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Study on behalf of Interpharma

The Importance of the Pharmaceutical Industry for Switzerland

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Foreword by Interpharma

Dr René Buholzer, General Secretary Interpharma

Switzerland and the pharmaceutical industry have been thriving side by side for decades. While attractive economic policies have fostered the impressive development of the research-based pharmaceutical industry, as a pillar of the economy, the pharmaceutical sector has simultaneously made an outstanding contribution to Switzerland's prosperity.

In 2018, the pharmaceutical industry contributed around 36 billion Swiss francs to direct value added. This means that, for every Swiss franc of value added in the pharmaceutical industry, an additional 73 centimes of value added was generated in other Swiss industries. This equates to around 26.1 billion Swiss francs. The total direct and indirect value added thus stood at more than 62.1 billion Swiss francs. This corresponds to 9.3 per cent of Switzerland's total economic output.

The pharmaceutical sector is an important employer. In 2018, around 46,800 people were directly employed in the pharmaceutical industry. Over the last two years, approximately 1,400 additional jobs have been created. This is a positive development both for the pharmaceutical industry and for its suppliers, as well as other sectors in which a further 207,000 people are employed thanks to the industry. All in all, around 254,000 jobs hinged on the success of the pharmaceutical sector in 2018. That corresponds to about 1 in 20 employees in Switzerland. In terms of labour productivity, the pharmaceutical sector outstrips other industries – both in Switzerland and abroad.

Accounting for 38 per cent of Swiss goods exports, the pharmaceutical industry is by far the most important export industry. Export revenue of around 88 billion Swiss francs largely stems from European countries. However, the strongest growth in demand in recent years has come from North America and Asia.

Optimal framework conditions remain key to being a successful, globally competitive pharmaceutical location. Switzerland must continue to be an attractive business location and keep pace with international markets. This calls for a joint stakeholder strategy to ensure the pharmaceutical sector continues to contribute significantly to making Switzerland an attractive business, research and residential location.

Interpharma

Dr René Buholzer, CEO

FACTS & FIGURES

3.1% p.a.
employment growth
over the past
10 years

Innovation

The basis for high productivity and competitiveness

27,200
employees with a tertiary degree

9,500
scientists (FTE)

Employment

46,800 employees
work in the Swiss pharmaceutical industry
thereof 20,400 women

Multiplier effects:
total employment is
5.4 times higher

5 times higher productivity than the Swiss industry average

5.9% p.a.
productivity growth
over the past
10 years

207,300
additional people are employed in other industries, due to the activities of the pharmaceutical industry

Source: BAK Economics

PHARMACEUTICAL INDUSTRY

CHF **6.5** bn
R&D expenditures

This makes the pharma industry the most research-intensive industry in Switzerland

9.3% p.a. value-added growth in the past 10 years

which contributed one third to aggregate GDP growth

Value added

CHF **36** bn
of value added is generated by the Swiss pharmaceutical industry

Productivity

CHF **808,000**
of value added per workplace

Multiplier effects: total value added is **1.7** times higher

CHF **26** bn
of value added is generated in other industries, due to the activities of the pharmaceutical industry

Data for 2018, except for innovation related indicators (2017)

In brief

The pharmaceutical industry is an important pillar of Switzerland's economy. The gross value added achieved in Switzerland in 2018 amounted to around 36.0 billion francs, accounting for 5.4 per cent of Switzerland's total economic output. Without the strong real value-added growth of 9.3 per cent per annum on average in the pharmaceutical industry, Swiss GDP growth would have been a third lower between 2008 and 2018. Other sectors also benefited from the success of the pharmaceutical industry: including the value chains involved in companies from other sectors, pharmaceutical activities contributed to around 62.1 billion francs in value added in 2018.

More than 20 years of steadily increasing capacities

Bucking two or so decades of declining employment in the other manufacturing industries, the pharmaceutical industry has witnessed a strong increase in staff capacities since 1996. Around 46,800 people were in employment in 2018. Increasing innovation intensity has led to a growth in job numbers over the last two decades, along with a growing need for a highly qualified workforce. The number of research and development personnel rose to around 9,500 full-time equivalent (FTE) employees by 2017; highly qualified employees with a tertiary qualification accounted for 58 per cent in 2017. Without access to international labour markets, local pharmaceutical companies would be far from able to cover such a high demand for skilled workers.

Pharmaceutical industry generates more than a quarter of the Swiss manufacturing value added

The demand for Swiss pharmaceuticals has been extremely dynamic over the past 20 years, demonstrating exceptionally strong growth even in periods of economic weakness. The nominal gross value added achieved by the pharmaceutical industry in 2018 amounted to around 36.0 billion Swiss francs, accounting for 5.4 per cent of Switzerland's total economic output. The proportion of total manufacturing value added now amounts to 28.7 per cent. Around half of export revenue in 2018 continued to stem from European countries.

However, the strongest growth in demand in recent years has come from North America and Asia. Accounting for 24 per cent of exports, the US is

the most important recipient country. Exports to Asia make up 17 per cent.

Increasing productivity leads to strong growth

In the past few years, the pharmaceutical industry has been the most important driver of Switzerland's manufacturing growth and, as a result, has contributed significantly to the growth of the total economy. This strong growth is largely due to the phenomenal increase in productivity. Real value added per full-time position (FTE) in 2018 was 3.4 times higher than in 1998, while the number of jobs doubled (+92%). In 2018, labour productivity in the pharmaceutical industry amounted to approximately 808,000 Swiss francs of value added per full-time position (FTE). For every job in the pharmaceutical industry, the value added achieved is thus around five times higher than the average for the total economy. The extremely high level of productivity achieved in the pharmaceutical industry reflects the high level of performance capabilities and competitiveness and is due to strong capitalisation, modern and efficient production facilities, above-average employee qualifications and intense innovation activities in the sector.

Pharmaceutical industry contributes significantly to reducing pharmaceutical prices

Owing to rising cost pressure in the healthcare system, growing competition and declining margins due to the appreciation of the Swiss franc, pharmaceutical prices have declined in recent years. In terms of value added, this recent decline in prices over the past ten years amounted to minus 5.0 per cent per annum on average. The pharmaceutical industry contributed significantly to moderating cost increases in the Swiss healthcare sector alone by slashing prices by over 1 billion Swiss francs.

Major importance for other sectors

For the manufacture of its products, the pharmaceutical industry needs a considerable amount of goods and services from other sectors. The demand for these goods and services in the pharmaceutical industry generates jobs in these sectors (and also among other suppliers).

Trade and industry also benefit from consumer spending by employees in the pharmaceutical companies. A model-based impact analysis shows that companies and employees from other sectors profit greatly from pharmaceutical company activities.

The impact analysis concludes that for every Swiss franc of value added in the pharmaceutical industry, an additional 73 centimes of value added is generated in other Swiss industries. Around 26.1 billion francs of additional value added is thus generated for the economy. The total amount of value added contributed amounted to around 62.1 billion francs in 2018. This corresponds to 9.3 per cent of gross value added for the total economy.

Effects in ...	the pharma industry	other industries	Total effect	Multiplier
Gross value added [CHF m]	35,967	26,089	62,056	1.7
in % of total economy	5.4	3.9	9.3	
Employees	46,811	207,319	254,130	5.4
in % of total economy	0.9	3.9	4.8	
Employees [FTE]	44,513	162,709	207,222	4.7
in % of total economy	1.1	3.9	5.0	
Hours worked [m hrs]	83	316	398	4.8
in % of total economy	1.0	3.9	5.0	
Gross wages and salaries [CHF m]	6,173	15,757	21,931	3.6
in % of total economy	1.6	4.1	5.7	
Exports [CHF m]	88,199			
in % of total goods exports	38.4			
in % of total exports	19.5			

Source: BAK Economics, FSO; possible rounding differences

The multiplier effect on employment is equally substantial. The production, research and development activities of pharmaceutical companies led to the employment of around 207,300 people in other companies in 2018. These employees were people from a wide range of sectors (chemical, consumer and investment goods, energy, construction, transport, financial, ICT, consulting, cleaning, security, etc.). A cumulative employee income of around 15.8 billion Swiss francs was associated with the additional jobs in other sectors of the economy. Thus, for every 1,000 francs of salary paid to employees in the pharmaceutical industry, an additional 2,600 francs of pay was generated on average in 2018 for employees from companies in other sectors.

1 The pharmaceutical industry as an employer

Bucking two or so decades of declining employment in other manufacturing industries, the pharmaceutical industry has witnessed a strong increase in staff capacities since 1996. Increasing innovation intensity has led to this growth in job numbers, along with a growing need for a highly qualified workforce.

1.1 Number of employees

Steady increase in staff capacities since 1996

Businesses adapting to structural change coupled with a major crisis in macroeconomic growth shaped the development of the pharmaceutical industry in the early nineties. During this period, the pharmaceutical industry cut employment by almost a third. Around 19,300 people were employed in Swiss pharmaceutical firms in 1996 – compared to 25,000 in 1980.

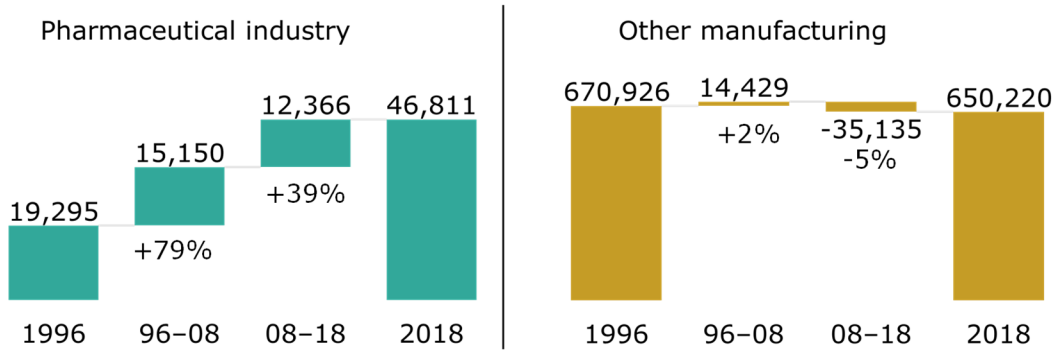
1996 marked a turning point. High investments in research and development, as well as added stimulus from global industry trends – such as demographic change, new technologies and the growing middle class in emerging markets – led to what has been a comparatively steady growth in employment since 1996, which has continued practically unchecked over the past 20 years, also in times of international economic crisis. Improvements in external economic conditions (e.g. the conclusion of bilateral agreements with the EU) and the establishment of other companies created additional momentum.

46,800 people were in employment in 2018. Overall, the number of employees has risen by around 27,500 since 1996. This corresponds to cumulative growth of 143 per cent; the cumulative growth in employment in the total economy amounted to 29 per cent in Switzerland in the same period.

A comparison of developments in the pharmaceutical industry with those in the other manufacturing industries highlights Switzerland's importance of the pharmaceutical industry as a manufacturing location. While the number of people employed by the rest of the manufacturing sector declined by around 20,700 between 1996 and 2018, pharmaceutical firms managed to create additional job opportunities during this period. Increasing capacities in the pharmaceutical industry has had a slightly positive impact on employment in the Swiss manufacturing sector since 1996 (+6,800 people or +1.0%).

Fig. 1-1 The number of employees has risen by 27,500 since 1996

Number of employees, 1996–2018



Source: BAK Economics, FSO

Although the momentum in the pharmaceutical industry has now somewhat slowed, it is still higher than the average for the total economy. During the course of digitalization, which enables the enhancement of business models on the one hand but calls for high levels of investment on the other, cost structures are consistently reviewed and processes optimised.

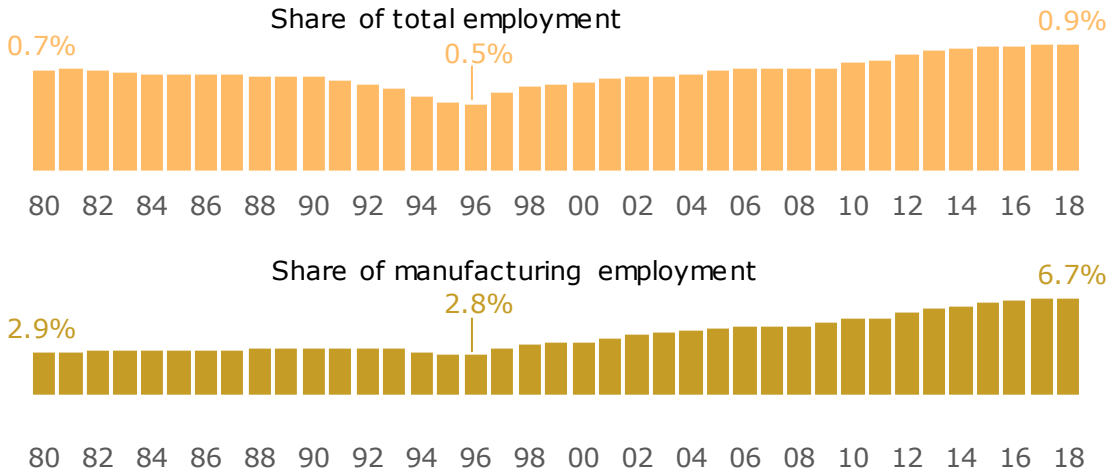
Such optimisations result in the outsourcing of services, relocation of central service facilities and restructuring in production. However, restructuring in production does not simply mean job losses in Switzerland. While the cost of chemically manufacturing some classic pharmaceutical products may be lower at other locations, jobs are continuing to be created in biotech production.

Importance for the job market

Two decades of increasing employment have also made pharmaceutical companies more important for the job market. The proportion of people in employment in the overall economy amounted to around 0.9 per cent in 2018, while the number of people employed in manufacturing sector was already at 6.7 per cent (cf. Fig. 1-2). The pharmaceutical industry thus provides one in fifteen jobs in the manufacturing sector.

Fig. 1-2 One in fifteen employees in the manufacturing sector works for a pharmaceutical company

Pharmaceutical industry share in total employment, 1980–2018



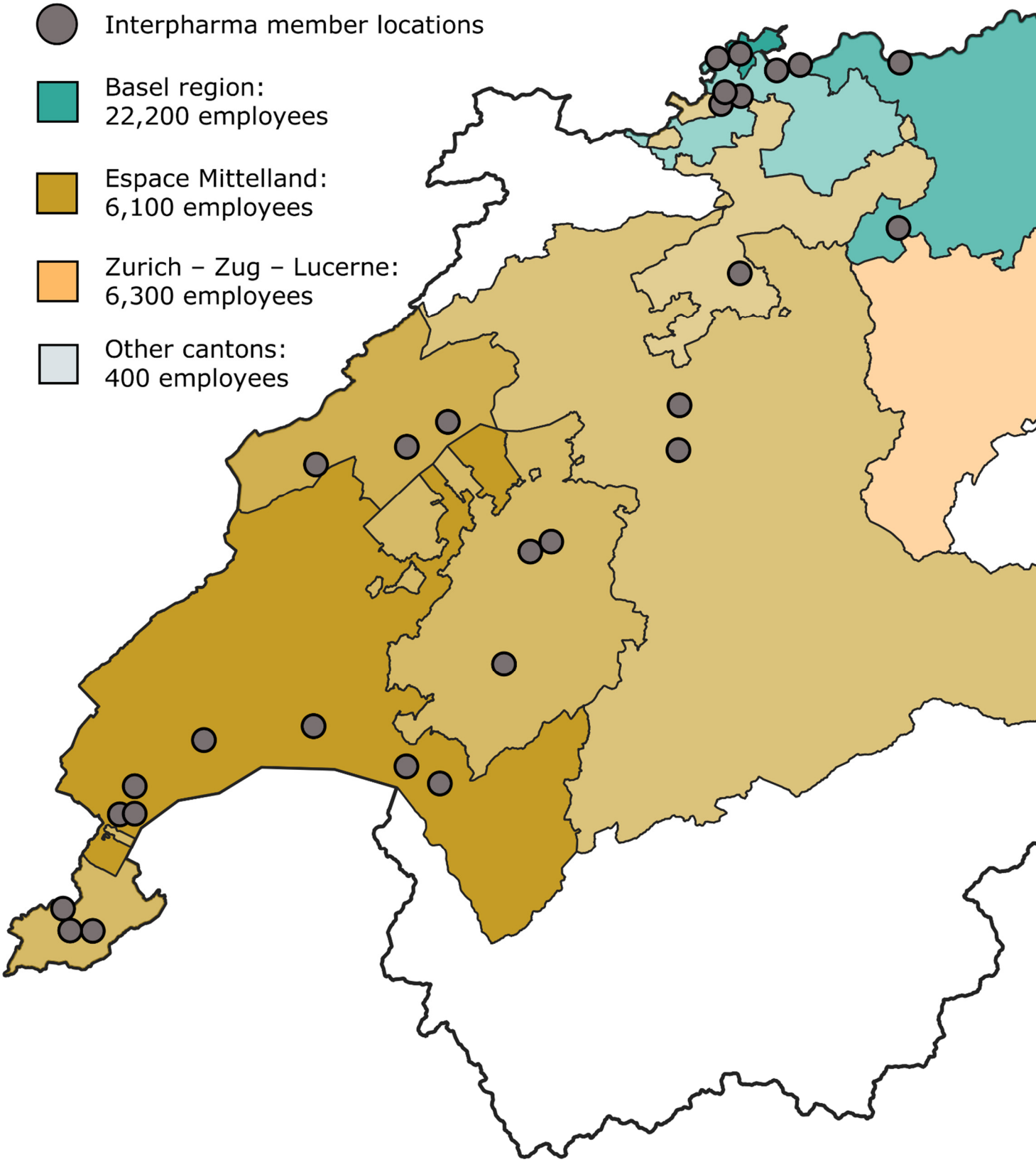
Source: BAK Economics, FSO

Definition of full-time equivalent employment (FTE)

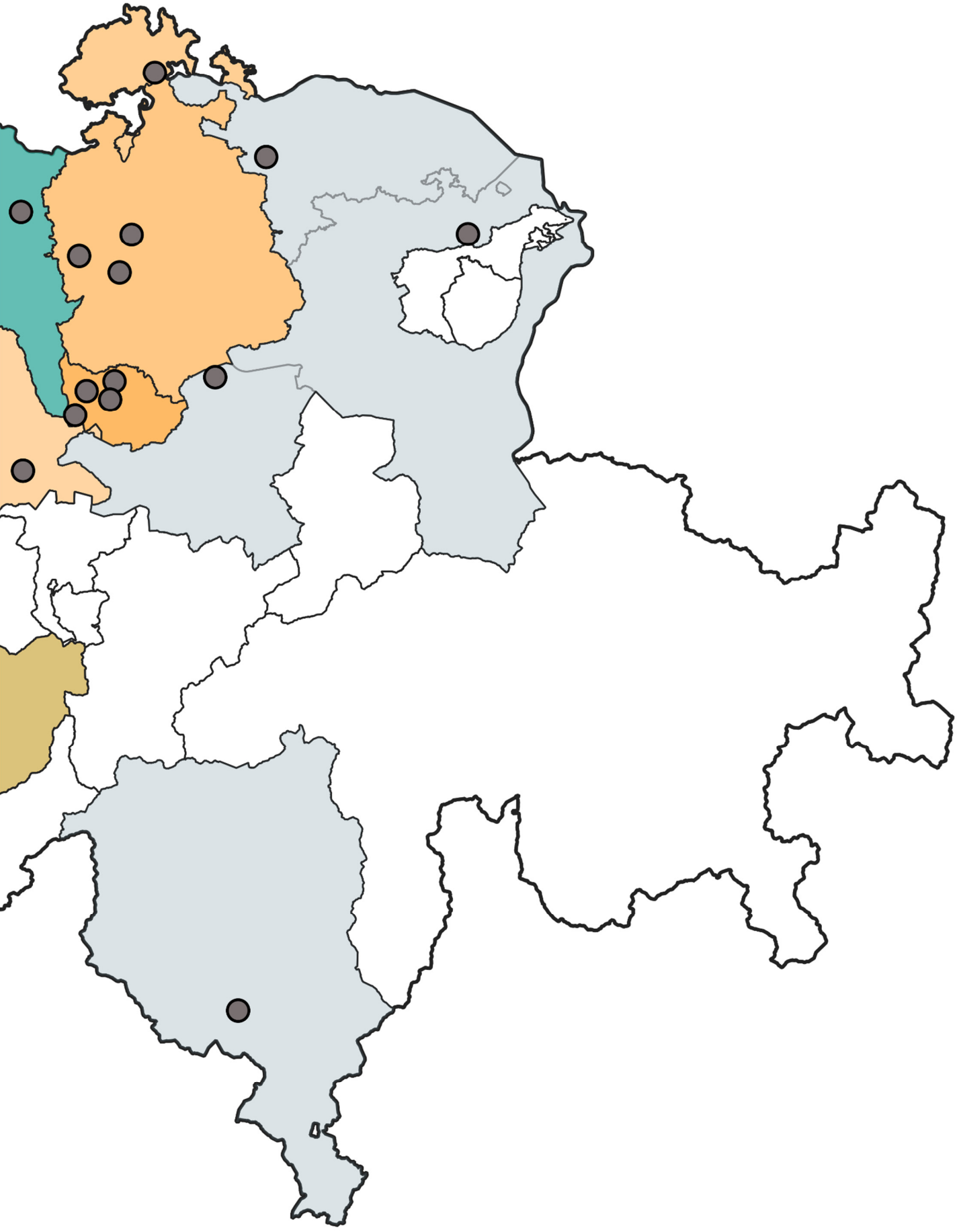
Differences in part-time structures mean that employment figures for the different sectors are only comparable to a limited extent. For this reason, full-time equivalent (FTE) employment is used as a measure for such comparisons. This measure gives the number of employees there would theoretically be if the volume of work done was performed exclusively by full-time employees.

Fig. 1-3 Regional distribution of Interpharma members

Number of employees and locations of Interpharma member companies by pharma cluster as at the end of 2018



The figures are based on the 23 companies that where Interpharma members in June 2019, including those that were not yet members in 2018. Not all companies break down certain key figures by country, which is why the relevant details are missing from these figures. In the case of groups with several divisions, only the details for the pharmaceutical division have been included.
Source: Interpharma



Full-time equivalent employment (FTE)

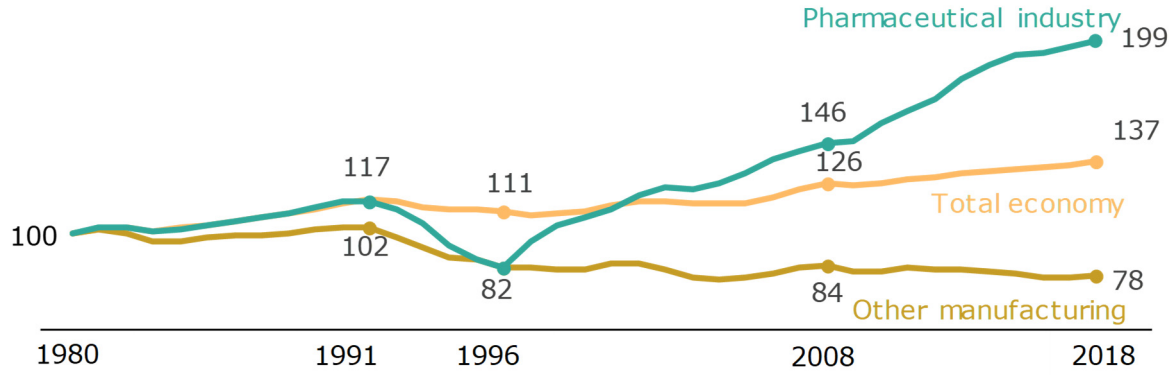
When measured in full-time equivalents, the pharmaceutical industry provided around 44,500 jobs (FTE) in 2018. This corresponds to 1.1 per cent of total employment and 7.0 per cent of total jobs in the manufacturing sector.

The figure of employment development further illustrates the structural transformation in the pharmaceutical industry in the early nineties, followed by strong, above-average growth in the subsequent two decades. The trend observed in the rest of the manufacturing sector, however, has been one of declining employment since 1991. The number of jobs in 2018 was down 22 per cent on 1980 (index value 78).

While the various economic cycles are still clearly recognisable in the rest of the manufacturing sector, employment development in the pharmaceutical sector has increasingly distanced itself from the national economic trend in recent decades.

Fig. 1-4 The number of jobs has doubled since 1980

Number of employees [FTE], 1980–2018, index 1980 = 100



Source: BAK Economics, FSO

1.2 Employment structure

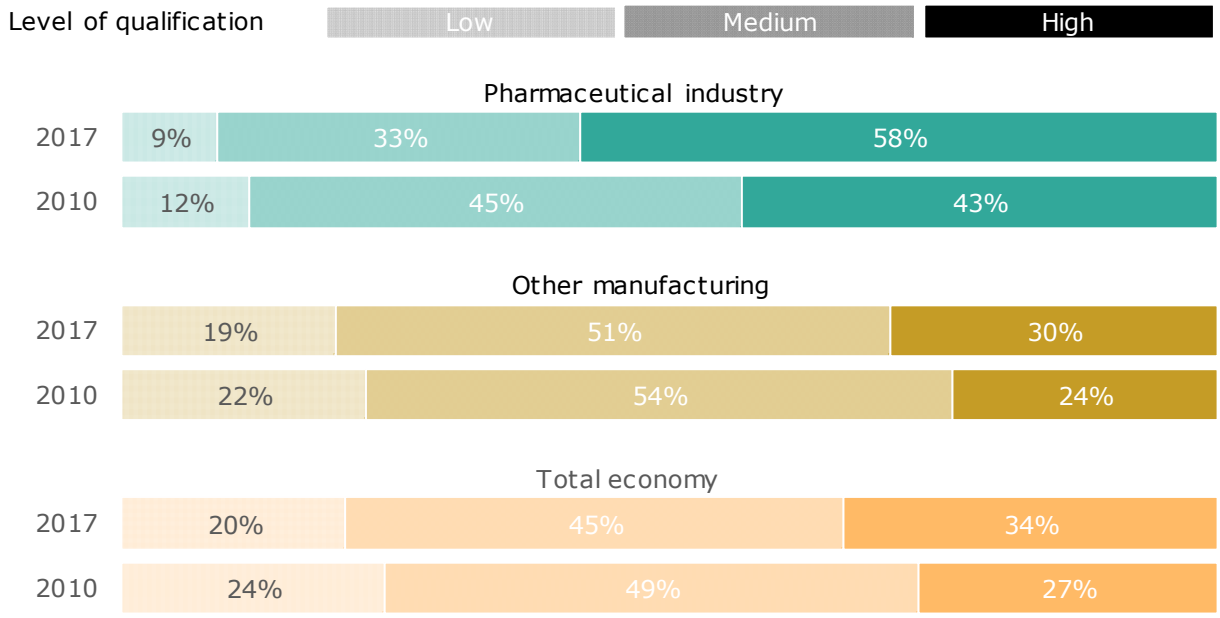
Qualification structure

The pharmaceutical industry is characterised by a very high and well-above-average intensity of research activities. International pharmaceutical companies invested around 6.5 billion francs in research and development (R&D) in Switzerland in 2017, around 2.1 billion francs more than in 2004. The number of employees in R&D rose from around 6,000 to around 9,500 (FTE) between 2004 and 2017. While the need for a highly qualified workforce rose considerably as a result of increasing research activity, automation and outsourcing activities in the area of medium- to low-skilled jobs dampened the momentum in employment.

Such development trends are very clearly reflected in the qualification structure of employment. Between 2010 and 2017, for example, the proportion of pharmaceutical industry employees with a tertiary qualification rose from 43 per cent to 58 per cent, while the proportion of employees with less than upper secondary education dropped from 12 per cent to 9 per cent.

Fig. 1-5 58 per cent of employees have a tertiary degree

Qualification structure in 2010 and 2017



Percentage of employees. The level of qualification is measured by educational achievement (low = lower secondary, medium = upper secondary, high = tertiary).
Source: BAK Economics, FSO

The rest of the manufacturing sector accounted for 30 per cent of highly qualified employees in 2017, the total economy for 34 per cent. Since

2010, the rest of the manufacturing sector and the total economy have seen an increase in demand for better qualified personnel. However, the gap between the pharmaceutical industry and other industries has once again widened in terms of the proportion of employees who have tertiary education.

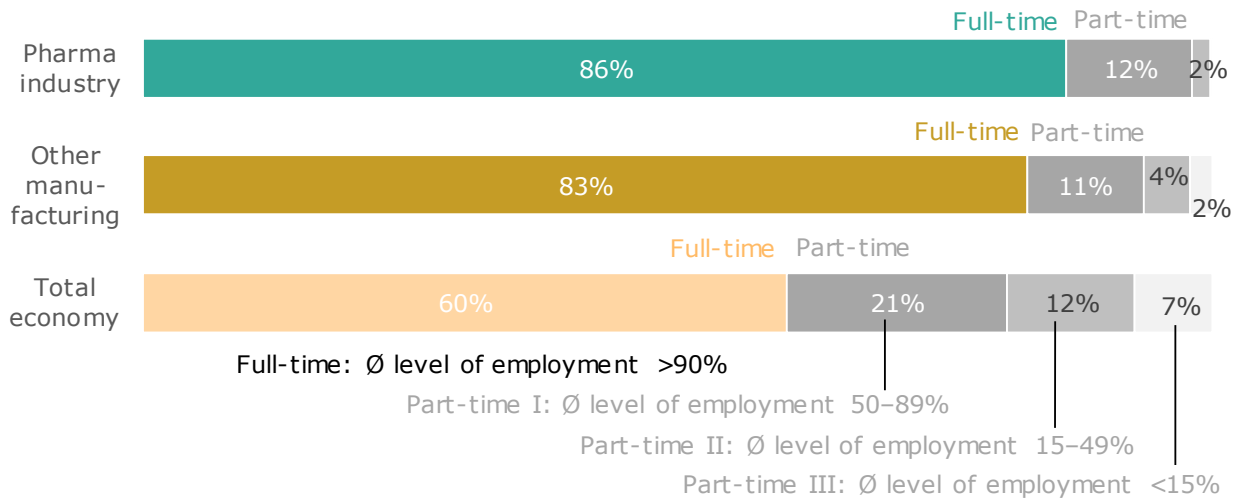
Since employees in the pharmaceutical industry tend to be better qualified, average wages tend to be higher than in other sectors. The gross wages and salaries paid to employees by Swiss pharmaceutical companies in 2018 amounted to around 6.2 billion francs – ultimately to the profit of the public sector in the form of income tax revenue.

Part-time structure

In terms of the part-time structure, work in the pharmaceutical sector does not differ significantly from the employment pattern in the rest of the manufacturing sector. 86 per cent of employees in 2018 worked more than 90 per cent (the statistical definition of "full-time employment"), placing the sector only slightly higher than the rest of the manufacturing sector (83%). Services industries such as the retail trade or the hospitality industry typically have a much higher proportion of part-time jobs than the manufacturing sector. The proportion of full-time employees in the total economy was therefore much lower at 60 per cent.

Fig. 1-6 Average level of employment is higher than in the total manufacturing sector and much higher than in the total economy

Percentage of employees by level of employment



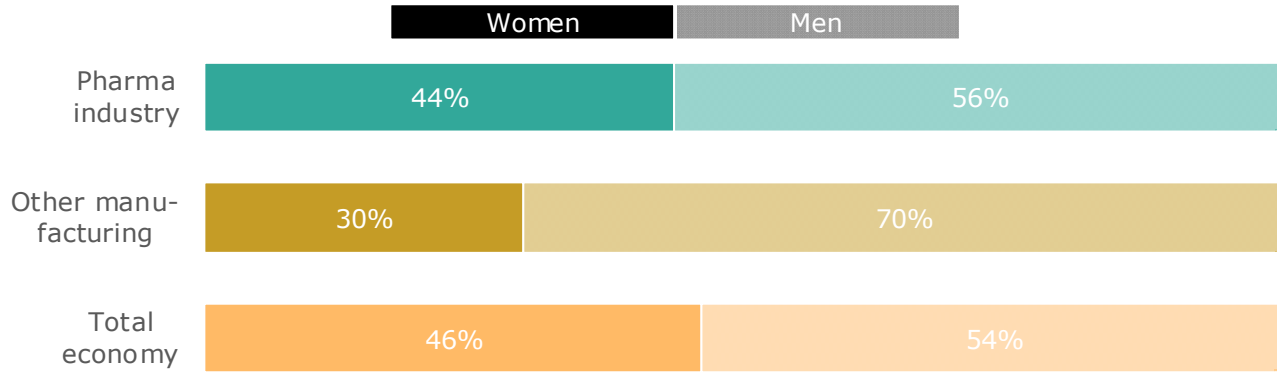
Source: BAK Economics, FSO

Proportion of women

In contrast to the part-time structure, the pharmaceutical industry differs significantly from the rest of the manufacturing sector in terms of the proportion of female employees. While the proportion of women working in the pharmaceutical industry in 2018 was around the national average (46%) at 44 per cent, men clearly dominated the rest of the manufacturing sector at 70 per cent.

Fig. 1-7 The proportion of women is clearly above the manufacturing sector average

Percentage of all employees by gender



Source: BAK Economics, FSO

1.3 Importance for other sectors

The effective importance of the pharmaceutical industry for Switzerland's job market is much greater than its 1.1 per cent proportion of all jobs (FTEs) might suggest because pharmaceutical company activities create further jobs in other sectors of Switzerland's economy.

For the manufacture of pharmaceutical products, goods and services are sourced from companies in a variety of other industries, sectors and abroad. For example, the production of pharmaceuticals requires machinery, chemical substances, insurance services, building/plant maintenance, cleaning and security services, IT services and energy.

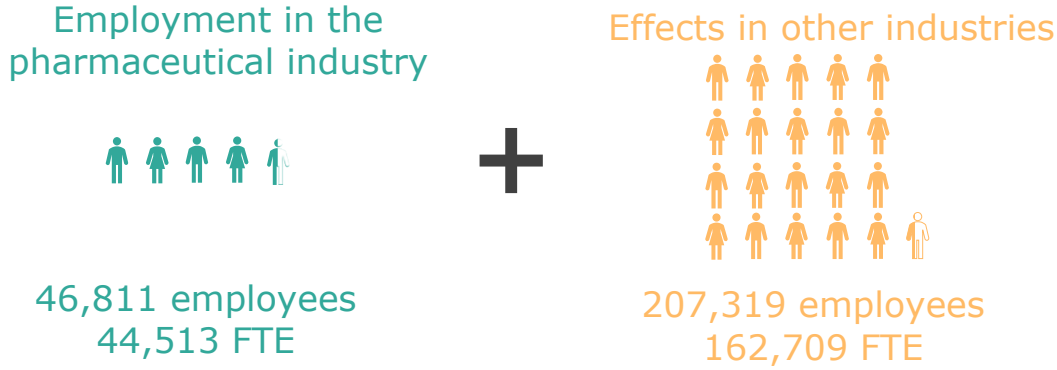
Trade and industry also benefit from consumer spending by employees in the pharmaceutical companies. The intertwined nature of these different businesses means that jobs in other sectors are likewise tied up with the production operations of pharmaceutical companies.

The extent to which the production, research and development activities of the pharmaceutical industry impacted employment in the total economy

in 2018 has been calculated on the basis of a macroeconomic impact model within the framework of this study. This model is used to analyse and quantify all relevant payment flows in an integration across the entire value chain (cf. section 5.1).

The impact analysis shows that thanks to the activities of Swiss pharmaceutical companies in 2018, around 207,300 people were employed in other Swiss companies. The total impact on employment amounts to around 254,100 jobs. That corresponds to about 1 in 20 employees in Switzerland.

Fig. 1-8 Total impact on employment is five times higher in the pharmaceutical industry due to multiplier effects

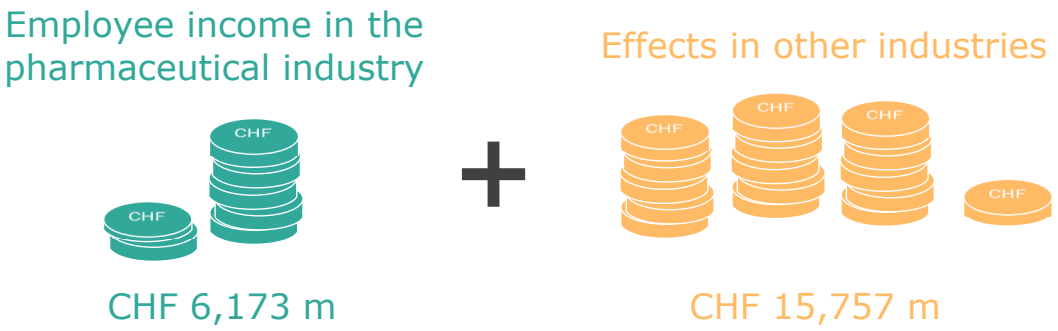


Source: BAK Economics

Income effects

Cumulative employee income of around 15.8 billion Swiss francs was associated with additional jobs in other sectors of the economy in 2018. Thus, for every 1,000 francs of salary paid to employees in the pharmaceutical industry, an additional 2,600 francs of pay was generated on average for employees from companies in other sectors. All in all, the pharmaceutical industry generated around 21.9 billion francs in national employee income in 2018. This corresponds to 5.7 per cent of the total economy.

Fig. 1-9 For every franc of salary paid in the pharmaceutical industry, an additional 2.6 francs of employee income is generated in other sectors



Source: BAK Economics

The following table outlines the impact on employment and income. In each case, the multiplier indicates the factor by which the overall impact is greater than the direct impact. For example, the employment multiplier 5.4 indicates that the overall impact is 5.4 times higher than the direct impact. This means that for every person employed in the pharmaceutical sector, an additional 4.4 people are employed on average in other sectors.

Tab. 1-1 Labour market effects, direct and in other industries, 2018

Effects in ...	the pharma industry	other industries	Total effect	Multi-plier
Employees	46,811	207,319	254,130	5.4
in % of total economy	0.9	3.9	4.8	
Employees [FTE]	44,513	162,709	207,222	4.7
in % of total economy	1.1	3.9	5.0	
Hours worked [m hrs]	83	316	398	4.8
in % of total economy	1.0	3.9	5.0	
Gross wages and salaries [CHF m]	6,173	15,757	21,931	3.6
in % of total economy	1.6	4.1	5.7	

Source: BAK Economics, possible rounding differences

2 Contribution of the pharmaceutical industry to value added

The pharmaceutical industry is an important pillar of Switzerland's manufacturing sector and has contributed significantly in recent years to economic growth in Switzerland. Businesses in other sectors also benefit from the success of pharmaceutical companies. In 2018, indirect value added of around 26.1 billion Swiss francs was created along the value chains involved. The total direct and indirect value-added effect thus stood at around 62.1 billion Swiss francs.

2.1 Economic output (direct value added)

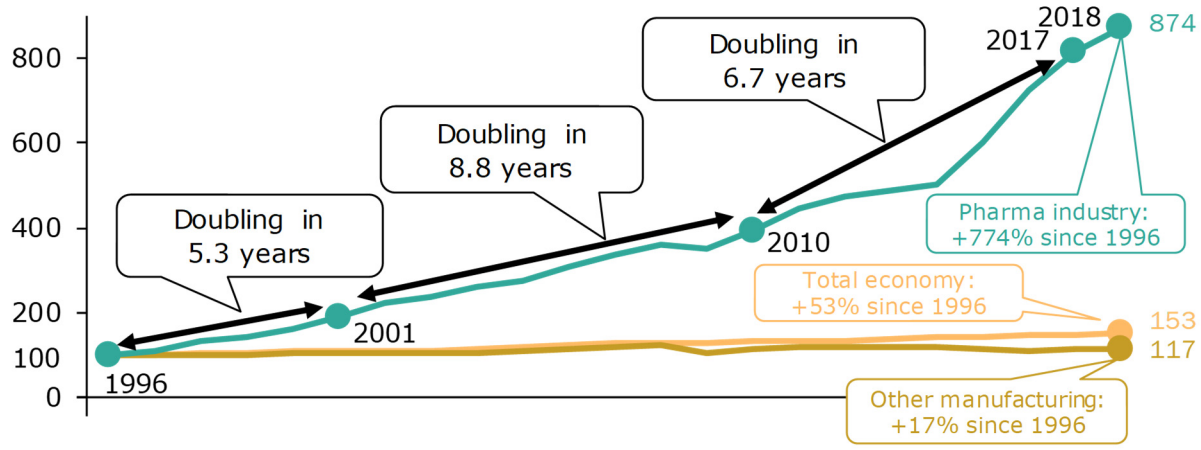
Real value added has doubled more than three times since 1996

The rise of Switzerland to become a major global pharmaceutical and biotechnological hub led to a strong increase in pharmaceutical production and value added from 1996. With the end of restructuring in 1996, real economic output doubled in the pharmaceutical industry in little more than five years, doubling again twice more from 2001 to 2017 at 8.8- and 6.7-year intervals. By 2018, real value added was 774 per cent higher than in 1996. Since 1996, real gross value added has thus doubled more than three times and is almost nine times higher than in 1996.

During this time, the real economic output of the total economy (real GDP) rose by a total of 53 per cent. Switzerland's economic output is thus almost 1.5 times higher than in 1996, while the real value added of the pharmaceutical industry is almost nine times higher than in 1996.

Fig. 2-1 Real gross value added was almost nine times higher in 2018 than in 1996

Index of real gross value added, 1996 = 100



Reading aid: Real value added is depicted as an index (base year 1996). The index value for 1996 is therefore the same for all rows (= 100). The value of 153 in 2018 for the total economy means that the real value added was 53 per cent higher in 2018 than in 1996. Double this figure would equate to a value of 200.
Source: BAK Economics, FSO

Definition of gross value added (GVA)

The second important measure for ranking the importance of an industry aside from employment is the gross value added as a contribution to the gross domestic product. The value added is an indicator of economic output and represents the economic value added that a company or an industry creates with production or the provision of a service.

Mathematically, the gross value added is the difference between the overall production of an economic entity and the preliminary goods and services needed for the output of that economic entity. These goods and services include all external production factors that are sourced from third parties and feed into production as input factors (e.g. raw materials, energy, rents, ICT services, etc.).

In terms of income, gross value added represents the amount disposable for the remuneration of the internal production factors labour and finance capital less amortisation (= net value added).

Nominal versus real gross value added
Economic accountants distinguish between real and nominal gross value added. While nominal value added represents the effective performance observed, real value added takes into account the impact of changing prices.

This deflation happens on a gross production value level (by means of production prices) as well as on a preliminary goods and services level (by means of the production prices of the supplying sectors).

Real value added shows the development of effective value added over time. It is unaffected by price trends and reflects the dynamic nature of production output in the sense of the quantity of products or services produced.

Value-added deflator
The value-added deflator is the ratio of nominal to real gross value added and shows the price trend for the proportion of production value relating to the respective sector's activity, namely the value added. If the nominal value added increases at a faster rate than the real value added, this is reflected by an increasing deflator. Conversely, if the real value added develops more dynamically than the nominal value added in terms of value, this leads to a declining deflator.

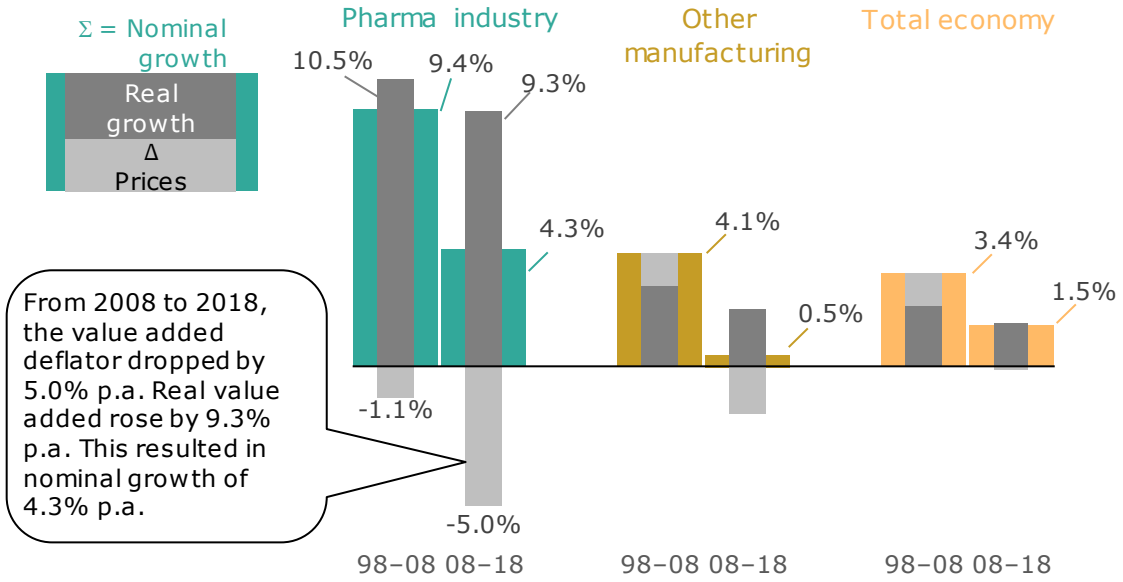
Increasing pressure on prices is reflected in declining sector deflator

The nominal development in terms of value has not kept pace with real growth in the past few years. Rising by just 4.3 per cent per annum between 2008 and 2018, it developed much less rapidly than real value added at 9.3 per cent. This is due to the increasing pressure on prices in the healthcare system, growing competition and declining margins due to the marked appreciation of the Swiss franc.

Over the past ten years, the value-added deflator has shown an annual average decline of 5.0 per cent. The deflator measures the price trend for the proportion of the production value relating to the pharmaceutical industry's activity.

Fig. 2-2 Over the past 20 years, the pharmaceutical industry has seen an above-average decline in prices

Breakdown of nominal value-added growth, 1998–2008 and 2008–2018



Reading aid: The illustration shows how nominal value-added growth (wide column) is achieved by combining (stacked columns) the change in real value added and prices (deflator). Real value added rose by 9.3 per cent per annum between 2008 and 2018, while the deflator dropped by 5.0 per cent per annum. This resulted in an average increase in nominal gross value added of 4.3 per cent per annum (+9.3% + (-5.0%) = 4.3%).
Source: BAK Economics, FSO

The strong decline in the value-added deflator can be taken as a clear indication that drug prices have dropped over the past ten years. Other statistics (FSO consumer price index, cf. following excursus) as well as drug reviews by the Swiss Federal Office of Public Health (FOPH) also substantiate this. According to the FOPH, the price reductions implemented since 2012 alone have led to savings of more than one billion Swiss francs for drugs covered by mandatory health insurance.

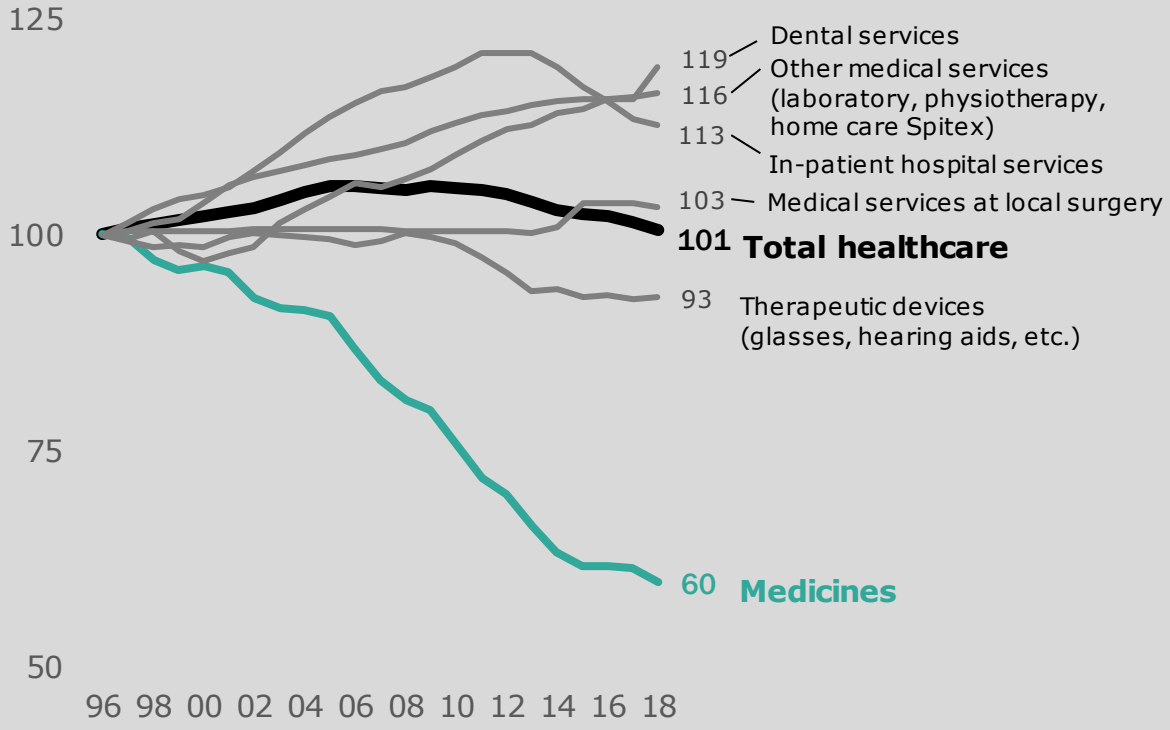
A comparison with the rest of the manufacturing sector also shows just how strong the pressure on prices really is in the pharmaceutical industry. Although generally, the appreciation of the Swiss franc had a much more profound effect on the manufacturing sector, its deflator only declined by 1.7 per cent per annum on average between 2008 and 2018. The average for the total economy even shows stagnation.

Excursus: Trend in consumer prices in Switzerland's healthcare sector

The downward trend in pharmaceutical product prices can also be traced back to the trend in consumer prices. Since the introduction of the Swiss Health Care Insurance Act in 1996, drug prices in Switzerland have dropped by on average 2.3 per cent per annum. Drug prices were thus 40 per cent lower in 2018 than in 1996. Consumer prices for the healthcare sector as a whole initially rose during this period (until 2006). As a result of the savings made in recent years, consumer prices virtually returned to the levels seen in 1996.

Fig. 2-3 40 per cent drop in drug prices since 1996

Trend in consumer prices for the healthcare sector and subsectors [index 1996 = 100], 1996–2018



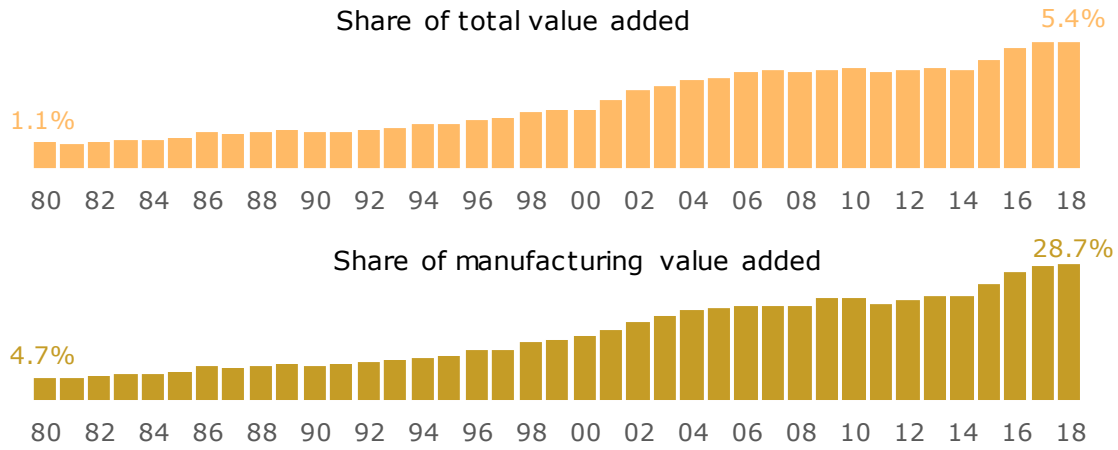
Source: FSO, BAK Economics

Share of total economy currently over 5 per cent

Despite the downward trend in prices, the nominal value added of the pharmaceutical industry still developed much more dynamically than in the rest of the manufacturing sector and the total economy over the past 20 years. The nominal gross value added achieved by the pharmaceutical industry in 2018 amounted to around 36.0 billion Swiss francs, accounting for 5.4 per cent of Switzerland's total economic output. The proportion of total manufacturing value added now amounts to 28.7 per cent.

Fig. 2-4 The share of manufacturing value added amounts to 28.7 per cent

Percentage of total gross value added, 1980–2018



Source: BAK Economics, FSO

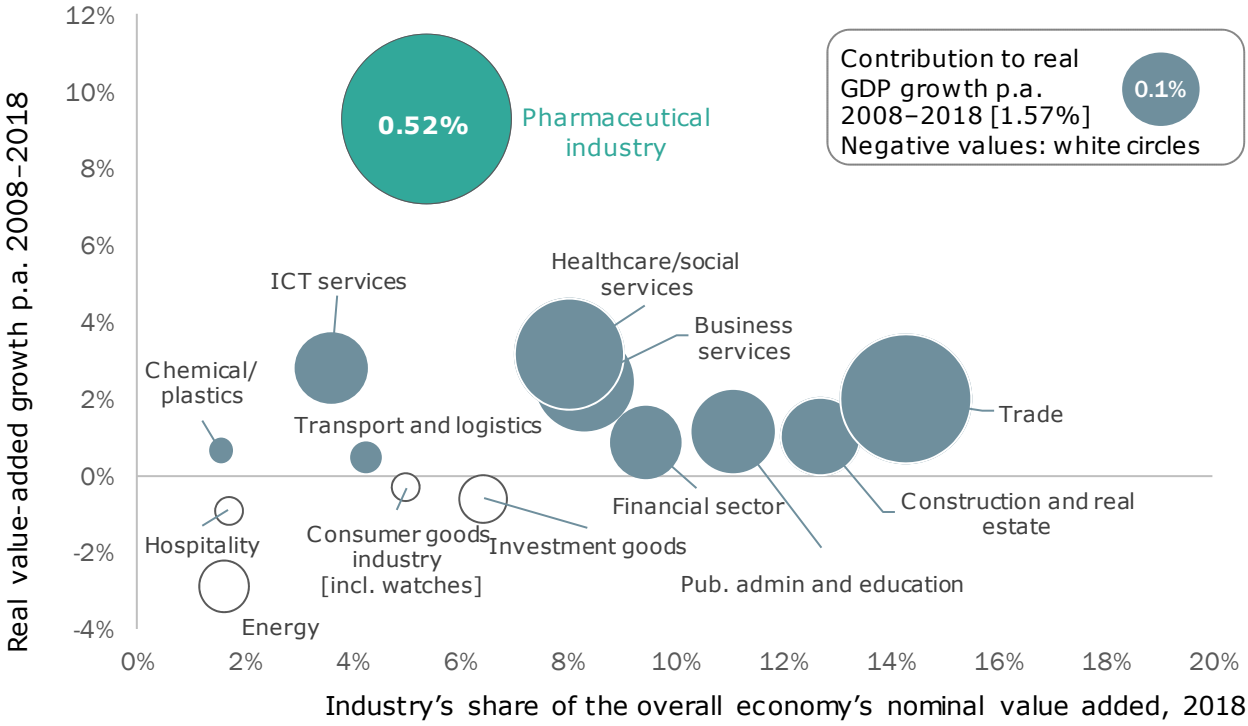
2.2 Contribution of the pharmaceutical industry to growth

Over the past ten years, the pharmaceutical industry has contributed significantly to the growth of the total economy. Between 2008 and 2018, Switzerland's pharmaceutical industry accounted for an annual 0.52 percentage points (pp) – around one-third – of GDP growth in real terms. The pharmaceutical sector is not only extremely important for the total economy, but is also the most important driver of Switzerland's manufacturing sector. With a few exceptions (e.g. the chemical industry), the remainder of the manufacturing sector was unable to contribute to real GDP growth (or rather, reduced the average growth of the total economy). Still not fully recovered from the effects of the financial and economic crisis, some manufacturing industries in 2018 continued to lag behind the level of real value added achieved before the financial crisis broke.

Trade proved to be the second-biggest contributor to GDP growth (wholesale and retail, garage trade) with +0.31 pp. The exceptionally strong momentum in the transit trade in particular had a positive effect. Health and social services came in third place (+0.23 pp), while business services took fourth place (+0.18 pp). Another growth driver worthy of mention is construction, which experienced a kind of "supercycle" as a result of high levels of immigration and low interest rates during the observation period (2008–2018) and thus contributed to GDP growth with 0.12 percentage points. The remaining growth contributions invariably came from the service sector (financial sector, ICT services, public administration).

Fig. 2-5 A third of Swiss GDP growth over the past ten years is attributable to the pharmaceutical industry

Industry contributions to real GDP growth, 2008–2018



Reading aid: The size of the bubbles shows how strongly individual sectors have contributed to the total growth of the Swiss economy. The growth contribution is derived from combining the size of a sector (proportion of the total economy) at the outset with its growth. For the current classification, the representation on the horizontal axis shows the current percentage of the economy (and not the percentage at the starting point on which the calculation of the growth contribution is based).
Source: BAK Economics, FSO

2.3 International comparison

The establishment of different international pharmaceutical companies in recent years shows that Switzerland and the current pharmaceutical cluster are highly appealing to global pharmaceutical companies. Regional pharmaceutical clusters play an exceptional role not only in terms of their respective regional economic significance but also on a national scale. In this respect, the Swiss pharmaceutical sector distinguishes itself from other countries.

Significance for the national economy

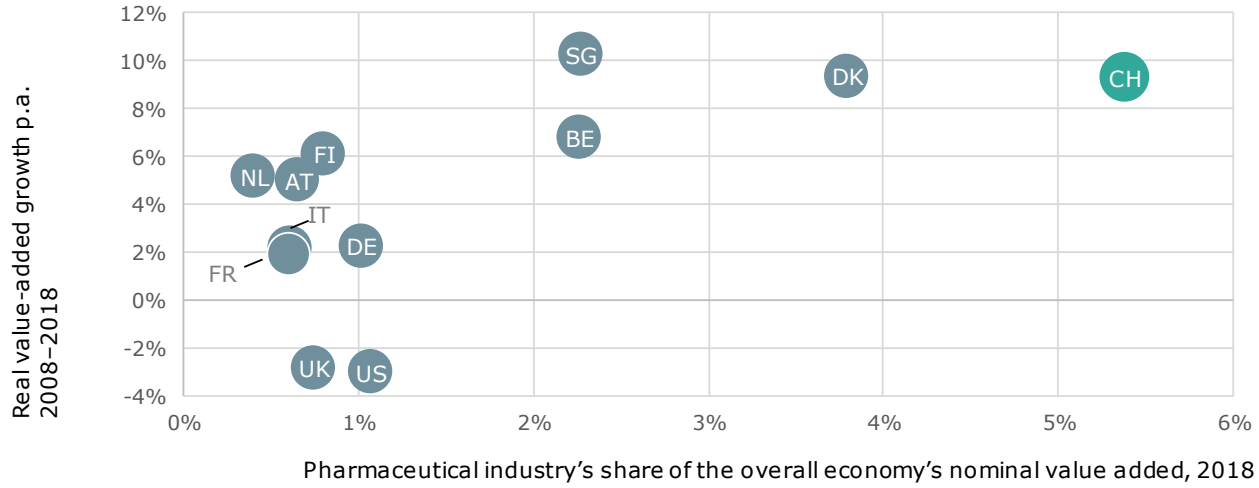
In Switzerland, the pharmaceutical industry accounted for 5.4 per cent of value added for the total economy in 2018 (cf. section 2.1). While above-average figures are also recorded for Denmark (3.8%), Singapore and Belgium (both 2.3%), they are still much lower than in Switzerland. The figures in numerous European industrial nations such as Germany, Finland, France, Italy, the Netherlands, Austria or the United Kingdom are around one per cent or less. The US has the largest pharmaceutical industry in terms of the absolute pharma value added. But in relation to the US total economy, the industry plays a less important role.

Growth

By international standards, the Swiss pharmaceutical industry thus outstrips other countries in terms of value-added growth. Within the sample of relevant European countries, as well as the US and Singapore, only the pharmaceutical industries in Denmark and Singapore demonstrated similar and slightly higher growth, respectively, than in Switzerland between 2008 and 2018. Equally high growth rates of more than 5 per cent per annum were reported in the pharmaceutical industry in Belgium, Finland, the Netherlands and Austria. The pharmaceutical industry in the US and the UK, however, reported a decline in real economic output over the past ten years.

Fig. 2-6 In no other country is the pharmaceutical industry as important for the national economy as in Switzerland

Importance for the national economy and growth of the pharmaceutical industry compared to other countries



Source: BAK Economics

2.4 Importance for other sectors

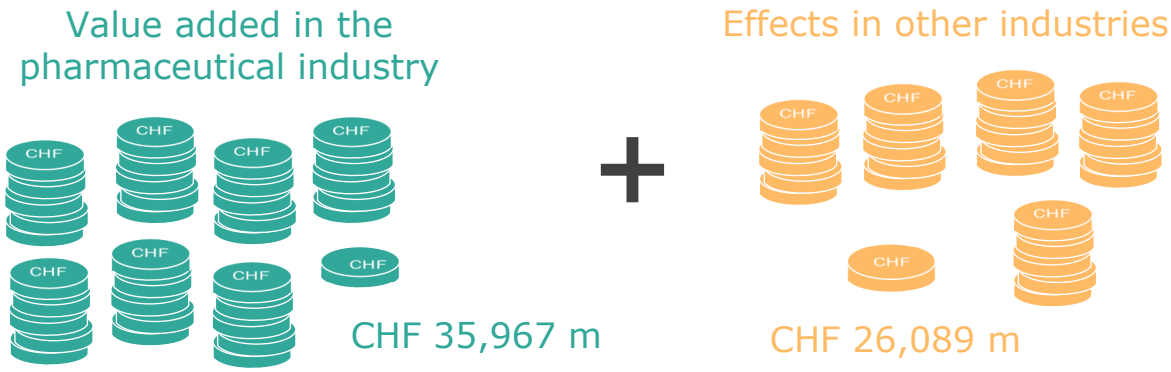
Non-sector value-added activities initiated by pharmaceutical products are attributable to companies from a wide range of industries – e.g. the chemical, consumer and investment goods, energy and water supply, construction, transport, finance, ICT and consulting industry as well as numerous other business services such as facility management, cleaning and security services.

The principle of impact analysis and the calculation of multipliers can also be applied by analogy for analysing job market effects on value added. With the aid of the impact model, all effects along the entire value-added chain can be taken into account. The result is the value added generated by other sectors through the research, development and production activities of pharmaceutical companies.

Model estimations conclude that, thanks to the production and research activities of the pharmaceutical industry in 2018, a value added of around 26.1 billion Swiss francs was generated in other sectors.

Fig. 2-7 Pharmaceutical industry activities generate a total of 62.1 billion francs in Switzerland

Value-added effects, direct and in other sectors, 2018



Source: BAK Economics

The total value added contributed in 2018 by pharmaceutical industry production and research activities amounted to around 62.1 billion francs. That corresponds to 9.3 per cent of Switzerland's total economic output. The value-added multiplier for 2018, calculated on the basis of the BAK Economics model (cf. annex), stood at 1.73. Thus, for every Swiss franc of value added in the pharmaceutical industry, approximately 73 centimes of additional value added is generated in other Swiss sectors.

Tab. 2-1 Value-added effects, direct and in other industries, 2018

Effects in ...	the pharma industry	other industries	Total effect	Multiplier
Gross value added [CHF m]	35,967	26,089	62,056	1.7
in % of total economy	5.4	3.9	9.3	

Source: BAK Economics

3 Labour productivity of the pharmaceutical industry

The increase in labour productivity as a result of greater capital investment, growing intensity in research and innovation as well as steadily increasing employee qualifications has been key to the value-added growth achieved over the last two decades. The pharmaceutical industry is by far the most productive economic sector, generating on average five times as much value added per job. By international standards, the pharmaceutical industry thus outstrips other countries.

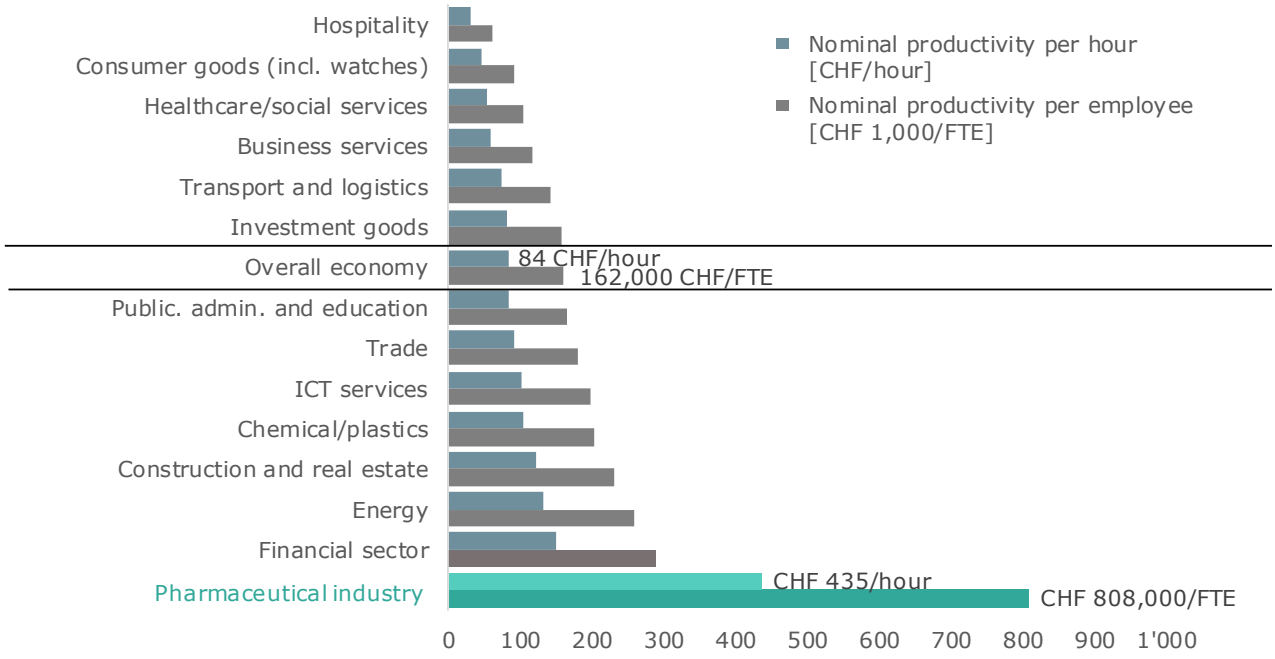
3.1 Level of labour productivity

Labour productivity is a reflection of the relationship between value added and work effort, this variable serving as an important indicator for assessing efficiency and competitiveness. Labour productivity depends on capital intensity (workplace equipment (systems, software, etc.)), organisational efficiency, intensity of innovation and employee performance (qualifications, adaptability, etc.).

Swiss pharmaceutical companies are distinguished by their strong capitalisation, modern and efficient research and production facilities, above average employee qualifications and intense innovation activities. In light of this, it is hardly surprising that the pharmaceutical industry generates by far the most value added per job out of all industries of the Swiss economy. In 2018, labour productivity in the pharmaceutical industry amounted to around 808,000 Swiss francs of value added per full-time position (FTE), or 435 francs per hour worked. The value added in relation to the work effort required is thus around five times higher in the pharmaceutical industry than in the Swiss total economy.

Fig. 3-1 Pharmaceutical industry generates five times as much value added per job as the national average

Labour and hourly productivity, 2018



Source: BAK Economics

3.2 Growth of labour productivity

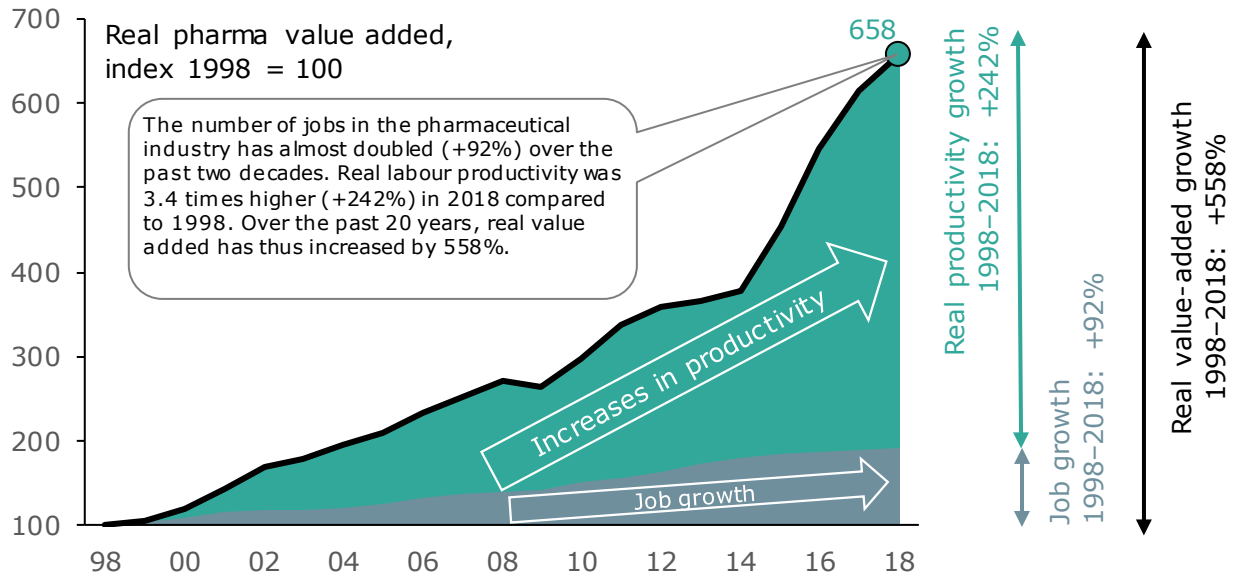
Productivity growth reduces costs, increases profitability and strengthens the competitiveness of pharmaceutical companies. Increases in productivity thus enable higher reserves for real investments, the financing of increasing research and development costs, dividend growth and wage increases.

Economic data from the last two decades clearly shows that the increase in labour productivity as a result of greater capital investment, growing intensity in research and innovation as well as steadily increasing employee qualifications has been key to the value-added growth achieved in the Swiss pharmaceutical industry.

Real labour productivity grew by 242 per cent between 1998 and 2018. The real value added per full-time job (full-time equivalent) was thus around 3.4 times higher in 2018 than in 1998, while the number of jobs almost doubled (+92%) in the same period. Combined, both effects (double the amount of jobs and more than three times the level of labour productivity) amounted to 6.5 times the amount of real value added in 2018 than in 1998 (up 558%).

Fig. 3-2 Increasing productivity has played a key role in pharmaceutical industry growth over the past 20 years

Real labour productivity, jobs and real value added, 1998–2018, index 1998 = 100



Source: BAK Economics

3.3 Contribution to productivity growth of the total economy

The pharmaceutical industry has contributed significantly to increasing total productivity with its high level of productivity growth. The 0.44 percentage points achieved over the past ten years can be attributed to increases in the pharmaceutical industry, which equates to exactly two-thirds of total productivity growth (0.66% p.a.).

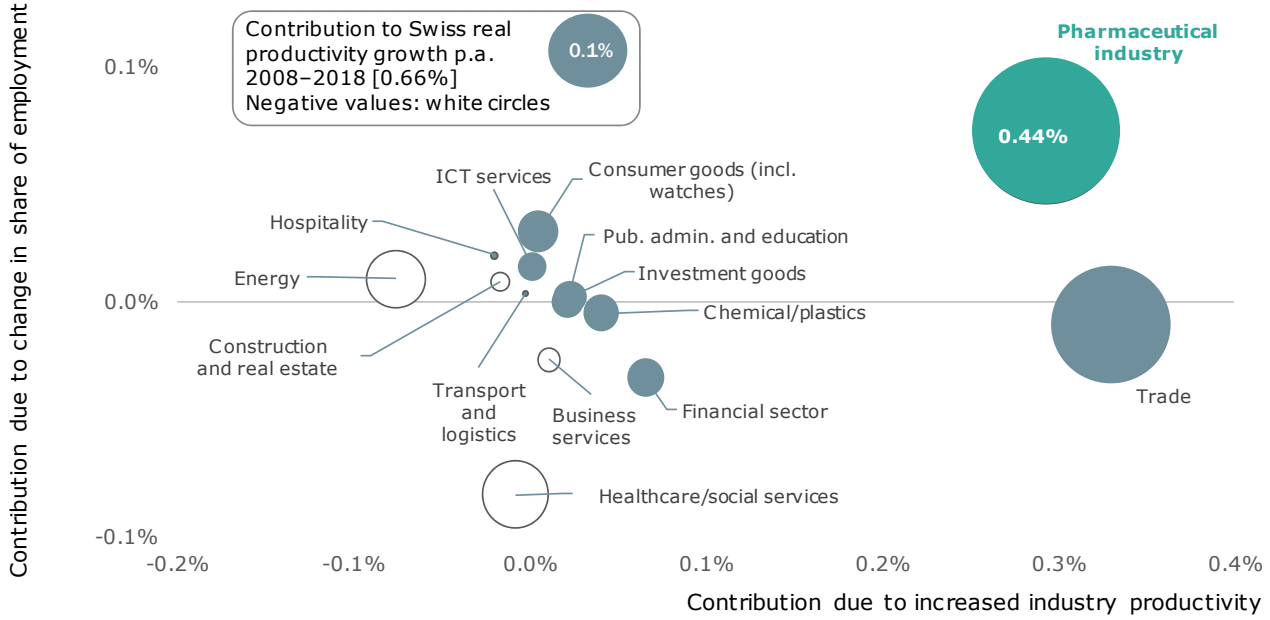
The size of the contributions made by each individual sector is shown in the illustration by the size of circles (see below).

The contribution made by the trade sector was similar to that made by the pharmaceutical industry (0.29 pp). Other (lower) positive contributions came from the investment and consumer goods industry, the chemical industry, the financial sector, ICT services and public administration.

The industries' contribution to growth can be broken down into three effects: a straightforward growth in productivity (impact of an increase in industry productivity on total productivity), structural change (impact of a change in the share of employment on total productivity) and (minor) interaction resulting from a combined change in equity and productivity.

Fig. 3-3 Two-thirds of total productivity growth is attributable to the pharmaceutical industry

Industry contributions to growth in Swiss productivity, 2008–2018



Reading aid: The size of the bubbles shows the contribution made by each individual sector to the total growth of labour productivity. This contribution is derived from a combination of three effects: (1) the productivity growth of the respective sector weighted by the share of employment at the outset, (2) the change in the share of employment of the sector in combination with the level of productivity at the outset relative to the average for the total economy and (3) an interaction effect resulting from the combination of changes in the share of employment and productivity growth in the industry.
Source: BAK Economics, FSO

The first two effects (productivity growth and structural change) are shown in figure 3-3 and indicate another unique characteristic: the pharmaceutical industry is the only sector in which pure productivity and structural change have a substantial and positive effect. While the pharmaceutical industry has become much more productive, employment has grown much higher than average, which is reflected in the increasing number of employees in pharma as a per cent of total employment. For example, the

trade sector is dominated by the straightforward productivity effect arising from the strong momentum in the transit trade.

3.4 International comparison

Rather than being distributed evenly throughout the country, industries often tend to be concentrated in a few locations (so-called clusters). For this reason, viewing an industry at a purely national level often falls short of the mark in an international analysis. Analyses of the international competitiveness of a sector are thus also based on analyses of regional clusters.

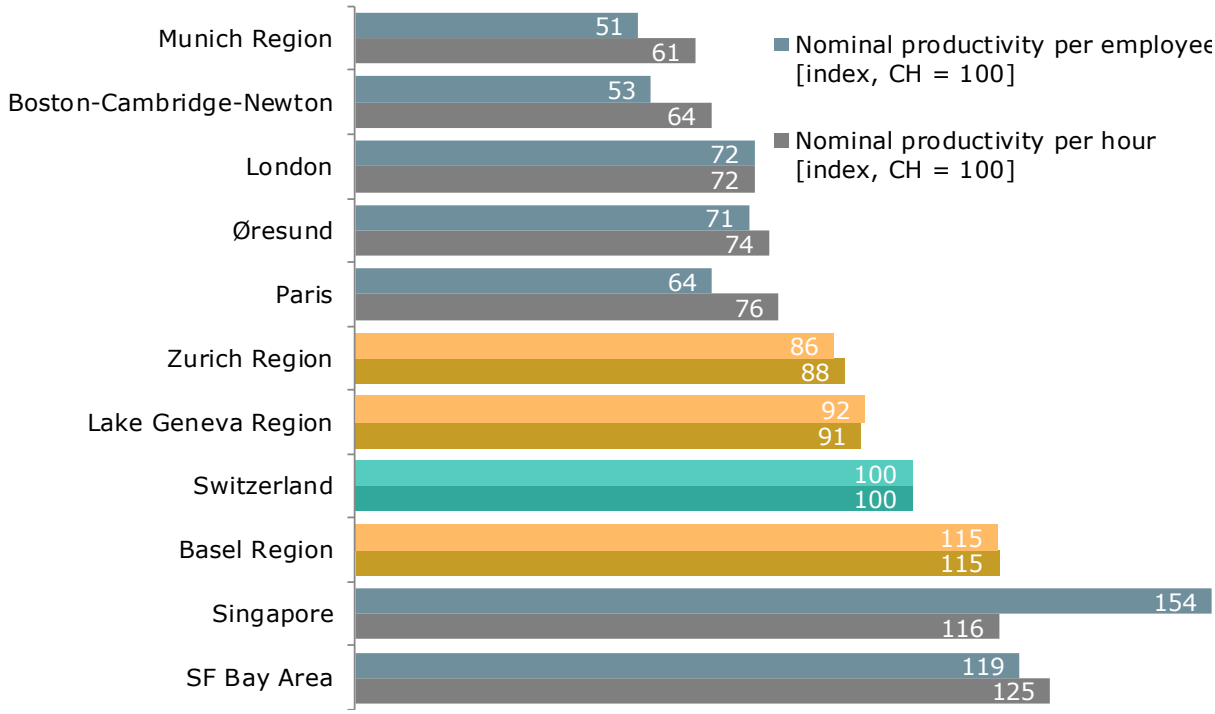
The following illustration shows a comparison of labour productivity for a selection of important international pharmaceutical clusters. This comparison is presented as an index in relation to the average Swiss value (index CH = 100) for both hourly productivity (dark coloured) and labour productivity (light coloured).

Based on hourly productivity by region, the San Francisco Bay Area ranks top with an index value of 125. Here, value added per hour worked is 25 per cent higher than in the Swiss pharmaceutical industry.

This is followed by Singapore (116) and the Basel region (115) at roughly the same level. In comparison, the regions Lake Geneva (91) and Zurich (88) are well below the Swiss average. Paris, Øresund and London form the third group of regions, with index values ranging between 76 and 72. The Boston-Cambridge-Newton and Munich regions are much lower again.

Fig. 3-4 By international standards, the productivity of the Basel region outstrips that of other countries; the regions Zurich and Lake Geneva occupy the upper middle rankings

Nominal labour productivity compared internationally, 2018
Adjusted for purchasing power, indexed: CH = 100



Source: BAK Economics

In terms of value added per employee (labour productivity), Singapore is by far the leader. Here, the index values for labour productivity and hourly productivity clearly differ. This is due to the high number of regular working hours in Singapore, which generate a much higher value added per employee.

The Basel region is also amongst the top three in terms of labour productivity. The index stands at 115 and thus only slightly below the second-ranking region, San Francisco (119). As in the case of hourly productivity, more than 20 index points stand in between the top three regions and other Swiss regions. The regions Øresund and London are in the third group. Paris can no longer quite keep up with these two regions in terms of labour productivity. This is due to the clear difference in regular working hours, which – unlike in Singapore – are well below average in Paris.

4 The pharmaceutical industry as an export sector

The pharmaceutical industry is by far the most important export sector. Demand from abroad shows great structural growth potential and has demonstrated comparatively strong growth in the past during periods of economic weakness. Consequently, the proportion of pharmaceutical exports in total goods exports rose significantly, amounting to 38.4 per cent in 2018. Export revenue in 2018 amounted to around 88.2 billion Swiss francs. Around half of export revenue originated from European countries; the strongest growth in demand in recent years came from North America and Asia.

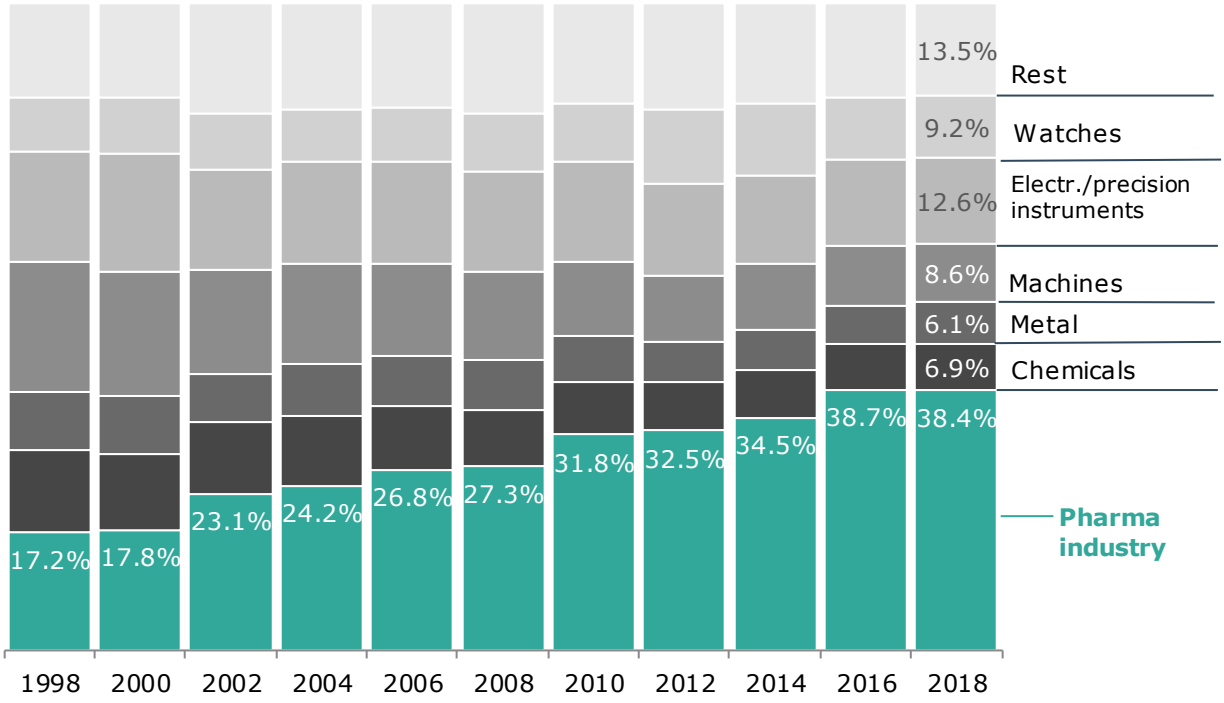
4.1 Percentage of total goods exports in Switzerland

The export volume of the pharmaceutical industry achieved a new record level in 2018 at around 88.2 billion Swiss francs. The pharmaceutical industry is thus the most important export sector. Over the past 20 years, the industry has developed at an impressive pace, increasing nominal exports (despite falling prices) per annum by an average of 8.2 per cent. The rest of the export sector shows an average increase of 2.4 per cent. The growing importance of the pharmaceutical industry for the export economy is reflected in the increase in the proportion of exports from around 17 per cent in 1998 to around 38.7 per cent in 2016. While real pharmaceutical exports continued to rise sharply at an above-average rate between 2016 and 2018, export value developed at roughly the same pace as the total export sector. Accordingly, the nominal share remained stable due to falling prices in the pharmaceutical industry.

The robustness of the pharmaceutical industry has become increasingly evident, particularly during difficult economic times, as the industry is much less cyclical than the rest of the manufacturing sector due to its strong structural potential growth. This correlation is also reflected in the following illustration by the percentage of pharmaceutical exports in total goods exports. The percentage shows a rising underlying trend as well as a stair-like trend in every economic contraction. The percentage of pharmaceutical exports thus rose significantly with both financial crises at the beginning and end of the previous decade as well as with the Swiss currency crisis (“Frankenschock”) in 2015.

Fig. 4-1 The proportion of pharmaceutical exports in total goods exports rose from 17.2 per cent in 1998 to 38.4 per cent in 2018

Percentage of total exports, 1998–2018



Percentage of nominal exports of an industry in total exports
Source: FCA, BAK Economics

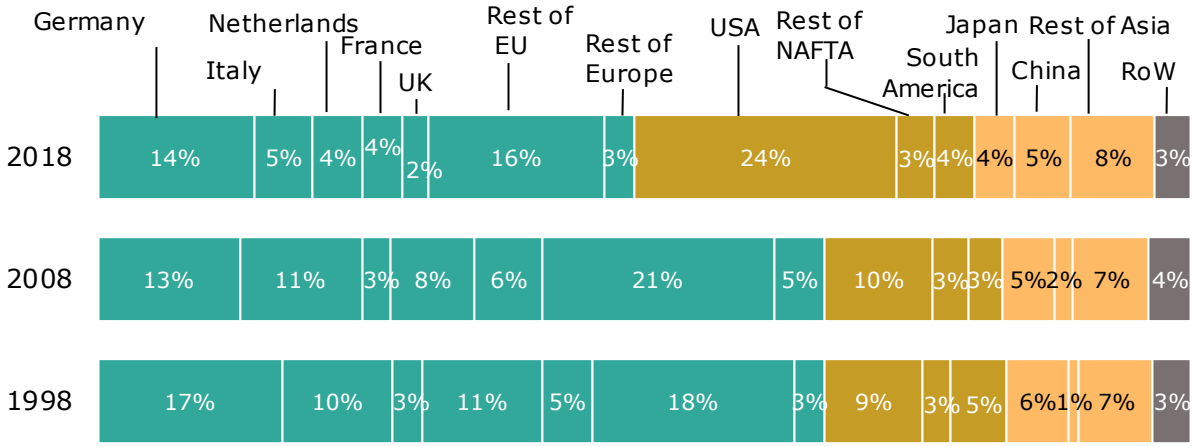
4.2 Exports by destination

With an export volume of 40.9 billion Swiss francs, the European Union was the most important market for pharmaceutical products from Switzerland in 2018 (46%). Germany (14%), Italy (5%), the Netherlands and France (4%) are the most important markets in the EU. The UK suffered a slump in exports from 6 to 2 per cent in 2018. This was due to adjustments made to parts of the supply chain in view of the upcoming Brexit, to avoid potential delays in exports and customs duties. In this regard, some of the goods originally supplied to the UK have now been exported to the Netherlands (and distributed from there to other countries).

For the first time in 2017, the European share of total pharmaceutical exports was below the 50 per cent mark. Other markets are growing at a faster pace and becoming increasingly important. A ten-year comparison (2008–2018) shows a clear increase in North America's share in particular. With a 24 per cent share, the US is the most important market. The importance of the US as a market has more than doubled over the past ten years.

Asia, too, is becoming an increasingly important market, accounting for a 17 per cent share in 2018. The growing middle classes and demographic changes are the structural growth drivers here. Exports especially to China have grown considerably. While 20 years ago, pharmaceutical products worth 167 million Swiss francs were still being exported from Switzerland to China (incl. Hong Kong), the value of exports to this country in 2018 already stood at 4.5 billion Swiss francs. Despite such rapid growth, it will be a long time before China reaches the level of the EU as a market for Swiss pharmaceutical exports. The EU market is still nine times bigger than China.

Fig. 4-2 Growth of pharmaceutical exports by destination, 1998–2018



Source: FCA, BAK Economics

5 Annex

5.1 Concept of impact analysis

Basic idea

The idea behind an impact analysis is to show all payment streams triggered in the context of the pharmaceutical industry's business activities and to quantify the associated impact on value added, employment and income. This gives a vertical integration of the impact along the entire value chain, from procurement through production to the sale of goods.

Impact levels

In principle, a distinction can be drawn between three impact levels: The first impact level includes the direct effects of the pharmaceutical industry, which concern the immediate economic output of the industry (gross value added) and the associated impact on employment and income. On the second impact level, various secondary effects arise that have to be specified; they include the orders placed with other companies in relation to production (preliminary goods and services) and also the consumer demand of the employees. The third impact level involves the total economic effects that arise in consequence of the various secondary effects.

The impact analysis is about quantifying the economic effects in the business cycle that occur as a result of the various secondary effects. Here, an impact model is used to consider the numerous multiplier effects that arise as a result of the various business relations between companies. For example, the production of pharmaceuticals requires machinery, semi-finished goods and electricity, which are sourced from other companies. For their part, the suppliers of goods and services also generate value added and create jobs.

Aside from these effects, the impact analysis takes into account the fact that the producers of semi-finished goods and other suppliers also obtain services from other companies, which in turn are also obtained from other providers, which likewise generate value added. The value-added effects become smaller in each additional "round". Using the impact model, the thought experiment can be mathematically solved and thus all the effects that arise from the secondary effects can be calculated.

Impact model

The key analytical instrument of impact analysis is the input-output model. This is a static-equilibrium model whose equation system is derived from the structural information about the composition of supply and demand for goods and services in an industry.

The basis of the input-output model is a schematic capture of the economy that illustrates how industries are intertwined and consumer demand, domestic production and goods imports are interrelated (cf. the following figure).

Fig. 5-1 Schematic diagram of an input-output table

Source: BAK Economics

The use of services and goods manufactured in the given industries is plotted on the horizontal axis. These either flow into other industries as preliminary goods and services or are directly used for consumer demand, invested or exported. The sum obtained from preliminary goods and services and consumer demand gives the aggregate demand.

The vertical axis shows the composition of total supply, which must correspond to total demand in a state of equilibrium. The total supply is made up of domestic production ("gross production value") and imports. Deducting the preliminary goods and services of an industry that are needed for production from the gross production value gives the gross value added of the industry concerned. The gross value added serves to remunerate the production factors labour and capital.[1]

There are various forms of input-output (IO) model. The classic IO model (type I) considers only the immediate effects with the suppliers involved at the different stages of the value chain ("indirect effects"). The use of income arising at these stages is not considered or specified model exogenously.

In the extended IO model (type II), the (partial) endogenization of private households takes into account the fact that a part of income is fed back into the economic cycle in the form of consumer spending. In a further extension step, company profits and the investments financed with these profits are also taken into account in the same way. In the economic cycle, the spending considered here (consumer spending or investments) also generates value added and employment ("induced effects").

Use of the extended type II model is often criticized because the causal link of the induced income effect with the primary impulse is much looser than that of the indirect effect. For example, consumer spending at the individual level is financed not only by employee income but also by other kinds of income (income from assets or state transfers).

The correlation between primary impulse and the induced consumer spending of the employees involved is much less stable than that with the production effects of the suppliers involved along the value chain. If additional production units are created by the suppliers involved using existing capacity, no additional jobs are generated, but very likely additional value

[1] In the interest of simplification, taxes and subsidies on products are excluded from the schematic diagram (but not from the model).

added. The more links there are between primary impulse and the corresponding effect in the value chain, the more uncertain the correlation becomes between primary impulse and the corresponding effects on jobs.

On the basis of further-reaching assumptions, it has to be assumed that the effects in the fully extended model, taking into account the income-induced effects at each impact stage, overestimate the actual interdependence between the economic activity of a sector or a company and the resulting overall macroeconomic effect. On the other hand, an analysis that uses the simple standard model in individual cases may fall short of its objective.

A middle way is to limit the induced effect to the impact exerted by the income of directly involved employees in the industry that is the focus of the analysis. A semi-extended IO model of this kind is used in this study by considers only the consumer spending of employees in the pharmaceutical industry.

A further restriction of the model considers the opportunistic income. Excluded from the analysis is (autonomous) consumer spending that is unrelated to employment in the pharmaceutical industry, as well as spending abroad (e.g. cross-border commuters in the pharmaceutical industry). The analysis thus considers only the endogenous consumer spending of people directly employed in the pharmaceutical industry that is related to the level of employee income.

5.2 Pharma multipliers compared with other countries

The influence of the pharmaceutical industry on the total economy is likewise analysed in other countries. This section provides a brief overview of the results obtained in these studies.

For the United States there is a study by Battelle Technology Partnership Practice (2011). They calculate both indirect and induced effects based on the input-output matrix of 2009. The value-added multipliers stand at 2.1 (type I) and 3.3 (type II), respectively. The multipliers for employment are much higher than those for value added at 3.1 for indirect effects and 5.9 for induced effects. As in Switzerland, the above-average labour productivity probably plays a decisive role here.

The study update from 2013 is based on lower multipliers both for value added and for employment. The type I multipliers stand at 1.6 for value added and 2.3 for employment, while the type II multipliers stand at 2.4 and 4.1, respectively.

In their analysis, "The Biopharmaceutical Sector's Impact on the U.S. Economy", the authors of Archstone Consulting (2009a) describe the multipliers for 2006. They arrive at an induced multiplier of 3.3 for the gross value added and 4.7 for employment. If the induced effects are disregarded and only the indirect effects are counted, much lower multipliers are obtained, namely 2.0 for real value added and 2.5 for the number of people in employment.

Aside from the national importance of the biopharmaceutical industry, Archstone Consulting (2009b) also calculated its importance for the regional economy of New York State in 2006. The multipliers are lower than those for the US total economy both for employment (type I: 1.7; type II: 2.4) and for value added (type I: 1.5; type II: 1.8).

The analysis by the Milken Institute (2004), "Biopharmaceutical Industry Contributions to State and U.S. Economics", arrived at multipliers with and without induced effects of 2.7 and 2.1 for gross value added and 4.5 and 3.0 for employment in 2003.

The report by TEConomy (2016), "The Economic Impact of the U.S. Biopharmaceutical Industry", shows value-added multipliers of 1.7 (type I) and 2.4 (type II) in 2014. These multipliers for employment are expectedly higher at 3.0 and 5.2.

In Scotland, the study by Ewen Peters Associates (2006), "Contribution of Pharma-Related Business Activity to the Scottish Economy", which was commissioned by the Association of the British Pharmaceutical Industry (ABPI), likewise considered the direct, indirect and induced effects. The study is based on an input-output table for 2003 and shows a type II multiplier of 1.6 both for value added and for employment.

In Germany, the multiplier values, including induced effects according to calculations by Polynomics (2009) based on the input-output table published for 2005, run to 2.1 for value added and 3.0 for employment. The value-added multiplier is still 1.5 when induced effects are disregarded. For the employment multiplier, a value of 1.8 is obtained when induced effects are disregarded.

Nusser and Tischendorf (2006) arrive at multipliers of 1.6 (type I) and 2.3 (type II) for employment based on the input-output matrix of 2003. The study by Weiss et al. (2004), "Die pharmazeutische Industrie im gesamtwirtschaftlichen Kontext: Ausstrahlung auf Produktion und Beschäftigung in den Zulieferbranchen" (The pharmaceutical industry in the total economic context: impact on production and employment in the supplier sectors) focused only on the direct and indirect effects of the pharmaceutical industry.

The update of this study in 2005 (Weiss et al., 2005), which is based on adjusted employment figures, identifies a value-added multiplier of 1.7 for 1995 and 1.8 for both 2000 and 2002. In the case of the employment multiplier, Weiss et al. (2004, 2005) arrive at a value of 1.9 for 1995 and 2000 and 2.0 for 2002.

In a company-specific study, Pavel et al. (2015) found a value-added multiplier (type II) of 3.1 and an employee multiplier of 4.8 for Novartis in Germany. This study also considers the multipliers of Novartis at regional level.

The study by Nora et al. (2016), which was commissioned by the European pharmaceutical industry association, shows value-added multipliers of 1.8 (type I) and 2.3 (type II) for 2014. In 2019, the association published an updated study with slightly lower value-added multipliers (type I: 1.5; type II: 2.1). The employment multipliers declined again, this time much more sharply (from 3.6/5.7 for type I/II multipliers to 2.2/3.9).

A study published in 2018 by the Portuguese pharmaceutical industry association shows a value-added multiplier of 1.6 (type I) and 2.2 (type II), respectively. The multipliers published by ABPI (2017) for the UK for 2015 are of a similar magnitude.

Ranking of multipliers for Switzerland's pharmaceutical industry

The multipliers calculated for Switzerland's pharmaceutical industry can be ranked as average overall in terms of value added (type I). For methodological reasons, the multiplier calculated for Switzerland is significantly lower than the type II multipliers, as BAK Economics is more conservative in differentiating the consumption effects triggered by wage income. The analysis considers only the endogenous consumer spending of people directly employed in the pharmaceutical industry that is related to the level of pharmaceutical employee income. Also considered is the fact that the salaries of cross-border commuters from abroad are largely paid in their country of residence.

As regards employment, however, the multipliers calculated for Switzerland are much higher than the comparative type I multipliers for other countries. This can be explained by the fact that the productivity differential between the pharmaceutical industry and the remaining industries involved in the whole value-added process is particularly high in Switzerland. Therefore, far more indirect jobs are dependent on a pharma job in Switzerland than abroad.

Tab. 5-1 International impact analyses of the pharmaceutical industry

Country/authors	Variable	Year	Type I	Type II
USA				
Milken Institute (2004)	Value added Employment	2003	2.1 3.0	2.7 4.5
Archstone Consulting (2009a)	Value added Employment	2006	2.0 2.5	3.3 4.7
Archstone Consulting (2009b) New York State	Value added Employment	2006	1.5 1.7	1.8 2.4
Battelle Technology Partnership Practice (2011)	Value added Employment	2009	2.1 3.1	3.3 5.9
Battelle Technology Partnership Practice (2013)	Value added Employment	2011	1.6 2.3	2.4 4.1
TEConomy (2016)	Value added Employment	2014	1.7 3.0	2.4 5.2
Scotland				
Ewen Peters Associates (2006)	Value added Employment	2009	- -	1.6 1.6
Germany				
Weiss et al. (2004)	Value added Employment	1995	1.7 1.9	- -
	Value added Employment	2000	1.8 1.9	- -
Weiss et al. (2005)	Value added Employment	2002	1.8 2.0	- -
Nusser and Tischendorf (2006)	Value added Employment	2003	- 1.6	- 2.3
Polynomics (2009)	Value added Employment	2005	1.5 1.8	2.1 3.0
Pavel et al. (2015)	Value added Employment	2012	- -	3.1 4.8
Nora et al. (2016)	Value added Employment	2014	1.8 3.6	2.3 5.7
Europe				
PwC (2019)	Value added Employment	2016	1.5 2.2	2.1 3.9
UK				
ABPI et al. (2017)	Value added Employment	2015	1.5 2.4	2.1 3.4
PwC (2019)	Value added Employment	2016		2.1 6.2
Portugal				
Apifarma (2018)	Value added Employment	2016	1.6 -	2.2 -
PwC (2019)	Value added Employment	2016		2.8 4.1
Switzerland				
PwC (2019)	Value added Employment	2016		2.2 4.7

Type I: Consideration of immediate effects on the upstream and downstream stages of value added (direct and indirect effects); type II: additional consideration of income effects (induced effects) on all upstream stages of the value chain.
Source: BAK Economics

5.3 Literature

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Figures

Tables

List of abbreviations

ABPI	Association of the British Pharmaceutical Industry
CH	Switzerland
CHF	Swiss francs
CPI	national consumer price index
EU	European Union
FCA	Federal Customs Administration
FOPH	Swiss Federal Office of Public Health
FSO	Federal Statistical Office
FTE	full-time equivalent
GDP	Gross domestic product
ICT	information and communications technology
IO model	input-output model
IT	information technology
KVG	Bundesgesetz über die Krankenversicherung (Swiss Federal Law on Health Insurance)
NOGA	General Classification of Economic Activities
R&D	research and development
RoW	rest of the world
SF Bay Area	San Francisco Bay Area
UK	United Kingdom
USA	United States of America
avg.	average
cf.	compare
fig.	figure
e.g.	for example
et al.	et alia
etc.	etcetera
hr(s)	hour(s)
i.e.	that is
incl.	including
m	million
bn	billion
p.a.	per annum
pp	percentage points
pub. admin	Public administration
tab.	table
thou.	thousand
vs	versus
Σ	total
Δ	difference
%	per cent

About Interpharma

Interpharma was founded in 1933 and is the association of research-based pharmaceutical companies in Switzerland. The 23 member companies account for more than 90 per cent of the market share for patented drugs in Switzerland and invest 6.5 billion Swiss francs per year in research and development in Switzerland. Interpharma is a driving force for efficient and high-quality healthcare that offers patients quick and easy access to innovative therapies and the best possible treatment. Our mission both at home and abroad is to ensure that patients receive first-class treatment, that innovations are rewarded and that our industry is able to contribute significantly to the welfare, growth and competitiveness of Switzerland.

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