

## Structure and dynamics of manufacturing production depth as reflected in the financial statements of German enterprises

*In the discussion about Germany's position as an industrial location and the establishment of new production strategies in connection with the increasing international division of labour, the value added of the non-financial corporate sector is often the focus of interest in the sphere of economic policy. Empirical analyses of this key reference variable for the productive activity and economic output of industries and sectors are based almost exclusively on national accounts data.*

*This study enhances this approach by drawing on data from the Bundesbank's corporate financial statements statistics, the aggregated variables of which move virtually in parallel with the national accounts data. By incorporating the microdata on enterprises' balance sheets and income statements which underlie these statistics, it can be shown that a strong relationship exists between the various business models and the degree of production depth.*

*The aggregated results clearly show that the value added increase in the manufacturing industry during the period between 1997 and 2012 did not keep pace with the expansion in output. Rather, intermediate consumption is gaining ever more in importance owing to the growing propensity to outsource and shift corporate activities, with the result that the production depth has declined on a permanent basis. Nevertheless, the contribution of industry to the total value added of all non-financial corporations in Germany has changed only insignificantly, although major differences can be seen at the sectoral level.*

*The analysis of the microdata shows that around one-quarter of enterprises generate more than half of their output internally and, contrary to the overall economic trend, have, in some cases, even increased the depth of their production. These enterprises, which mainly operate as very flexible small companies in regional markets with made-to-order or small-batch production processes or which are found in the SME sector of the specialised capital goods industry, achieve a very high return on sales with predominantly in-house production; this, however, is associated with perceptibly slower growth dynamics. Their business model is subject to special conditions, which do not apply to the majority of enterprises in the manufacturing industry.*

## Value added and production depth as approaches for measuring and modelling the economic structure

*Production depth – central indicator of production structure*

Production depth – the ratio of value added to gross revenue – is a key reference variable for macroeconomic structural analyses of industries or economic sectors. This ratio, which is derived from the output approach of the national accounts, quantifies in-house production as a share of total output and reflects the degree of vertical integration in production processes.<sup>1</sup> Given the growing international division of labour and the associated modernisation strategies of the industry, questions such as these are increasingly the main focus of economic policy analyses at present.<sup>2</sup>

*A priority issue of strategic corporate planning*

From a business perspective as well, the choice between producing products and services internally or procuring them externally (“make-or-buy” decision) is a key issue within the framework of strategic corporate planning and supply chain management. The last decade, especially, has seen a systematic management of the production depth and a continuous shift of operational activities in value-added chains and networks in the manufacturing industry. A study recently published by the Eurosystem’s Competitiveness Research Network (CompNet) clearly shows that the division of labour in the production of goods and services in the form of global value-added chains and networks has, in many areas, now emerged as the predominant production strategy worldwide.<sup>3</sup> Here, the spectrum stretches from more hierarchy-driven to more market-related forms of coordination, ranging from a shift of production activities to subsidiaries and associated companies, the establishment of joint ventures and networks, to the outsourcing of production to third-party companies. In doing so, enterprises can make use of production capacities and production locations both domestically (nearshoring) and abroad (offshoring).<sup>4</sup>

National and international studies alike on this topic typically draw on national accounts results. However, these data provide an insufficient basis for more nuanced structural analyses as it is not only a sector-specific differentiation of the results that is required, but also breakdowns by corporate characteristic, such as size and legal form. The relationships between business models, the organisation of production and the resulting impact they have on the various balance sheet and income statement ratios of manufacturing enterprises in Germany are also of central importance in this context. Such questions can be extensively analysed using the Bundesbank’s microdata, which are also used as the underlying data basis for this study.<sup>5</sup>

## Factors determining the depth of production

From a production theory perspective, determining the optimal production depth is primarily a cost-based decision, although the definition and substance of the expense items in question can differ significantly. If the question of the optimal production depth is boiled down to a straightforward outsourcing decision, ie the choice between external procurement and complete in-house production, the difference between internal production cost and external market prices constitutes the relevant decision-making parameter. Viewed from this angle,

*Cost as a relevant decision-making parameter in optimising the degree of production depth ...*

<sup>1</sup> By the same token, it also provides information on the level of externally procured intermediate consumption in relation to gross revenue.

<sup>2</sup> See Deutsche Bundesbank, The German economy in the international division of labour: a look at value added flows, Monthly Report, October 2014, pp 27-42.

<sup>3</sup> See F di Mauro and M Ronchi, Assessing European competitiveness: the contribution of CompNet research, CompNet Report, June 2015, pp 24 ff.

<sup>4</sup> General information on this topic can be found in R Coase (1937), The nature of the firm, *Economica*, Vol 4, pp 386 ff; O E Williamson (1992), Markets, hierarchies, and the modern cooperation. An unfolding perspective, *Journal of Economic Behaviour and Organization*, Vol 17, pp 335 ff.

<sup>5</sup> The essence of the definition of business models focuses on the organisational design of production processes and is often described using the term “organisation of value added”. See, for example, A Osterwalder and Y Pigneur (2010), Business model generation, pp 14 ff.

outsourcing production activities to third parties will always be the more favourable option if, in the short view, the market price demanded in the procurement markets is lower than the variable cost of in-house production or, from a long-term perspective, if the outsourcing costs are lower than the total cost of in-house production.<sup>6</sup>

*... and generic competitive advantages*

These considerations can be linked up to the accumulation of generic competitive advantages, which can be achieved mainly through cost leadership and by focusing on the core business.<sup>7</sup> By specifically harnessing the advantages of specialisation and the cost-cutting potential offered by economies of scale, economies of scope and learning curve effects, businesses strive to achieve the biggest possible cost advantage over the competition and to consequently strategically secure their market position, as a low unit cost provides particularly effective protection against rivals. As far as managing the production depth is concerned, this results in the systematic outsourcing of those product areas which are not top performers and which are suboptimal from a production cost and competitive perspective.

*Transaction cost as well as ...*

Instead of the straightforward, dichotomous choice to either “make or buy”, the decision-making problem can, however, also culminate in setting different degrees of vertical integration and thus creating intermediary forms of organisation between market- and hierarchy-driven arrangements. Here, the main focus is on the transaction cost resulting from the transfer of rights of disposal and activities between enterprises. These comprise initiation cost, agreement cost, settlement cost, monitoring cost as well as adjustment cost and are the outcome of imperfect markets in which agents operate with bounded rationality and opportunistic and supposedly risk-neutral behaviour.<sup>8</sup> Given that exogenous environmental factors and conduct risk among market players give rise to transaction-related uncertainty and that cost-reducing effects, economies of scale and synergy effects can be realised with a

growing number of identical transactions, the minimisation of transaction cost plays a decisive role when determining the degree of vertical integration.

Another point that can be included in such optimisation considerations is that the existence of imperfect factor markets means that tangible and intangible resources are distributed heterogeneously across enterprises and therefore constitute, primarily in the form of knowledge-based core competences, the pivotal basis for realising comparative competitive advantages and sustainable revenue surpluses.<sup>9</sup> Such strategically distinctive resources are characterised by the fact that they are seen by customers as adding value, but also as being difficult to imitate, hard to substitute and scarce. All areas of activity must therefore be checked during production planning to see whether they contain any strategic resources. Insofar as the latter are used during production, external procurement measures would run up a high opportunity cost by neutralising competitive advantages. Hence, only those products and services whose production does not require any such core competences should be outsourced. Joint ventures, meanwhile, come into play as intermediary solutions whenever an enterprise’s own pool of resources is outdated and they open up an opportunity to acquire new core competences from competitors, or if the resources necessary to overcome barriers to

*... resource-based cost*

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<sup>6</sup> When operating at full capacity, the opportunity costs must also be factored into this costing model in the form of the contribution margin lost as a result of other production activities not being carried out.

<sup>7</sup> See M E Porter (2000), *The competitive advantage: creating and sustaining superior performance*, sixth edition, pp 99 ff. Another generic strategy is to differentiate along other dimensions to achieve a unique selling point.

<sup>8</sup> See A Picot (1991), *Ein neuer Ansatz zur Gestaltung der Leistungstiefe*, *Zeitschrift für betriebswirtschaftliche Forschung*, Vol 43, No 4, p 344.

<sup>9</sup> See J B Barney (1991), *Firm resources and sustained competitive advantage*, *Journal of Management*, Vol 17, pp 99-120; B Wernerfeldt (1984), *A resource-based view of strategy*, *Strategic Management Journal*, Vol 5, pp 171-180.

market entry are lacking when tapping new markets.<sup>10</sup>

It is to be assumed that in the business operations of globally active enterprises, all the theoretical explanatory factors will ultimately play a more or less important role in determining the production depth. However, the respective weight of these factors is likely to be influenced by economic dynamics and the attendant adjustments that need to be made in a highly competitive global environment.

## ■ Data and study design

The present study is based on data taken from the Bundesbank's corporate financial statement statistics for manufacturing enterprises for the period from 1997 to 2012.<sup>11</sup> This comprehensive stock of single-entity financial statements can be used to representatively model the situation in manufacturing by extrapolating distributions and to drill down the national account aggregates to the firm level.<sup>12</sup> The following will first examine whether the national account aggregates can be coherently modelled with the results of the corporate financial statement statistics, which is a prerequisite for carrying out further structural studies with the microdata. Based on extrapolated corporate financial statement data, an analysis will then be made of the longer-term developments and the distribution of value added and production depth by sector. The second part of the study focuses on factors determining value added and production depth at the enterprise level. For this purpose, enterprises are grouped by degree of production depth so that a comparison can be made between the extrapolated ratios of the group of enterprises with high production depth and those of the remaining enterprises. This study also looks into the question of what bearing the diverging business models of enterprises with different degrees of production depth have on the balance sheet and income statement. The study concludes by analysing developments in the results of oper-

ations and net assets of these two groups over the last 15 years.

## ■ Developments in industrial value added and production depth in the corporate financial statement statistics

Our analysis starts out by comparing developments in the gross and net value added aggregates taken from the national accounts with the extrapolated results from the Bundesbank's corporate financial statement statistics for the manufacturing industry in the period between 1997 and 2012. The gross value added series show an almost identical pattern, albeit only from 2000 and only up to 2011.<sup>13</sup> The observed deviation in annual results remains at less than 2%. Net value added moved in a similarly synchronous fashion, but with levels diverging by just over 10% per year, the gap over the period as a whole is far wider. These stronger deviations in the net variables are due primarily to differences in the statistical recording of depreciation in the Federal Statistical Office's structural surveys and the corporate financial state-

*National accounts and financial statement aggregates show similar underlying pattern*

*Empirical analysis – approaches and objectives*

<sup>10</sup> See, for example, T Rautenstrauch, L Generotzky and T Bigalke (2003), *Kooperationen und Netzwerke: Grundlagen und empirische Ergebnisse*, pp 36 ff.

<sup>11</sup> 1997 was the starting date for the Bundesbank's data pool. It provides a consistently coherent data history because it not only has a uniform classification scheme but also ensures that the information has a high level of completeness.

<sup>12</sup> The statistical data for the manufacturing industry extrapolated for the population are based on around 23,000 financial statements per year. The individual dataset for the 2012 financial year contains financial statements from almost 21,000 manufacturing enterprises. The data are extrapolated using the expansion by ratio estimate broken down by sector, legal form and size category on the basis of sales figures from the company register. It is inevitable that the variance of the extrapolated aggregates will tend to be understated, as only group arithmetic means are weighted and not the firm-level data. For more information on the extrapolation procedure see Deutsche Bundesbank, *The methodological basis of the Deutsche Bundesbank's corporate balance sheet statistics*, Monthly Report, October 1998, pp 49-64.

<sup>13</sup> The even sharper divergence in the series from 1997 to 1999 is likely to be due to the build-up phase for the data pool, while the discrepancy last year is a result of the data in the Bundesbank's corporate financial statement statistics still being incomplete at the current end.

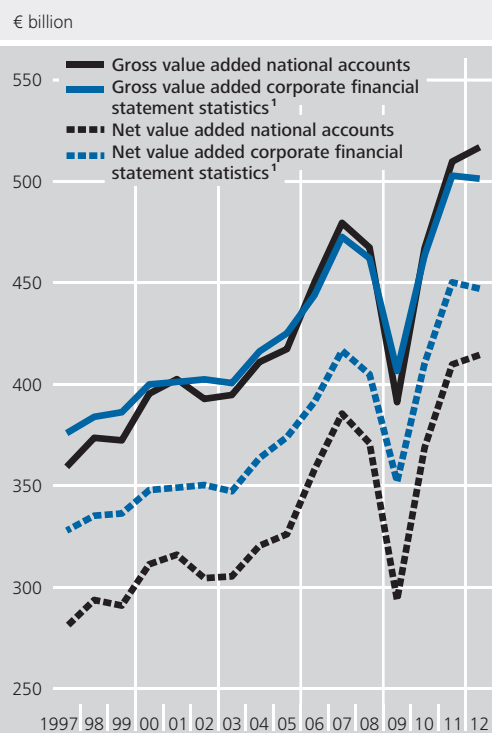
ment statistics.<sup>14</sup> For all the methodological discrepancies, a comparison of the results as a whole shows that the dynamics are strongly aligned, even in different phases of the economic cycle. This finding is a major precondition for investigating value added aggregates at a more disaggregated level based on financial statement data and for calculating indicators derived therefrom that shed light on structural changes in the German economy.

According to the extrapolated results of the Bundesbank's corporate financial statement statistics, gross and net value added in manufacturing rose by just over one-third on average across all areas of activity in absolute terms in the 1997-2012 period under review (see the table on page 60). They thus increased only around half as strongly as output or gross revenue plus other operating income. Growth in value added variables was far weaker because intermediate consumption has become increasingly important, both in the form of raw materials, consumables and supplies and services purchased. Intermediate consumption roughly doubled in value in the period under review. This is because enterprises have increasingly outsourced functional areas of operational activities to third parties or shifted them into value chains and networks.

*Trend towards lower production depth*

On balance, manufacturing industry is showing a sustained trend toward lower production depth. The period under review saw this indicator fall by 6 percentage points from 29.3% to 23.3% in gross-value-added terms.<sup>15</sup> The importance of intermediate consumption purchased for output has increased steadily in all areas of economic activity to the extent that in 2012 only a quarter of the enterprises analysed were still generating at least half of their output internally. This is a pervasive structural pattern, irrespective of the legal form and firm size under analysis and whether activities are more likely to rank among the winners or losers of structural change in industry. Ultimately, these truly far-reaching shifts in the production structure mean that, for many enterprises and parts

### Comparison of value added calculations for manufacturing\*



\* Based on the national accounts and corporate financial statement statistics. <sup>1</sup> Extrapolated results.  
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of industry, production and manufacturing activities which, by rights, are typical hallmarks of this sector, are increasingly playing second fiddle; this is also making it more and more difficult to categorise them in the industry standard classification system.

The other areas of the non-financial corporate sector are also moving in this direction, with the result that the relative share of manufacturing in the value added of non-financial enter-

*Share of manufacturing in total value added unchanged*

<sup>14</sup> The Federal Statistical Office notes in this regard that it is practically impossible to record depreciation for the national accounts data using a uniform measurement approach and figures therefore have to be estimated, at least in part. See O Hennchen (2006), Strukturdaten zum Verarbeitenden Gewerbe. Methoden und Ergebnisse der Strukturhebungen 2004, Wirtschaft und Statistik, No 7, p 738. The figures for the corporate financial statement statistics are collected on the basis of largely uniform depreciation rules under tax law which are also likely to be utilised given that such write-downs are tax deductible.

<sup>15</sup> Studies on international competitiveness primarily use gross value added, as does the present study, as it means that the aggregates calculated using both counting methods have the closest match.

### Developments in value added broken down by sector of manufacturing industry from 1997 to 2012

Economic activity	Gross value added			Net value added		
	€ billion		Per-centage change	€ billion		Per-centage change
	1997	2012		1997	2012	
Manufacturing	376.0	501.4	33.4	328.0	447.2	36.3
<i>of which</i>						
Manufacture of food products, beverages and tobacco products	30.9	36.7	18.8	25.5	31.7	24.3
Manufacture of textiles, apparel, leather, leather goods and shoes	9.1	6.5	-28.6	8.2	6.0	-26.8
Manufacture of wood and paper products and printing	27.7	23.8	-14.1	23.6	20.3	-14.0
Manufacture of chemicals and pharmaceuticals	42.8	50.1	17.1	35.9	43.6	21.4
Manufacture of rubber and plastic products, glass and glass products and other non-metallic mineral products	31.0	37.3	20.3	26.2	33.2	26.7
Manufacture of basic metals and fabricated metal products	51.0	67.5	32.4	45.0	60.3	34.0
Manufacture of computer, electronic and optical products and electrical equipment	47.7	70.0	46.8	42.9	64.2	49.7
Manufacture of machinery and equipment	55.7	78.6	41.1	51.4	73.5	43.0
Manufacture of transport equipment	54.5	92.7	70.1	46.7	80.0	71.3

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prises in Germany as a whole – in both gross and net terms – has shown only minor changes throughout the period under review. The share in 2011 was even unchanged against the starting year at 40.5%; there was a difference of only ½ percentage point in net terms. The corporate financial statement data therefore provide no empirical evidence to indicate a significant structural shift in the German economy towards the services sector.<sup>16</sup>

*Structural change clearly intra-industrial rather than inter-industrial ...*

However, this overall picture of German industry suggesting a relatively stable underlying pattern turns out to be far more nuanced and much more dynamic in a sector-based analysis.<sup>17</sup> Above-average growth in both gross and net value added can be ascertained for the manufacture of transport equipment, machinery and equipment, and computer, electronic and optical products and electrical equipment; this is associated with a perceptible increase in these sectors' shares in the total value added of manufacturing (from 1 to 4 percentage points).

Developments moved in the opposite direction in the manufacture of textiles, apparel, leather, leather goods and shoes and of wood and paper products and printing. In the period under review, these sectors saw a distinct decline in value added, both gross and net, in absolute terms, which resulted in a substantial fall in their contribution to total value added in manufacturing. Although below-average, the

*... mostly to the detriment of durable goods and non-durable goods industries*

<sup>16</sup> However, such studies based on a sector classification also do not show the actual extent of the increase in production-related services which are included in both intermediate consumption and in-house production.

<sup>17</sup> Note, however, that the problem of the growing share of services in industrial output is barely visible in the corporate financial statement statistics because much of the service-related intermediate consumption is impossible to isolate as a component of other operating expenses. Moreover, information on services purchased as a sub-item of cost of materials is not consistently available for all financial statements. According to the data extrapolated for manufacturing, they only amounted to around 10% overall and grew in proportion with the cost of materials, which is not consistent with the results of other empirical studies. See, for example, A Eickelpasch (2014), Funktionaler Strukturwandel in der Industrie: Bedeutung produktionsnaher Dienste nimmt zu, DIW Wochenbericht, No 33, pp 759-70.

### Developments in the structure of value added broken down by sector of manufacturing industry from 1997 to 2012

Item	Gross value added			Net value added		
	%		Change in percentage points	%		Change in percentage points
	1997	2012		1997	2012	
Manufacturing as a share of the non-financial corporate sector	40.7	39.5	- 1.2	41.3	39.6	- 1.7
Share of manufacturing by activity						
Manufacture of food products, beverages and tobacco products	8.2	7.3	- 0.9	7.8	7.1	- 0.7
Manufacture of textiles, apparel, leather, leather goods and shoes	2.4	1.3	- 1.1	2.5	1.3	- 1.2
Manufacture of wood and paper products and printing	7.4	4.7	- 2.7	7.2	4.5	- 2.7
Manufacture of chemicals and pharmaceuticals	11.4	10.0	- 1.4	11.0	9.7	- 1.3
Manufacture of rubber and plastic products, glass and glass products and other non-metallic mineral products	8.2	7.4	- 0.8	8.0	7.4	- 0.6
Manufacture of basic metals and fabricated metal products	13.6	13.5	- 0.1	13.7	13.5	- 0.2
Manufacture of computer, electronic and optical products and electrical equipment	12.7	14.0	1.3	13.1	14.4	1.3
Manufacture of machinery and equipment	14.8	15.7	0.9	15.7	16.4	0.7
Manufacture of transport equipment	14.5	18.5	4.0	14.2	17.9	3.7

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development of value added is at least still positive in absolute terms in other parts of manufacturing.<sup>18</sup> Measured in terms of their share of value added, the importance of these sectors, which in any case represent only a small section of German industry, has diminished again somewhat, with the gross and net ratios dipping by as much as 1 percentage point. The metal-working industry is something of an exception; it managed to broadly maintain its position in the sector comparison, and its value added is in line with the manufacturing average. One reason for this is that although output in this industry showed a strong increase, the positive effect was slightly overshadowed by the marginally sharper growth in intermediate consumption.

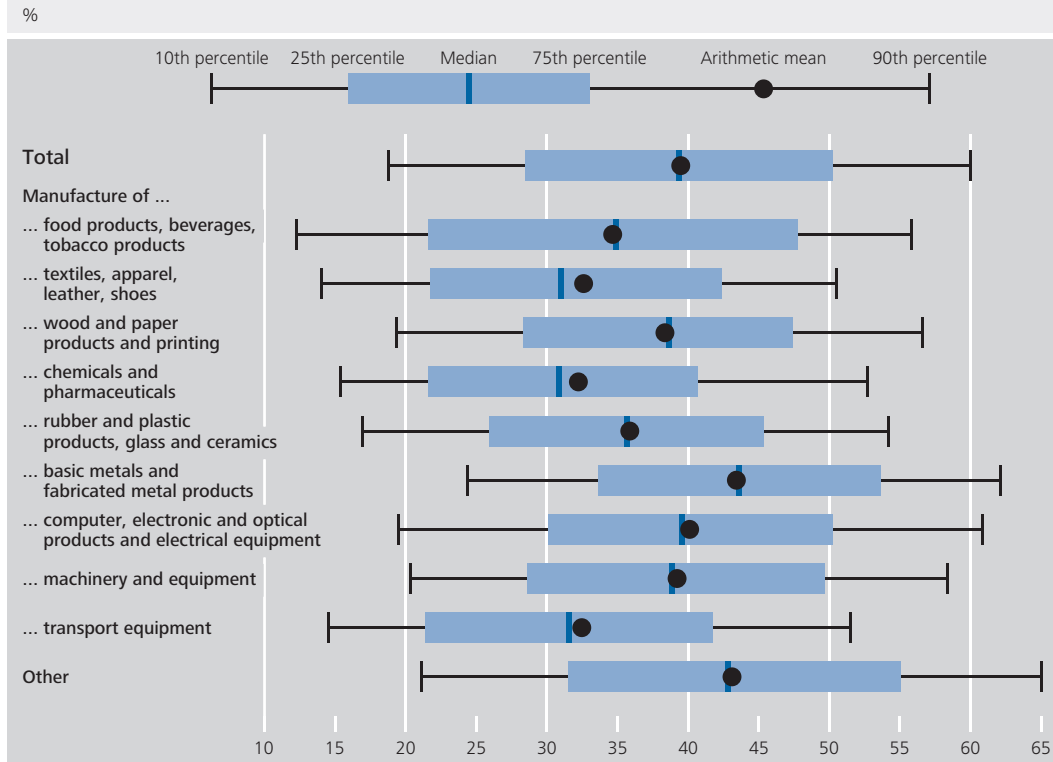
the wood, paper and printing industry, for example, below-average output growth has coincided with a noticeable rise in the intensity of intermediate consumption, while the textiles and leather industry has even seen further rises in the intensity of intermediate consumption in conjunction with an absolute fall in the output volume. The structural change at the sectoral level sketched out in this article thus follows a pattern commonly seen in advanced economies, with the focus of production shifting ever further away from commodity-, labour- and capital-thirsty activities towards knowledge-intensive and technology-driven manufacturing structures, which are a major feature of the capital goods industry in particular.

*Various patterns to the fall in production depth*

The findings show that the reduction in production depth, which has seen individual sectors experience a fall in their share of value added in the wake of intra-industrial structural change, differs from one sector to another. In

<sup>18</sup> These are the manufacture of food products, beverages and tobacco products; the manufacture of chemicals and pharmaceuticals; the manufacture of rubber and plastic products, glass and glass products and other non-metallic mineral products.

### Extrapolated distribution of production depth broken down by sector of manufacturing industry for 2012



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*Some significant sector-specific differences*

The textiles, apparel, leather and shoes sector, the chemicals and pharmaceuticals industry, and the transport equipment manufacturing sector all have a low production depth, albeit for different reasons. In Germany's textiles industry, cost considerations have pushed much of production – with the exception of technical textiles – to low-wage countries since the 1970s.<sup>19</sup> By contrast, the situation in the chemicals and pharmaceuticals industry is largely the result of the particular production conditions required for the manufacture of industrial and base chemicals, the need for large quantities of commodities meaning that this sector has no more than a very low value added share. As for the transport equipment manufacturing sector, production depth is mainly low here because this sector has been a frontrunner in the creation of global value added chains and networks for many years, primarily with the aim of tapping new markets, optimising production, and increasing competitiveness.<sup>20</sup>

Production depth is higher for the manufacture of machinery and equipment, the manufacture of basic metals and fabricated metal products, the manufacture of computer, electronic and optical products and electrical equipment, the manufacture of wood and paper products and printing, and for the manufacturing sectors grouped under the heading "other" as well.<sup>21</sup> The main reason for this is likely to be their special production conditions. Indeed, customer-specific production, small lot sizes and particularly stringent quality and availability require-

<sup>19</sup> See IMU Institut (2009), Branchenanalyse Textilindustrie. Untersuchungen zur Situation und Entwicklung der Branchen „Textilgewerbe“ (WZ 17), pp 5 ff.

<sup>20</sup> Many car manufacturers and suppliers spun off entire development functions and components plants to subsidiaries or associated companies, transferred responsibility for supplying production facilities to logistics service providers, handed over model development to engineering partners and relocated the production of niche models to affiliated enterprises at home or abroad.

<sup>21</sup> This category comprises the manufacture of coke oven products and mineral oil, furniture, other goods and the repair and installation of machinery and equipment. Owing to poor representability, these figures are added together.



ments probably call for a high level of in-house production in these sectors.

*Relevance of transaction cost and factor specificity as explanatory factors*

The differences in the sector-specific arithmetic means for production depth suggest that the theoretically derived factors “transaction cost” and “specificity of factor use” can go a long way towards explaining production depth. Since sector, as a characteristic, is very highly correlated with production technology and research and knowledge intensity, it is possible to clearly separate individual sectors where the use of advanced technologies, a high degree of technological specialisation, and research- and knowledge-intensive production play an especially important role. This is particularly the case in the manufacturing industry (above all the manufacture of machinery and equipment, the manufacture of computer, electronic and optical products and electrical equipment, and the manufacture of basic metals and fabricated metal products).<sup>22</sup>

## Comparison of enterprises with varying degrees of production depth

*Grouping by production depth reveals diverging enterprise types ...*

Structural differences exposed by the sectoral breakdown can be analysed in an even more nuanced fashion by grouping the manufacturing enterprises contained in the Bundesbank’s data pool for the 2012 financial year by production depth and then comparing them. These data are likewise extrapolated to achieve the most representative results possible. This comparison places the focus, above all, on those enterprises that buck the general trend by continuing to operate with a very high production depth. To isolate these particular enterprises, the extrapolated distribution is divided into quartiles, with the top 25% of enterprises, accounting for just under 29,500 of the almost 118,000 manufacturing firms, being assigned to the group with a high degree of production depth, ie over 50% in-house production. The remaining enterprises, numbering just over 88,000, are represented by the control group

of enterprises with a low or medium level of production depth (ranging from more than 6% to 50%).

As expected, the sector-specific differences in the distribution of production depth are also reflected in the structural profile of the extrapolated sectoral composition of the groups of enterprises with a high and low value added level. Sectors with an, on average, low share of in-house production are far less common in the group of manufacturing-intensive enterprises than those with high levels of in-house production. This can be seen clearly with the sectors that manufacture textiles, apparel, leather and shoes, and transport equipment, where the share in the control group is nearly three times as high as that of enterprises with a high degree of production depth. The metal-working industry and the residual group of enterprises are significantly overrepresented in this latter category, with the sector for the manufacture of computer, electronic and optical products and electrical equipment also being slightly overrepresented.

*... with the expected sector-specific differences ...*

Clearly, production depth also varies with enterprise size. 96.1% of enterprises with a high degree of manufacturing intensity belong to the category of smaller enterprises with sales of less than €10 million, just 2.9% are medium-sized enterprises (sales from €10 million to less than €50 million), and only 0.7% are large enterprises (sales from €50 million and more). In the control group, meanwhile, only 82.9% are small enterprises, 12.0% are medium-sized enterprises and no less than 5.1% are large enterprises. The breakdown of production depth by legal form correlates with that by size category. Thus, the share of non-corporations

*... and large disparities depending on size and legal form*

<sup>22</sup> Although the dispersion is quite similar in the sector comparison, with highly symmetrical curves, it must not be forgotten that the high degree of aggregation in the double-digit economic activities in no way implies the grouping-together of uniform production structures. A more nuanced view ought to be taken here, but the available data do not allow this. Moreover, as already mentioned, the extrapolation procedure systematically causes an underestimation of variance.

### Distribution of enterprises\* with varying degrees of production depth by sector, size category, legal form and group affiliation

% of enterprises

Characteristic	Enterprises grouped by degree of production depth <sup>1</sup>	
	1st to 3rd quartile	4th quartile
<b>Sector</b>		
Manufacture of food products, beverages and tobacco products	11.3	9.2
Manufacture of textiles, apparel, leather, leather goods and shoes	3.2	1.1
Manufacture of wood and paper products and printing	13.2	9.6
Manufacture of chemicals and pharmaceuticals	2.9	1.2
Manufacture of rubber and plastic products, glass and glass products and other non-metallic mineral products	10.7	6.2
Manufacture of basic metals and fabricated metal products	21.4	30.9
Manufacture of computer, electronic and optical products and electrical equipment	9.9	10.1
Manufacture of machinery and equipment	11.2	10.4
Manufacture of transport equipment	2.7	1.1
Other	13.6	20.1
<b>Size category</b>		
Sales less than €2 million	54.7	76.8
Sales from €2 million to less than €10 million	28.2	19.6
Sales from €10 million to less than €50 million	12.0	2.9
Sales of €50 million and more	5.1	0.7
<b>Legal form</b>		
Corporation	60.2	53.0
Non-corporation	39.8	47.0
<b>Group affiliation</b>		
Group enterprise	70.9	60.7
Standalone enterprise	29.1	39.3

\* Extrapolated results for the 2012 financial year. <sup>1</sup> Gross value added in relation to the sum of gross revenue and other operating income. The threshold to the 4th quartile is 50.25%.

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among manufacturing-intensive enterprises is around 7 percentage points higher than for the control group, with the exact inverse being true for corporations. This is consistent with the finding that standalone enterprises make up just over 10 percentage points more of the group of manufacturing-intensive enterprises than of those which generate less than half of their output internally.

A comparison of selected balance sheet and income statement ratios reveals just how fundamentally the business models of enterprises with a high degree of production depth differ from those for which intermediate consump-

tion accounts for the bulk of their gross revenue. Looking at the assets side there is, as might be expected, a sizeable difference in the deployed capital stock. Investment in fixed capital by enterprises with overwhelmingly in-house production amounts, on average, to 38.3% of total assets, which is 11 percentage points higher than in the control group of enterprises with a low or medium level of production depth. The latter only have a tangible fixed asset ratio of 27.3%, which shows that substantial in-house manufacturing operations call for a corresponding capital stock. This also explains the large differences in the depreciation ratios of both groups, the figure of 5.3% for the manufacturing-intensive enterprises being nearly twice that of the other enterprises.

Similarly striking differences can also be seen in inventory levels. The inventories-to-total-assets ratio for enterprises with a high level of in-house production stands at 15.1%, which is just over half that of companies that largely outsource production (27.0%). The higher proportion of capital tied up in the form of inventories is due, above all, to large buffer stocks of work in progress, finished goods and merchandise. These enterprises hold large-scale inventories with a view to cushioning production risks and maintaining a strong capacity to deliver goods to downstream buyers in the process chain. A likely factor here is that the ability to optimise logistics management in the form of flexible order contracts or just-in-time deliveries, and in doing so, to shift inventory risk to suppliers tends to be largely the preserve of particularly large enterprises and powerful players in the procurement market.<sup>23</sup> As is to be expected, trade receivables at enterprises with a high degree of intermediate consumption is likewise perceptibly higher than for the group of enterprises with a low level of outsourced production. Businesses that focus on in-house production would appear to need higher liquidity levels to cover peaks in funding requirements

*... in other asset and liability positions*

*Fundamental differences in business models reflected in capital stock, ...*

<sup>23</sup> See H Müller (2013), *Erfolgreich am Markt: Strategien und Wege für den Mittelstand*, p 145.

and unforeseeable expenses, which is reflected in a cash-to-total-assets ratio that is about one-quarter higher. Various empirical studies have found clear evidence that there is an exchange relationship of a kind between maintaining such a liquidity buffer and drawing on short-term liabilities.<sup>24</sup>

... and in financing

While the manufacturing-intensive firms can generally be expected to have a markedly higher equity capital ratio than the others (because they also strive for a certain degree of financial autonomy), the difference is not that great, as these enterprises also take up external funds on a considerable scale, particularly in the form of bank liabilities. Liable capital makes up 30.3% of the total assets of manufacturing-intensive firms, which is only 4 percentage points higher than the corresponding figure for the other enterprises (26.3%). Bank liabilities account for 33.5%, constituting a gap of almost 7 percentage points, with differences in both short-term and long-term liabilities being recorded. This suggests that the higher level of bank borrowing is partly attributable to less recourse being made to trade credit and intra-group financing. In the case of trade payables, the ratio of the enterprises in the fourth quartile (11.5%) is only about half as high as that for the other manufacturing enterprises. For group liabilities, the latter are almost 4 percentage points ahead. It therefore also appears plausible that firms in the first to third quartiles – which are integrated to a greater extent in group structures and can also cover their funding requirements via intra-group sources – are less inclined to cultivate their equity capital because, if need be, a group financing vehicle or the group parent will raise the external funds and cover the loans with their liable capital.

Strongly divergent performance due to ...

The manufacturing-intensive enterprises fare much better in terms of the performance measures derived from the income statement.<sup>25</sup> At 9.5%, their return on sales was more than three times as high as that of the control group. This reflects the fact that, at an arithmetic mean of 61.7%, the manufacturing-intensive

### Selected key balance sheet and income statement figures of enterprises\* with varying degrees of production depth (arithmetic means)

Item	Enterprises grouped by degree of production depth <sup>1</sup>	
	1st to 3rd quartile	4th quartile
	As a percentage of total assets	
Tangible fixed assets	27.3	38.3
Inventories	27.0	15.1
Receivables	30.5	29.1
from trade	19.0	17.5
from affiliated companies	6.1	6.1
Cash	9.5	12.4
Equity	26.3	30.3
Liabilities	77.4	71.8
to credit institutions	26.9	33.5
of which short-term	14.7	16.4
from trade	22.8	11.5
to affiliated companies	14.6	10.8
	As a percentage of gross revenue <sup>2</sup>	
Gross income	50.3	78.4
Gross value added	33.7	61.7
Cost of materials	49.7	21.6
Personnel expenses	26.1	44.1
Depreciation	3.0	5.3
Operating result	30.6	56.5
Annual result after taxes	3.0	9.5

\* Extrapolated results for the 2012 financial year. 1 Gross value added in relation to the sum of gross revenue and other operating income. The threshold to the 4th quartile is 50.25%. 2 Sales and changes in stocks of finished goods and work in progress.

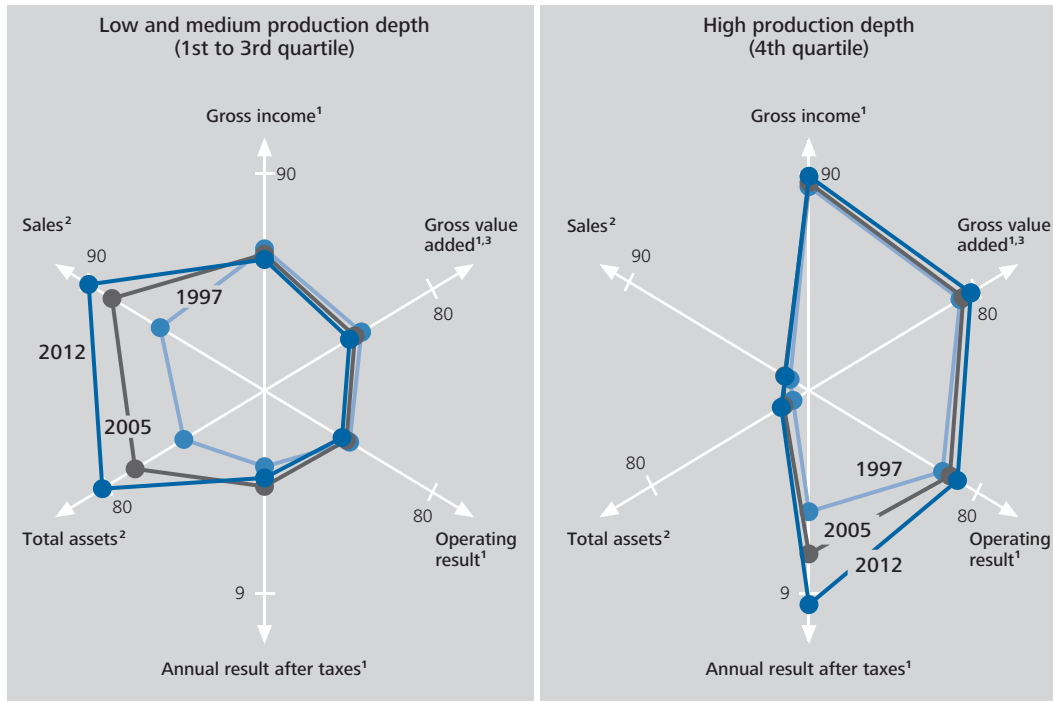
Deutsche Bundesbank

firms' gross value added ratio is almost twice as high as that of enterprises with a high level of intermediate consumption (33.7%), which, of course, also has something to do with grouping the enterprises according to production depth. A key determinant of the differences in the returns on sales is the considerably lower cost of materials, which, at 21.6%, is just over 28 percentage points below the comparative value for firms with a high level of intermediate

<sup>24</sup> This relationship is very clear in international comparisons. See, for example, H Friderichs, Ergebnisse vergleichbarer Bilanzanalysen für französische und deutsche Unternehmen, KfW-Research Mittelstands- und Strukturpolitik, Issue 23, June 2001, pp 54 f.

<sup>25</sup> These major differences are not primarily caused by the divergent composition of the two groups, consisting of corporations and non-corporations, and thus by the imputed entrepreneur's remuneration that is to be taken into account for the latter. The arguments put forward against this are that there is only a 6 percentage point difference in the shares of non-corporations in the two groups and the gap between the respective annual result before taxes is just as marked. Furthermore, even if the corporations and non-corporations are viewed in isolation, there are still large differences in the returns of the manufacturing-intensive enterprises and the other enterprises.

Development of selected key figures of enterprises\*  
 grouped by degree of production depth



\* Arithmetic means of an extrapolated balanced sample of manufacturing enterprises for the 1997, 2005 and 2012 financial years.  
 1 As a percentage of gross revenue. 2 In € million. 3 Gross income plus other operating income less other operating expenses.  
 Deutsche Bundesbank

... different cost  
 and revenue  
 structures

consumption (49.7%). A low production depth results *per se* in a significantly lower return on sales, but this should not necessarily be taken as indicating that the return on equity is correspondingly poor. The fact that the ratio of net income for the year to gross revenue for enterprises with a large production depth is particularly high is primarily due to an overall more favourable cost structure, which can be seen in the operating result with a gap of almost 26 percentage points. The very significant differences in production cost are mainly down to comparatively low personnel expenses, which, in the case of manufacturing-intensive enterprises, do not fully offset the cost advantages of sourcing less intermediate consumption. For enterprises with a high production depth, the ratio of personnel expenses to gross revenue comes to 44.1%, while the cost-of-materials ratio is only 21.6%. By contrast, firms that predominantly procure products and services externally and thus have a very high material cost (49.7%), record a disproportionately lower

comparative value of 26.1% for personnel expenses. Overall, this means that these two expense items amount to 65.7% of gross revenue for manufacturing-intensive enterprises, while for the other enterprises they make up a considerably greater share of 75.8%. This impacts in full on returns and explains why the return on sales after taxes of the manufacturing enterprises under review in the fourth quartile is more than three times as high.

Judging by the empirical findings presented earlier in this article, one could be led to conclude that the increased division of labour as well as the close-knit German economy, with the associated high degree of specialisation and attendant outsourcing of production, are down to a lack of competitiveness and a poor performance by domestic industry. That line of thinking is put forward, for instance, in studies on the import content of German exports,

*Performance of  
 both groups  
 over time*

which sometimes depict the German economy as a type of bazaar economy.<sup>26</sup>

However, a longer-term comparison of developments in value added, output and earnings of the two groups of enterprises under review over the course of the last 15 years shows that the economic reality is more complex and considerably more nuanced. As was made clear by the study results presented above, the enterprises with a high degree of production depth that the study focuses on are primarily small enterprises which operate very successfully, generally in regional markets, using production strategies based on “made to order” or small-batch manufacturing. However, there is also a group of larger medium-sized manufacturing firms which have succeeded in carving out an excellent market position and sustainably improving their performance, also on a longer-term basis, by intensifying their in-house production in research- and knowledge-intensive as well as technologically specialised niche sectors. These enterprises were able to further increase their gross income, value added and operating result from an already very high level by around 4 percentage points during the period under review, and thus to almost double their return on sales on a sustainable basis – measured in terms of the annual result after taxes – compared with the start of the observation period in 1997.<sup>27</sup> However, this strong earnings performance goes hand in hand with fairly moderate growth in the business volume (+26%) and the company size or total assets (+73.8%) during the 15 years under review. By contrast, enterprises with a low or medium production depth saw reductions of between 3 and 4 percentage points in their gross income, value added and operating result and were only able to marginally improve their profitability from 2.7% to 3.1%. However, these comparatively unfavourable developments in the cost and earnings structure of these firms were accompanied by significantly more dynamic growth in the business volume and total assets. While sales went up by 69%, total assets saw as much as a two-fold rise.

In summary, based on these findings, the conclusion can be drawn that the reduction in production depth caused by the changes in the global division of labour and new global production strategies has tended to weigh on the earnings structure of the majority of manufacturing enterprises in Germany. By contrast, however, these firms have reaped even greater benefits from international trade and growth in the global economy by breaking into new sales markets and gaining new customers. This had a lasting positive impact on the long-term growth trend of German industry, as clearly illustrated by a recent Bundesbank study of value added flows.<sup>28</sup> In this respect, opening up German industry to a more international division of labour was a very suitable strategy for success in a globalised economy.

## ■ Conclusion

Changes in the global economic setting have brought about lasting structural change in the manufacturing industry over the last 15 years. While the industry’s overall contribution to gross domestic product has remained broadly stable, the weightings of individual sectors of this key area of the German economy have shifted considerably, with the capital goods sector benefiting from a marked process of intra-industry structural change.

Microdata analysis has shown that the production strategies and the associated business models are sometimes very different even within individual sectors. On the one hand, alongside the bulk of typical small enterprises with manufacturing-intensive “made to order” and small-batch manufacturing, the manufacturing industry also comprises very successful,

*Structural change towards capital goods producers*

*Successful specialised SMEs*

*Increase in return on sales versus ...*

*... growth in business volume*

<sup>26</sup> For more information, see, for example, R Aichele, G Felbermayr and I Heiland (2013), Neues aus der Basarökonomie, ifo Schnelldienst, No 66, pp 17 ff.

<sup>27</sup> The calculations for the dynamic analysis are based on an extrapolated balanced sample which represents around 15,000 manufacturing enterprises and thus inevitably deviates from the results of the first section.

<sup>28</sup> See Deutsche Bundesbank (2014), op cit, pp 28 ff.

more medium-sized enterprises in highly specialised, research- and knowledge-intensive high-tech areas, sometimes with a niche character. Both groups of enterprises have a relatively high value added combined with a higher production depth and, thanks to their strong market position, are able to generate returns on sales that far eclipse the averages. However, this comes at the price of below-average sales growth.

*Production shift  
drives group  
formation*

By contrast, for the vast majority of industrial enterprises operating internationally, opening up the industry to a more global division of labour and less favourable cost and earnings structures was a recipe for success in a globalised world economy and an effective way of participating in full in global growth. The associated growing decline in production depth also seems to have driven the increased group formation observed in Germany, as the outsourcing of production and services requires

subsidiaries and joint ventures to be set up or shareholdings to be acquired.<sup>29</sup> In the single-entity financial statements, this phenomenon is reflected in a massive upturn in businesses interlinking their production and financing operations. The efficient management of this mounting complexity and the increased mutual dependencies is a key reason for the economic strength of German industry. Modelling these multifaceted sectoral developments in the non-financial corporate sector precisely and reliably presents an entirely new set of statistical challenges, particularly with regard to the provision of integrated macro and micro information.<sup>30</sup>

*Resulting  
statistical  
challenges*

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<sup>29</sup> It can be assumed that the observed differences in returns will decrease, at least in part, if group entities are looked at, although this cannot be clarified using the available data.

<sup>30</sup> At the European level, the Figaro Project (Full International and Global Accounts for Research in Input-Output Analysis) and the DMES Task Force on Global Production and Integrated Global Accounts were set up for this purpose.