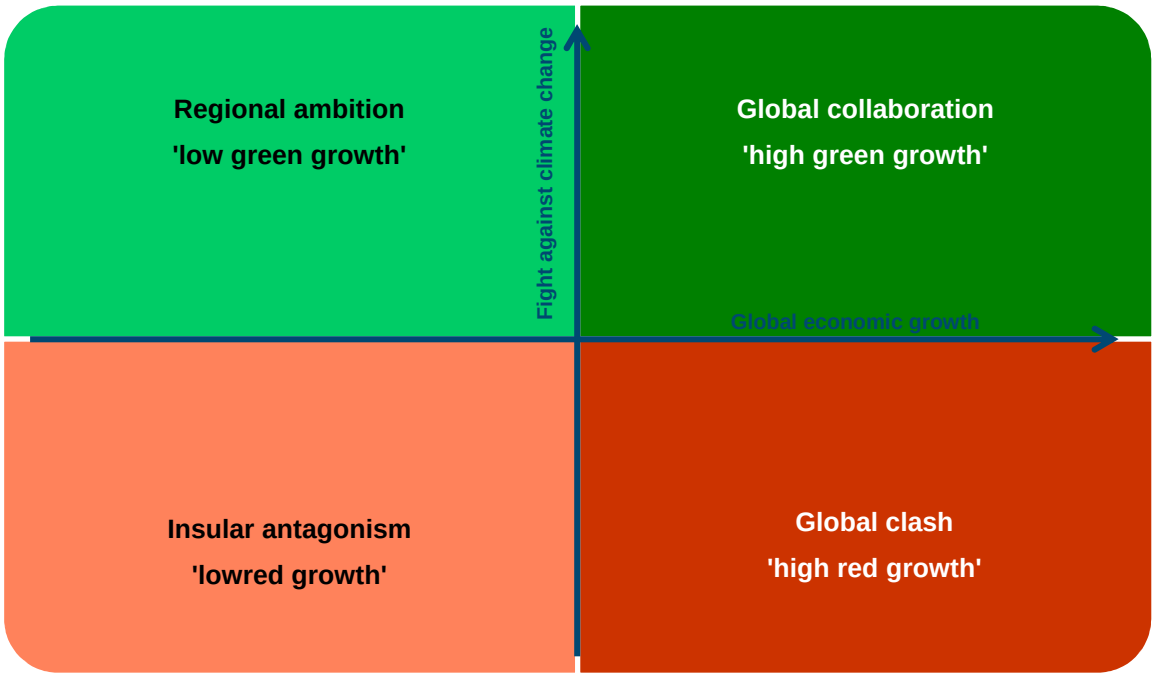
› **Global economic growth:** distinguishing between a period of sustained strong global economic growth ('*high global growth*') and a situation where global economic growth is constrained ('*low global growth*').

› **Fight against climate change:** distinguishing between a situation where there is widespread acknowledgement of the need for action to address global warming, climate change and sustainability

issues (‘*green policy context*’) and a situation in which there is only limited attention and consensus on the need for actions to address these issues (‘*red policy context*’).

The interaction of these two dimensions enables the elaboration of four contrasting scenarios, which we outline in the following subsections.

Figure 88 / Four future scenarios



5.2. GLOBAL COLLABORATION (‘HIGH GREEN GROWTH’)

This scenario combines strong global economic growth with global consensus and a shared vision and collaborative approach to tackling climate change and sustainability issues. The latter is accompanied by the development of clear strategies and stable ‘green’ regulatory frameworks and, in turn, an increased international harmonisation of the broad policy and regulatory frameworks for construction.

Strong economic growth will result in an acceleration of global demand for infrastructure and capital projects and for the provision of affordable housing and other buildings, particularly in response to rapidly increasing urbanisation in emerging economies. At the same time, policy-makers and clients alike will demand resource-efficient, sustainable and smart buildings and infrastructure – especially as rapid economic growth pushes prices of energy and raw materials upwards while, simultaneously, concerns grow over rising emissions of greenhouse gases, etc. linked to increasing economic activity. Consequently, there is a strong push for public sector investments in sustainable construction to both address infrastructure capacity requirements and to meet ‘green’ targets. Similarly, with the combination of stable and supportive policy and regulatory frameworks and strong expectations for the return on investments, private investors are attracted to pursue long-term sustainable construction investments.

Strong global growth is assumed to be conducive to an acceleration of globalisation, which will be associated with increased integration of the global construction value chain (Global-CVC). This integration will be characterised by collaboration both along the supply chain and between construction contractors and clients in an effort to develop solutions to meet the transition to a low carbon economy and to address other economic and societal challenges. To a significant extent, integration of the European construction value chain (European-CVC) will be subsumed in global developments. Specifically, value chain integration will emphasise knowledge and competence based specialisation. Increased global demand for resource efficient, sustainable and smart buildings and infrastructure should provide enhanced opportunities for Europe to export advanced sustainable and smart construction products and solutions. While, at the same time, either directly or in partnership with local contractors, European construction and engineering firms should be able to leverage their expertise to expand their presence in global markets.

Conversely, pressure on construction costs due to rising commodity prices and materials costs will precipitate the European construction industry to look for low-cost sources of supply, in turn pushing-up the import penetration of low-value and commoditised building materials and products. At the same time, emboldened by strong growth in their local and regional markets, emerging economy construction contractors – and equipment and product suppliers – will seek to expand their global reach, including in Europe. Not least, such moves may be initiated in an effort to acquire access to technology and know-how, either in the form of partnerships arrangements with European constructors or through mergers and acquisitions (M&A).

The drive to tackle climate change and sustainability issues, combined with clear strategies and stable ‘green’ regulatory frameworks, will provide the basis for a substantial stimulation of investments in research and development to address the demand for resource efficient, sustainable and smart construction. In particular, there will be a focus on investments to improve the sustainability and resource efficiency of buildings and infrastructure but, also, targeting improvements in production efficiency and to address resource shortages (i.e. for building materials).

With strong growth leading to a tightening of labour markets, the sector can expect to be faced by labour shortages. At the same time, there will be a need to raise the skill profile of the sector; particularly (in this scenario) in relation to equipping the workforce with the necessary competences associated with climate change and sustainability issues. This will imply the need for improvements in workforce management (e.g. flexible work-organisation practices) and deployment of enabling technologies (e.g. ICT), combined with investments in human capital development (e.g. training). Such development should contribute to improvements in the poor employment image that traditionally characterises the construction sector (e.g. unattractive working conditions, few openings for academically qualified persons, limited opportunities for skills and career development, and high vulnerability to economic cycles) which should also help to alleviate recruitment constraints.

In terms of allocation of value added and the relative ‘balance of influence’ within the construction value chain, there will be a trade-off between the increasing complexity of construction works that will strengthen the role of ‘downstream’ actors (e.g. construction and engineering contractors and ‘user phase’ service suppliers) and the need for advanced building products and equipment, which will favour ‘upstream’ suppliers. Overall, the potential for mutual gains along the value chain will favour greater collaboration, promoting technology development and diffusion and innovation.

5.3. GLOBAL CLASH ('HIGH RED GROWTH')

In this scenario, despite strong global economic growth, there is a general lack of will to address global warming, climate change and sustainability issues.

As above, strong economic growth leads to an acceleration of demand but this is accompanied with an emphasis on cost-based competition and rapid implementation of projects (i.e. high project turnaround). Public sector investments will be driven by the need to meet infrastructure requirements associated with strong economic growth including those arising from increased urbanisation. However, without the attention to tackling climate change and sustainability issues and the absence of supporting policy and regulatory frameworks, private investments will be predominantly motivated by short-term speculative impulses rather than delivering long-term sustainable solutions. This will result in more adversarial relations between construction contractors and their clients, as the latter emphasise cost reduction over quality.

As with the 'global collaboration' scenario, strong global growth will be conducive to an acceleration of globalisation and increased integration of the Global-CVC. Integration and specialisation will, however, be driven largely by cost-based competitive pressures. This has the potential to result in global (re-)location of labour intensive or low value adding production activities – particularly for construction products and equipment – away from high cost regions such as Europe. Again, development of the European-CVC will be subsumed in global trade and specialisation patterns, with increased import penetration of low-value and commoditised building materials and products. At the same time, with only limited opportunities for European suppliers arising from demand for 'green' construction, European industry will face a significant challenge to identify new high value added markets. This will result in a struggle between globalisation's tendency towards fragmentation – particularly, geographical 'vertical specialisation' within value chains for specific construction products – and a trend towards increased concentration as firms search to rationalise production and reduce costs, for example through local and regional M&A activities aimed at cost savings and economies of scale. Emerging economy construction contractors that have benefited from growth in their domestic and regional markets and have increased both in size and capabilities, will seek to leverage their lower cost base to expand their international presence, including entry into developed country markets. Overall, competition in markets throughout the world is expected to intensify.

Without the 'green' incentive and stable policy and regulatory framework, investments in R&D and innovation activities will be undertaken on a more ad hoc basis, targeted towards cost reduction and efficiency gains and, where they are necessary, to address specific shortages or rapidly increasing costs of production materials and other inputs.

As with the 'global collaboration' scenario, the construction sector will face tightening labour markets and skill shortages; though the latter may be less acute as there will be less need to develop specific competences (e.g. in domains such as energy efficiency and renewable energy sources, sustainable construction and life-cycle approaches) implicit is a 'green' scenario. Faced by a strong drive for cost competitiveness, the sector will focus attention on process improvements that can increase efficiency of work organisation. The sector may, however, be less well placed to take initiatives to more broadly improve working conditions and confront the negative image of the construction sector. Such conditions may push the sector to seek out alternative supplies of labour, for example using migrant workers.

Although strong construction growth should raise demand throughout the construction value chain, it will be accompanied by significant pressure on margins as cost conscious clients demand low-price solutions. This will lead to tension in the supply chain of construction materials, products and equipment as different segments within the chain attempt to extract their share of limited overall margins. With strong growth resulting in increasing demand for materials and rising commodity prices, upstream suppliers of materials – at least those that are not predominantly destined for use in construction – will be somewhat insulated from specific developments in the construction sector. And, with downstream construction contractors acting as the gatekeepers to markets, it is the middle segments of the construction value chain (i.e. manufacturers of construction products and equipment) that find themselves being squeezed the most.

5.4. REGIONAL AMBITION ('LOW GREEN GROWTH')

This scenario combines weak global economic growth with a situation in which there is a general consensus on the need to tackle climate change and sustainability issues. In contrast to the 'global collaboration' scenario, low growth – which brings other considerations to the fore of policy approaches – makes it more difficult to reach global consensus and shared approaches to tackling sustainability and climate change. Under these conditions, there is a tendency towards the development of local and regional approaches, with different regions developing their own policy approaches and 'green' regulatory frameworks for construction.

Weak economic growth will result in a slowdown in global demand for new infrastructure and capital projects, although underlying demographic developments and societal challenges will continue to influence demand for housing and social amenities, especially in developing/emerging regions. Demand for construction will primarily be driven by renovation and replacement of the existing stock of buildings and infrastructure, which will be stimulated by (regional) 'green' policy approaches and targets. This will be reflected in planned public investments directed towards sustainable infrastructure which, given constrained public finances, will emphasise the cost-effectiveness of projects and job-creation potential. At the same time, to leverage its own funding, the public sector will seek to promote public-private-partnerships (PPP) as a means to encourage private investments in infrastructure projects and other replacement and renovation works. Despite low overall growth prospects, the creation of clear and stable policy approaches and 'green' regulatory frameworks should make such PPPs attractive to private investors.

Low global growth rates are assumed to result in a slowing of globalisation and a stagnation of integration of the Global-CVC. However, this will not (necessarily) slow integration at a local and regional level, which will be spurred by collaboration among CVC actors that is orientated towards the development of regional solutions; for example, in the development of 'green' construction products targeted to specific needs of the 'domestic' regional market. Investments in R&D and innovation activities will seek to strike a balance between addressing 'green' concerns (e.g. sustainability and resource efficiency) and the pressure to achieve cost reduction and efficiency gains to boost competitiveness in a construction market with limited growth prospects. Global diffusion of technologies and innovative products will, however, be partially restrained by the emergence of local and regional oriented policy approaches and inter-regional difference in regulatory frameworks. For both European firms seeking to access international markets and competitors looking to enter European markets,

regional/local presence will be of increasing importance in order to adapt supply to the requirements of regional/local demand conditions and regulatory conditions.

Although low economic growth implies that labour market pressures will be limited, this will not prevent shortages arising for specific competences and qualifications; for example, as in the 'global collaboration' scenario, in relation to necessary skills associated with climate change and sustainability issues. The construction sector will, therefore, be faced by the need to implement investments in human capital development (e.g. training), including those required for implementation of 'green' and other enabling technologies (e.g. ICT). However, as growth in demand for construction will only be modest, financing investments in human capital development may prove difficult for the sector.

Although overall growth in construction demand will be weak, which will raise cost-based competitive pressures, there will also be a shift in the structure of demand towards replacement and renovation works. As in the 'global clash' scenario, cost-based competitive pressures will create pressure on margins throughout the construction value chain. Unlike the 'global clash' scenario, however, these will stretch all the way back to 'upstream' suppliers of raw materials to the construction sector. Nonetheless, the need for advanced building products and equipment to meet 'green' construction requirements will imply that opportunities for higher value added creation will exist within the construction supply chain. This will result in a variety of trade-offs arising out of the increasing complexity of construction projects, and the need to strike a balance between the 'green' credentials and the cost effectiveness of construction products and production methods. As with the 'global collaboration' scenario, these conditions will favour greater collaboration – albeit in a local or regional setting – along the construction value chain.

5.5. INSULAR ANTAGONISMS ('LOW RED GROWTH')

This scenario combines weak economic growth with a collapse in efforts to tackle sustainability and climate change issues.

Rather than seeking out global or even regional solutions, countries become increasingly inward looking as they try to respond to the consequences of poor economic conditions. With the exception of short-term reactive public investment projects to support construction activity and stem job losses, demand for infrastructure and capital projects drops significantly. At the same time, absence of clear and stable policy approaches and regulatory frameworks for construction contribute to a collapse in investor confidence and a shortage of capital to finance construction projects. As even the demand for renovation and replacement work – except most essential projects to maintain existing infrastructure – the overall outcome is a widespread crisis in the construction sector.

As in the 'regional ambition' scenario, low global growth rates result in a slowing of globalisation and a stagnation of integration of the Global-CVC, reinforced by the fragmentation of (local) policy and regulatory frameworks. Even integration at the regional level is hit by a tendency towards protectionist measures, such as 'buy local' policies, as public authorities seek to defend the position of domestic firms. Notwithstanding these defensive impulses, public and private clients are increasingly focused on cost reduction (lowest price), with the result that margins in the sector are squeezed and cost-based

competition intensifies. Consequently, client-customer relations become more adversarial and conflictual.

The combination of low economic growth and very restrictive conditions in construction markets, R&D investments and innovation activities are concentrated only in those areas that are clearly linked to increased efficiency and cost savings. Moreover, the incentives to undertake such activities are further diminished by low diffusion rates for new technologies and increasing fragmentation of markets resulting from stalling globalisation and rising protectionist measures. Given low expected returns on investments, there is a slump in R&D investments and innovation.

With the combination of weak labour markets and an emphasis on cost reduction, there will be little incentive or scope for firms to implement investments in human capital development or improve working conditions.

Construction will be characterised by a ‘buyers’ market’, where clients hold the upper hand and will be able to exercise significant pressure on contractor’s margins. In turn, contractors will seek to extract cost reductions on their suppliers, thus final market pressures will be passed backwards up the construction supply chain. Overall, this will create significant tensions between the various segments of the supply chain of construction materials, products and equipment. In the European context, this may lead to increased import penetration from low-cost suppliers of construction materials and products. However, with global protectionist measures restricting European exports, any such development may be met by a backlash from European suppliers demanding action against ‘unfair’ competition from cheap foreign imports.

6. Conclusions and recommendations

Throughout the study key findings have been introduced at the start of each section, with the aim to provide the reader insights into the functioning of the construction value chains (CVC), its structure, performance, fundamentals as well as the key trends and challenges that can be observed.

In this chapter we select three key conclusions that in our opinion would benefit from further policy responses:

Integration of CVC is slowly increasing and viewed as desirable. Given the potential benefits, there is a need to facilitate this development and encourage further integration of CVC across Europe.

Intra-EU integration of the CVC is increasing (Section 4.2), bringing benefits throughout (Section 4.1). The EU has a strong position in parts of global trade, in particular in the upstream sectors which are specialising. Given the global context and potential future scenarios (Chapter 5) integration of not only intra-EU CVC, but also global CVC should be encouraged.

Policy recommendation:

There is a need to keep supporting an enhanced integration of the single market, in particular for SMEs, which are often subcontractors to the large firms that export.

Encourage and support R&D as well as projects that could facilitate smarter integration, such as: big data, smart sourcing, online auctioning platforms for construction services EU-wide etc.

Productivity gains are a key driver to improve CVC performance and EU's export competitive advantage, therefore R&D into new products/efficiency gains should be encouraged.

Our analysis indicates that productivity improvements are one of the main driving factors behind financial performance and health (Section 3.1.4). In addition we have observed that productivity gains upstream in the CVC also improve the financial health of the construction sector itself (Section 4.1.4), which in turn helps the whole CVC due to the inter-linkages (Sections 3.2.1 and 2.2). Lastly in terms of extra-EU exports the EU has a strong competitive advantage when it comes to high value added products, which almost always have high productivity measure (Section 4.3.3).

Policy recommendation:

Encourage R&D and investment into productivity, new products and efficiency techniques.

Set standards to force higher quality products and buildings to stimulate supply and private sector investment into productivity and innovation.

The results show that construction should not be studied only in isolation, but as part of the CVC. Given the importance of the CVC, further investigation should be made into the internal relationships and functioning of the CVC both internally and across the EU.

Results such as the fact that the construction sector benefits from productivity gains in its upstream suppliers (chapter 4.1) show that construction should no longer be studied in isolation (compare to the isolated results in 3.1). Secondly, CVC integration (chapter 4.2) and country difference (chapter 3.3) show the importance of and the need for a deeper understanding of the cross-border nature of the CVC.

Policy recommendation:

The policy-maker should increasingly consider the construction sector as part of the CVC, rather than in isolation.

More investigation should be conducted in further uncovering the internal functioning of the CVC as well as the Intra-EU dimension of the CVC.

In addition based on the four scenarios presented in chapter 5 the following policy recommendations are seen as desirable in the event of that scenario:

Global collaboration 'high green growth'

Under this scenario there is a need for not only continuing to develop skills to ensure that the CVC has a high skilled labour force in order to meet the necessary high value added products and services; the appeal of the CVC should also be improved to attract more workforce into the sectors.

Regulation should set high 'green standards' to ensure that the trend of fighting climate change continues, thus ensuring that the EU's CVC builds on its first mover advantage and continues to have a strong position.

There should be a focus on trade liberalisation and opening up of third country markets, to allow EU's CVC firms to export, given their strong position in the market.

Global clash 'high red growth'

In this scenario to counter the fierce international competition, global value chains fragmentation into niche productions there is a need to strengthen intra-EU CVC integration. This will not only allow EU firms to compete on a global scale, but also gain from economies of scale.

Particular policy focus should be on the middle segment of the value chain, which in this scenario will get squeezed the most.

In the absence of a general desire to fight climate change, there is a need for the policy-maker to step in and push green standards and regulation, in order to kick-start and develop the market towards. This will drive the change towards the high value added green CVC products and serviced, where the EU has a

competitive advantage. And given the economic climate, big firms will have the necessary financial resources to conduct the needed investment without public support.

Regional ambition 'low green growth'

To prevent the regionalisation facilitate the need for cost effectiveness, the policy-maker should facilitate cross-border integration of the CVC and actively participate in building a cross EU CVC.

In times of low economic growth, policy-makers should support companies in meeting green, sustainable and smart buildings demands and standards – most typically by R&D funding, anti-cyclical public procurement (building public buildings with very high green standards) and possibly fiscal stimuli.

Insular antagonisms 'low red growth'

In this difficult scenario there is a need to invest into efficiency of the CVC. For example by reducing cross country barriers to avoid national protectionisms and allow efficiency gains.

Additionally in order to stimulate a move towards green growth, the policy-maker should engage in counter-cyclical public procurement of high standards of green construction and well as invest substantially into R&D and new products.

Annexes

ANNEX I: DATA DEFINITION OF THE CONSTRUCTION AND UPSTREAM SECTORS

CONSTRUCTION *(Onsite construction and civil engineering)*				
NACE 2	**GENERAL CONSTRUCTION & CIVIL ENGINEERING (41.1, 41.2, 42.1, 42.2, 42.9, 43.9)**		**NACE 1.1**	
41.1	Development of building projects			[Not identifiable under NACE 1.1]
41.2	Construction of residential and non-residential buildings		45.21	General construction of buildings and civil engineering works
42.11	Construction of roads and motorways		45.23	Construction of motorways, roads, airfields and sport facilities
42.12	Construction of railways and underground railways		45.24	Construction of water projects
42.13	Construction of bridges and tunnels		45.25	Other construction work involving special trades
42.21	Construction of utility projects for fluids			
42.22	Construction of utility projects for electricity and telecommunications			
42.91	Construction of water projects			
42.99	Construction of other civil engineering projects n.e.c.			
43.91	Roofing activities		45.22	Erection of roof covering and frames
43.99	Other specialised construction activities n.e.c.		45.5	Renting of construction or demolition equipment with operator

Notes:
1. NACE 2 'Development of building projects' (41.1) and 'Civil Engineering' (42.x) include activities previously covered under NACE 1.1. 'Development and selling of real estate', which cannot be separately identified.
2. NACE 2 'Construction of residential and non-residential buildings' (41.2) and 'Roofing activities' (43.91) include (installation) activities previously covered under NACE 1.1 'Manufacture of builders' carpentry and joinery' (20.3), which cannot be separately identified.
3. NACE 2 'Construction of residential and non-residential buildings' (41.2) includes (installation) activities previously covered under NACE 1.1 'Manufacture of builders' ware of plastics' (25.23), which cannot be separately identified.
4. NACE 2 'Construction of residential and non-residential buildings' (41.2) includes (assembly/installation) activities previously covered under NACE 1.1 'Manufacture of metal structures and parts of metal structures' (28.11), which cannot be separately identified.

(ctd.)

CONSTRUCTION *(Onsite construction and civil engineering)*				
NACE 2	**DEMOLITION & SITE PREPARATION (43.1)**		**NACE 1.1**	
43.11	Demolition		45.11	Demolition and wrecking of buildings; earth moving
43.12	Site preparation			
43.13	Test drilling and boring	=	45.12	Test drilling and boring
NACE 2	**INSTALLATION ACTIVITIES (43.2)**		**NACE 1.1**	
43.21	Electrical installation		45.31	Installation of electrical wiring and fittings
43.22	Plumbing, heat and air-conditioning installation		45.32	Insulation work activities
43.29	Other construction installation		45.33	Plumbing
Notes: 1. NACE 2 'Other construction installation' (43.29) includes (repair/maintenance) activities previously covered under NACE 1.1 'Manufacture of lifting and handling equipment' (29.22), which cannot be separately identified. 2. NACE 1.1 'Installation of electrical wiring and fittings' (45.31) includes activities (installation of fire and burglar alarms), which are covered under NACE 2 'Security systems service activities' (80.2).				
NACE 2	**BUILDING COMPLETION & FINISHING (43.3)**		**NACE 1.1**	
43.31	Plastering	=	45.41	Plastering
43.32	Joinery installation		45.42	Joinery installation
43.33	Floor and wall covering	=	45.43	Floor and wall covering
43.34	Painting and glazing	=	45.44	Painting and glazing
43.39	Other building completion and finishing		45.45	Other building completion
Notes: 1. NACE 2 'Joinery installation' (43.32) includes (installation) activities previously covered under NACE 1.1 'Manufacture of builders' carpentry and joinery' (20.3), which cannot be separately identified. 2. NACE 2 Joinery installation' (43.32) includes (installation) activities previously covered under NACE 1.1 'Manufacture of builders' ware of plastics' (25.23), which cannot be separately identified. 3. NACE 2 Joinery installation' (43.32) includes (installation) activities previously covered under NACE 1.1 'Manufacture of builders' carpentry and joinery of metal' (28.12), which cannot be separately identified.				

MINING & QUARRYING				
NACE 2	**QUARRYING (08.1)**		**NACE 1.1**	
8.11	Quarrying of ornamental and building stone, limestone, gypsum, chalk and slate		14.11	Quarrying of ornamental and building stone
			14.12	Quarrying of limestone, gypsum and chalk
			14.13	Quarrying of slate
8.12	Operation of gravel and sand pits; mining of clays and kaolin		14.21	Operation of gravel and sand pits
			14.22	Mining of clays and kaolin
Notes: 1. NACE 1.1 'Quarrying …' (14.1x) includes activities which are covered under NACE 2 'Support activities for other mining and quarrying' (09.9). 2. NACE 1.1 'Operation of gravel and sand pits' (14.21) and 'Mining of clays and kaolin' (14.22) include activities which are covered under NACE 2 'Support activities for other mining and quarrying' (09.9).				

RAW PRODUCTS				
PLASTIC PRODUCTS				
NACE 2	**MANUFACTURE OF BUILDERS' WARE OF PLASTIC (22.23)**		**NACE 1.1**	
22.23	Manufacture of builders' ware of plastic		25.23	Manufacture of builders' ware of plastic
Notes: 1. NACE 2 'Manufacture of builders' ware of plastic' (22.23) includes activities previously covered under NACE 1.1. 'Other manufacturing n.e.c.' (36.63), which cannot be separately identified. 2. NACE 1.1 ''Manufacture of builders' ware of plastic' (25.23) includes activities (installation), which are covered under NACE 2 'Construction of residential and non-residential buildings' (41.2) and NACE 2 'Joinery installation' (43.32), which cannot be separately identified.				
WOOD PRODUCTS				
NACE 2	**SAWMILLING & PLANING OF WOOD (16.1)**		**NACE 1.1**	
16.1	Sawmilling and planing of wood		20.1	Sawmilling and planing of wood; impregnation of wood
Notes: 1. NACE 2 'Sawmilling and planing of wood' (16.1) includes activities previously covered under NACE 1.1. 'Forestry and logging' (2.01), which cannot be separately identified.				
NACE 2	**MANUFACTURE OF BUILDERS' CARPENTRY & JOINERY (16.2 part)**		**NACE 1.1**	
16.21	Manufacture of veneer sheets and wood-based panels	=	20.2	Manufacture of veneer sheets; manufacture of plywood, lamin-board, particle board, fibre board and other panels and boards
16.22	Manufacture of assembled parquet floors		20.3	Manufacture of builders' carpentry and joinery
16.23	Manufacture of other builders' carpentry and joinery			
CEMENT, LIME, PLASTER & CONCRETE PRODUCTS				
NACE 2	**MANUFACTURE OF CEMENT, LIME & PLASTER (23.5)**		**NACE 1.1**	
23.51	Manufacture of cement	=	26.51	Manufacture of cement
23.52	Manufacture of lime and plaster	{	26.52	Manufacture of lime
		{	26.53	Manufacture of plaster
NACE 2	**MANUFACTURE OF PRODUCTS OF CEMENT, PLASTER & CONCRETE (23.6)**		**NACE 1.1**	
23.61	Manufacture of concrete products for construction purposes		26.61	Manufacture of concrete products for construction purposes
23.62	Manufacture of plaster products for construction purposes	=	26.62	Manufacture of plaster products for construction purposes
23.63	Manufacture of ready-mixed concrete	=	26.63	Manufacture of ready-mixed concrete
23.64	Manufacture of mortars	=	26.64	Manufacture of mortars
23.65	Manufacture of fibre cement	=	26.65	Manufacture of fibre cement
23.69	Manufacture of other articles of concrete, plaster and cement	=	26.66	Manufacture of other articles of concrete, plaster and cement

(ctd.)

STONE PRODUCTS				
NACE 2	**CUTTING, SHAPING & FINISHING OF STONE (23.7)**		**NACE 1.1**	
23.7	Cutting, shaping and finishing of stone	=	26.7	Cutting, shaping and finishing of ornamental and building stone
INTERMEDIATE PRODUCTS				
GLASS PRODUCTS				
NACE 2	**MANUFACTURE OF GLASS & GLASS PRODUCTS (23.1 part)**		**NACE 1.1**	
23.11	Manufacture of flat glass	=	26.11	Manufacture of flat glass
23.12	Shaping and processing of flat glass	=	26.12	Shaping and processing of flat glass
23.14	Manufacture of glass fibres	=	26.14	Manufacture of glass fibres
Additional Comments 1. NACE 2 'Manufacture and processing of other glass, including technical glassware' (23.19) includes activities for manufacture of glass blocks, slabs, bricks, squares and tiles etc. used for building and construction purposes.				
CLAY BUILDING MATERIALS & CERAMIC PRODUCTS				
NACE 2	**MANUFACTURE OF CLAY BUILDING MATERIALS (23.3)**		**NACE 1.1**	
23.31 23.32	Manufacture of ceramic tiles and flags Manufacture of bricks, tiles and construction products, in baked clay	=	26.3 26.4	Manufacture of ceramic tiles and flags Manufacture of bricks, tiles and construction products, in baked clay
Notes: 1. NACE 1.1 'Manufacture of bricks, tiles and construction products, in baked clay' (26.4) includes activities which are covered under NACE 2 'Repair of other equipment' (33.19) and 'Installation of industrial machinery and equipment' (33.2).				
NACE 2	**MANUFACTURE OF CERAMIC SANITARY FIXTURES (23.4 part)**		**NACE 1.1**	
23.42	Manufacture of ceramic sanitary fixtures	=	26.22	Manufacture of ceramic sanitary fixtures
CHEMICAL PRODUCTS				
NACE 2	**MANUFACTURE OF PAINTS, VARNISHES, MASTICS & GLUES (22.3, 20.5 part)**		**NACE 1.1**	
20.3	Manufacture of paints, varnishes and similar coatings, printing ink and mastics	=	24.3	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
Notes: 1. NACE 1.1 'Manufacture of glues and gelatines' (24.62) includes activities which are covered under NACE 2 'Manufacture of other chemical products n.e.c.' (20.59).				
Additional Comments 2. NACE 2 'Manufacture of other chemical products n.e.c.' (20.59) includes activities for manufacture of prepared additives for cement, mortars or concretes.				

(ctd.)

METAL STRUCTURES				
NACE 2	**MANUFACTURE OF METAL STRUCTURES (25.1, 25.2 part)**		**NACE 1.1**	
25.11	Manufacture of metal structures and parts of structures		28.11	Manufacture of metal structures and parts of structures
25.12	Manufacture of doors and windows of metal		28.12	Manufacture of builders' carpentry and joinery of metal
25.21	Manufacture of central heating radiators and boilers		28.22	Manufacture of central heating radiators and boilers

Notes:

1. NACE 1.1 'Manufacture of metal structures and parts of structures' (28.11) includes activities which are covered under NACE 2 'Cold forming or folding' (24.33), 'Repair of fabricated metal products' (33.11) and 'Construction of residential and non-residential buildings' (41.2).
2. NACE 1.1 'Manufacture of builders' carpentry and joinery of metal' (28.12) includes activities which are covered under NACE 2 'Joinery installation' (43.32).
3. NACE 1.1 'Manufacture of metal structures and parts of structures' (28.11) includes activities which are covered under NACE 2 'Repair of fabricated metal products' (33.11).

CONSTRUCTION MACHINERY *(Machinery for mining, quarrying and construction)*				
NACE 2	**MANUFACTURE OF MACHINERY FOR MINING, QUARYING & CONSTRUCTION (28.9 part)**		**NACE 1.1**	
28.92	Manufacture of machinery for mining, quarrying and construction		29.52	Manufacture of machinery for mining, quarrying and construction

Notes:

1. NACE 2 'Manufacture of machinery for mining, quarrying and construction' (28.92) includes activities previously covered under NACE 1.1. 'Manufacture of tools' (28.62) and 'Manufacture of motor vehicles' (34.1), which cannot be separately identified.
2. NACE 1.1 'Manufacture of machinery for mining, quarrying and construction' (29.52) includes activities which are covered under NACE 2 'Manufacture of other special-purpose machinery n.e.c.' (28.99) and 'Repair of machinery' (33.12).

Additional Comments

1. NACE 2 'Manufacture of lifting and handling equipment' (28.22) includes activities for manufacture of tower and mobile cranes and some parts for machinery covered under 'Manufacture of machinery for mining, quarrying and construction' (28.92).

INTERMEDIARIES *(Distribution of construction materials and equipment)*				
WHOLESALE – CONSTUCTION MATERIALS, MACHINERY & EQUIPMENT				
NACE 2	**WHOLESALE DISTRIBUTION (46.1 part, 46.4 part, 46.7 part)**		**NACE 1.1**	
46.13	Agents involved in the sale of timber and building materials	=	51.13	Agents involved in the sale of timber and building materials
46.63	Wholesale of mining, construction and civil engineering machinery	=	51.82	Wholesale of mining, construction and civil engineering machinery
46.73	Wholesale of wood, construction materials and sanitary equipment		51.53	Wholesale of wood, construction materials and sanitary equipment
46.74	Wholesale of hardware, plumbing and heating equipment and supplies	=	51.54	Wholesale of hardware, plumbing and heating equipment and supplies
Notes: 1. NACE 2 'Wholesale of wood, construction materials and sanitary equipment' (46.73) includes activities previously covered under NACE 1.1. 'Wholesale of china and glassware, wallpaper and cleaning materials' (51.44) and 'Wholesale of other household goods' (51.47), which cannot be separately identified.				
RETAIL – CONSTUCTION MATERIALS, MACHINERY & EQUIPMENT				
NACE 2	**RETAIL DISTRIBUTION (47.5 part)**		**NACE 1.1**	
47.52	Retail sale of hardware, paints and glass in specialised stores	=	52.46	Retail sale of hardware, paints and glass
RENTING & LEASING OF CONSTUCTION EQUIPMENT				
NACE 2	**RENTING & LEASING OF CONSTUCTION EQUIPMENT (77.3 part)**		**NACE 1.1**	
77.32	Renting and leasing of construction and civil engineering machinery and equipment		71.32	Renting of construction and civil engineering machinery and equipment
Notes: 1. NACE 1.1 'Renting of construction and civil engineering machinery and equipment' (71.32) includes activities which are covered under NACE 2 'Renting and leasing of other machinery, equipment and tangible goods n.e.c.' (77.39). 2. **NB:** Renting of construction or demolition equipment with operator is included in NACE 2 'Other specialised construction activities n.e.c.' (43.99) and NACE 1.1 'Renting of construction or demolition equipment with operator' (45.5)				

REAL ESTATE				
NACE 2	**REAL ESTATE ACTIVITIES (68)**		**NACE 1.1**	
68.1	Buying and selling of own real estate	=	70.12	Buying and selling of own real estate
68.2	Renting and operating of own or leased real estate	=	70.2	Letting of own property
68.31	Real estate agencies	=	70.31	Real estate agencies
68.32	Management of real estate on a fee or contract basis		70.32	Management of real estate on a fee or contract basis
Notes: 1. NACE 1.1 'Management of real estate on a fee or contract basis' (70.32) includes activities which are covered under NACE 2 'Combined facilities support activities' (81.1).				

PROFESSIONAL CONSTRUCTION SERVICES				
NACE 2	**ARCHITECTURAL, ENGINEERING & TECHNICAL SERVICES (71.1)**		**NACE 1.1**	
71.11	Architectural activities		74.2	Architectural and engineering activities and related technical consultancy
71.12	Engineering activities and related technical consultancy			
Notes: 1. NACE 1.1 'Architectural and engineering activities and related technical consultancy' (74.2) includes activities which are covered under NACE 2 'Photographic activities' (74.2) and 'Other professional, scientific and technical activities n.e.c.' (74.9).				

OTHER SERVICES RELATED TO CONSTRUCTION				
COMPUTER-RELATED SERVICES				
NACE 2	**COMPUTER AND INFORMATION SERVICE ACTIVITIES (62, 63)**		**NACE 1.1**	
62.0	Computer programming, consultancy and related activities			
63.1	Data processing, hosting and related activities			
63.9	Other information service activities			
EMPLOYMENT SERVICES				
NACE 2	**EMPLOYMENT ACTIVITIES (78)**		**NACE 1.1**	
78.1	Activities of employment placement agencies			
78.2	Temporary employment agency activities			
78.3	Other human resource provision			
BUSINESS SUPPORT SERVICES				
NACE 2	**SECURITY, CLEANING & GENERAL OFFICE SUPPORT ACTIVITIES (80, 81, 82)**		**NACE 1.1**	
80.1	Private security activities			
80.2	Security systems service activities			
80.3	Investigation activities			
81.1	Combined facilities support activities			
81.2	Cleaning activities			
81.3	Landscape service activities			
82.1	Office administrative and support activities			
82.2	Activities of call centres			
82.3	Organisation of conventions and trade shows			
82.9	Business support service activities n.e.c.			
LEGAL AND ACCOUNTING SERVICES				
NACE 2	**LEGAL, ACCOUNTING & MANAGEMENT CONSULTANCY ACTIVITIES (69, 70)**		**NACE 1.1**	
69.1	Legal activities			
69.2	Accounting, bookkeeping and auditing activities; tax consultancy			
70.2	Management of consultancy activities			
70.1	Activities of head offices			

ANNEX II: METHODOLOGY & DATA USED

Data sources

Supply and Use Tables, Eurostat (chapter 2.2)

The calculation of the composition of intermediate inputs is based on data from Eurostat's consolidated supply and use tables (SUT) for 2011[76]. These data provide EU-level[77] estimates of intermediate consumption disaggregated into 64 industry/product categories.[78] The data also provide a breakdown between 'domestic' (EU supplied) and 'imported' (extra-EU imports) supply of intermediate inputs. The underlying data are reported in current (2011) values at basic prices[79].

Intermediate consumption consists of the value of the goods and services consumed as inputs by a process of production; in other words, the value of goods or services that are either transformed or 'used up' in the process of production. Intermediate consumption includes all non-durable goods and services with an expected life of less than one year. It excludes, however, those with an expected life of one year or more. The consumption of these fixed assets (which may be tangible or intangible assets), which are used repeatedly or continuously in processes of production (for more than one year), is recorded as consumption of fixed capital.[80]

It should be noted that fixed assets include inter alia machinery and equipment (and other items such as computer software). The presented data do not, therefore, reflect the construction sectors acquisition and use of construction and other machinery and equipment.

Comext, Eurostat, and Comtrade, UN (chapters 2.3, 3.2, 3.3, 4.2, 4.3)

All upstream product group trade data are retrieved from two different sources. For most of the analyses in the present report, Eurostat's Comext portal contained all the required trade data at the 8-digit HS classification level. More specifically, it contains information on trade flows from EU Member States towards all other EU Member States, as well as towards our 8 identified non-EU partners and the world as a whole. Comext is therefore the main source of data for the trade analyses. UN Comtrade is used whenever the reporting country of the trade flow is not an EU MS; for instance in the calculation of the revealed comparative advantage and annual growth rates. The disadvantage of this database is that it is less detailed, as trade data are only available at the 6-digit HS classification level. This means that there may be an overestimation of trade flows, which include products that are not (directly) related to the construction sector.

For an exact overview of the identified HS-classification codes for each of the upstream product group trade flows, we refer to the Excel files with all the information.

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[76] For more information, see: European Communities (2008), '*Eurostat Manual of Supply, Use and Input-Output Tables*', Office for Official Publications of the European Communities, Luxembourg.

[77] 27 Member States, excluding Croatia.

[78] Products categories are based on NACE Rev 2 'Classification of Products by Activity (CPA)'.

[79] The basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, on that unit as a consequence of its production or sale; it excludes any transport charges invoiced separately by the producer.

[80] Consumption of fixed capital represents the reduction in the value of the fixed assets used in production during the accounting period resulting from physical deterioration, normal obsolescence or normal accidental damage.

Structural Business Statistics, Eurostat (chapters 2.1, 2.3, 3.2, 3.3, 4.1)

Regarding data on aggregate sector performance, we employ time series coming from Eurostat Structural Business Statistics. Data at sector level are retrieved by cumulating or averaging information at NACE 4-digit level. Total of the EU is based on the summation of Member States (MS) individual observations. Whenever data gaps for a MS or at the European data were encountered these have been interpolated.

Firm-level data, Amadeus, Bureau Van Dijk (chapters 3.3, 4.1)

As concerns firm-level data, we collected information relative to firms' balance sheets, as provided by the Amadeus database released by Bureau Van Dijk. A set of 401,510 firms was gathered, by considering only those firms indicating as their primary business activity one of the NACE 4-digits code considered in the industry classification in Annex II. We then proceeded to extract a representative stratified sample, on the basis of the firms' size distribution as reported by Eurostat (*i.e. the shares of micro, small, medium and large firms out of the total, for each sector considered).* Only those firms reporting data for 2014 for the relevant parameters were considered. For each firm we collected data for 2006-2008-2010-2012-2014.

Structure of the Construction value chain (chapter 2.2)

This part of the study adopts a value chain perspective of the construction sector and its linkages to other economic segments/activities, such that it can be quantified based on measures derived from multi-regional input-output tables. From a value chain perspective an individual industry can basically be looked at in two dimensions. First, the structure from which the industry sources its intermediates (the 'upstream' industries) to produce its final output (also referred to as the 'backward linkages' of this industry). Multi regional input-output tables allow intermediates to be broken down into sourcing from various industries and countries (or aggregates) showing to which extent the industry is – domestically and internationally – vertically integrated. Second, the structure of sale of its gross output to other industries (the 'downstream' industries) and the final absorption (the industry's 'forward linkages') again can be broken down in a similar way as outline above.

Using measures focusing on these two perspectives, the construction value chain (CVC) of a particular economy can be characterised and compared across countries (EU-total, EU Member States and other major economies) and over time, allowing one to identify the place of the individual CVC's in the global value chains and compare to other countries' performance (e.g. US, China, Japan).

This part of the study uses two sets of databases: In the first part, we use Eurostat Input-Output (IO) Tables. For the period 2000 to 2007, IO-tables are available according to the NACE Rev. 1 classification system, for 2008 to 2011 according to the NACE rev 2 classification system. The construction industry is represented by one section F 'Construction' (identical to group 45) in the former system and by section 'F' Construction (identical to group 41, 42 and 43) in the latter one. The second part relies on the WIOD (World Input-Output Database) which covers the period 1995-2011 and 40 countries (the EU27 Member States, without Croatia, and 13 major economies) plus a rest-of-world category. In the WIOD data the construction industry is represented by one item according to NACE Rev. 1 classification system, section F 'Construction' (identical to group 45).

The characteristics and advantages of individual datasets might be summarised as follows: The most recent Eurostat tables (2008-2011) are based on NACE Rev. 2 and thus offer a more detailed breakdown into 64 products (CPA categories), which is more detailed in in particular for service products. Eurostat symmetric IO tables are provided on a product by product basis. The WIOD database gives detailed linkages with the world both for intermediate and final products. Comparison over time is provided (all years 2000-2011 are available on NACE 1 Rev. 1 classification system). WIOT data are based on an industry by industry approach. Basically, comparing results from WIOD and Eurostat data, these do not differ a great deal at the aggregated level. Interesting new results emerge at the more disaggregated level where more information is available on the NACE Rev. 2 classification system (e.g. basic metals and fabricated metals are extra, business services are spilt up in more detail).

As such, in the first chapter the EU27 construction sector and its structural features are described based on the Eurostat data are, in the second chapter results are presented based on the WIOD, focusing on the time dimensions and aspects of international linkages. More concretely, in a first step, the study focuses on the aggregated EU27 construction sector, its pattern of international (and vertical) integration and its changes over time considering years 2000, 2007 and 2011, where possible, in order to see changes up to the crisis and trends thereafter. The linkages of the EU27 construction sector – both backward and forward – with other industries by country are analysed in detail. Further, these data capture the construction sector's sales to final demand, particularly investment demand.

Regressions and modelling (chapter 3.5 and chapter 4)

We employed a linear regression framework for the vast majority of the analysis developed, hence by using OLS estimators. Results are corrected for a set of control variables, including dummies for time, country and sectors fixed effects. The standard procedure of hypothesis testing was used to analyse the significance of individual coefficients and regressions.

Regarding the relation between the firms' credit cycle and their level of indebtedness a quadratic regression framework was used, based on the hypothesis of the existence of a non-linear relation between the two parameters.

Financial performance and risks (chapter 4.2)

When considering the financial performance of a sector from an investor point of view there are four main indicators that he/she will consider:

- **Profitability of the companies:** if a company has good profit margins it is likely to be resilient to competition, but also have positive future outlook.
- **Financial health of a company:** this key indicator is in other words the credit rating/scoring of a company. We have used a composite indicator called Altman's Z, which measures the likelihood that a company will go bankrupt within a year. The higher the indicator, the better financial health of the company.
- **Investor returns:** is the bottom line for many investors. We measure it with Return on Equity (ROE) ratio, which measures how effective is the company in increasing shareholder equity.

› **Risks and volatility:** Risks are a major factor in any investment analysis and the more volatile a company is (do its returns change from year to year), or a sector, the more risky it is and will be less attractive to the investor. We have calculated volatility by the size of the standard deviation in comparison to the magnitude of the mean, the higher the difference the higher the volatility and therefore risks.

Herfindahl Index explained (chapter 4.7)

The Herfindahl Index (officially the Herfindahl-Hirschman Index, or HHI) is an often-used measure of market concentration. The HHI is calculated as the sum of market shares of all partners in the trade relationship of a single Member State. The HHI changes if the number of trading partners changes over time, as well as when the relative sizes of the partners change. More specifically, if the number of trading partners goes up, as a measure or market concentration, the HHI will decline. Similarly, if the trade flow becomes more concentrated on a small number of partners, the HHI will increase. In the context of this study, it can be used to measure the export and import diversification of Member States in their intra-EU trade pattern. An increase in HHI denotes a more concentrated trade pattern, whereas a decrease is to be interpreted as a more diversified trade pattern. In formula form, this reads:

$$HHI = \sum_{i=1}^{N} s_i^2$$

where *s* denotes the market share of country *i*. The HHI is then calculated for every upstream product group for every year. In order to determine possible import/export diversification, the Excel command 'LINEST' was used to calculate the slope of the change in HHI. This was then matched with the corresponding Standard Error and a t-statistic at the 0.05% significance level (9 Degrees of Freedom = 2.262), so that significant changes in the HHI between 2004 and 2014 are identified.

Revealed Comparative Advantage explained (chapter 4.9)

The Revealed Comparative Advantage (RCA) is a measure of international competitiveness, and reflects the share of the export value of a given sector in the total exports of a country, compared to the corresponding figure of competitors.

$$RCA = \frac{E_{ij}/E_{it}}{E_{nj}/E_{nt}}$$

Where *E* denotes exports, *i* = extra-EU28, *j* = all identified HS 6-digit codes in that product group, *t* = total exports, *n* = important partner country. If the share of exports of a given sector in total exports is larger for one country than for the competitor, that country is said to enjoy a revealed comparative advantage (and the corresponding RCA index is larger than one). For this study, the extra-EU export flows are benchmarked against the eight relevant trading partners. The reported years are 2004, 2009, 2014 to reflect pre-crisis, crisis, and post-crisis RCAs, and values higher than one indicate that the benchmarked country has a revealed comparative advantage.

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- Graph of the month:
  - Exchange rate of Turkish lira vs. US dollar, 2007-2017
  - Foreign tourist arrivals in Turkey in 1987-2017, % change year-on-year
- Opinion Corner: What does the Turkish referendum result mean for the economy?
- List of acronyms
- Aggregating import tariff rates: a review of methodological approaches
- Trade effects of non-tariff measures: the 'chlorinated chicken' case
- EU trade regulations and the WTO dispute settlement on hygienic poultry
- The editors recommend for further reading
- Monthly and quarterly statistics for Central, East and Southeast Europe

› Index of subjects – April 2016 to April 2017

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by Tetiana Bogdan and Michael Landesmann with contributions by Peter Havlik and Vladimir Gligorov

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› Graph of the month: Share of innovative enterprises in EU Member States, in %
› Opinion corner: What is the reason for the numerous business disputes between the government of Kosovo and foreign enterprises?
› How to use EU funds earmarked for fostering cohesion more efficiently?
› Social innovation and the EU policy initiatives
› The effects of EU research projects in the field of social innovation
› The knowledge economy and the labour market: the role of social partners
› The editors recommend for further reading
› Statistical Annex: Monthly and quarterly statistics for Central, East and Southeast Europe
› Index of subjects – March 2016 to March 2017

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- Graph of the month: Adjusted wage share in EU-CEE countries in 1995-2016, as % of GDP
- Opinion corner: Is the falling wage share in most EU-CEE countries a symptom of the 'race to the bottom'?
- Globalisation and the 'race to the bottom': intended and unintended consequences
- Reducing unemployment in the euro area: What is the appropriate fiscal policy stance?
- The economic role of railway networks – a historical perspective
- The editors recommend for further reading
- Statistical Annex: Monthly and quarterly statistics for Central, East and Southeast Europe
- Index of subjects – February 2016 to February 2017

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