The economic and societal footprint of the pharmaceutical industry in Europe

Technical Report
June 2019

pwc

Contents

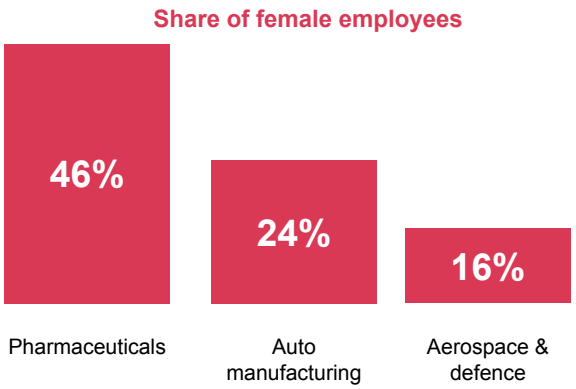
Pharmaceutical companies have created a thriving industry that makes an economic and societal contribution to the EU

We have shown that the whole of the pharmaceutical industry across the EU in 2016 contributed to ...

€206 billion
in Gross Value Added and ...

2.5 million
jobs

46% of people employed directly by the industry are women



Medicines benefit millions of people on a daily basis. In just a subset of medicines within HIV (HAART) and breast cancer (HER2+, HR+) we saw that ...

Over 650,000
people in the EU were treated with these medicines between 2007 - 2017, who are estimated to have gained around ...

2 million
healthy life years, leading to around ...

€27 billion
In productivity gains for EU economies, and approximately ...

€13 billion in healthcare cost savings due to avoided complications

Setting the scene

Highlighting the broader value that the industry delivers can contribute to more holistic dialogue and decision-making

- With **greater pressure on government finances**, the **public debate** has frequently turned on the **high prices** of new medicines
- This debate **ignores the direct and indirect benefits** that the industry brings to both the field of medicine and the wider patient population, all whilst overlooking the wider societal impact the industry has on economies
- To **highlight the broader value the sector delivers within the EU**, we have sought to demonstrate the economic, health and societal impact of the industry in Europe using several approaches. We consider:

The economic impact of the industry

The health and societal impact of the industry through the case studies on select therapeutic areas

The value pharmaceutical companies place on incentives, specifically IP incentives

Our analysis consisted of three main components: economic, health & societal, and the role of IP incentives

	Purpose	Methodology overview	Outputs
Economic	Demonstrate the current scale of the Pharmaceutical industry in the EU-28	PwC global input-output multiplier model to estimate pharmaceutical multipliers in each country Combining the multipliers with direct GVA and employment enables Indirect and Induced impacts to be measured	For the year 2016: ● Direct, indirect and induced GVA of pharmaceutical industry ● Direct, indirect and induced employment of pharmaceutical industry ● Estimates of labour productivity ● Comparisons to other major industries
Health & societal	For specific therapeutic areas (breast cancer, HIV), demonstrate the value that pharmaceutical innovation has brought through improved health outcomes and productivity gains	Incremental changes in health outcomes and costs based on reimbursement submissions and/or academic literature Estimate productivity based on work days gained due to avoided absenteeism Patient volumes based on IQVIA data	For patients being treated with selected medicines between 2007 and 2017, incremental changes in terms of: ● Healthy life years ● Productivity ● Change in healthcare system costs
Role of IP incentives	Understand the relevance and importance of IP incentives to pharmaceutical industry activity and investment in Europe	Survey of EFPIA corporate members	Opinions on, inter alia: ● Importance of IP incentives to R&D, manufacturing, commercial operations versus other factors ● Change in activity if IP incentives were to be phased out

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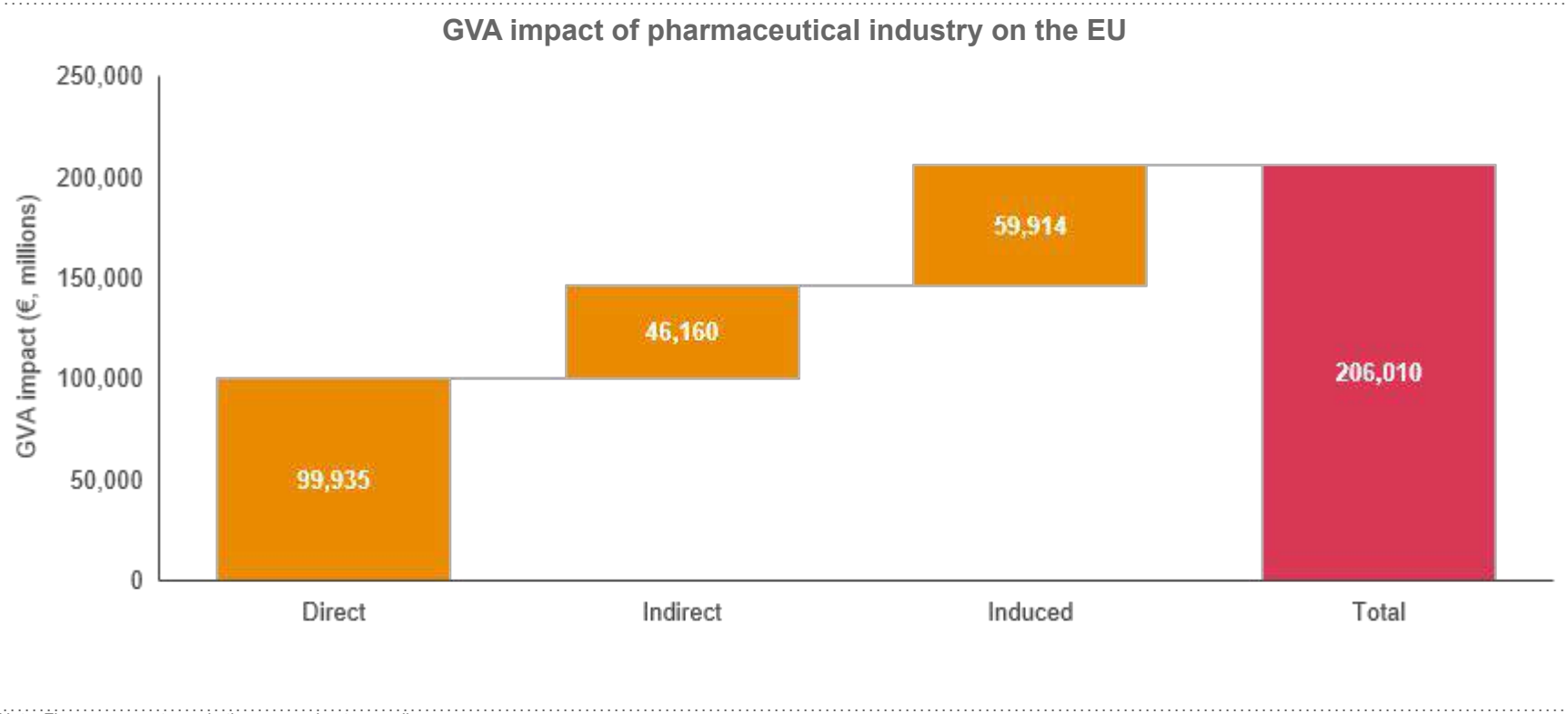
Economic impact assessment

The pharmaceutical industry supports a total of 1.4% of the EU's GDP

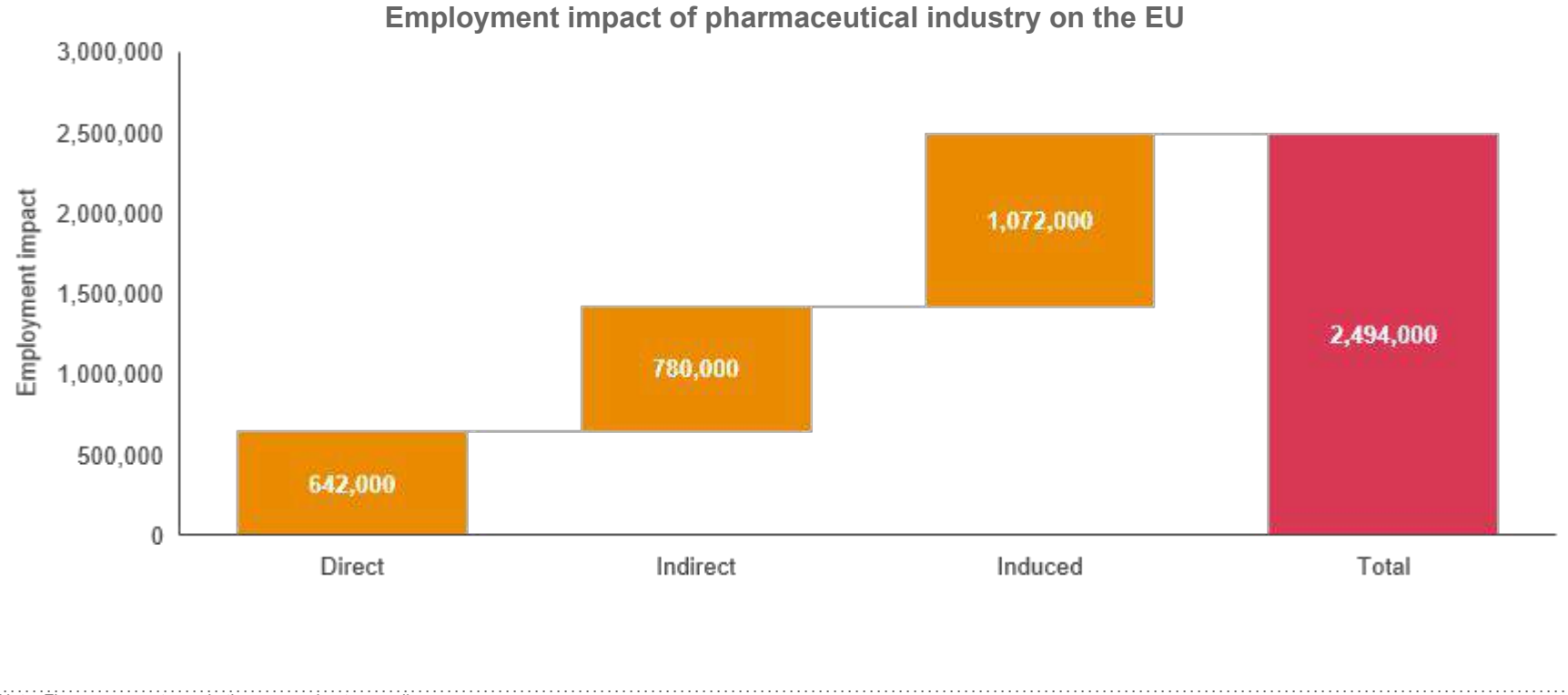
- The pharmaceutical industry contributed a total of €206 billion in GVA to the EU's economy in 2016.
- The industry directly contributes 0.7% of the region's GDP, while its total contribution is equivalent to 1.4% of the region's GDP.



Note: Figures may not equal other pages due to rounding.

The pharmaceutical industry supported nearly 2.5 million jobs across the EU

- The pharmaceutical industry contributed nearly 2.5 million jobs to the EU in 2016, many of which are high skilled and highly productive.
- The jobs supported directly by the pharmaceutical industry account for approximately 0.2% of the region's employment, while its total contribution is equivalent to 0.9% of the region's employment.



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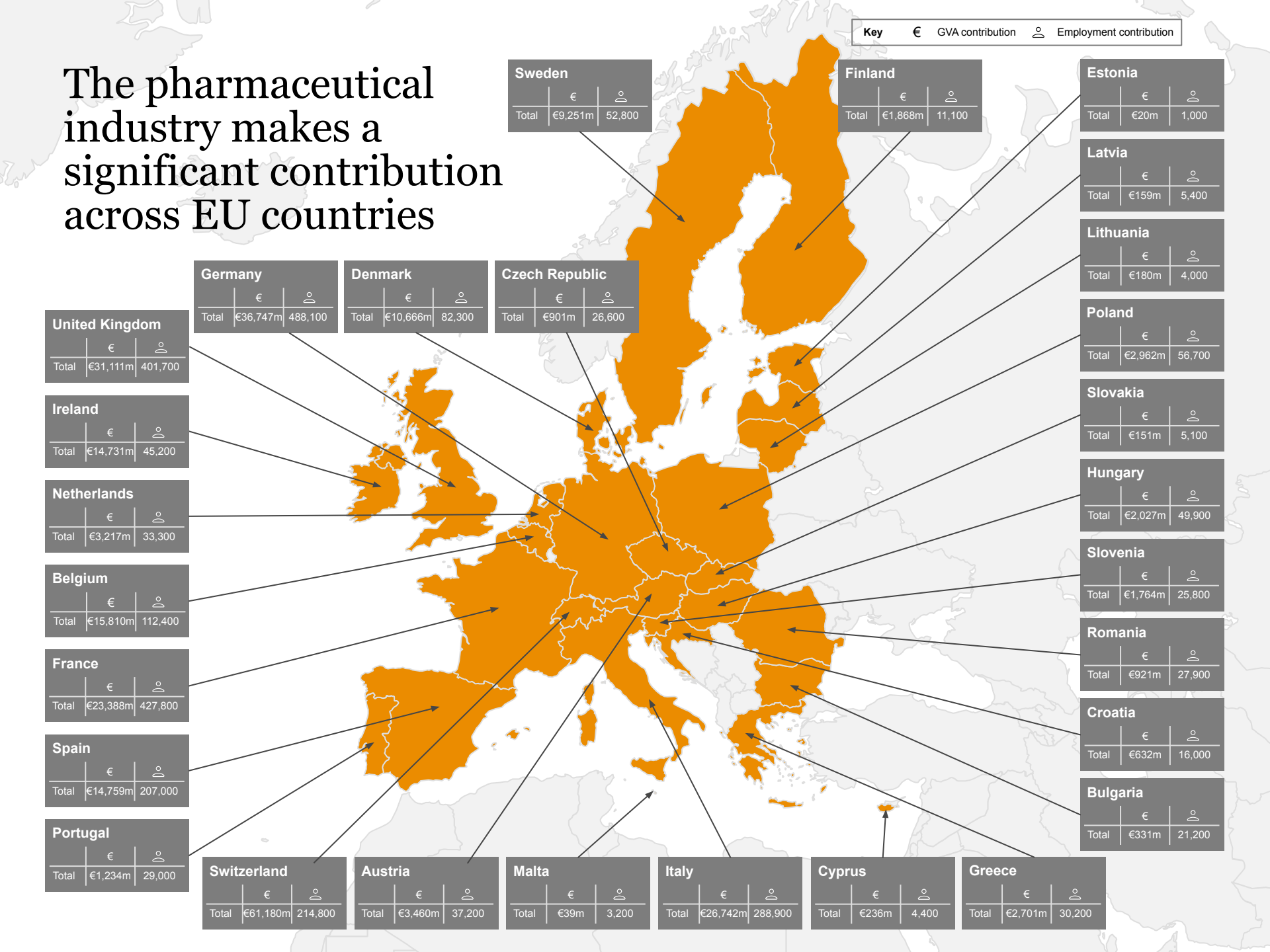
The pharmaceutical industry makes a significant contribution across EU countries



The pharmaceutical industry is highly productive, and directly employs a large number of highly skilled staff (1)

Pharmaceuticals

€100bn
Direct Gross Value Added (2016)

642,000
Direct Employment (2016)

€156,000
Value added per employee

Automotive manufacturing

€211bn
Direct Gross Value Added (2016)

2,480,000
Direct Employment (2016)

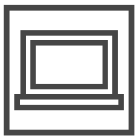
€85,000
Value added per employee

Aerospace manufacturing

€45bn
Direct Gross Value Added (2016)

410,000
Direct Employment (2016)[1]

€102,000
Value added per employee



Computer programming

€261bn
Direct Gross Value Added (2016)

3,180,000
Direct Employment (2016)[1]

€82,000
Value added per employee

1. Eurostat do not publish a figure for 2016. We have estimated aerospace employment for 2016 using the GVA growth rate, as 2016 data is not available.
Source: Eurostat, PwC analysis. Note: we have selected comparator industries which are important to the economy, high value, and with a significant international presence. Our analysis suggests that the pharmaceutical industry (defined by NACE code C21) has one of the highest rates of productivity of any industry.

The pharmaceutical industry is highly productive, and directly employs a large number of highly skilled staff (2)

Pharmaceuticals

€100bn
Direct Gross Value Added (2016)

642,000
Direct Employment (2016)

€156,000
Value added per employee

Telecommunications

€163bn
Direct Gross Value Added (2016)

1,010,000
Direct Employment (2016)

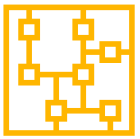
€161,000
Value added per employee

Architectural and engineering activities

€178bn
Direct Gross Value Added (2016)

2,520,000
Direct Employment (2016)[1]

€71,000
Value added per employee



Information service activities

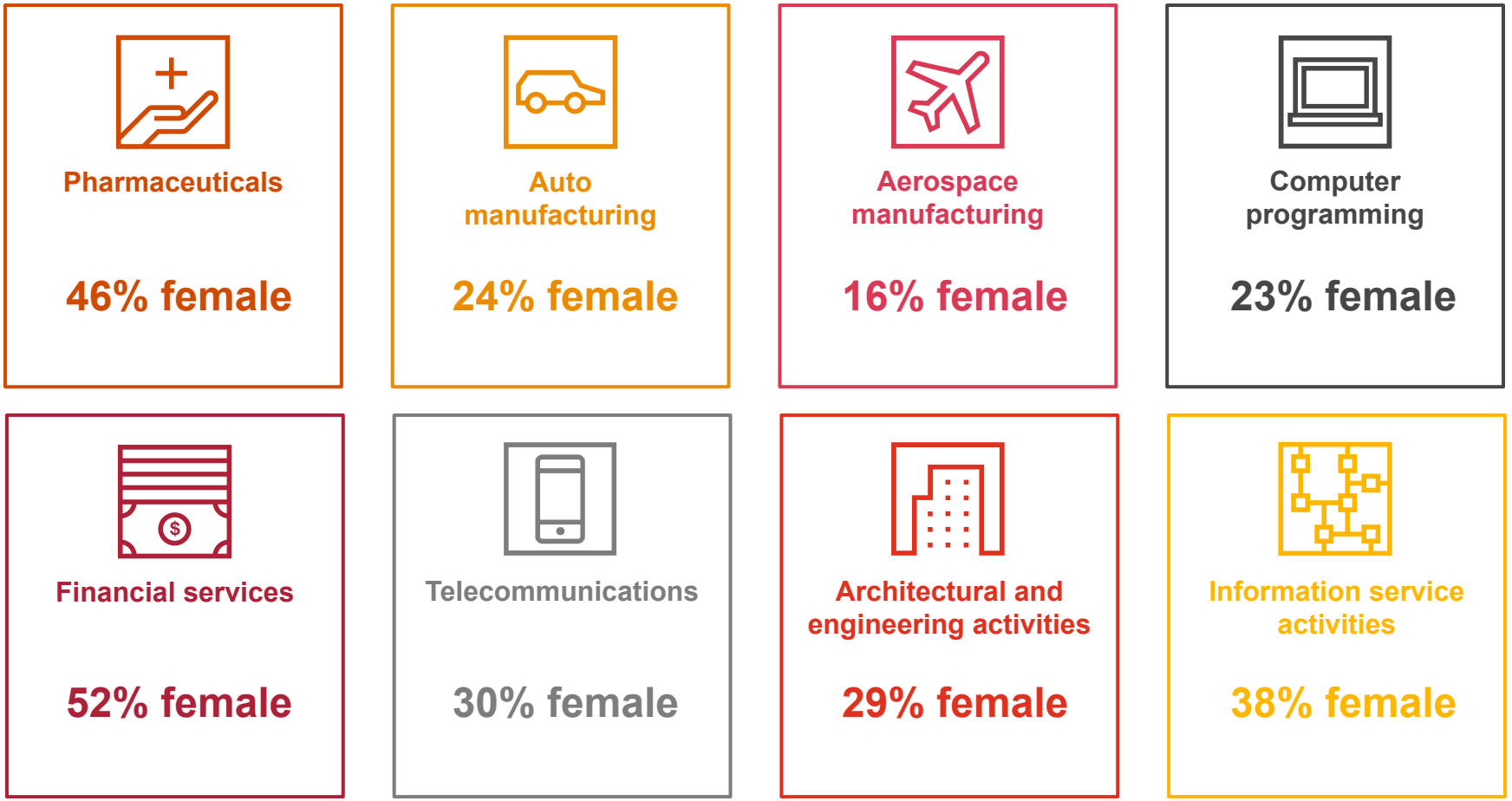
€40bn
Direct Gross Value Added (2016)

500,000
Direct Employment (2016)[1]

€80,000
Value added per employee

1. Eurostat do not publish a figure for 2016. We have estimated aerospace employment for 2016 using the GVA growth rate, as 2016 data is not available.
Source: Eurostat, PwC analysis. Note: we have selected comparator industries which are important to the economy, high value, and with a significant international presence. Our analysis suggests that the pharmaceutical industry (defined by NACE code C21) has one of the highest rates of productivity of any industry.

The pharmaceutical industry has a higher proportion of females in its workforce than many other key industries



Impact of the Orphan Regulation

Orphan diseases affect 30 million people in the EU and treatment options are limited or non-existent

To qualify for orphan designation in the EU, the prevalence of the condition cannot be more than 5 in 10,000.

More than half of newly diagnosed cases are in children, 1 in 3 of which will die before their 5th birthday

Fewer than 15% of orphan diseases benefit from even minimal amounts of scientific knowledge

95% of rare diseases have no approved therapies

Ronny, diagnosed with neuroendocrine tumors, a type of orphan cancer

"I did what people do in movies and asked how long I had to live. And the oncologist said: "months, years…" And I kind of switched off after that. But what he did say after that was: "But with the right treatment you could live a lot longer."

Because I had access to the right treatment at the right time, I'm now living a reasonable quality of life and have been able to do things."

In this context, orphan incentives are of particular importance...

In this field, the most relevant incentive is the EU Orphan Regulation, which provides 10 years of market exclusivity to such medicines, alongside protocol assistance, reduced fees for regulatory activities, and additional incentives for SMEs. This regulation has both encouraged the development of medicines used to treat rare disease, and supported the establishment of SMEs focused on the research and discovery of orphan drugs.

Sources: European Medicines Agency, EvaluatePharma Orphan Drug Report 2015/2018.

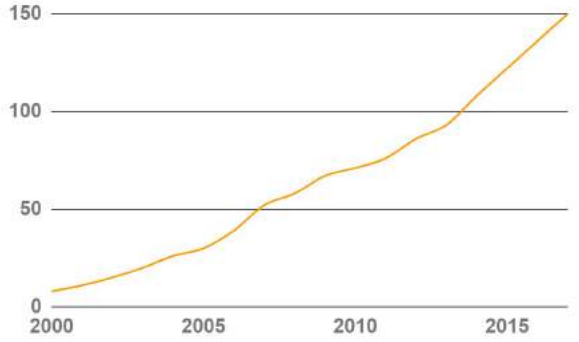
Since the adoption of the Orphan Regulation in late 1999, the number of orphan medicines in the EU has risen steadily

Prior to 2000, only 8 products had been authorised to treat rare diseases in the EU. Now there are over 150.

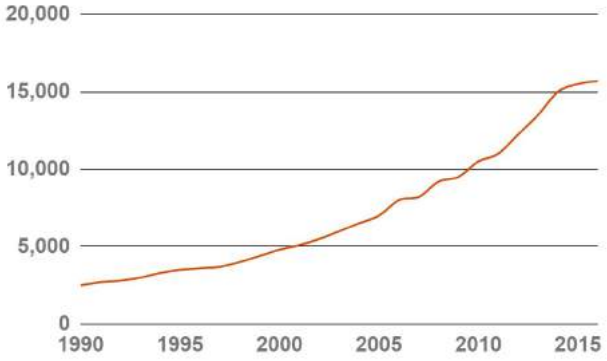
The number of medicines granted orphan designation by the European Commission has risen year on year - this suggests a greater number of higher quality applications

The benefits have also been seen in research and development - the number of scientific publications on rare diseases has risen at faster rate since 2000

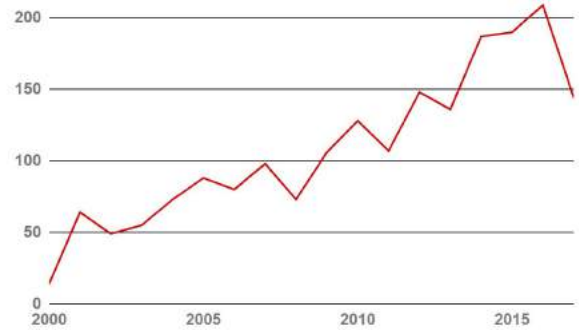
Cumulative number of authorised orphan medicines in the EU



Worldwide number of scientific publications on rare diseases



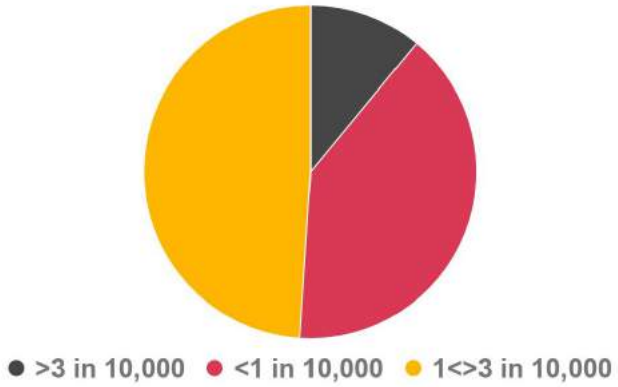
Number of orphan designations approved by the European Commission



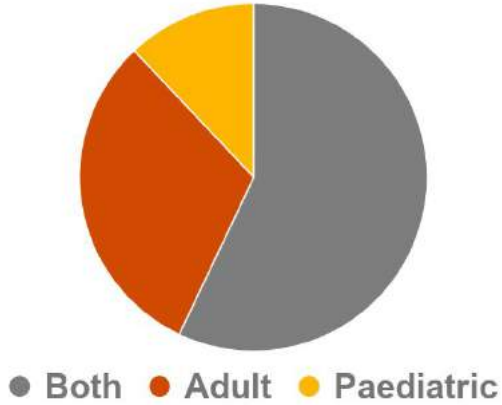
Sources: European Medicines Agency, EvaluatePharma Orphan Drug Report 2015/2018, PubMed.

Existing orphan medicines treat a wide variety of indications, with many focusing on orphan cancers

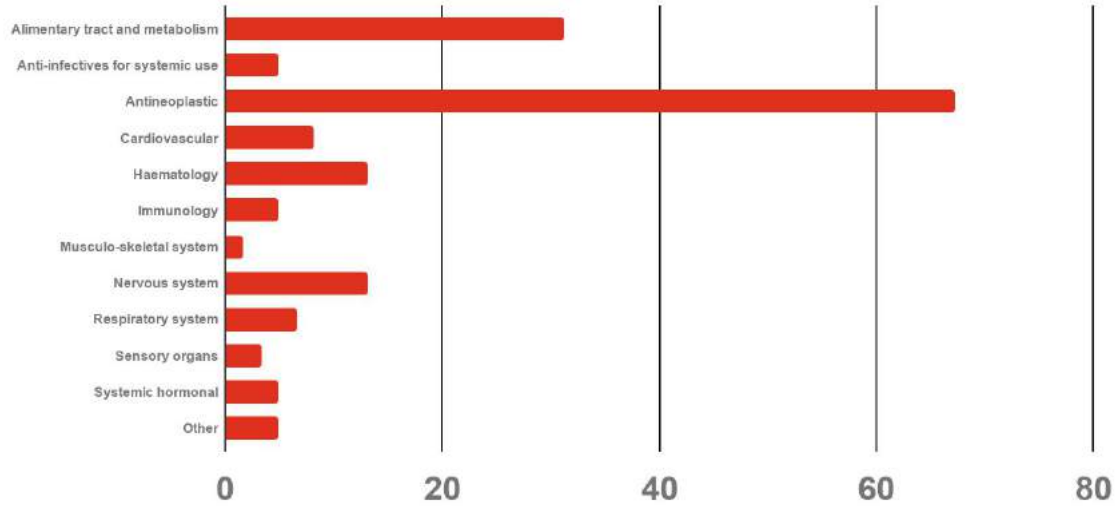
Prevalence of designated orphan conditions from 2000 to 2018



Intended patient group for orphan designations from 2000 to 2018



Number orphan medicines with marketing authorisations by therapeutic area



- **The majority of orphan designations from 2000 to 2018 were designed for conditions affecting less than 3 in 10,000 people**
- **Orphan cancer medicines account for over 40% of all orphan medicines**

Source: European Medicines Agency

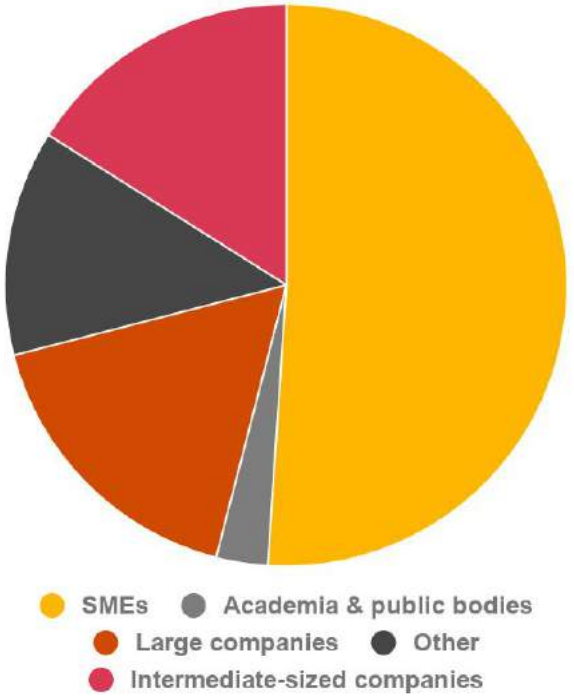
The Orphan Regulation has added benefits for SMEs not available to larger companies

SMEs* benefit from reduced fees for key services, including scientific advice, pre- and post-authorisation procedures, and applications for marketing authorisations

In 2015, protocol assistance for orphan drugs developed by SMEs represented 44% of all protocol assistance procedures

More than half the medicines receiving orphan designation are developed by SMEs

Types of organisations with orphan designations in development from 2002 to 2012

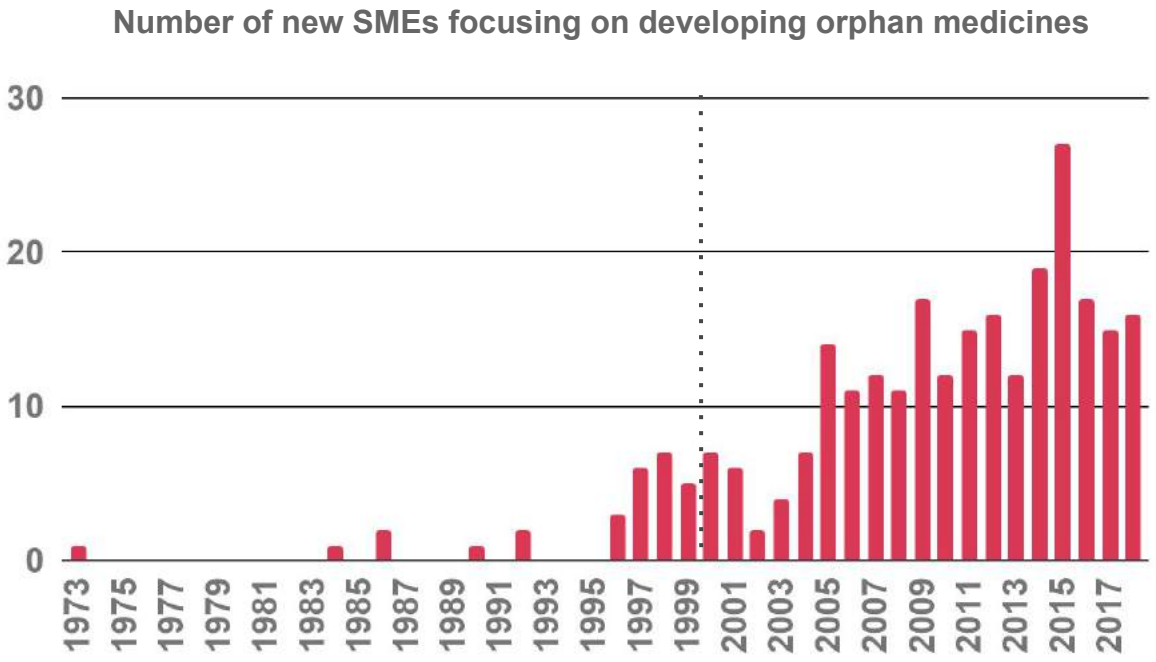


*SMEs are defined as enterprises with fewer than 250 employees and either an annual turnover of not more than €50 million or an annual balance-sheet total of not more than €43 million.

Sources: European Medicines Agency 'Report on the 10th anniversary of the SME initiative', 2016
Morel. T 'Regulatory watch: the orphan drug pipeline in Europe', 2016
CRA Report: 'An evaluation of the economic and societal impact of the orphan medicine regulation',2017

Since the Orphan Regulation was introduced, there has been a significant rise in orphan-focused SMEs

- One potential **attraction of orphan medicines to SMEs** is the opportunity to **attract early investment**
- **Venture capitalists investing** in orphan medicine startups typically do so **on average one year before** they would in a non-orphan medicine equivalent (CRA, 2017)



There has been a notable increase in the number of SMEs developing orphan medicines since 2000. The 248 SMEs started since the introduction of the Orphan Regulation employ over 8,700 people.

Sources: European Medicines Agency SME Register, CRA Report: 'An evaluation of the economic and societal impact of the orphan medicine regulation' - 2017

In summary, the Orphan Regulation is fundamental to creating a dynamic market for orphan medicines developers

Orphan diseases represent a **significant unmet need** - **30 million people** in the EU

The Orphan Regulation has helped to **address market failures in order to tackle this unmet need**, as evidenced by the increase in orphan medicines since its introduction

The Orphan Regulation has been **particularly valuable to SMEs** who can operate in a wide breadth of niche disease areas with less direct competition

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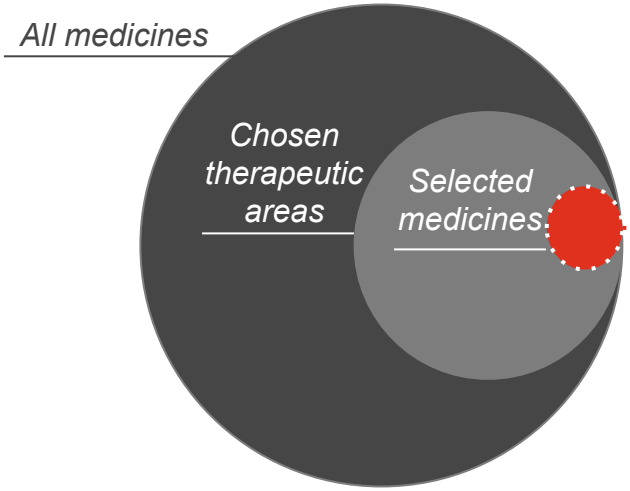
Case studies

Beyond the huge contribution to the European economy, the pharmaceutical industry provides major health and societal benefits to the lives of millions of European residents

We present case studies on a selection of innovative medicines in two therapeutic areas, which represent different diseases profiles (non-communicable and communicable, acute and chronic). While representing only a fraction of the benefits, our analysis intends to bring some of these benefits to life.



Impact of selected medicines

~ Over 1.9m healthy life years[1] are expected to be gained; **273,000 associated** with patients **starting treatment in 2017** alone.

The medicines we explored delivered expected productivity gains of approximately **362,000 additional working years**, which is worth **€27 billion to the EU economy**.

Directly related complications avoided as a result of these treatments are associated with **€13 billion in avoided healthcare costs.**

'Healthy life years' is used as the plain english equivalent refers to of the technical term: Quality-Adjusted Life Years (QALYs). The QALY is a widely used health outcome measure which reflects both the length and quality of life lived. One healthy life year is the same as one QALY and is equal to 1 year of life in perfect health. Or, for example, 2 years living with a severe illness which reduces quality of life by 0.5.

Our selected therapeutic areas cover different disease profiles

Our chosen therapeutic areas (breast cancer and HIV) cover different disease profiles, both non-communicable and communicable, acute and chronic that affect different age and socioeconomic groups.

Selection of medicines within therapeutic areas

Within the therapeutic areas, we selected a subset of medicines that represent an innovation in their field of medicine that addressed a previously unmet patient need.

Therapeutic area	Breast cancer	HIV
Category of drug	Adjuvant HER2+ and HR+ therapies	Highly active antiretroviral therapy (HAART)
Specific medicines	• trastuzumab • pertuzumab • trastuzumab emtansine • ribociclib • palbociclib • lapatinib	• emtricitabine/eilpivirine/tenofovir disoproxil • elvitegravir/cobicistat/emtricitabine/tenofovir alafenamide (as fumarate) • dolutegravir/abacavir/ lamivudine • efavirenz/ emtricitabine/tenofovir disoproxil (as fumarate)
Standard of care comparator	Typically chemotherapy, tumour resection and radiotherapy (where possible)	Dual NRTI therapy without protease inhibitors

Breast cancer

Prior to 2005, certain types of breast cancer had little in the way of treatment options beyond ineffective chemotherapy

Comparator standard of care (SoC)

Differs by medicine, typically includes:

- Tumour resection and radiotherapy where possible
- Pre- and post- surgical non-targeted adjuvant therapy

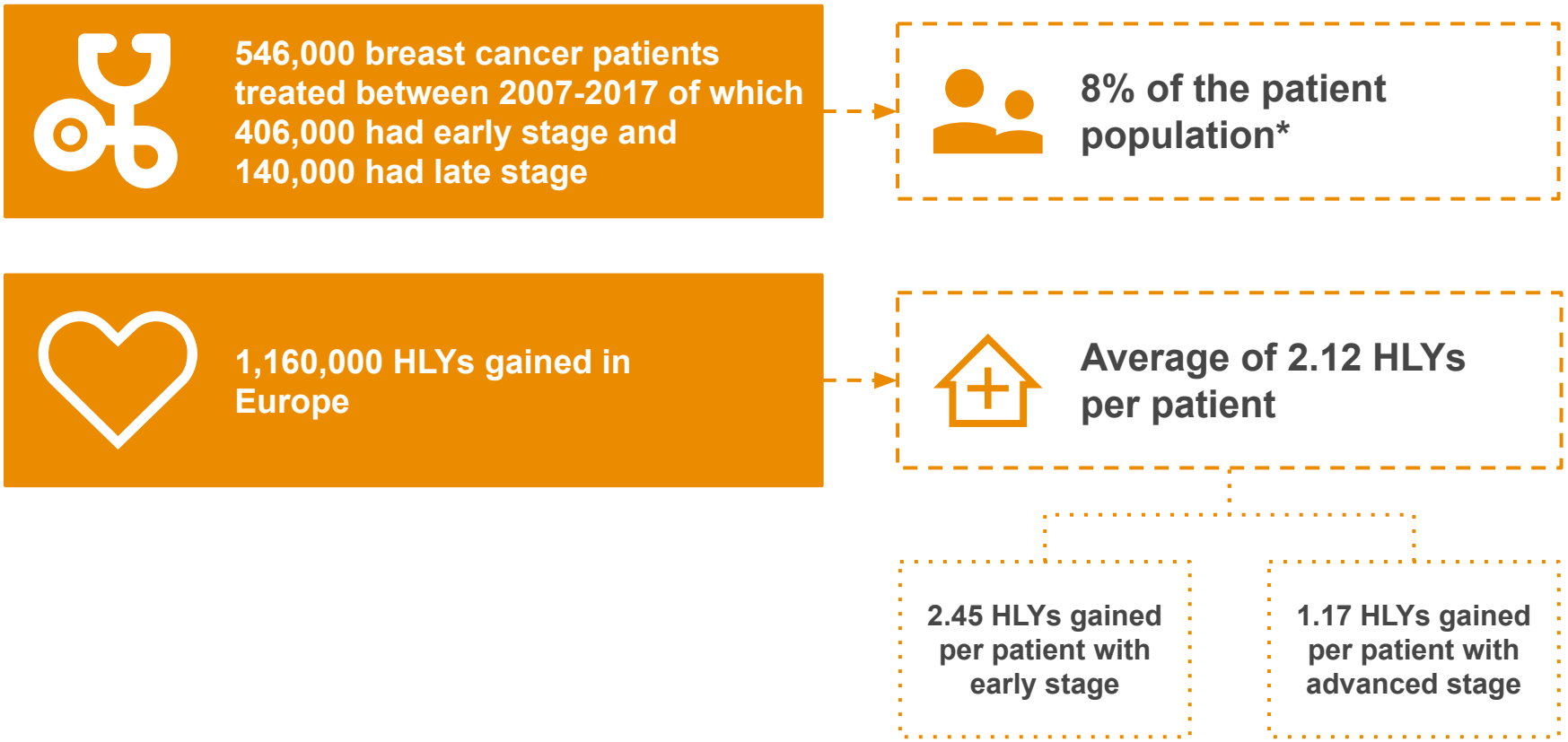
Medicines analysed

Adjuvant therapy that is targeted to the cancer's phenotypic profile (HER2+, HR+)

Unmet Need

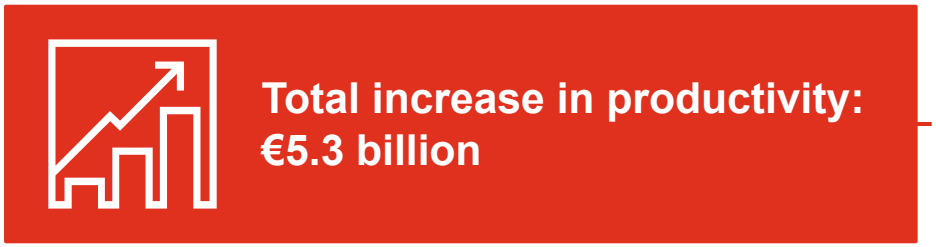
- The subset of medicines we analysed **addressed unmet need** in terms of early and advanced HER2+ and advanced HR+ breast cancer.
- Prior to 2005, **there were few treatments targeting these aggressive forms of breast cancer**.
- The chemotherapy available had poor response rates with overall survival at around 20 months.
- The medicines we selected represent evolutionary therapies that represent the **first antibody targeted therapies** approved in this field of cancer and their subsequent innovations.

The advent of HER2+ and HR+ targeted treatments have resulted in the gain of over 1 million HLYs in Europe



***With only c. 4% of patients with advanced breast cancer eligible for HER2+ treatment, and 10% of patients with early stage cancer eligible for HER2+ treatment, this is a significant proportion of the eligible population**

Thanks to an increase in working days, these medicines enable productivity gains of approx €9,700 per patient

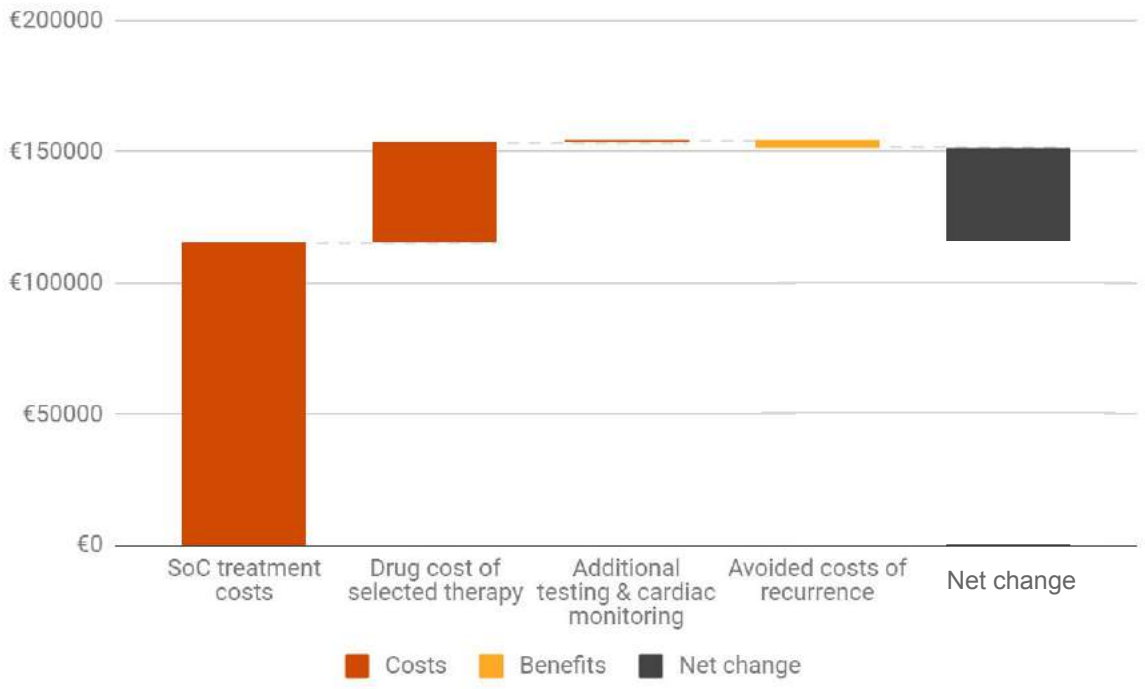


Productivity gain is only expected for patients with early breast cancer. We assume there are no productivity gains for patients with advanced cancer as treatments are only administered in final few months of life. We assume that the action of the two early breast cancer treatments on the duration spent at each stage of the disease is similar, and therefore so is their effect.

*Source: Luengo-Fernandez et al. 2013. Economic burden of cancer across the European Union: a population-based cost analysis.

These medicines result in additional drug and testing costs, but fewer costs of recurrence for early stage patients

Net change in healthcare costs for breast cancer is estimated at €36,200 per patient (see Appendix 2 for details on methodology and assumptions).



Additional drug and testing costs of €39,400 per patient are partially offset for early breast cancer by avoided costs of recurrence of €3,200

These innovations deliver a wider impact on both patient family members and the broader cancer population

Improved health **alleviates burden** on primary caregivers. One study found that **among breast cancer caregivers, 30% suffered from depression** and almost 80% of employed caregivers missed work.

Four biosimilars of trastuzumab have recently made it to market, indicating a **drive from pharmaceutical companies to continue delivering impact**.

These **innovations paved the way** for targeted treatment across all different cancer types.

Suzanne's story: For the chance to become a grandmother

When Suzanne found out at the end of her early breast cancer treatment that she had metastasis in her lungs, the first thought that crossed her mind was that she wanted to see her grandchildren one day. Fortunately, her oncologist opted for curative treatment, and five years later, her cancer is still inactive.

Suzanne wants to raise awareness that living with cancer is more than just a medical problem - it limits professional opportunities, reduces patients' contribution to society, restricts quality of life and traps people in financial insecurity and emotional isolation fuelled by unawareness.

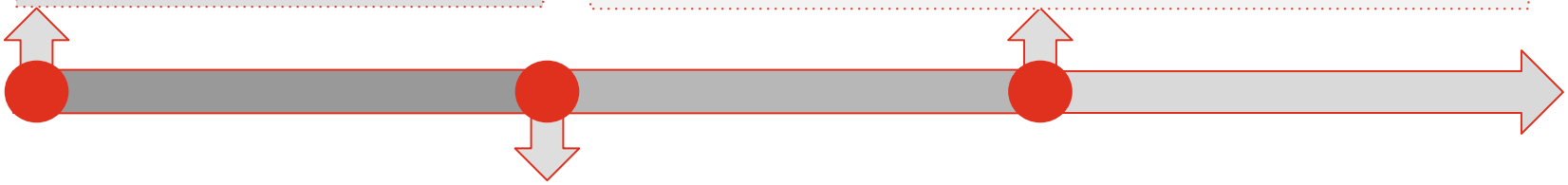
HIV

Thanks to pharmaceutical innovation, HIV has transformed from a death sentence to a treatable, chronic disease

Timeline of HIV treatment development

Early 1990s: Mainstream practice was dual therapy combining two NRTIs, AZT with zalcitabine (ddC) or didanosine (ddI).

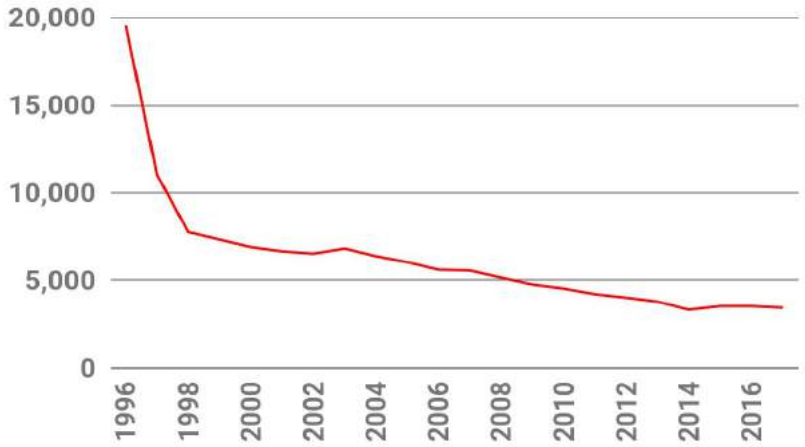
2000s onwards: Backbone therapies made over this time period became more efficacious with fewer side effects. Major drug developments have been the ability to combine triple therapy into a single tablet (STR), as well as CCR5 and integrase inhibitors.



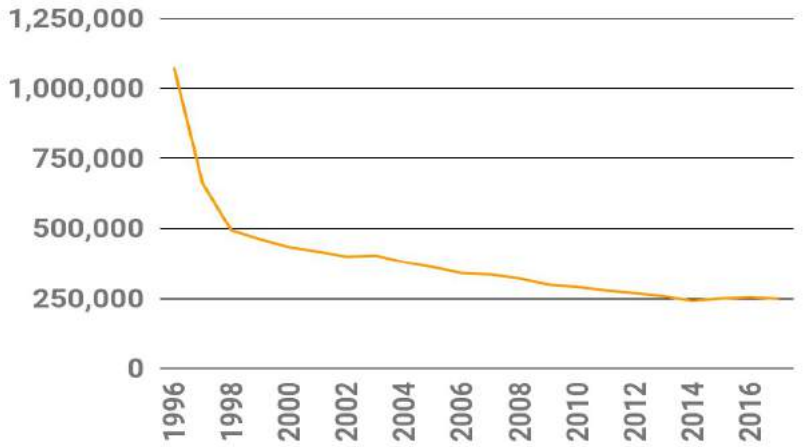
Mid 1990s: Advent of triple therapy, later called HAART, thanks to the development of protease inhibitors, the first of which was saquinavir. Early forms of HAART later saw great improvement through the creation of PI-boosters and the development of the back-bone NRTIs.

Thanks to pharmaceutical innovation, HIV has transformed from a death sentence to a treatable, chronic disease

HIV/AIDS-related deaths*



Burden of disease (in DALYs) for HIV/AIDS**



Patrick's story: Living with HIV evolved so quickly

Patrick Reyntiens was diagnosed as HIV-positive in 1985. At the time, the disease was close to a death sentence. The great breakthrough came in 1996, with the introduction of 'AIDS Cocktails' (early HAART). Initially, Patrick was on 20 - 30 pills a day. Patients felt sicker on the medication than from the virus itself. These days, Patrick takes only five pills. Many patients only have to take one. Patrick's quality of life has improved enormously. He takes time to raise awareness of HIV. He's hopeful treatment will continue to improve and there might even be a cure one day.

*Source: Our World in Data - statistics included for Western Europe 1996 - 2017
**Source: Global Health Data Exchange - statistics included for European Union 1996 - 2017

The impact of HAART relative to historic dual NRTI therapies without protease inhibitors has been significant

Comparator standard of care (SoC)

Dual NRTI therapy without protease inhibitors, for example zidovudine and zalcitabine or didanosine.

Medicines analysed

Fixed dose combinations of the molecules that form HAART therapy, called single tablet regimen (STR).

Unmet Need

- The subset of medicines we analysed **addressed an unmet need** in terms of HIV treatment.
- Prior to the advent of HAART, an **HIV diagnosis was considered** by many to be **a death sentence**.
- In the early 1990s, dual NRTI therapy (AZT with zalcitabine or didanosine) was the SoC and it presented limited success in lowering viral load and was accompanied by severe side effects.
- Now there are more than 30 HIV drugs available, we have chosen to focus on STRs because:
  - They **present efficacious treatment with the lowest toxicity profile**
  - This class of medicines overcome the biggest challenge facing HIV drug development, targeting the HIV virus without the cost of patient toxicity

The advent of HAART therapies have resulted in the gain of nearly 800,000 HLYs in Europe

***The medicines we have chosen are single tablet therapies. Many people are treated with multi tablet regimens with the same active ingredients**

Thanks to an increase in working days, average productivity gains per patient were around €200,000

Increase in productivity per patient expected to result in gains of €22 billion

Over 6 years of potential productivity gained per patient

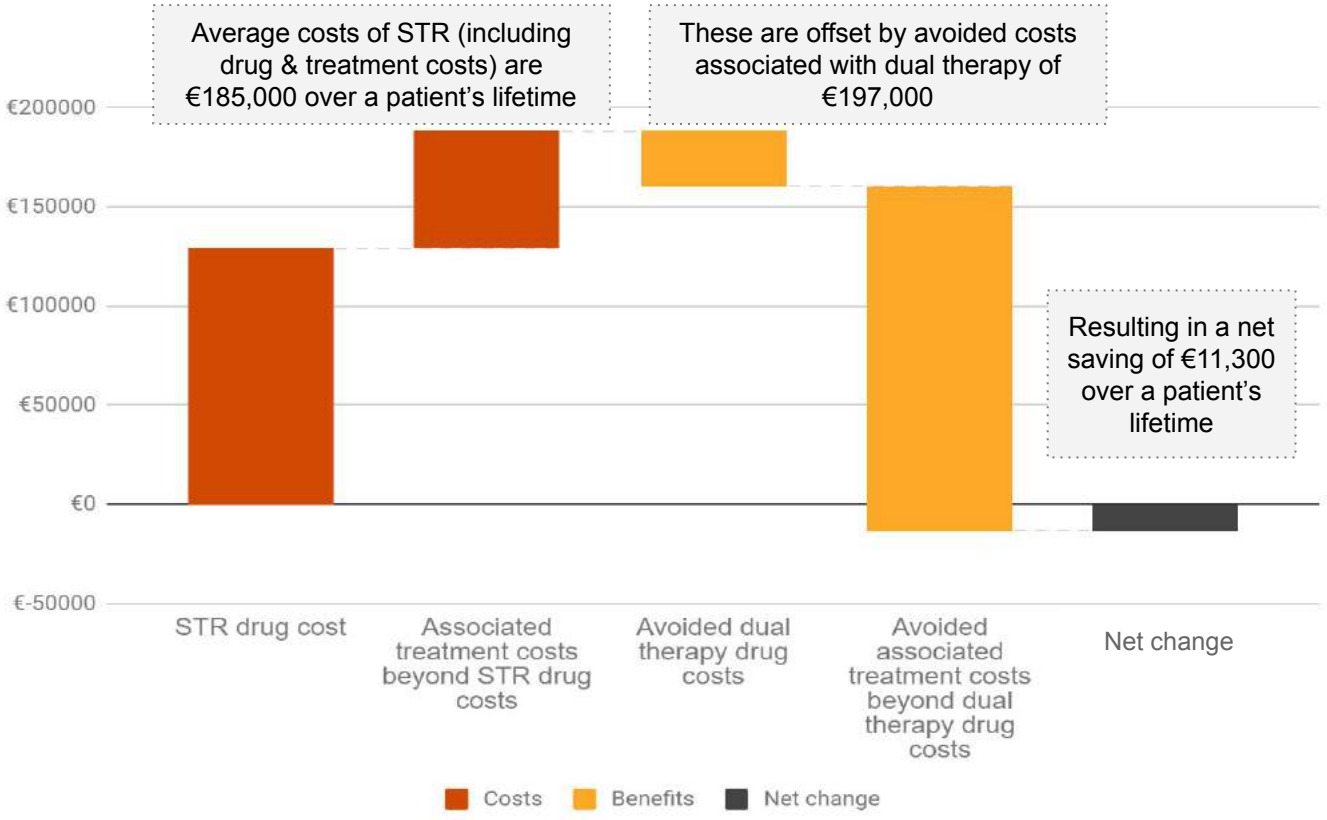
Our assessment relative to dual NRTI therapy reveals a net cost reduction over a 30 year time horizon

Increased cost of medicines is significantly offset by reduced treatment costs

There could be a net saving in healthcare of around €11,000 per patient

Our current assessment relative to dual NRTI therapy reveals a net cost reduction over a 30 year time horizon

In our base case scenario, the estimated net change in healthcare costs for HIV is -€11,300 per patient, or -€376 per year. See Appendix 2 for more details on methodology and assumptions.

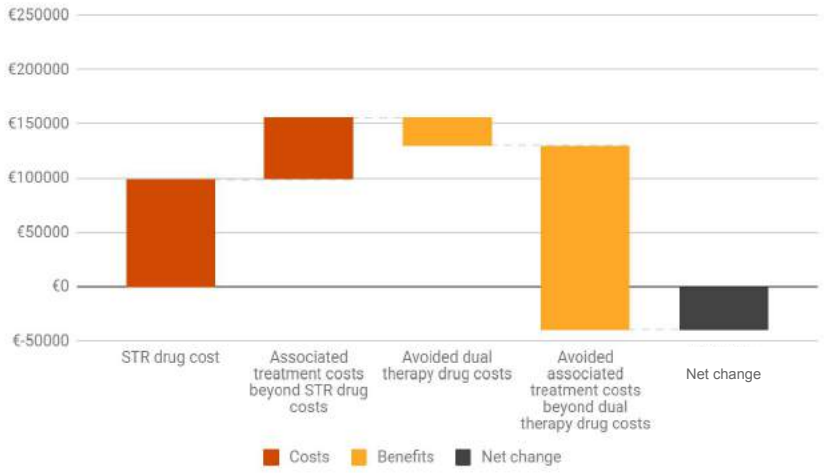


NB: The incremental cost shown here does not capture non-HIV-related lifetime healthcare costs, which are expected to be higher under the selected medicines due to extension of life

…. however, the net impact on healthcare costs are sensitive to assumptions

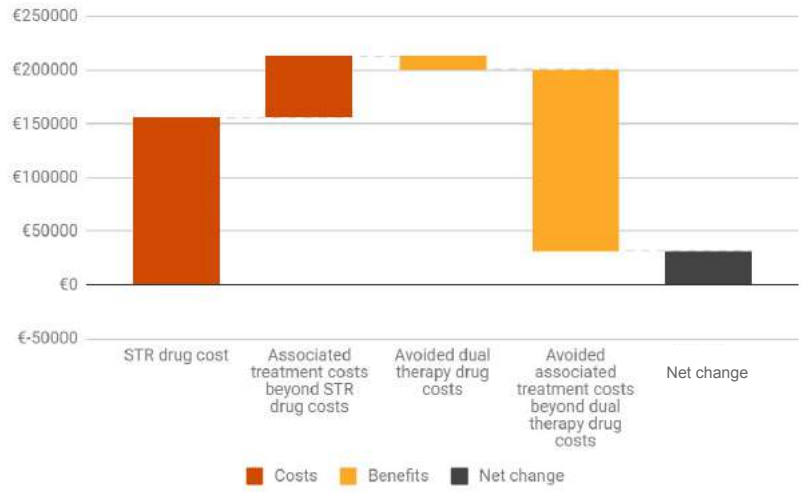
The estimated impact on healthcare costs is highly sensitive to assumptions because the assumptions are applied over a long period of 30 years (the length of the assumed treatment duration). Sensitivity analysis suggests that the net position in terms of healthcare costs could be an even higher net saving or a potential net cost, depending on the assumptions applied.

Optimistic scenario: - €40,000 per patient (net saving)



Assumptions:
- 80% price drop post loss of exclusivity (LoE) for STRs
- No discount on list price for dual therapy

Pessimistic scenario: +€31,000 per patient (net cost)



Assumptions:
- 20% price drop post LoE for STRs
- 50% discount on list price for dual therapy

These innovations have potential further impact in terms of inequalities in health and on HIV transmission rates

Health inequality

- HIV infection is higher in more vulnerable groups of society, particularly those from a lower socioeconomic background.
- Gains in HIV treatment could thus **disproportionately benefit a lower socioeconomic group**.

Transmission rates

- HAART could have a wider impact on HIV transmission rates in Europe through lowering virologic load to undetectable levels and through their use as post-exposure prophylaxis.
- At undetectable levels, risk of transmission can be considered negligible.
- Reduced transmission could **lower overall HIV prevalence** and therefore lessen its health burden in the European population.

d

Role of IP incentives

A survey of EFPIA corporate members provides insight into the importance of the European incentives model

Research and development of new medicines can be a long, complex, risky - and ultimately expensive (at around $2bn* to bring a drug to market) - process

The European incentives model is designed to encourage continued innovation by providing additional protection to medicines (that make it to market) from competition

To help understand the importance of the current incentives model, and the potential effects of dismantling it, we undertook a survey of 18 EFPIA corporate members

Incentives explored in the survey

Supplementary Protection Certificates (SPC) refer to the exclusivity period provided under EU law, to partly offset the loss of patent protection time for pharmaceutical and plant protection products that occurs due to the compulsory lengthy testing and clinical trials process these products require in order to obtain marketing authorization

Regulatory Data Protection refers to protection of drug safety and efficacy data submitted for market approval (8 years of data exclusivity +2 (+1) years of marketing protection)

Orphan Market Exclusivity refers to the 10 year market exclusivity and specific development support for medicines granted orphan designation

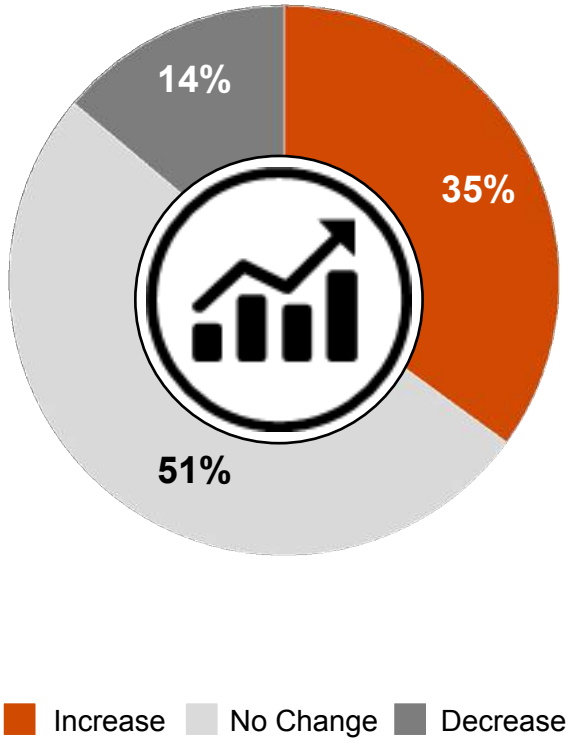
Paediatric Rewards refers to the rewards for conducting paediatric studies as required by the EMA i.e. a six month extension of SPCs or, in the case of orphan medicines a 2 year extension of the orphan market medicines exclusivity period

*Source: DiMasi et al. (2016) Innovation in the pharmaceutical industry: new estimates of R&D costs

Respondents indicated that they have increased investment in the EU over the past three years

Change in European footprint

% or respondents reporting a change in the last 3 years



Key Insights

- **More than twice as many increases in activity or investment compared to decreases** over the last three years, indicating that the industry is generally expanding its European footprint
- **R&D and Commercial are the segments of the value chain that have benefited most from this trend** as a result of maturing pipelines, incremental investments in existing facilities and capabilities, new product launches and partnership-led R&D approaches

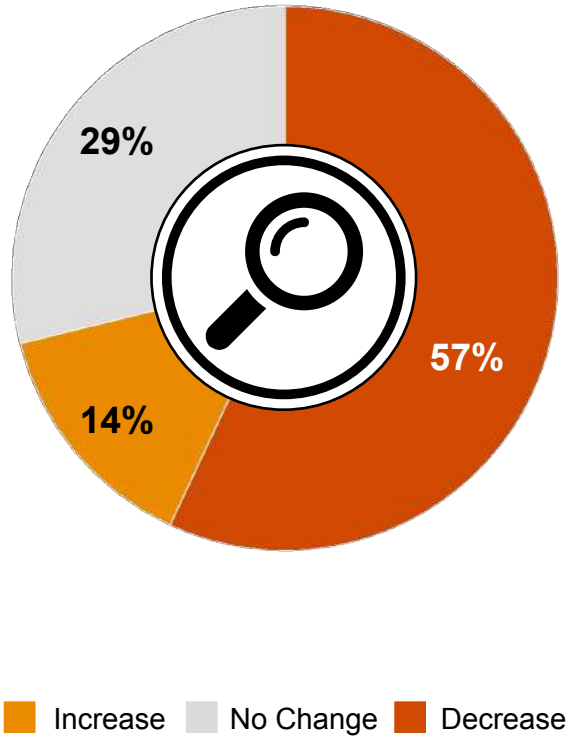
> *"We made multi-million € investments focused on modernizing existing R&D facilities, ramping up R&D activities, and enhancing R&D capabilities"*

> *"Investments have been increased by more than 10% per year over the last 3 years to launch new products, continue increasing our investments in our existing portfolio, support the creation of new affiliates, and reinforce our expertise and global organisation"*

Companies described moving towards a narrower R&D focus with resources concentrated in core therapeutic areas

Change in R&D focus

% or respondents reporting a change in number of TAs



*Source: Sawyers C. Targeted cancer therapy. Nature. 2004 Nov;432(7015):294.

Key Insights

- **Over two thirds report having changed R&D focus** in the last five years.
- Of those, the overwhelming **majority opted for a narrow R&D focus** and decreased the number of therapeutic areas in which they were active. Targeted therapies have been shown to be more effective[1]

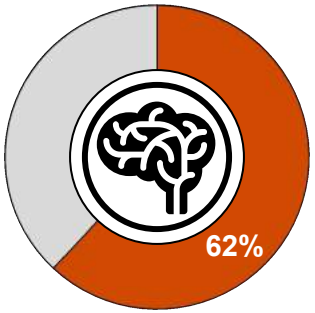
> *"We have reduced the overall number of therapeutic areas for internal R&D in general, but are investing more in these fewer areas."*

> *"We made investments in more targeted therapies with better patient outcomes for specific populations. We aim to cover therapeutic areas with the highest unmet medical needs."*

Companies indicated incentives and quicker market access are the leading factors influencing R&D investment decisions

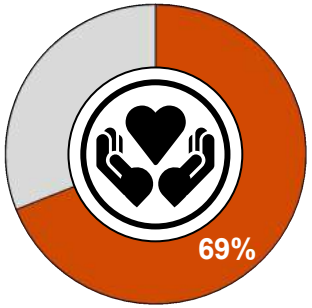
	Overall Rank
IP Incentives	1
Accelerated approval / early access schemes	2
Skills and wage costs of labour	3
Size of economy and potential for growth	4
Macro-economic / political issues (e.g. inflation, political uncertainty)	5
Attractiveness to conduct clinical trials	6
Tax rates	7
Infrastructure and transport	8

Ranking in Top 3 (%)



IP Incentives

Important across the value chain, crucial in influencing R&D and Commercial investment decisions.



Accelerated approval / early access schemes

Important factor in influencing R&D and Commercial investment decisions, less so for Manufacturing.

Dismantling the current incentive model would have a negative impact on pharmaceutical companies' R&D activity

Scenario

Existing IP incentives are phased out in Europe over a period of 4-5 years. Other factors remain the same, including funding for medicines and market access / reimbursement hurdles for innovative medicines.

Over half of respondents suggest this would lead to a **reduction** in their R&D and Commercial footprints **of over 25%**

Conclusions

Incentives are important to ensuring the pharmaceutical industry continue to deliver broader value to the EU

The current incentives model is important to ensuring continued R&D investment by the pharmaceutical industry in Europe

Innovation has brought health benefits to patients with previously unmet needs and fostered a thriving industry that significantly contributes to European GDP and jobs

The benefits go beyond what we have quantified: improved psychosocial health of patients and carers, contribute to the informal economy, and stimulate innovation across different medical disciplines

Appendix 1: Economic impact assessment methodology

We have estimated the size of the economic contribution of the pharmaceutical industry in Europe

We have estimated the economic contribution of the pharmaceutical industry (defined here as the pharmaceutical and life science companies developing and distributing medicines and vaccines) to the economies of Europe. We have estimated this contribution using input-output analysis, in terms of both **GVA** and **employment**.

- GVA captures the gross economic contribution that a sector makes to the economy, in terms of the value that its activities add to overall economic output. GVA is broadly equivalent to GDP but it excludes some indirect taxes. It is commonly used to measure the value of a company or sector of the economy for whom it is difficult to attribute certain taxes.
- Employment captures the number of people who work for a sector, who have a contract of employment and receive compensation in the form of salaries.

We have demonstrated that the pharmaceutical industry makes a significant contribution, both at a country and regional level. We have also shown the high value nature of the jobs created by the industry.

We have extended the analysis by comparing the contribution of the pharmaceutical industry with other key and/or industrial industries, such as automotive manufacturing and financial services.

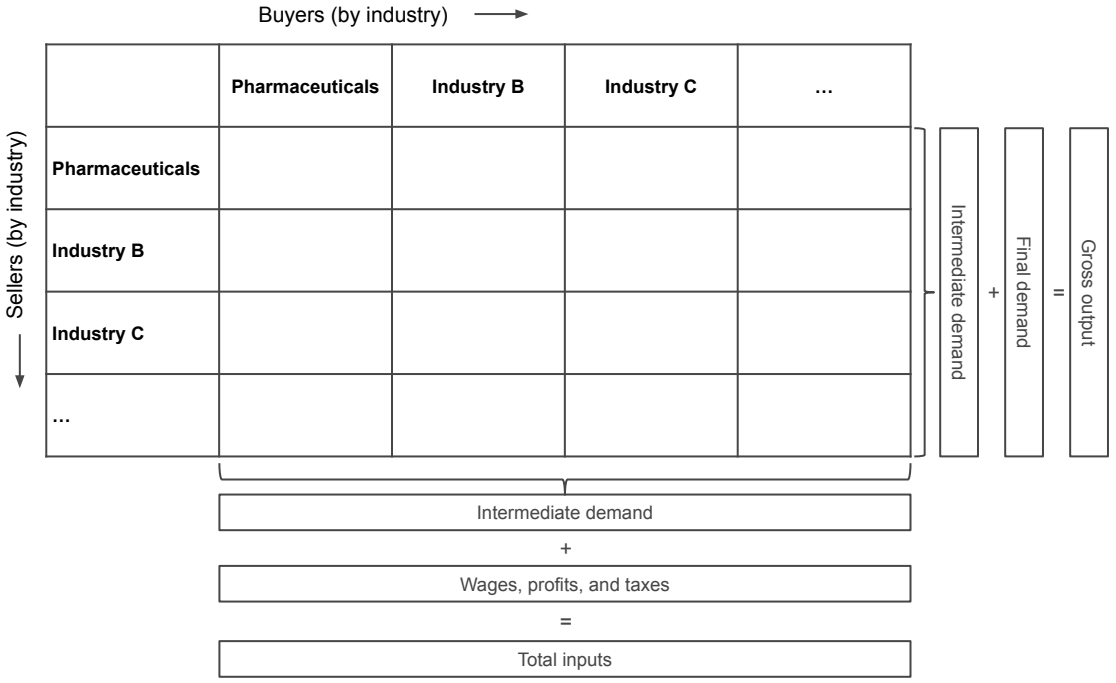
Finally, we have looked at the proportion of the workforce that are female, and show that the industry is ahead of other key industries in terms of workforce equality.

We used input-output analysis to estimate the economic contribution of the pharmaceutical industry

Input-Output analysis involves studying how firms transform inputs (such as primary goods and machinery) into outputs in order to estimate the industry's economic contribution. It is a Nobel Prize winning approach, which is commonly used for impact assessment and measuring the contribution of an industry to the economy.

The approach is built on input-output tables, which are developed by national statistics bodies using real company data. They describe how much each industry buys and sells from/to every other, how much each industry spends on primary inputs such as wages and profits, and measures final demand. An example of an input-output to the right.

Conceptual view of Input-Output table

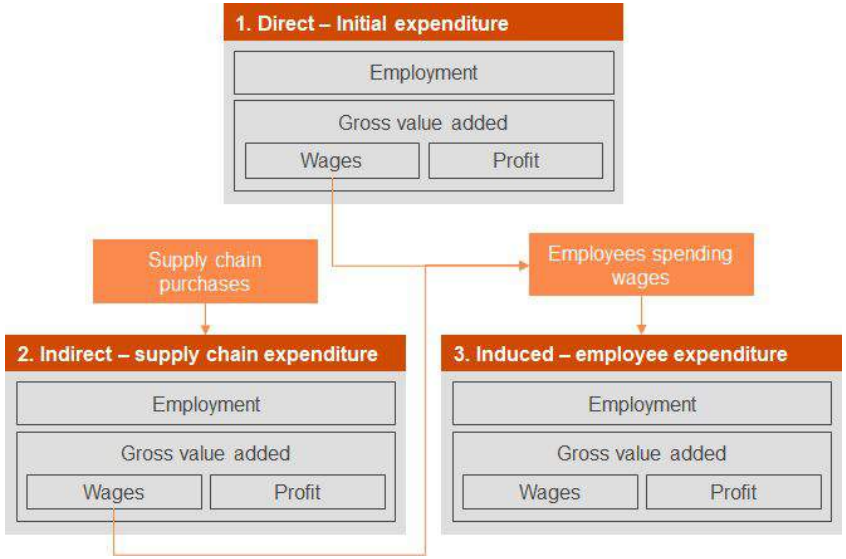


Input-output analysis allows us to estimate the direct, indirect, and induced impacts of the pharmaceutical industry

We used input-output analysis to estimate the size of the contribution an industry makes to the economy, as well as the size of each component: the direct, indirect and induced impacts.

1. Direct economic impact	Consists of the economic value that the industry created directly and the number of people that organisations within the industry employ.
+	
2. Indirect economic impact	Consists of the impact of the industry's expenditure on suppliers (for example, by purchasing raw materials) and suppliers' expenditure through subsequent tiers of the supply chain.
+	
3. Induced economic impact	Consists of the impact of employees of both the pharmaceutical industry and its supply chain spending their wages.
=	
Total impact	

Each of the components of the total contribution are interrelated, and build upon each other. The relationships between each of the components are shown below.



Our methodology involved three steps, and the first step was to review and agree the base data

Our approach to estimating the economic contribution of the pharmaceutical industry involved three steps.

Overview of our economic modelling approach

Broadly, the approach involved review existing economic statistics for the pharmaceutical industry in Europe and agreeing the correct base data, calculating the indirect and induced multipliers for GVA and employment, and then using these multipliers to estimate the indirect and induced contributions of the industry.

1. Review and agree existing economic statistics for the pharmaceutical industry in Europe
2. Calculate indirect and induced multipliers for GVA and employment
3. Estimate indirect and induced contributions

Step 1: Review and agree existing economic statistics for the pharmaceutical industry in Europe

The first step of our approach involved reviewing existing economic statistics for the pharmaceutical industry in Europe

A number of sources publish data for GVA and employment by industry including, for example, Eurostat, GTAP, and World Input-Output Database.

For consistency and reliability, we defined the pharmaceutical industry as NACE code C21 (Manufacture of basic pharmaceutical products and pharmaceutical preparations), and agreed to use the latest GVA and employment data from Eurostat. In most cases, the latest available data was from 2016. In cases where the data published by Eurostat is either out-of-date or completely missing, we have used data provided by EFPIA or national statistics offices.

We present the agreed base figures, along with their sources on the following pages.

We agreed to use the latest available Eurostat data for GVA and employment, except where it is unavailable or unreliable (1)

Country	Direct GVA (€m)		Direct employment	
	Figure	Source	Figure	Source
Austria	1,839	Eurostat (2016)	14,652	Eurostat (2016)
Belgium	8,664	Eurostat (2016)	35,711	ONSS (2017), provided by EFPIA.
Bulgaria	148	Eurostat (2013). No later data is available from Eurostat.	8,515	Eurostat (2016)
Croatia	308	Eurostat (2016)	4,864	Eurostat (2016)
Cyprus	95	Eurostat (2016)	1,573	Eurostat (2016)
Czech Republic	447	Eurostat (2016)	9,635	Eurostat (2016)
Denmark	6,829	Eurostat (2016)	26,963	Statistics Denmark (2016), provided by EFPIA.
Estonia	8	Eurostat (2015). No data is available for 2016 from Eurostat.	314	Eurostat (2015). No data is available for 2016 from Eurostat.
Finland	1,277	Eurostat (2016)	4,484	Eurostat (2016)
France	11,260	Eurostat (2016)	98,786	LEEM (2017), provided by EFPIA.
Germany	17,763	Eurostat (2016)	130,731	Eurostat (2016)
Greece	539	Eurostat (2016)	8,969	Eurostat (2016)
Hungary	1,240	Eurostat (2016)	18,067	Eurostat (2016)
Ireland	12,658	Eurostat (2014). Ireland's Central Statistics Office (CSO) has suspended publication of this data series for this industry. The CSO's measure 'modified Gross National Income' shows the industry has grown 22% between 2014 and 2017, so this may be an underestimate.	29,766	IDA/Enterprise Ireland (2018), provided by IPHA. No data is available for 2016 from Eurostat.

Sources: Eurostat, WIOD, PwC analysis

We agreed to use the latest available Eurostat data for GVA and employment, except where it is unavailable or unreliable (2)

Country	GVA impact (€m)		Employment	
	Figure	Source	Figure	Source
Italy	8,330	Eurostat (2016)	66,000	Farmaindustria, ISTAT (2016).
Latvia	85	Eurostat (2016)	2,113	Eurostat (2016)
Lithuania	122	Eurostat (2015). No data is available for 2016 from Eurostat.	1,220	Eurostat (2015). No data is available for 2016 from Eurostat.
Luxembourg[1]	No data	No data, so excluded from the analysis.	No data	No data, so excluded from the analysis.
Malta	17	World Input-Output Database (2014). No data available from Eurostat.	1,165	Eurostat (2015). No later data is available from Eurostat.
Netherlands	2,086	Eurostat (2016)	12,671	Eurostat (2016)
Poland	1,073	Eurostat (2016)	23,047	Eurostat (2016)
Portugal	436	Eurostat (2016)	6,678	Eurostat (2016)
Romania	316	Eurostat (2016)	9,149	Eurostat (2016)
Slovakia	63	Eurostat (2016)	2,235	Eurostat (2016)
Slovenia	805	Eurostat (2014). No later data is available from Eurostat.	6,514	Eurostat (2011). No later data is available from Eurostat.
Spain	4,783	Eurostat (2016)	41,049	Eurostat (2016)
Sweden	4,191	Eurostat (2016)	11,836	Eurostat (2016)
Switzerland	27,735	Federal Statistics Office (2016p). Agreed with Interpharma.	46,138	Federal Statistical Office (2017). No data is available from Eurostat. Agreed with Interpharma.
United Kingdom	14,985	ONS (2017) converted using Eurostat (2017) exchange rate. Eurostat data was unreliable. Agreed approach with ABPI.	65,250	ONS (2017). Eurostat data was unreliable. Agreed approach with ABPI.

Sources: Eurostat, WIOD, PwC analysis. 1. No data is published for GVA or employment in Luxembourg's pharmaceutical industry. Following discussion with EFPIA members, we agreed to exclude it from the analysis as the industry in the country is very small.

The second step was to calculate indirect and induced multipliers for GVA and employment

Step 2: Calculate indirect and induced multipliers for GVA and employment

The size and extent to which an industry's activities impact the wider economy are commonly presented as multipliers. We estimate two types of multiplier, for both GVA and employment: a type 1 multiplier describes the size of the indirect effects, while a type 2 multiplier describes the size of the indirect and induced effects.

We have used the 2014 input-output tables published by the World Input-Output Database to estimate these multipliers. The World Input-Output Database provides input-output tables for 56 industries and 43 countries, including the 28 countries that compose the EU and Switzerland. We have used this database to estimate multipliers for NACE code C21, the manufacture of basic pharmaceutical products and pharmaceutical preparation.

A Type 1 multiplier captures the direct and indirect impacts of an industry, and is calculated as follows:

$$\frac{\text{Direct impact + Indirect impact}}{\text{Direct impact}}$$

A Type 2 multiplier captures the direct, indirect, and induced impacts of an industry, and is calculated as follows:

$$\frac{\text{Direct impact + Indirect impact + Induced impact}}{\text{Direct impact}}$$

These multipliers can be interpreted as follows:

	Type 1 multiplier	Type 2 multiplier
GVA	A Type 1 GVA multiplier of 1.5 is interpreted as 'for every €1 spent by the pharmaceutical industry, 50 cents of benefit is created in the supply chain.'	A Type 2 GVA multiplier of 2.5 is interpreted as 'for every €1 spent by the pharmaceutical industry, €1.50 of benefit is created through the supply chain and employees spending their wages.'
Employment	A Type 1 employment multiplier of 1.7 is interpreted as 'for every job created in the pharmaceutical industry, 0.7 jobs are created in the supply chain.'	A Type 2 employment multiplier of 3.0 is interpreted as 'for every job created in the pharmaceutical industry, 2 jobs are created in the supply chain and through employees spending their wages.'

We estimated and agreed multipliers for each country (1)

Country / Region	GVA multipliers		Employment multipliers	
	Type 1	Type 2	Type 1	Type 2
Europe average	**1.49**	**2.09**	**2.22**	**3.93**
Austria	1.35	1.88	1.59	2.53
Belgium	1.46	1.82	2.27	3.15
Bulgaria	1.55	2.32	1.59	2.49
Croatia	1.47	2.05	1.89	3.28
Cyprus	1.40	2.50	1.44	2.76
Czech Republic	1.56	2.02	2.02	2.76
Denmark	1.26	1.56	2.03	3.05
Estonia	1.65	2.39	2.01	3.12
Finland	1.20	1.46	1.68	2.47
France	1.49	2.08	2.53	4.33
Germany	1.51	2.07	2.25	3.73
Greece	2.27	5.01	1.83	3.37
Hungary	1.28	1.63	1.71	2.76
Ireland	1.08	1.17	1.18	1.52
Italy	1.84	3.21	2.19	4.38
Latvia	1.36	1.88	1.59	2.57
Lithuania	1.19	1.47	1.75	3.30
Malta	1.77	2.28	2.02	2.68

Source: WIOD, PwC analysis.

We estimated and agreed multipliers for each country (2)

Country / Region	GVA multipliers		Employment multipliers	
	Type 1	Type 2	Type 1	Type 2
Europe average	**1.49**	**2.09**	**2.22**	**3.93**
Netherlands	1.30	1.54	1.82	2.63
Poland	1.86	2.76	1.67	2.46
Portugal	1.74	2.83	2.29	4.35
Romania	1.74	2.92	1.86	3.05
Slovakia	1.69	2.42	1.64	2.32
Slovenia	1.69	2.21	2.65	3.97
Spain	1.81	3.09	2.55	5.04
Sweden	1.77	2.21	3.23	4.46
Switzerland	1.60	2.21	2.31	4.66
United Kingdom	1.38	2.13	2.68	6.15

Source: WIOD, PwC analysis.

Some multipliers were significantly higher/lower than the region's average, but there are real-world reasons for this (1)

Country / Region	GVA multipliers		Employment multipliers		Why are multipliers high/low?
	Type 1	Type 2	Type 1	Type 2	
Europe average	**1.49**	**2.09**	**2.22**	**3.93**	
Greece	2.27	5.01	1.83	3.37	Greece has relatively high GVA multipliers, and the type 2 GVA multiplier is particularly high. This may be caused by lower wage and price levels in Greece than elsewhere in Europe, which means companies and employees buy predominantly from local companies. This is likely particularly true in high value industries, where prices are likely to be higher.
Netherlands	1.30	1.54	1.82	2.63	The Netherlands has relatively low GVA and employment multipliers. This is likely due to it being a relatively small country, which is strongly integrated with the rest of Europe. This means companies that operate in the country's pharmaceutical industry are likely to procure a large share of their supply chain from elsewhere in Europe. Consumers are also likely to spend a larger share of their income on imported goods and services than domestically produced goods and services.

Some multipliers were significantly higher/lower than the region's average, but there are real-world reasons for this (2)

Country / Region	GVA multipliers		Employment multipliers		Notes
	Type 1	Type 2	Type 1	Type 2	
Europe average	**1.49**	**2.09**	**2.22**	**3.93**	
Slovakia	1.69	2.42	1.64	2.32	Slovakia has relatively low GVA and employment multipliers. This is likely due to it being a relatively small country, which is strongly integrated with the rest of Europe. This means companies that operate in the country's pharmaceutical industry are likely to procure a large share of their supply chain from elsewhere in Europe. Consumers are also likely to spend a larger share of their income on imported goods and services than domestically produced goods and services.
Spain	1.81	3.09	2.55	5.04	Spain has relatively high employment multipliers, and the type 2 employment multiplier is particularly high. This may in part be due to the fact that wage and price levels are lower in Spain than elsewhere in Europe, which means companies and employees are likely to buy predominantly from local companies.

Some multipliers were significantly higher/lower than the region's average, but there are real-world reasons for this (3)

Country / Region	GVA multipliers		Employment multipliers		Notes
	Type 1	Type 2	Type 1	Type 2	
Europe average	**1.49**	**2.09**	**2.22**	**3.93**	
Switzerland	1.60	2.21	2.31	4.66	Switzerland has relatively high type 2 multipliers, particularly for employment. This is consistent with the high rates of productivity in the country's industry. High productivity feeds through to higher wages and living standards, and these wages are spent on a variety of goods and services, which in turn support other industries and a large number of jobs.
United Kingdom	1.38	2.13	2.68	6.15	The United Kingdom has a relatively high type 2 employment multiplier. This is consistent with the high rates of productivity in the country's industry. High productivity feeds through to higher wages and living standards, and these wages are spent on a variety of goods and services, potentially significantly from lower productivity and lower skilled industries, which supports a large number of jobs.

A study on Portugal found similar multipliers, but we have used the multipliers estimated as part of this work for consistency

McKinsey conducted a study of the pharmaceutical industry in Portugal for Apifarma in 2018*. We present their results, along with the multipliers that we estimated as part of this study, in the table below.

Comparison of multipliers with previous study for Portugal

	GVA multipliers		Employment multipliers	
	Type 1	Type 2	Type 1	Type 2
McKinsey (2018)	1.6	2.2	4	10
PwC	1.74	2.83	2.29	4.35

McKinsey found higher employment multipliers, but lower GVA multipliers than our analysis. This is in part because the definition of the industry is broader in the McKinsey study than in our analysis, and includes manufacturing, commercial/retail, and research and development. As such, the results are not directly comparable, and we have agreed to use the multipliers estimated in this study for the analysis.

*Sources: Apifarma (2018) 'Apifarma – holistic perspective on the value of medicines in Portugal'. Note: McKinsey present their economic contribution results in terms of GDP. This is broadly similar to GVA, and so it is reasonable to compare the two types of multiplier.

A study on Switzerland found similar multipliers, but we have used the multipliers estimated as part of this work for consistency

BAK Economics conducted a study of the pharmaceutical industry in Switzerland for Interpharma in 2017*. We present their results, along with the multipliers that we estimated as part of this study, in the table below.

Comparison of multipliers with previous study for Switzerland

	GVA multipliers		Employment multipliers	
	Type 1	Type 2	Type 1	Type 2
BAK Economics (2017)		1.7		5.0
PwC	1.60	2.21	2.31	4.66

BAK Economics used an alternative approach to estimate the economic contribution of the pharmaceutical industry, which includes type 1 effects and some type 2 effects in a single multiplier. The approach limits the induced effects to only the contribution from employees directly involved in the pharmaceutical industry. As such, it is not directly comparable, and we have agreed to use the multipliers estimated as part of this study for the analysis.

*Source: BAK Economics (2017) The Importance of the pharmaceutical industry for Switzerland.

A study on the United Kingdom found similar multipliers, but we have used the multipliers estimated as part of this work for consistency

PwC UK conducted a study of the pharmaceutical industry in the United Kingdom for the ABPI in 2017*. We present their results, along with the multipliers that we estimated as part of this study, in Table 7 below.

Comparison of multipliers with previous study for the United Kingdom

	GVA multipliers		Employment multipliers	
	Type 1	Type 2	Type 1	Type 2
PwC (2017)	1.38	1.63	3.14	4.40
PwC	1.38	2.13	2.68	6.15

PwC's study for the ABPI used an alternative approach to estimate the economic contribution of the pharmaceutical industry, which involved surveying British companies that operate in the industry. As such, the results are not directly comparable with the multipliers that we have estimated for other countries, and we have agreed to use the multipliers estimated as part of this study for consistency. Nonetheless, the results for the multipliers are relatively similar. The type 2 multipliers are higher in this study than the 2017 study, however this is consistent with the fact that the pharmaceutical industry in the United Kingdom is highly productive.

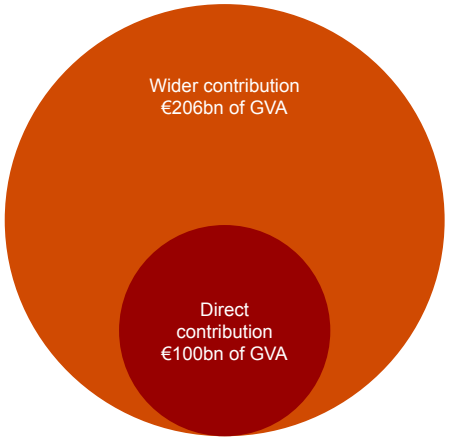
*Source: PwC (2017). The economic contribution of the UK Life Sciences industry.

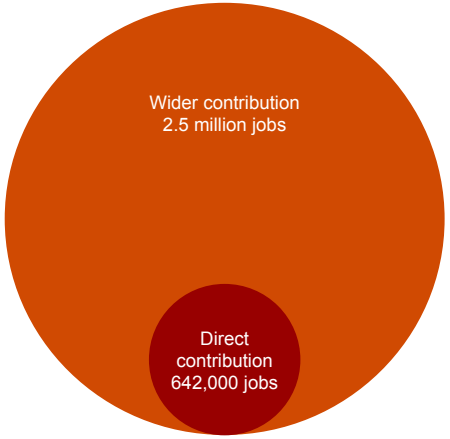
The third step was to estimate the indirect and induced contributions of the pharmaceutical industry by country

Step 3: Estimate indirect and induced contributions

We then combined the base data agreed in step 1 with the multipliers estimated as part of step 2. We have shown that:

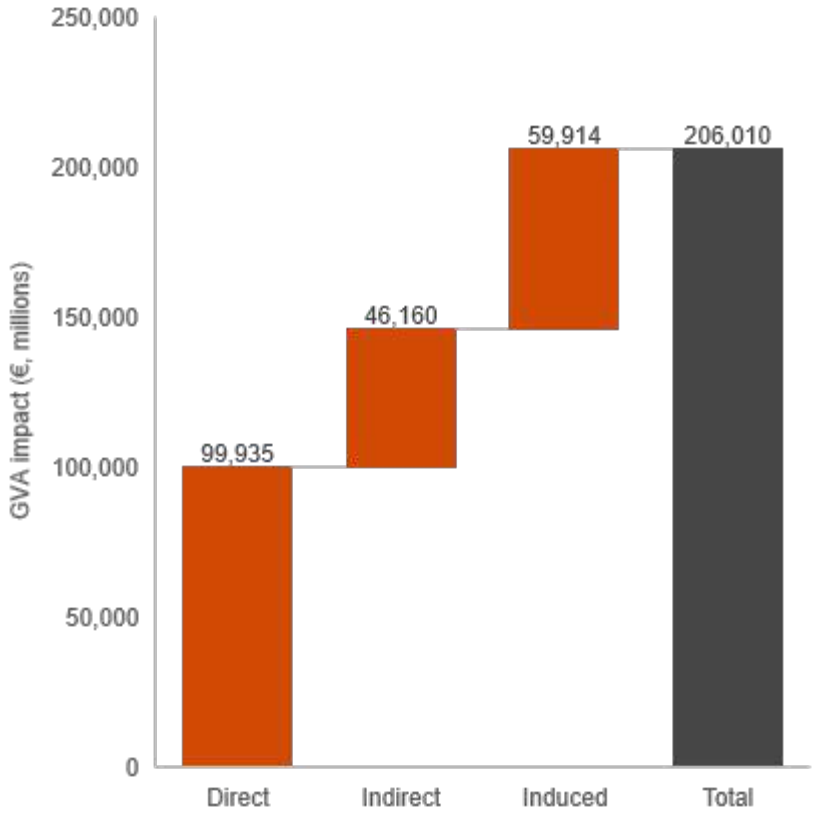
- The pharmaceutical industry is a major contributor to the European Union in terms of GVA and employment. We estimate that in total, it supported €206 billion in GVA and 2.5 million jobs in 2016.
- The industry's GVA contribution is primarily through direct effects, while the industry's employment contribution primarily through induced effects. This is consistent with the industry being highly productive.
- The industry contributes a total of 1.4% of the European Union's GDP, and 0.9% of the region's employment.
- The pharmaceutical industry is highly productive, creating €156,000 of GVA per worker, which compares favourably to other key industrial industries
- 46% of employees in the industry are female, which is much higher than other STEM-based industries such as aerospace and automotive manufacturing.



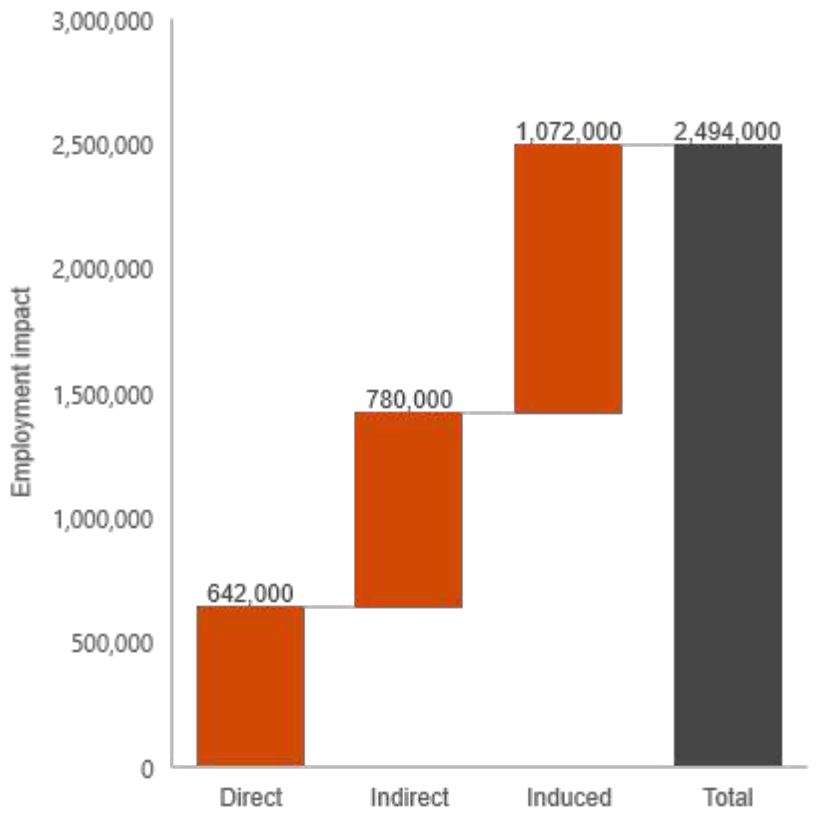


Our estimates show the pharmaceutical industry has a significant impact on GVA and employment in Europe (1)

GVA impact of pharmaceutical industry on the EU



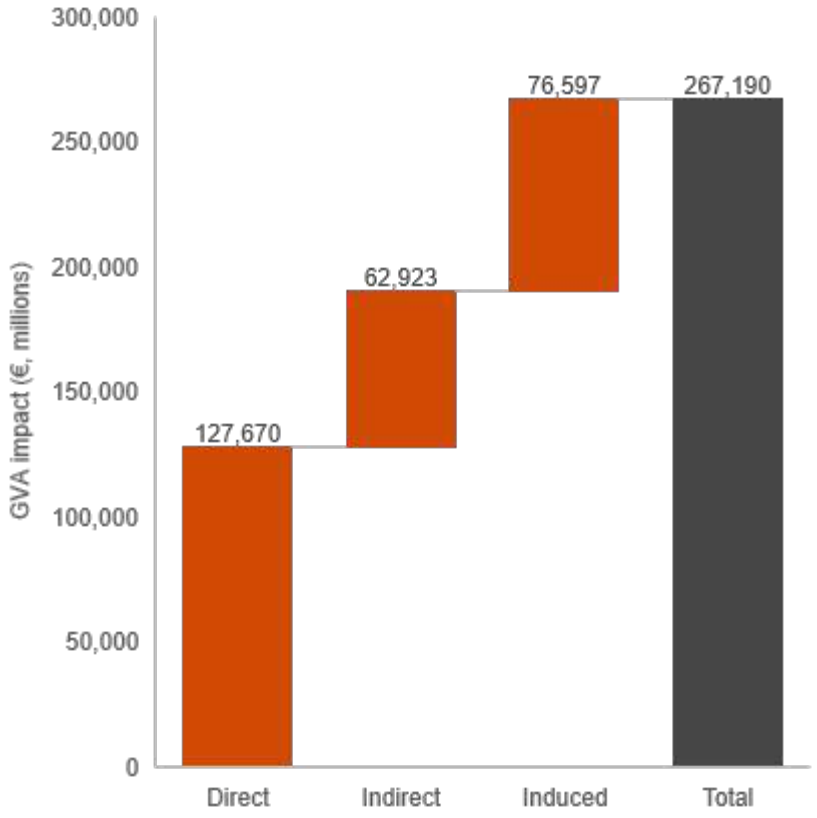
Employment impact of pharmaceutical industry on the EU



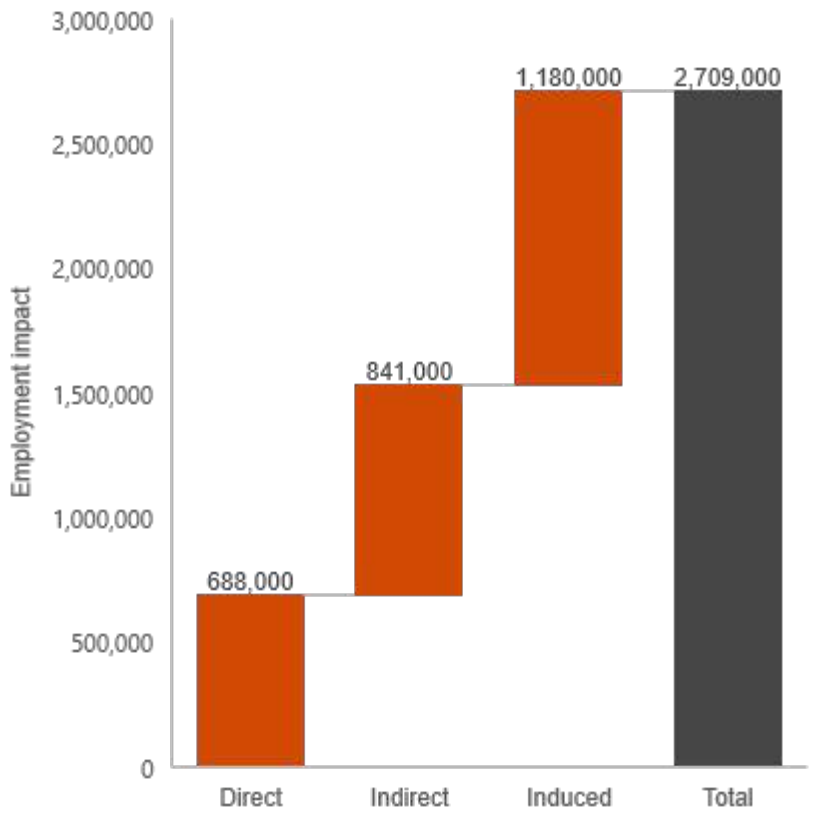
Note: Figures may not equal other pages due to rounding.

Our estimates show the pharmaceutical industry has a significant impact on GVA and employment in Europe (2)

GVA impact of pharmaceutical industry on EU28 plus Switzerland



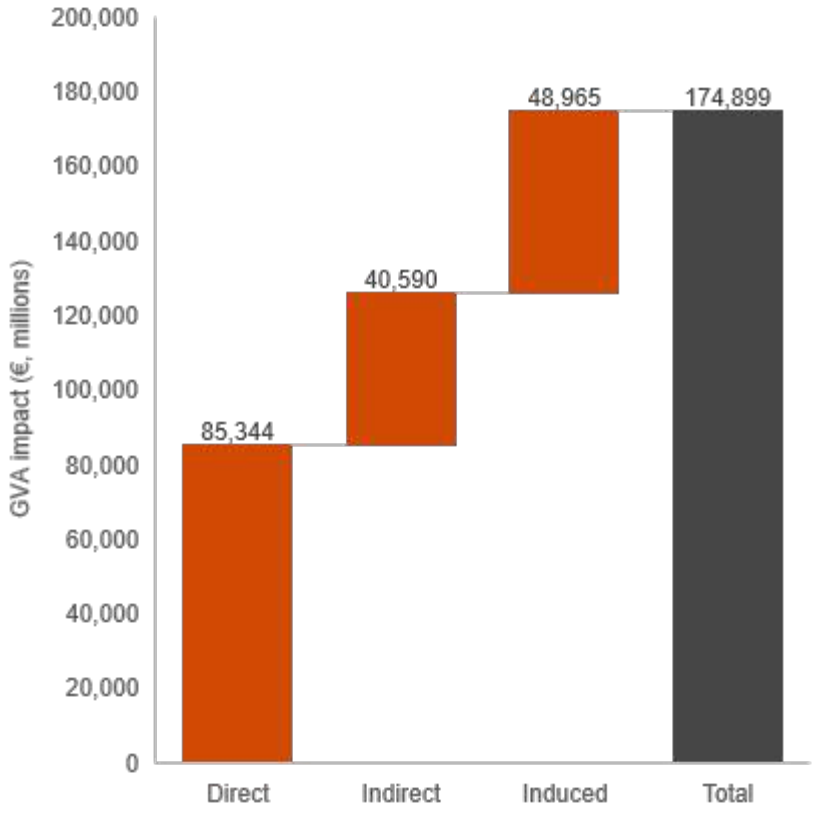
Employment impact of pharmaceutical industry on EU28 plus Switzerland



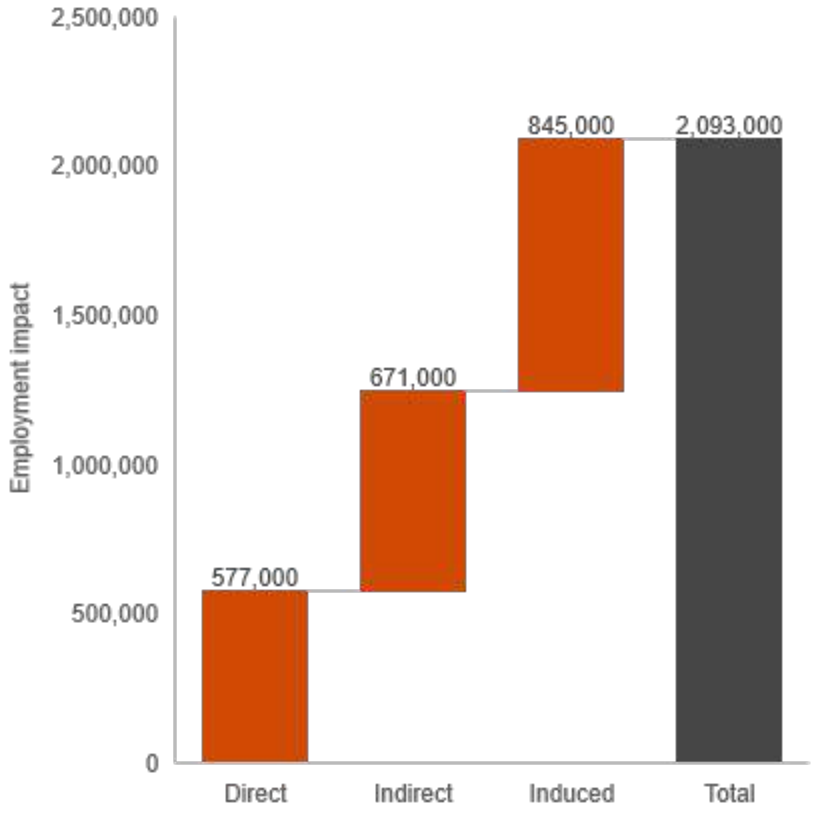
Note: Figures may not equal other pages due to rounding.

Our estimates show the pharmaceutical industry has a significant impact on GVA and employment in Europe (3)

GVA impact of pharmaceutical industry on the EU27 (excl. UK)



Employment impact of pharmaceutical industry on the EU27 (excl. UK)



Note: Figures may not equal other pages due to rounding.

The pharmaceutical industry has a significant impact on GVA, particularly through direct effects (1)

Country / Region	GVA impact (€m)				% of total GDP
	Direct	Indirect	Induced	Total	Total
Austria	1,839	649	972	3,460	1.0%
Belgium	8,664	3,952	3,194	15,810	3.7%
Bulgaria	142	79	110	331	0.7%
Croatia	308	145	178	632	1.4%
Cyprus	95	38	103	236	1.3%
Czech Republic	447	252	202	901	0.5%
Denmark	6,829	1,780	2,058	10,666	3.8%
Estonia	8	5	6	20	0.1%
Finland	1,277	257	334	1,868	0.9%
France	11,260	5,510	6,618	23,388	1.0%
Germany	17,763	9,128	9,856	36,747	1.2%
Greece	539	683	1,479	2,701	1.5%
Hungary	1,240	342	444	2,027	1.8%
Ireland	12,632	968	1,130	14,731	5.4%
Italy	8,330	6,970	11,442	26,742	1.6%
Latvia	85	30	44	159	0.6%
Lithuania	122	24	34	180	0.5%

The pharmaceutical industry has a significant impact on GVA, particularly through direct effects (2)

Country / Region	GVA impact (€m)				% of total GDP
	Direct	Indirect	Induced	Total	Total
Malta	17	13	9	39	0.4%
Netherlands	2,086	622	508	3,217	0.5%
Poland	1,073	921	967	2,962	0.7%
Portugal	436	322	476	1,234	0.7%
Romania	316	234	372	921	0.5%
Slovakia	63	43	46	151	0.2%
Slovenia	797	553	414	1,764	4.4%
Spain	4,783	3,857	6,119	14,759	1.3%
Sweden	4,191	3,211	1,849	9,251	2.0%
Switzerland	27,735	16,763	16,682	61,180	10.1%
United Kingdom	14,591	5,570	10,949	31,111	1.3%
Total	**128,000**	**63,000**	**77,000**	**267,000**	

Note that the above totals include Switzerland, and therefore differ to those in the main report

The pharmaceutical industry employs a significant number of people, particularly through induced effects (1)

Country / Region	Employment impact				% of total employment
	Direct	Indirect	Induced	Total	Total
Austria	14,700	8,700	13,800	37,200	0.8%
Belgium	35,700	45,500	31,200	112,400	2.3%
Bulgaria	8,500	5,100	7,600	21,200	0.7%
Croatia	4,900	4,300	6,800	16,000	0.9%
Cyprus	1,600	700	2,100	4,400	1.1%
Czech Republic	9,600	9,800	7,200	26,600	0.5%
Denmark	27,000	27,700	27,600	82,300	2.8%
Estonia	300	300	400	1,000	0.2%
Finland	4,500	3,000	3,600	11,100	0.4%
France	98,800	151,000	178,000	427,800	1.5%
Germany	130,700	162,900	194,500	488,100	1.2%
Greece	9,000	7,400	13,800	30,200	0.6%
Hungary	18,100	12,800	19,000	49,900	1.1%
Ireland	29,800	5,200	10,200	45,200	No data
Italy	66,000	78,400	144,500	288,900	1.1%
Latvia	2,100	1,300	2,000	5,400	0.6%
Lithuania	1,200	900	1,900	4,000	0.3%

The pharmaceutical industry employs a significant number of people, particularly through induced effects (2)

Country / Region	Employment impact				% of total employment
	Direct	Indirect	Induced	Total	Total
Malta	1,200	1,200	800	3,200	1.6%
Netherlands	12,700	10,400	10,200	33,300	0.4%
Poland	23,000	15,500	18,200	56,700	0.3%
Portugal	6,700	8,600	13,700	29,000	0.6%
Romania	9,100	7,900	10,900	27,900	0.3%
Slovakia	2,200	1,400	1,500	5,100	0.2%
Slovenia	6,500	10,700	8,600	25,800	2.6%
Spain	41,000	63,500	102,500	207,000	0.9%
Sweden	11,800	26,400	14,600	52,800	1.0%
Switzerland	46,100	60,200	108,500	214,800	4.6%
United Kingdom	65,300	109,700	226,700	401,700	1.2%
Total	**688,000**	**841,000**	**1,180,000**	**2,709,000**	

Note that the above totals include Switzerland, and therefore differ to those in the main report

Appendix 2: Methodology for estimating health and societal impacts

We developed a bottom-up method to estimate the health, productivity and cost impacts of the therapeutic areas

At a high-level, our method involved estimating:

Number of patients treated between 2007 - 2017 using data from IQVIA

QALYs using data from reimbursement submissions and academic literature

Productivity gains in terms of GDP from reduced absenteeism as a result of improved health

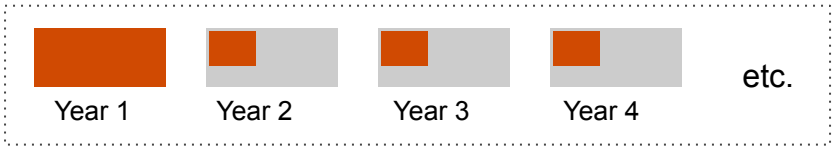
Net change in medicine and treatment costs

The following slides explain each of these steps in more detail at a generalised level, and then specific to each of the therapeutic areas (TAs).

We used IQVIA data to estimate the number of patients treated and costs of the medicines

Number of patients:

- Where a medicine is authorised for more than one indication, IQVIA data on volumes have been apportioned between the relevant indications based on prevalence and eligibility.
- The volume that is relevant to the selected indication is then used to calculate number of annual doses, and thus number of patients treated.
- In order to avoid double counting ongoing patients, for the first year a drug is purchased in a country the full number of patients derived from relevant volume/annual dose is used, and for following years a ratio of new to existing patients is applied.



For HIV the ratio of incidence to prevalence is used.

For breast cancer, the expected treatment time is used to approximate number of novel patients each year using the following ratio, which takes into account how long a patient would on average be taking a drug for: 1 - ((Treatment time - 1) / Treatment time)

Cost of medicines:

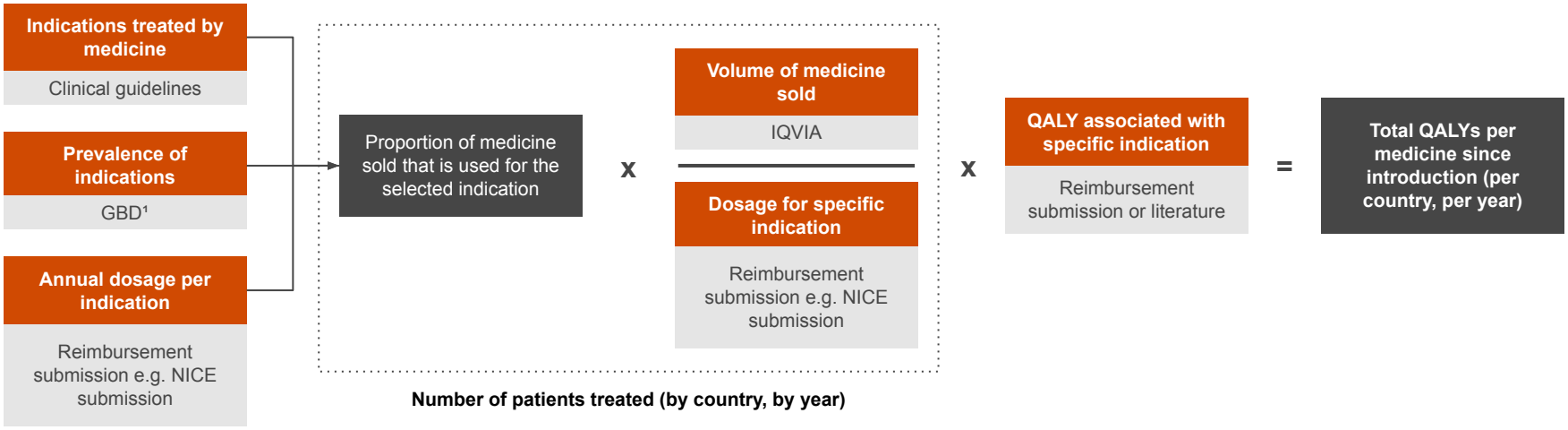
IQVIA data on volumes and sales has been used to derive cost of medicines, by using Sales and Volume (kg) data to calculate cost per kilogram, then multiplying by annual dosage (from EMA/WHO) to evaluate annual cost per patient of the medicines

Limitations:

- Data are unavailable for Cyprus and Malta.
- Within the data sources, there are some low volume values which do not have a corresponding cost, or have a very low cost. These are not considered material within aggregated numbers.
- There is also significant variation between countries; this may be due to a range of factors, such as lower healthcare spend, availability of the medicine in that country, or variation in method or accuracy of third party data collection

We have calculated health impact by estimating the incremental QALYs gained resulting from chosen treatments

The diagram below explains the generalised methodology developed for estimating incremental QALYs. TA-specific application of the generalised methodology are provided later in this section.



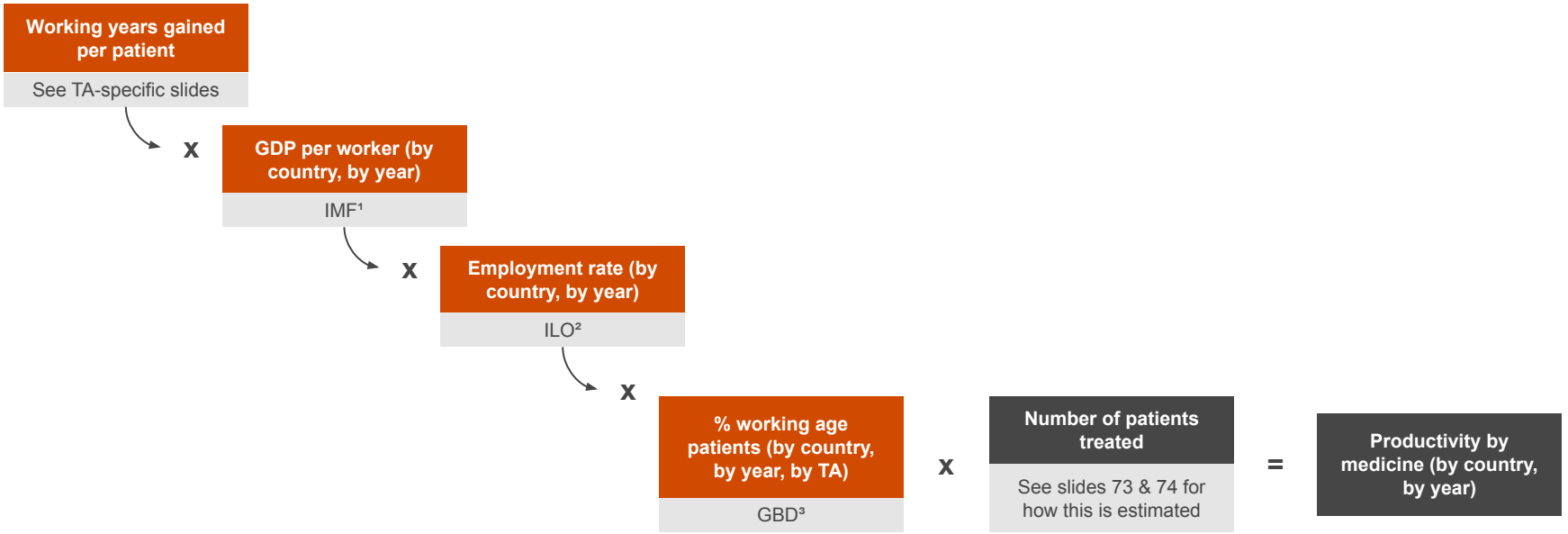
- Total QALYs per medicine since introduction are aggregated across years to give total QALYs per therapeutic area.
- In cases where medicines are specific to sub-indications e.g. specific types of breast cancer, additional research has been conducted into the relevant proportion of the wider indication that this would represent.

References:
¹ Global Burden of Disease

KEY
Data
Source

Productivity gains are estimated based on the incremental gains in working years resulting from the treatments

The diagram below explains the generalised methodology developed for estimating incremental productivity. TA-specific application of the generalised methodology are provided later in this section.



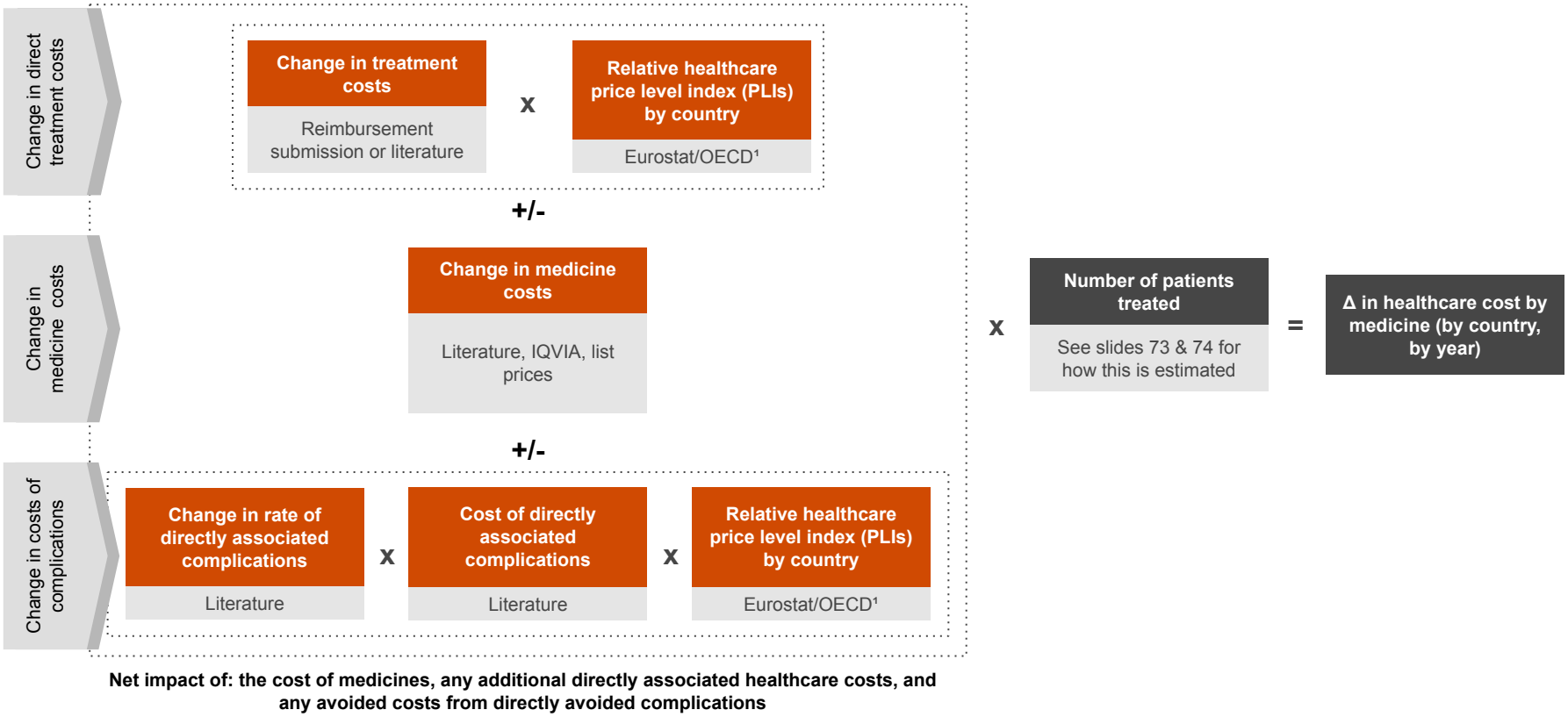
To assess productivity gains, the focus is on reduced absenteeism; this is due in part to the difficulty of estimating changes to presenteeism relative to the general population. We have taken a human capital approach, and used annual GDP per worker (by country). Quantified productivity gains refer only to paid work which is a part of a wider productivity benefit; qualitative discussion regarding unpaid work is incorporated in the Summary Report.

References:
[1] International Monetary Fund
[2] International Labour Organization
[3] Global Burden of Disease

KEY
Data
Source

Costs reflect estimated net costs associated with direct treatment, medications and complications

The diagram below explains the generalised methodology developed for estimating incremental costs. TA-specific application of the generalised methodology are provided later in this section.



Net impact of: the cost of medicines, any additional directly associated healthcare costs, and any avoided costs from directly avoided complications

KEY

Data

Source

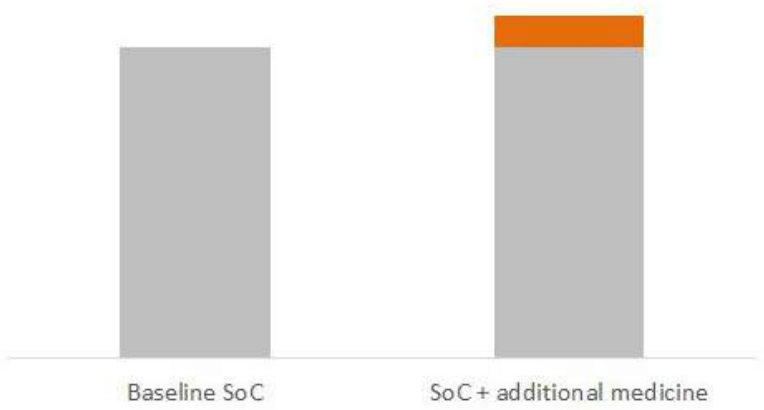
References:

¹ Koechlin et al., 2014. Comparing Hospital and Health Prices and Volumes Internationally: Results of a Eurostat/ OECD Project

Our analysis of benefits and costs focuses on the improvement relative to previous standards of care

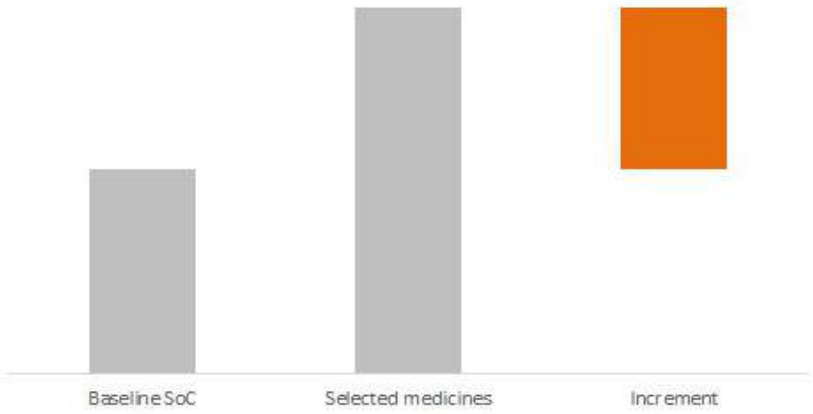
It is the **incremental** benefits and costs (encompassing health, productivity and healthcare costs) which are considered, relative to a previous standard of care (SoC).

Impact of additional treatment



For breast cancer, the selected medicines are **additional to** standard of care (typically chemotherapy, tumour resection and radiotherapy). The increment here is the *additional* impact (indicated in orange on the diagram above).

Impact of replacement treatment



For HIV, the selected medicines act as a **replacement** for previous standard of care (dual NRTI therapy without protease inhibitors); the increment here is the *relative* impact (indicated in orange on the diagram above).

Our results are dependent on a number of assumptions

Assumptions:

- **Health impact:** As we are unable to find QALYs for every country, we assume that the proportion of people receiving these treatments in specific EU countries is an accurate representation of the EU population.
- **Accuracy: I**QVIA data is representative of the actual volume and cost of drugs sold.
- **Discounting:** future costs and benefits are discounted using a consistent social discount rate of 3.5%.
- **Duration:** QALYs, costs, and productivity benefits are estimated for the assumed treatment duration.

Therapeutic area	Assumed treatment duration	Basis
Breast cancer	1 year to 2.1 years	Consistent with models used in reimbursement submissions from which QALY values were sourced[1–8]
HIV	30 years	Consistent with model used in literature from which QALY values taken[9–10]

References:

[1] Dvortsin et al., 2016. Comparative Cost-Effectiveness of Drugs in Early versus Late Stages of Cancer; Review of the Literature and a Case Study in Breast Cancer

[2] Durkee et al., 2015. Cost-Effectiveness of Pertuzumab in Human Epidermal Growth Factor Receptor 2–Positive Metastatic Breast Cancer

[3] Roche, 2006. Achieving Clinical Excellence in the Adjuvant Treatment of HER2 Positive Breast Cancer

[4] NICE, 2019. Pertuzumab for adjuvant treatment of HER2-positive early stage breast cancer

[5] NICE, 2017. Trastuzumab emtansine for treating HER2 positive advanced breast cancer after trastuzumab and a taxane (review of TA371)

[6] NICE, 2017. Ribociclib with an aromatase inhibitor for previously untreated, hormone receptorpositive, HER2-negative, locally advanced or metastatic breast cancer

[7] NICE, 2017. Palbociclib in combination with an aromatase inhibitor for previously untreated metastatic, hormone receptor-positive, HER2-negative breast cancer

[8] NICE, 2012. Lapatinib or trastuzumab in combination with an aromatase inhibitor for the first-line treatment of metastatic hormone-receptorpositive breast cancer that overexpresses HER2

[9] Staessens et al., 2017. Genvoya cost-effectiveness for first-line HIV treatment.

[10] Juday et al., 2013. Cost-effectiveness of the once-daily efavirenz/emtricitabine/tenofovir tablet compared with the once-daily elvitegravir/cobicistat/emtricitabine/tenofovir tablet as first-line antiretroviral therapy in HIV-infected adults in the US

Breast cancer - early stage

Our analysis estimates the impacts of two medicines that treat early stage breast cancer

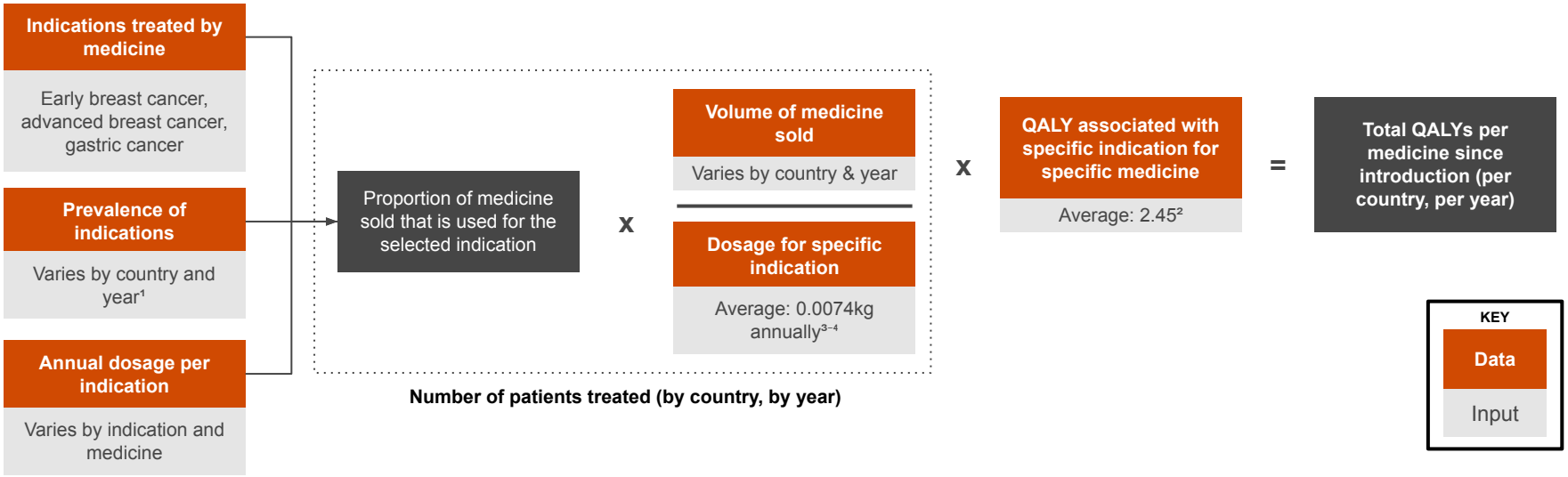
We have evaluated the health and societal impact of the following medicines from their date of introduction (or 2007, whichever is later) to 2017:

INN	Introduction in Europe[1]	Loss of Exclusivity
trastuzamab	2000	2014[2]
pertuzamab	2013	Still exclusive

References:
[1] European Medicines Agency
[2] Generics and Biosimilars Initiative

Health impact of breast cancer medicines: application of generalised methodology

The diagram below shows how we applied the generalised methodology for health impact to the breast cancer therapeutic area, identifying specific inputs and their sources.



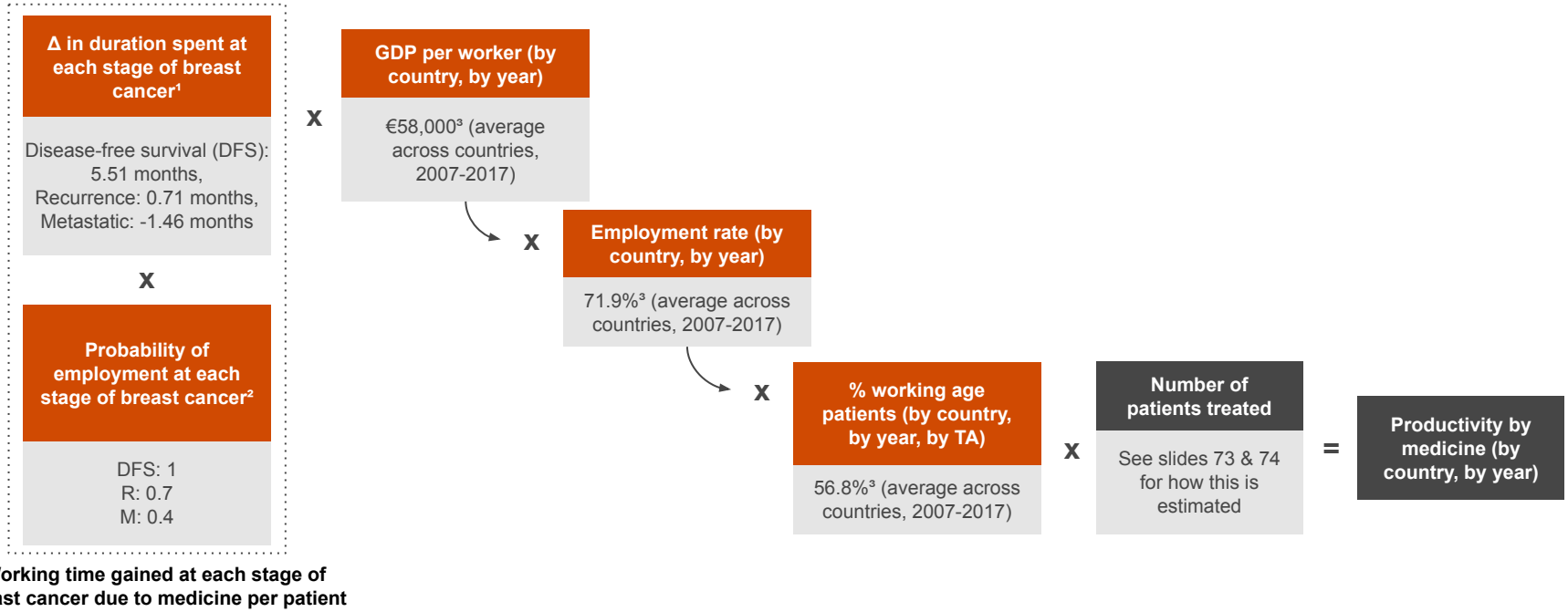
- The total QALYs per medicine per country per year were calculated by multiplying the average QALY by the number of patients treated by these medicines.
- To identify the number of patients treated we established the amount of drug sold in kg and divided this by its average annual dosage, as well as the proportion of this medicine sold for the selected indication in the case where it is used to treat more than one indication.
- Total QALYs per medicine since introduction are aggregated across years to give total QALYs per therapeutic area.
- The QALY gain refers to the incremental QALYs gained over a person's lifetime relative to standard of care assuming they take the treatment for a specified duration. These QALYs are discounted in accordance with NICE guidance.

References:

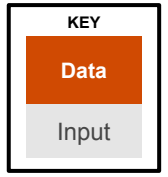
[1] Global Burden of Disease
[2] See references on slide 78
[3] European Medicines Agency
[4] World Health Organization

Productivity impact of breast cancer medicines: application of generalised methodology

The diagram below shows how we applied the generalised methodology for productivity gains to breast cancer, and identifies specific inputs and their sources.



- The change in time spent at each stage of breast cancer as a result of treatment was identified in the literature.
- To calculate the working days gained owing to treatment with each medicine, this time period was multiplied out by the probability of employment at each stage of breast cancer.
- To ensure the annual productivity gain per country was reflective of country-specific trends in employment and yearly earnings, the number of working days gained at each stage of breast cancer was multiplied out by several other factors including national employment rate and percentage of patients of working age.



References:

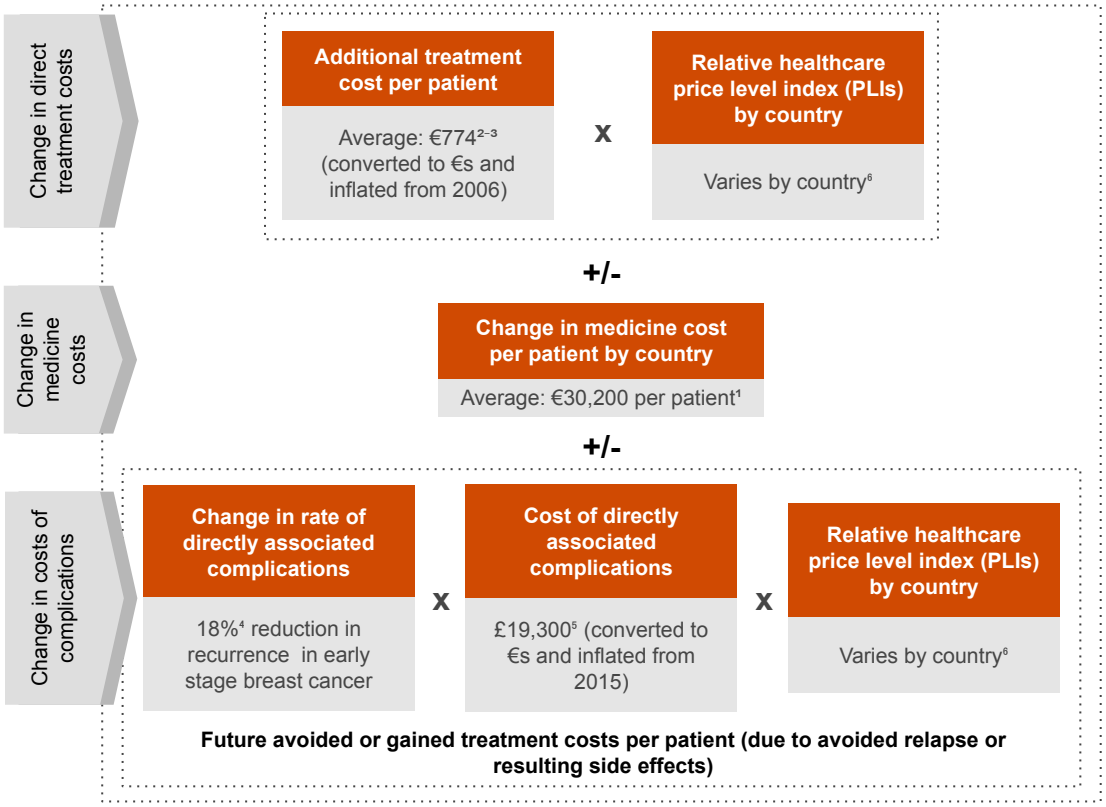
[1] Roche, 2006. Achieving Clinical Excellence in the Adjuvant Treatment of HER2 Positive Breast Cancer

[2] Nerenz et al., 2011. A simulation model approach to analysis of the business case for eliminating health care disparities

[3] See references on slide 75

Healthcare costs impact of breast cancer medicines: application of generalised methodology

The diagram below shows how we applied the generalised methodology for healthcare costs to breast cancer, and identifies specific inputs and their sources.



Additional treatment costs incurred for these particular treatments incorporate testing and cardiac monitoring.

References:

[1] IQVIA
[2] Roche, 2006. Achieving Clinical Excellence in the Adjuvant Treatment of HER2 Positive Breast Cancer
[3] NICE, 2015. Preoperative test: Routine preoperative tests for elective surgery
[4] Dobson, 2005. Trastuzumab halves risk of recurrence of breast cancer in some women
[5] Karnon et al., 2007. Health care costs for the treatment of breast cancer recurrent events: estimates from a UK-based patient-level analysis
[6] Koechlin et al., 2014. Comparing Hospital and Health Prices and Volumes Internationally: Results of a Eurostat/ OECD Project

KEY: Data / Source

Breast cancer - advanced stage

Our analysis estimates the impacts of six medicines that treat advanced stage breast cancer

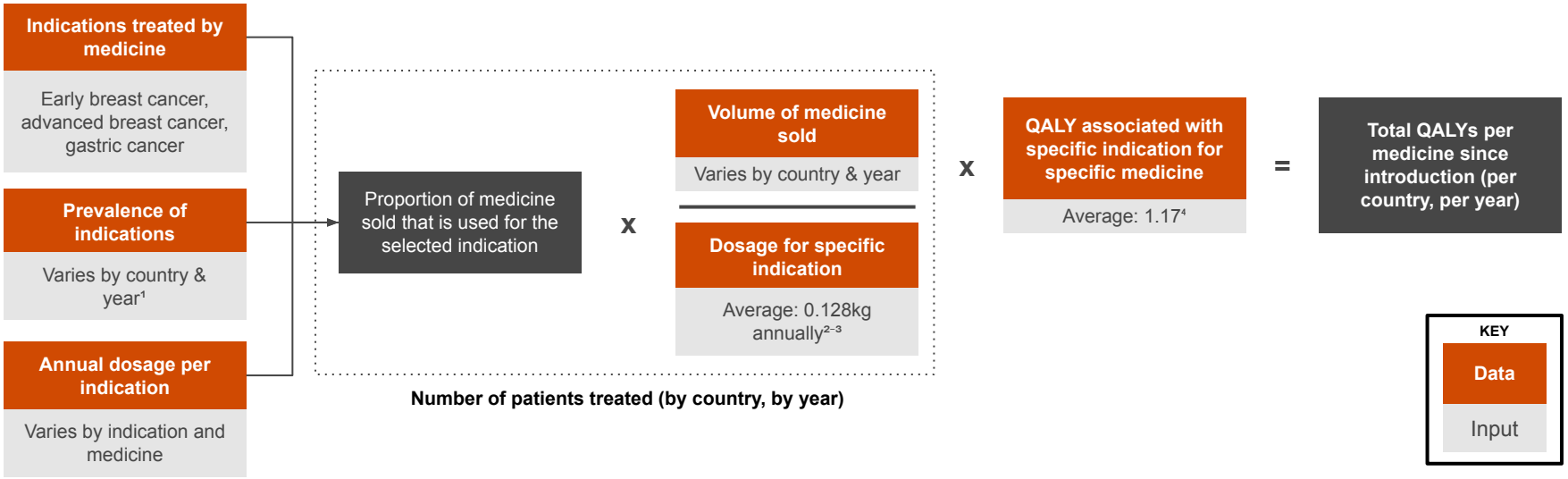
We have evaluated the health and societal impact of the following medicines from their date of introduction (or 2007, whichever is later) to 2017:

INN	Introduction in Europe[1]	Loss of Exclusivity
trastuzamab	2000	2014[2]
pertuzamab	2013	Still exclusive
trastuzumab emtansine	2013	Still exclusive
ribociclib	2017	Still exclusive
palbociclib	2016	Still exclusive
lapatinib	2008	Still exclusive

References:
[1] European Medicines Agency
[2] Generics and Biosimilars Initiative

Health impact of breast cancer medicines: application of generalised methodology

The diagram below shows how we applied the generalised methodology for health impact to the breast cancer therapeutic area, identifying specific inputs and their sources.



- The total QALYs per medicine per country per year were calculated by multiplying the average QALY by the number of patients treated by these medicines
- To identify the number of patients treated we established the amount of drug sold in kg and divided this by its average annual dosage, as well as the proportion of this medicine sold for the selected indication in the case where it is used to treat more than one indication
- Total QALYs per medicine since introduction are aggregated across years to give total QALYs per therapeutic area
- The QALY gain refers to the incremental QALYs gained over a person's lifetime relative to standard of care assuming they take the treatment for a specified duration. These QALYs are discounted in accordance with NICE guidance.

References:

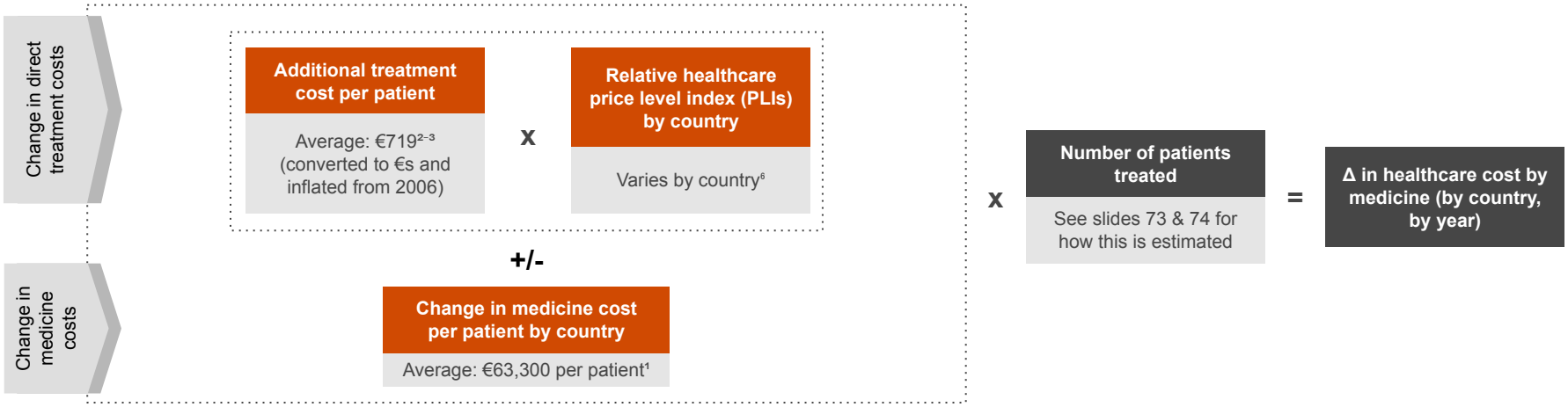
[1] Global Burden of Disease
[2] European Medicines Agency
[3] World Health Organization
[4] See references on slide 78

Productivity impact of breast cancer medicines: application of generalised methodology

N.B. Productivity gains for advanced cancer treatments are considered negligible because the majority of patients are over retirement age and incremental gains from these treatments in terms of additional working days tend to be low.

Healthcare costs impact of breast cancer medicines: application of generalised methodology

The diagram below shows how we applied the generalised methodology for healthcare costs to breast cancer, and identifies specific inputs and their sources.



- Additional treatment costs incurred for these particular treatments incorporate testing and cardiac monitoring.
- Treatments for advanced breast cancer are considered to not have a significant impact on reducing recurrence.

KEY
Data
Source

References:
[1] IQVIA
[2] Roche, 2006. Achieving Clinical Excellence in the Adjuvant Treatment of HER2 Positive Breast Cancer
[3] NICE, 2015. Preoperative test: Routine preoperative tests for elective surgery
[4] Koechlin et al., 2014. Comparing Hospital and Health Prices and Volumes Internationally: Results of a Eurostat/ OECD Project

HIV

Our analysis estimates the impact of four medicines

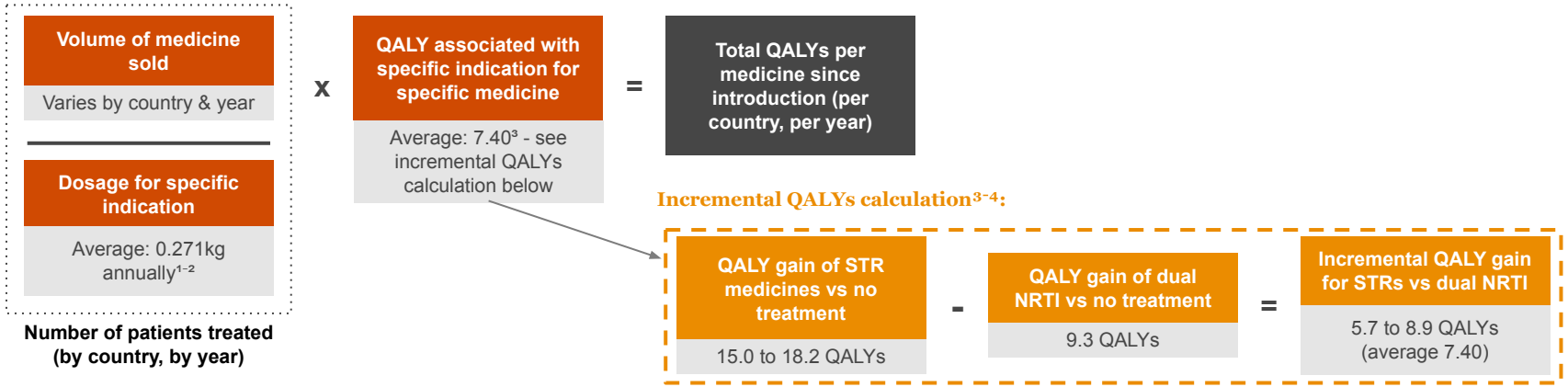
We have evaluated the health and societal impact of the following single tablet-regimen (STR) medicines from their date of introduction (or 2007, whichever is later) to 2017:

INN	Introduction in Europe[1]	Loss of Exclusivity
emtricitabine, rilpivirine, tenofovir	2011	Still exclusive
efavirenz, emtricitabine, tenofovir	2007	2017
abacavir, dolutegravir, lamivudine	2014	Still exclusive
elvitegravir, cobicistat, emtricitabine, and tenofovir	2015	Still exclusive

References:
[1] European Medicines Agency

Health impact of HIV medicines: application of generalised methodology

The diagram below shows how we applied the generalised methodology for health impact to the HIV therapeutic area, identifying specific inputs and their sources.



- The total QALYs per medicine per country per year were calculated by multiplying the average QALY by the number of patients treated by these medicines.
- To identify the number of patients treated we established the amount of drug sold in kg and divided this by its average annual dosage.
- Total QALYs per medicine since introduction are aggregated across years to give total QALYs per therapeutic area.
- The QALY gain refers to the incremental QALYs gained over a person's lifetime relative to standard of care assuming they take the treatment for a specified duration. These QALYs are discounted in accordance with NICE guidance.
- Some of the QALYs used to calculate health impact are from a cost-effectiveness analysis performed by a healthcare consulting firm. Our assumption is that these are accurate and representative.
- By using multiple research papers to estimate incremental QALYs and healthcare costs against historic dual therapy we are introducing a level of uncertainty into our health impact calculations.

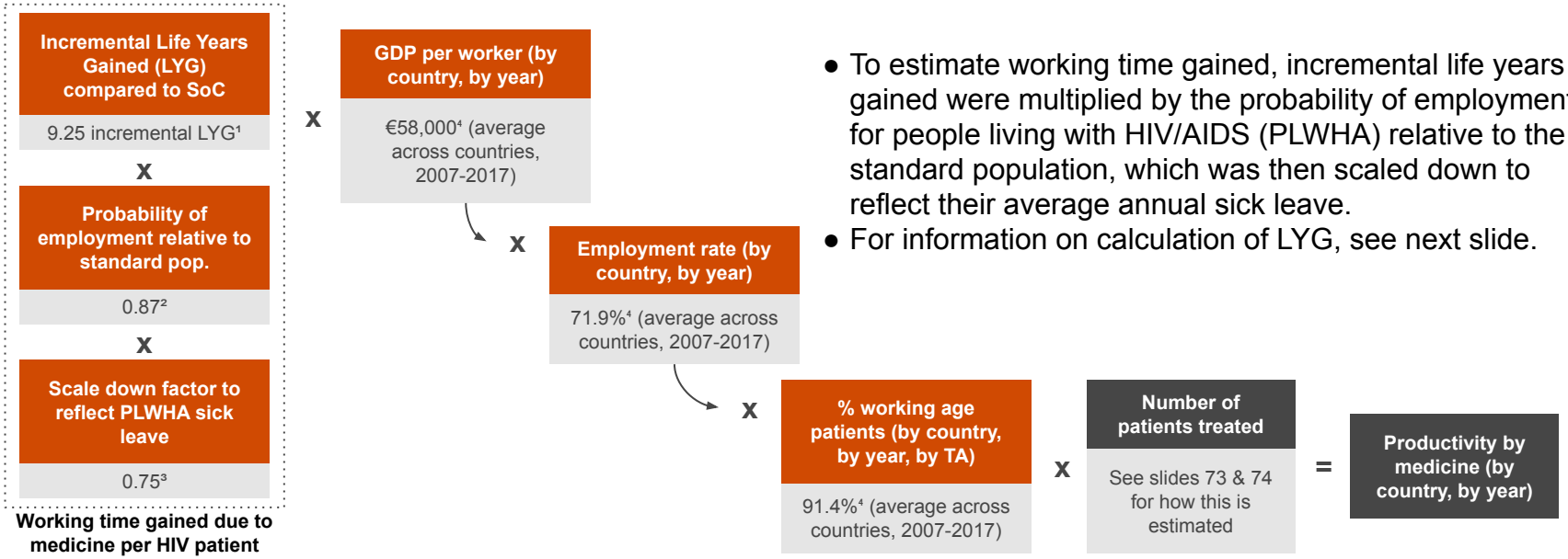
References:

[1] European Medicines Agency
[2] World Health Organization
[3] See references on slide 78
[4] Miners et al., 2001. Assessing the cost-effectiveness of HAART for adults with HIV in England

KEY
Data
Source

Productivity impact of HIV medicines: application of generalised methodology (1)

The diagram below shows how we applied the generalised methodology for productivity gains to HIV, and identifies specific inputs and their sources.



- To estimate working time gained, incremental life years gained were multiplied by the probability of employment for people living with HIV/AIDS (PLWHA) relative to the standard population, which was then scaled down to reflect their average annual sick leave.
- For information on calculation of LYG, see next slide.

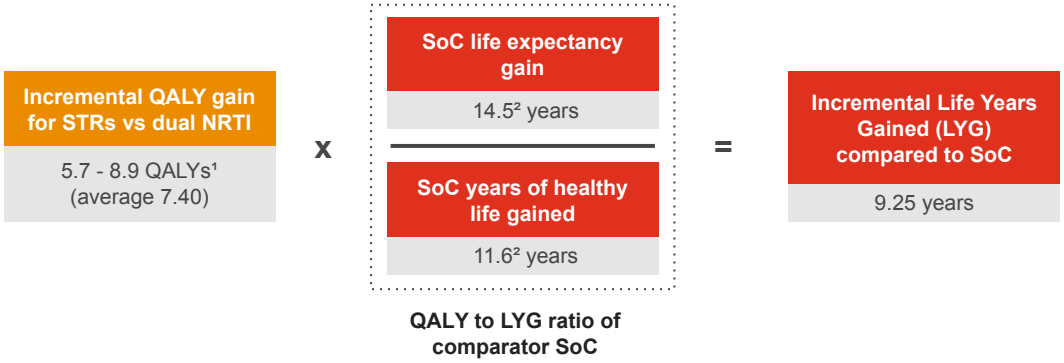
- To ensure the annual productivity gain per country was reflective of country-specific trends in employment and yearly earnings, the number of productive of years gained was multiplied out by several other factors including national employment rate and percentage of patients of working age
- There is some evidence to suggest that PLWHA tend to have lower than average socioeconomic status, thus using average GDP per worker may be overstating benefits. However, the extent to which this should be reduced is too uncertain to determine, due to lack of data specific to the EU.

References:
[1] See slide 93
[2] Public Health England, 2016. HIV in the UK
[3] Verbooy et al., 2018. Are people living with HIV less productive at work?
[4] See references on slide 75

KEY
Data
Input

Productivity impact of HIV medicines: application of generalised methodology (2)

The increase in overall life expectancy was calculated using the QALY to life expectancy increase ratio under the comparator standard of care. This was used to transform the incremental QALYs into their equivalent life expectancy gain.

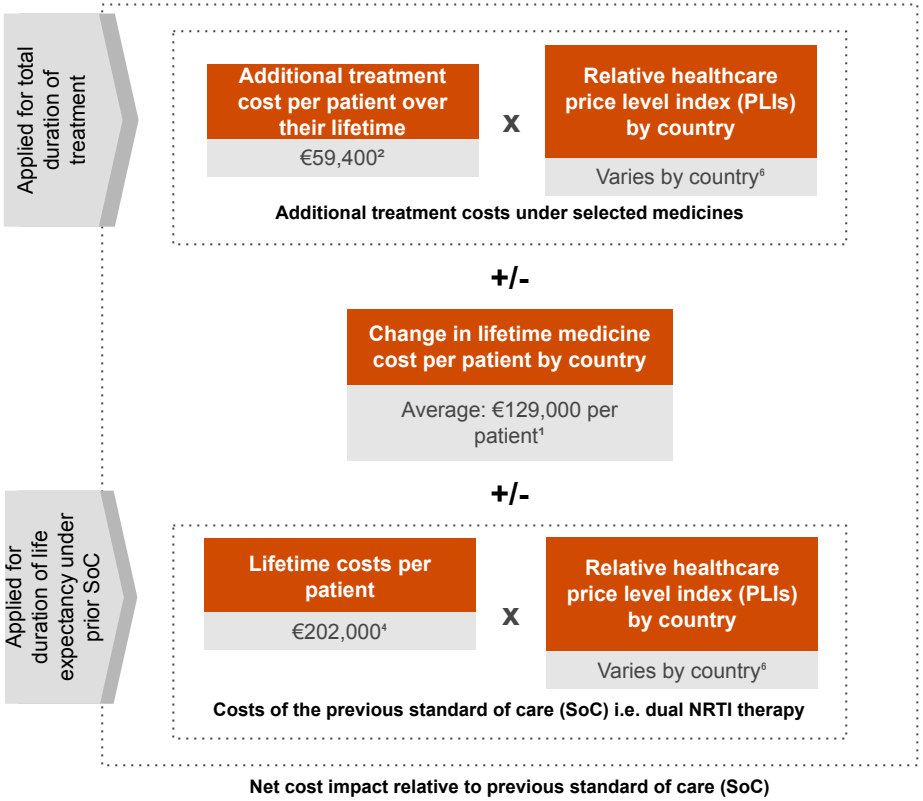


References:
[1] See references on slide 78
[2] Miners et al., 2001. Assessing the cost-effectiveness of HAART for adults with HIV in England

KEY
Data
Source

Healthcare costs impact of HIV medicines: generalised methodology

The diagram below shows how we applied the generalised methodology for healthcare costs to the HIV therapeutic area, and identifies specific inputs and their sources.



x

Number of patients treated

See slides 73 & 74 for how this is estimated

=

Δ in healthcare cost by medicine (by country, by year)

- Values on this slide refer to lifetime costs
- For our midpoint estimate, a price reduction of 50% relative to IQVIA price following loss of exclusivity (LoE) has been assumed in line with the proportional price drop for dual NRTI therapy post-LoE and also Jerveland et al. 2017[5]
- Net healthcare cost is very sensitive to price adjustments. See slide 37 for results of sensitivity analysis
- For more details on cost assumptions, see next slide

KEY

Data

Source

References:

[1] IQVIA

[2] Treskova et al, 2016. Analysis of contemporary HIV/AIDS health care costs in Germany

[3] Koechlin et al., 2014. Comparing Hospital and Health Prices and Volumes Internationally: Results of a Eurostat/ OECD Project

[4] Beck, 1999. Changing cost of English HIV service provision 1996–1997

[5] Jervelund et al, 2018. Study on the economic impact of supplementary protection certificates, pharmaceutical incentives and rewards in Europe

Treatment costs for our base case scenario (all costs shown in 2016 €)

	Figure	Value (annual cost per patient)	Comment	Source
Comparator standard of care	Dual NRTI drug costs	€1,440	Lamivudine / zidovudine generic	• NHS generic list prices
	Wider treatment costs under dual NRTI therapy scenario	€8,971	Largely due to higher rates of progression to AIDS and associated inpatient costs	• Literature[1]
Our selected medicines of focus	Costs of STRs within scope of analysis	Average annual cost pre LoE: €7,848 - €11,513	IQVIA values for first ten years, then post LoE a price drop of 50% is assumed.	• IQVIA • Price drop is in line with proportional price drop for dual therapy post LoE and also Jerveland et al. 2017[2]
	Wider treatment costs under HAART	€3,023	32% of ART costs (€7,848 - 11,513)	• Literature[3]

References

[1] Beck, 1999. Changing cost of English HIV service provision 1996–1997

[2] Jerveland et al.. 2017: Study on the economic impact of supplementary protection certificates, pharmaceutical incentives and rewards in Europe

[3] Treskova et al., 2016. Analysis of contemporary HIV/AIDS health care costs in Germany, Gonzalo et al., 2008. Socio-Economic Impact of Antiretroviral Treatment in HIV patients. An Economic Review of Cost Savings after Introduction of HAART

Appendix 3: Health & productivity results from case studies by country

Country-specific results of the health and productivity benefits can be extracted using the following tables

Example of results for Germany:

Breast cancer

In Germany between 2007-2017, 108,000 breast cancer patients were treated with the medicines analysed, leading to ...

227,000 healthy life years gained and ...

€1.1 billion in productivity gains

HIV

In Germany between 2007-2017, 18,000 HIV patients were treated with the medicines analysed, leading to ...

134,000 healthy life years gained and ...

€3.9 billion in productivity gains

Breast cancer results by country (1 of 2)

Country / Region	Number of patients treated	Healthy life years gained	Productivity gain (€)
Europe	***557,900***	***1,184,000***	***5,493,000,000***
Austria	11,100	23,500	121,599,000
Belgium	17,100	36,400	185,278,000
Bulgaria	4,300	8,900	8,563,000
Croatia	3,800	8,200	13,709,000
Czech Republic	6,000	12,600	26,695,000
Denmark	9,200	19,600	129,490,000
Finland	6,300	13,300	74,592,000
France	89,700	186,900	1,009,000,000
Germany	108,300	227,000	1,067,000,000
Greece	1,200	2,400	6,252,000
Hungary	7,200	15,100	24,582,000
Ireland	6,400	13,600	104,076,000
Italy	76,500	166,000	689,795,000

Note: The above totals include Switzerland, and therefore differ to those in the main report. Total may not equal sum of components due to rounding. Additionally, limited availability of data has resulted in some countries being excluded.

Breast cancer results by country (2 of 2)

Country / Region	Number of patients treated	Healthy life years gained	Productivity gain (€)
Latvia	730	1,600	2,889,000
Lithuania	90	190	295,800
Netherlands	21,200	46,200	282,284,000
Poland	18,300	37,600	67,425,000
Portugal	8,100	17,000	46,238,000
Romania	7,300	16,000	19,918,000
Slovakia	4,300	8,900	20,122,000
Slovenia	2,300	4,900	14,053,000
Spain	48,300	102,500	416,560,000
Sweden	11,500	24,900	144,200,000
Switzerland	11,800	24,800	201,769,000
United Kingdom	76,800	165,800	816,542,000

Note: Total may not equal sum of components due to rounding. Additionally, limited availability of data has resulted in some countries being excluded.

HIV results by country (1 of 2)

Country / Region	Number of patients treated	Healthy life years gained	Productivity gain (€)
Europe	***108,900***	***806,500***	***23,236,000,000***
Austria	1,300	9,700	305,921,000
Belgium	2,900	23,400	627,494,000
Bulgaria	20	160	960,500
Croatia	50	460	4,217,000
Czech Republic	80	730	8,868,000
Denmark	1,500	10,800	392,844,000
Finland	420	3,000	84,120,000
France	16,400	121,300	3,897,000,000
Germany	17,600	134,000	3,875,000,000
Hungary	60	530	4,833,000
Ireland	2,800	19,900	889,892,000
Italy	14,900	116,700	2,869,000,000

Note: The above totals include Switzerland, and therefore differ to those in the main report. Total may not equal sum of components due to rounding. Additionally, limited availability of data has resulted in some countries being excluded.

HIV results by country (2 of 2)

Country / Region	Number of patients treated	Healthy life years gained	Productivity gain (€)
Latvia	160	1,400	16,677,000
Lithuania	10	60	766,500
Luxembourg	20	150	7,072,000
Netherlands	4,000	29,100	933,755,000
Poland	2	10	112,200
Portugal	4,200	26,100	393,317,000
Slovakia	20	130	1,706,000
Slovenia	80	740	11,953,000
Spain	19,400	151,500	3,588,000,000
Sweden	2,500	18,600	705,022,000
Switzerland	4,000	31,100	1,532,000,000
United Kingdom	16,500	106,800	3,086,000,000

Note: Total may not equal sum of components due to rounding. Additionally, limited availability of data has resulted in some countries being excluded.

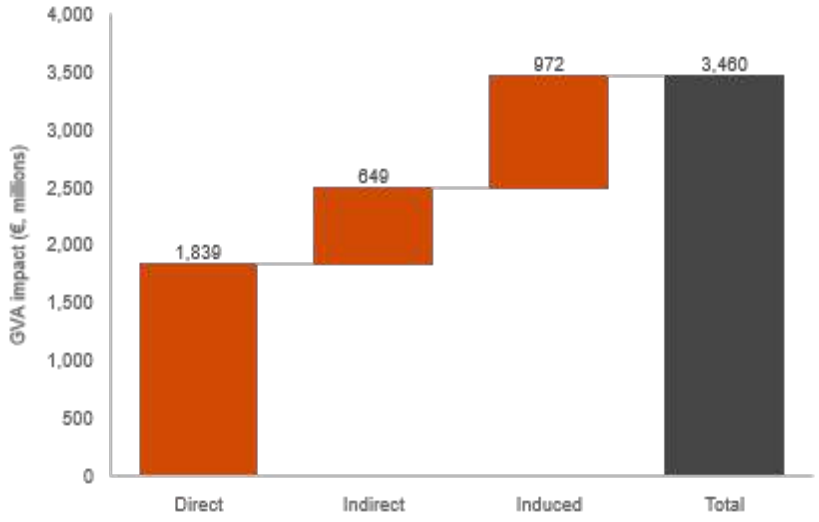
Appendix 4: Country by country economic results

Economic impact of the pharmaceutical industry in Austria

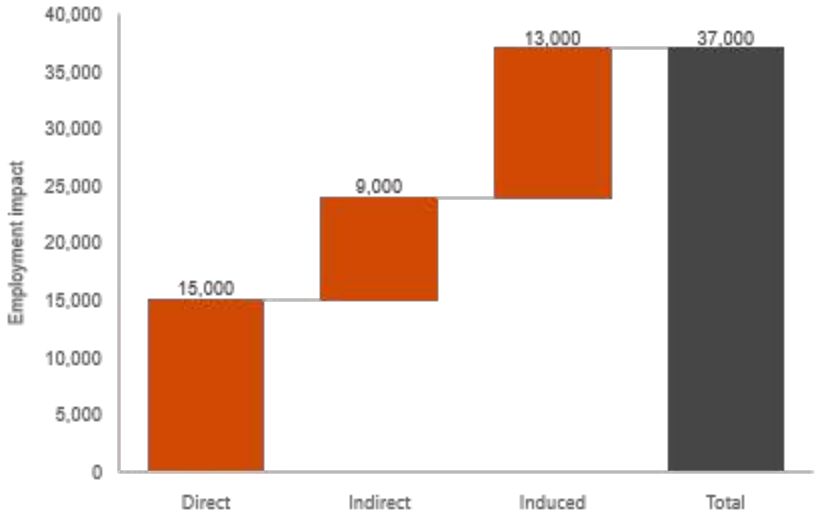
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Austria's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €3.5 billion in GVA and 37,000 jobs. This is approximately 1.0% of total GDP and 0.8% of total employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



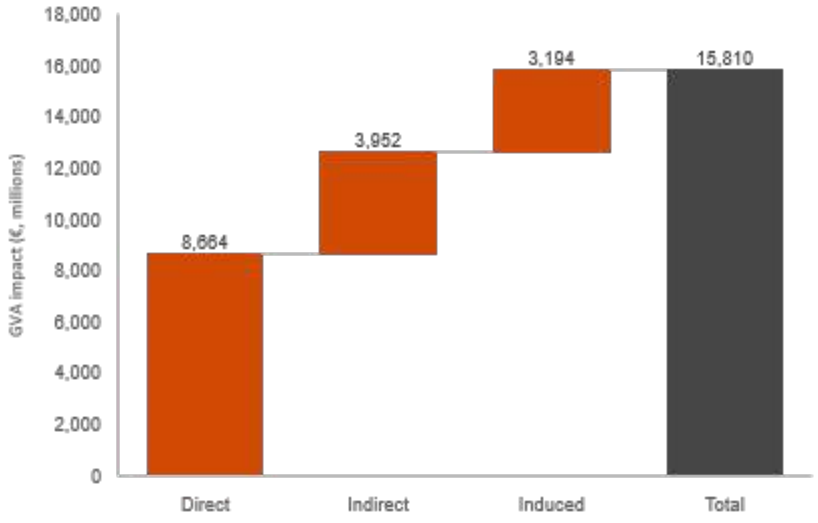
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Belgium

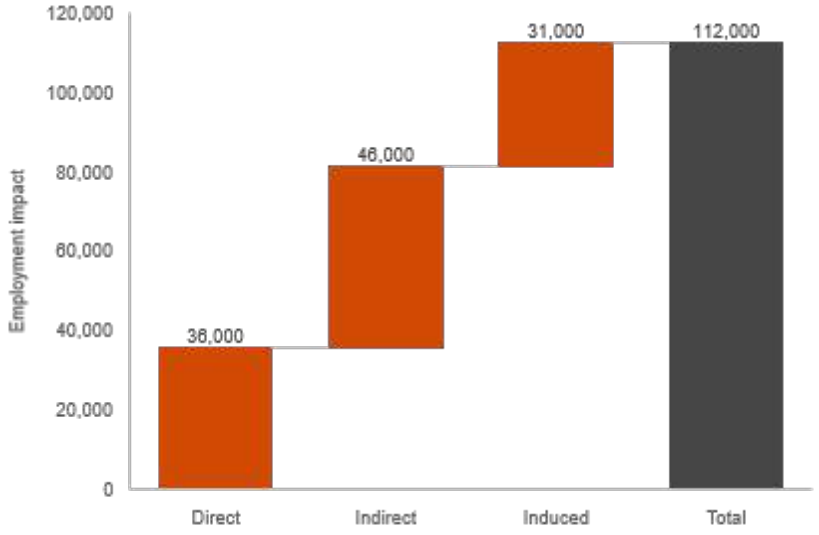
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Belgium's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €15.8 billion in GVA and 112,000 jobs. This is approximately 3.7% of total GDP and 2.3% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



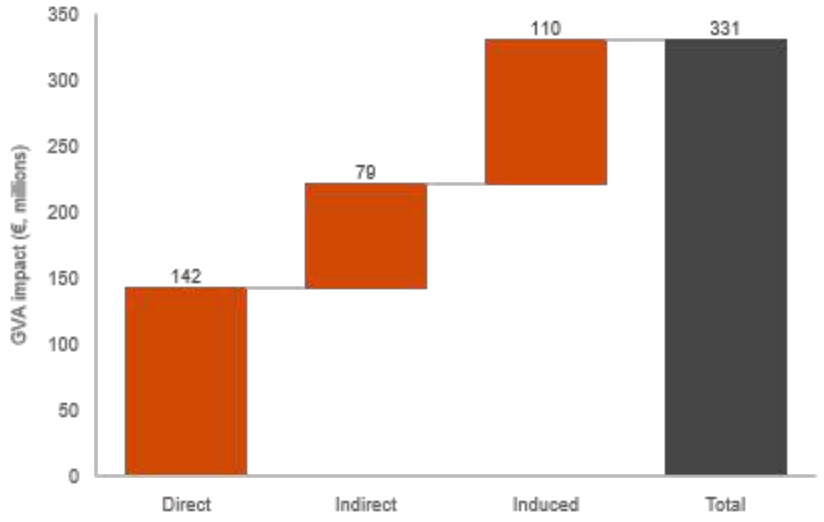
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Bulgaria

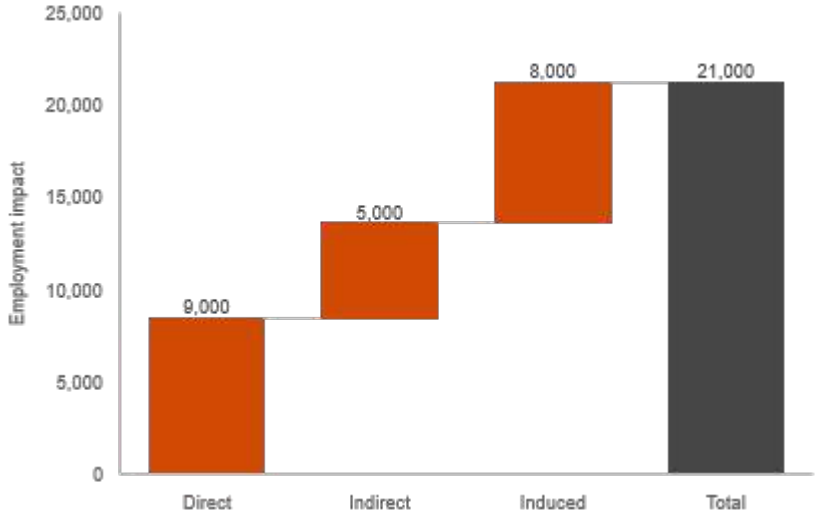
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Bulgaria's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €331 million in GVA and 21,000 jobs. This is approximately 0.7% of total GDP and employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



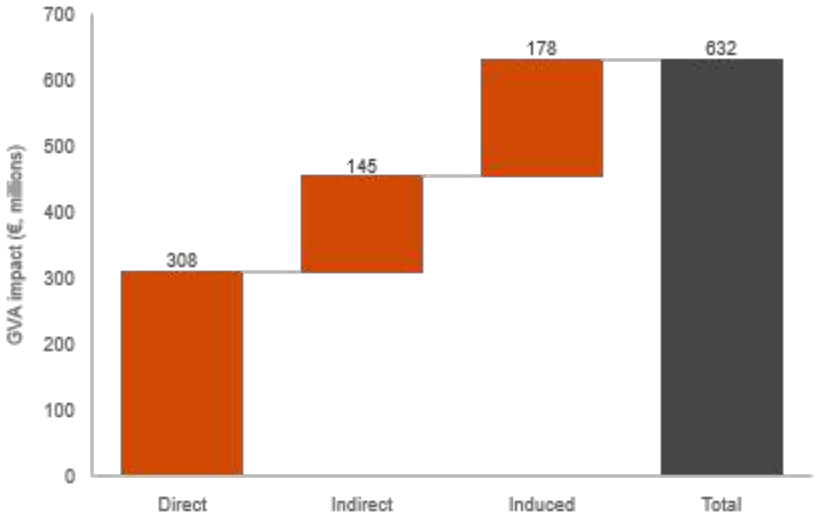
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Croatia

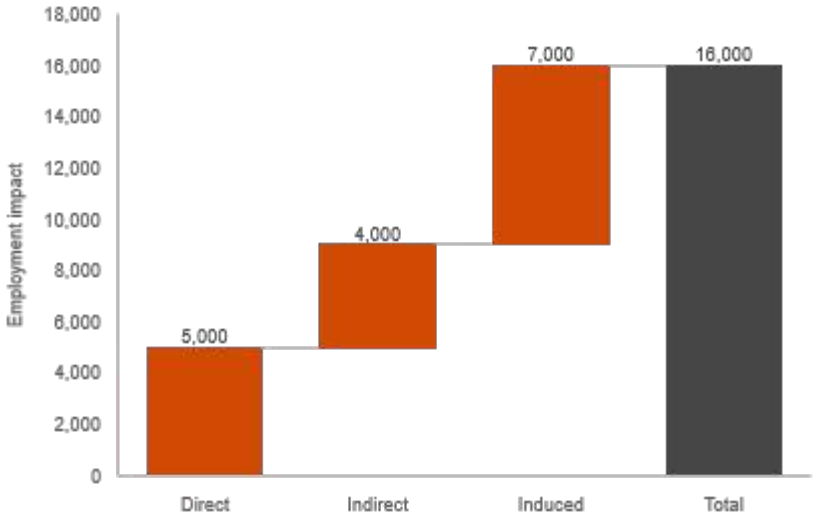
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Croatia's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €632 million in GVA and 16,000 jobs. This is approximately 1.4% of total GDP and 0.9% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



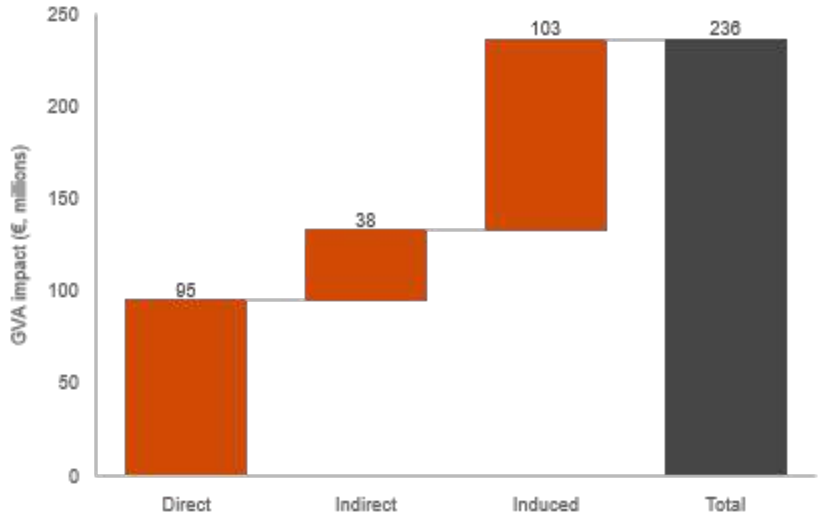
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Cyprus

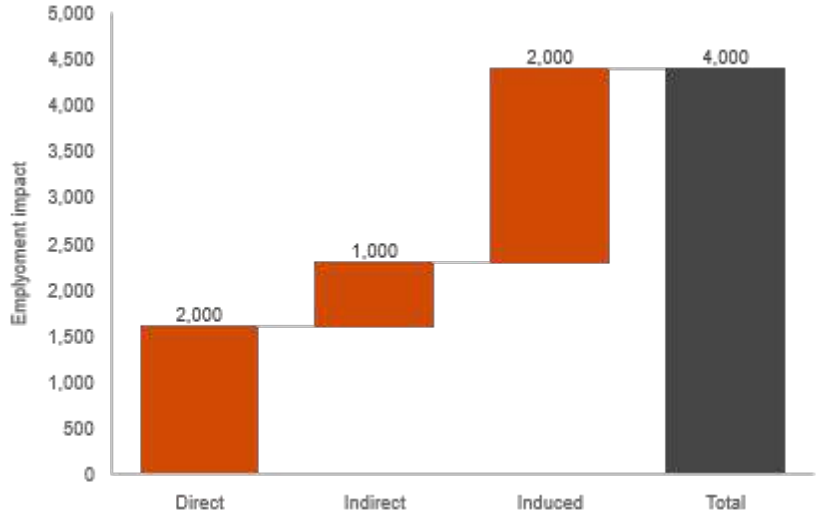
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Cyprus' economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €236 million in GVA and 4,000 jobs. This is approximately 1.3% of total GDP and 1.2% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



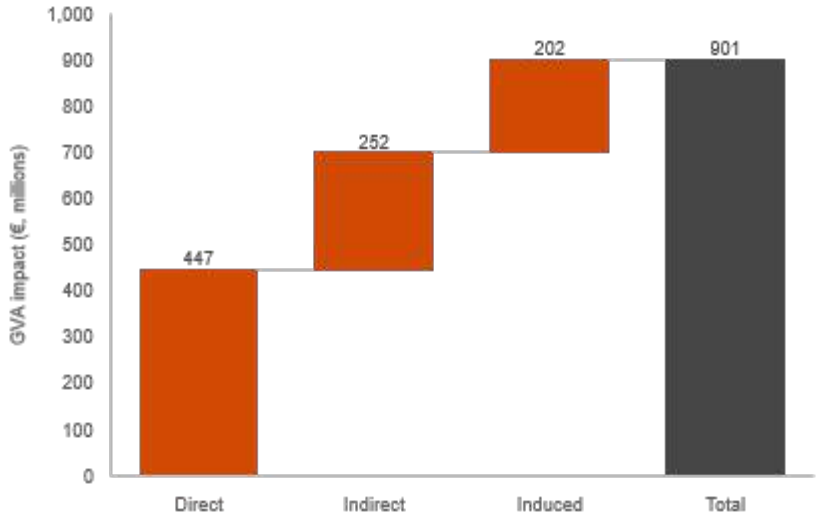
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in the Czech Republic

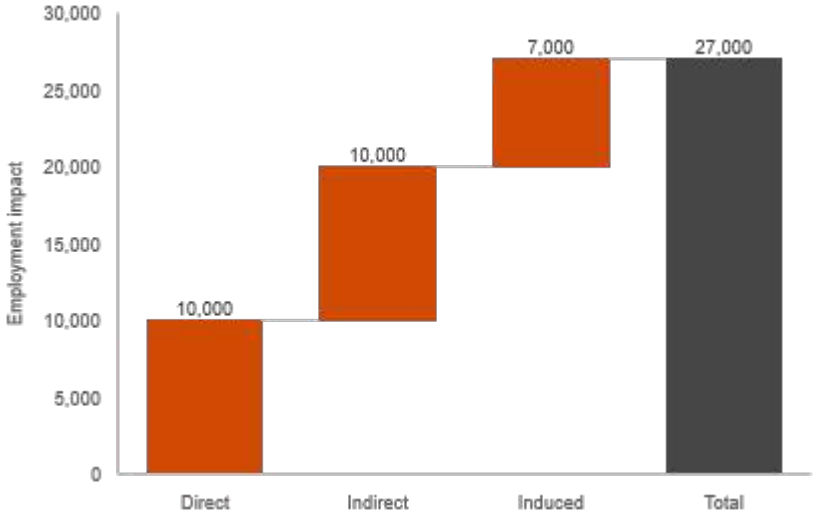
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to the Czech Republic's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €901 million in GVA and 27,000 jobs. This is approximately 0.5% of total GDP and employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



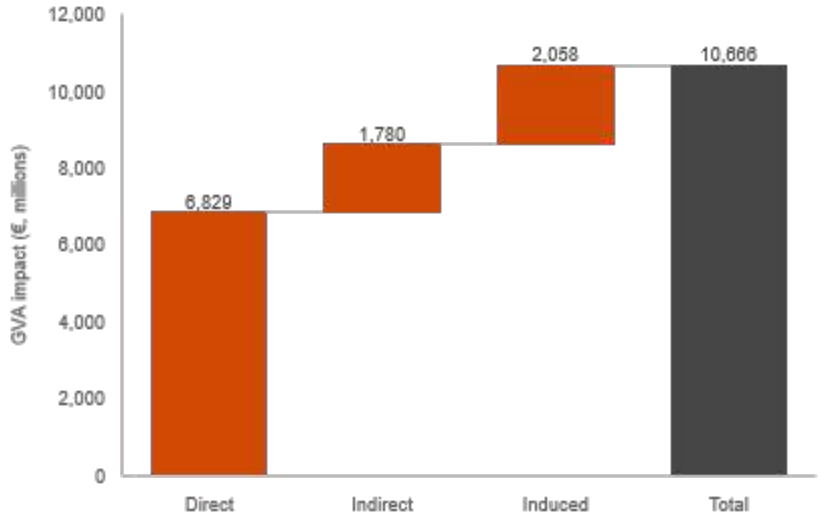
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Denmark

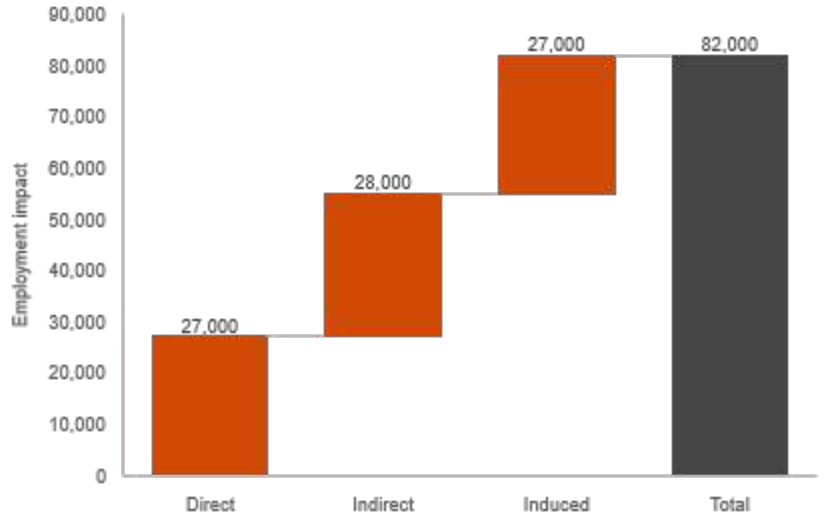
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Denmark's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €10.7 billion in GVA and 82,000 jobs. This is approximately 3.8% of total GDP and 2.8% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



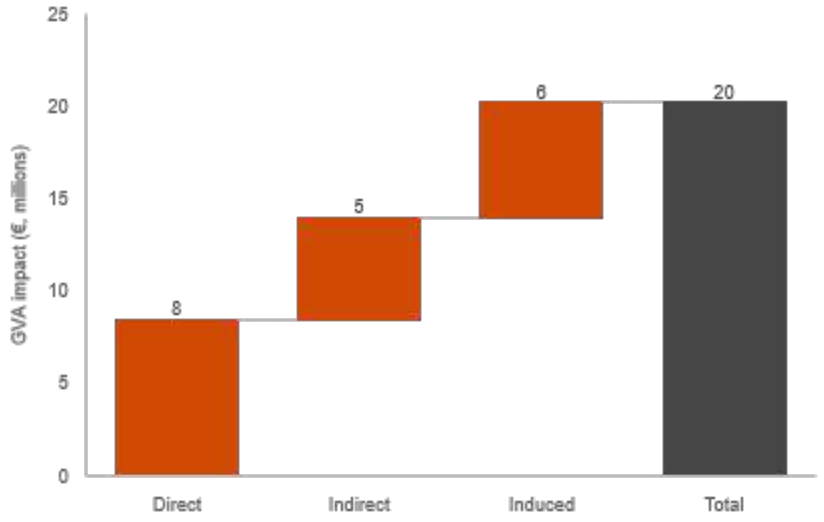
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Estonia

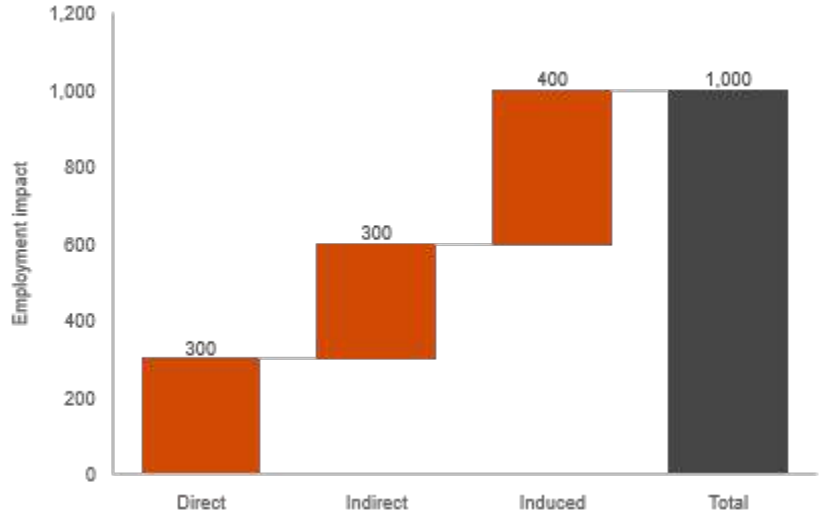
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Estonia's economy. Our analysis shows that the sector supports a total of €20 million in GVA and 1,000 jobs. This is approximately 0.1% of total GDP and 0.2% of total employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



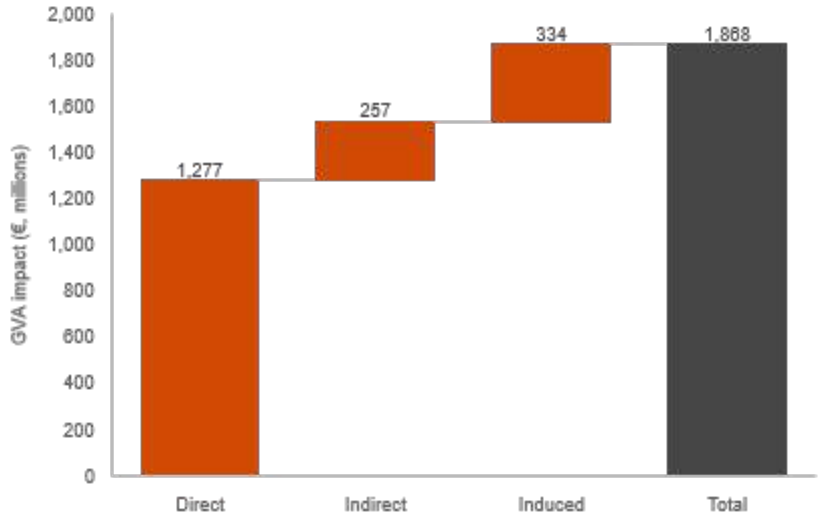
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Finland

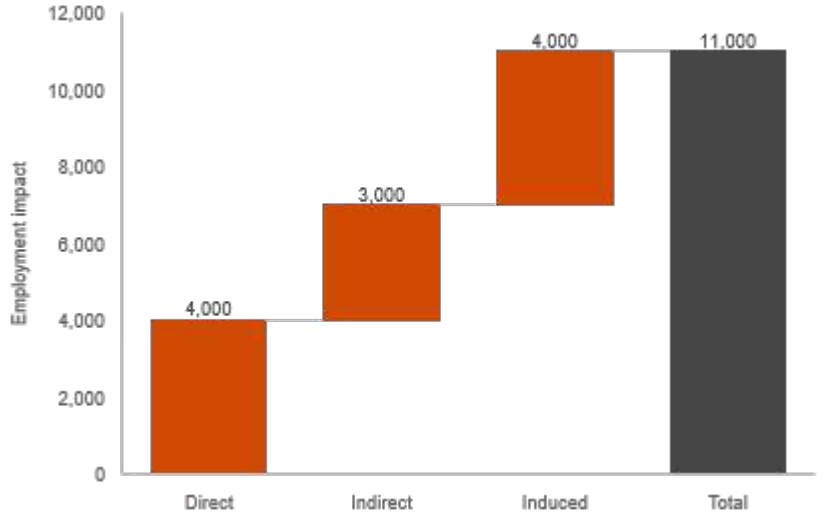
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Finland's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €1.9 billion in GVA and 11,000 jobs. This is approximately 0.9% of total GDP and 0.4% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



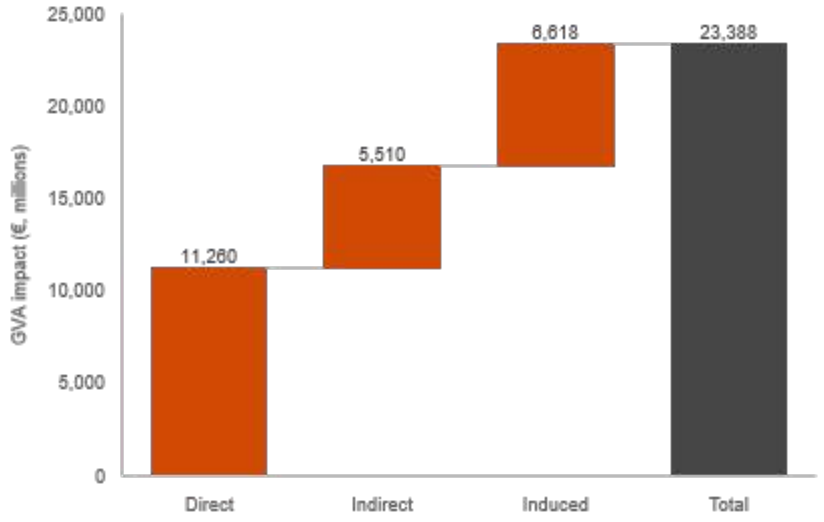
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in France

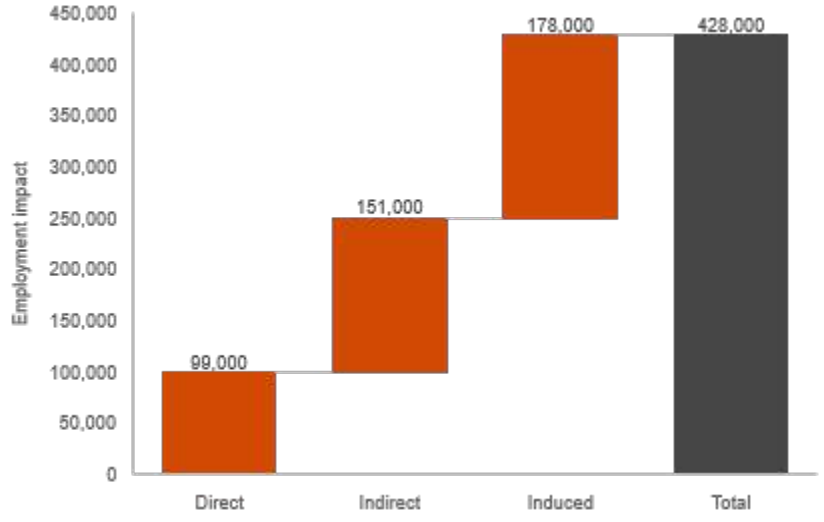
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to France's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €23.4 billion in GVA and 428,000 jobs. This is approximately 1.0% of total GDP and 1.5% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



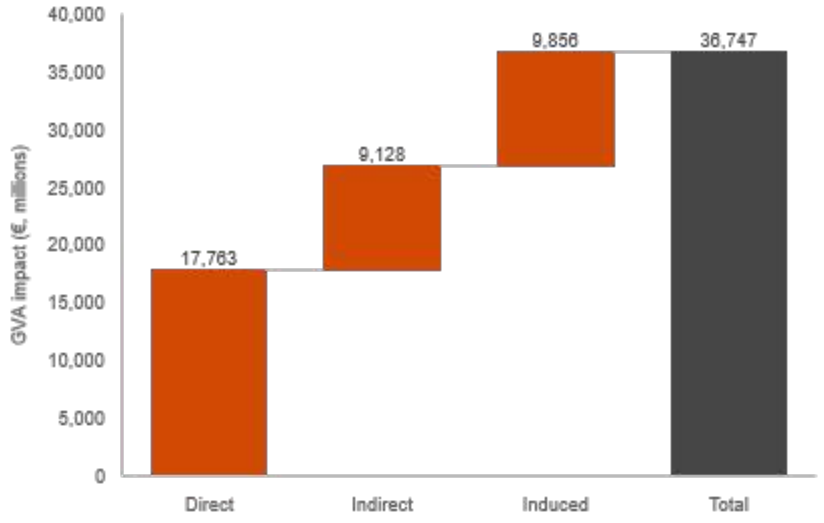
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Germany

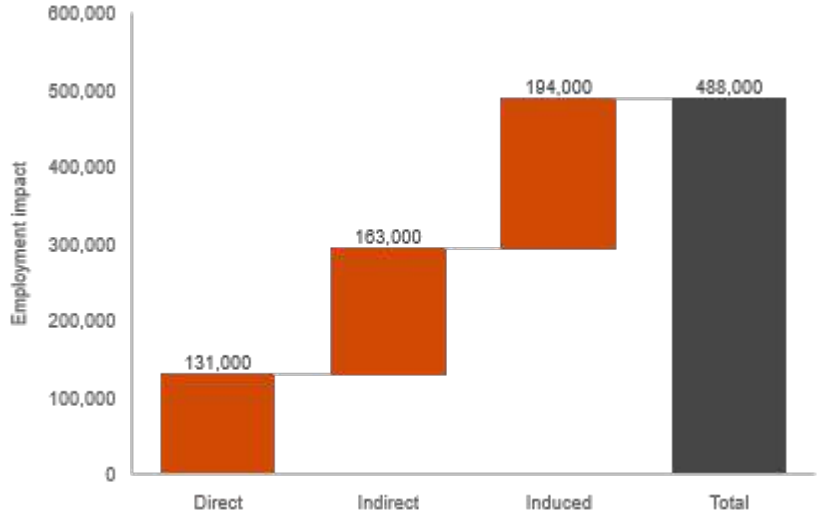
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Germany's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €36.8 billion in GVA and 488,000 jobs. This is approximately 1.2% of total GDP and employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



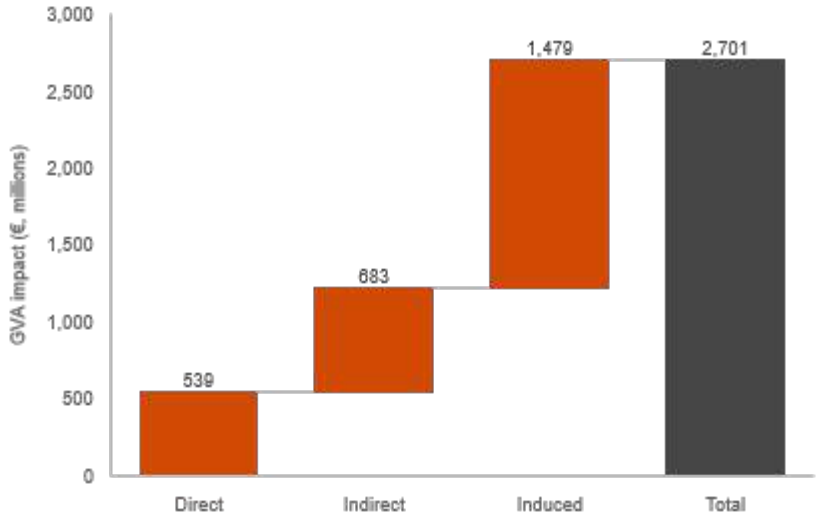
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Greece

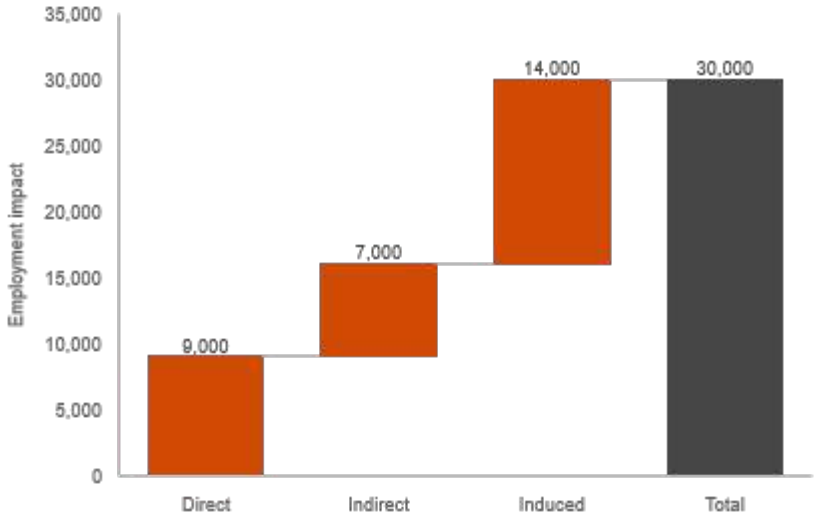
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Greece's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €2.7 billion in GVA and 30,000 jobs. This is approximately 1.5% of total GDP and 0.6% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



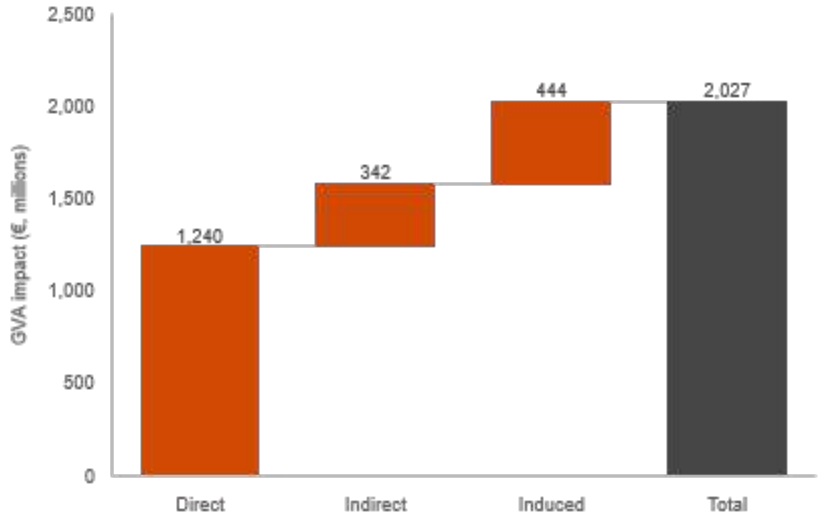
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Hungary

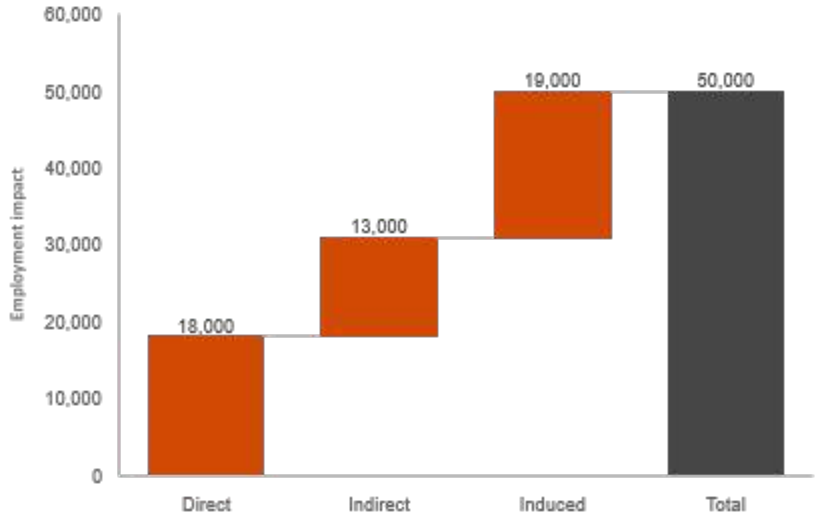
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Hungary's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €2.0 billion in GVA and 50,000 jobs. This is approximately 1.8% of total GDP and 1.1% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



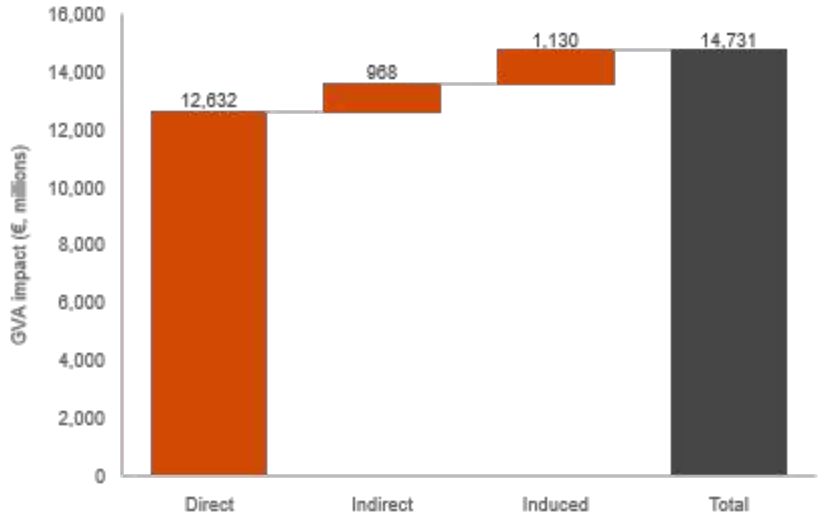
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Ireland

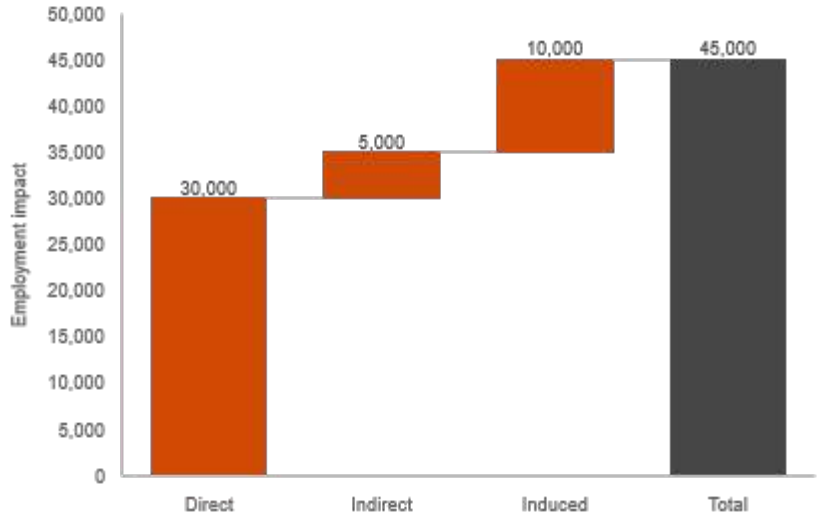
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Ireland's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €14.7 billion in GVA and 45,000 jobs.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



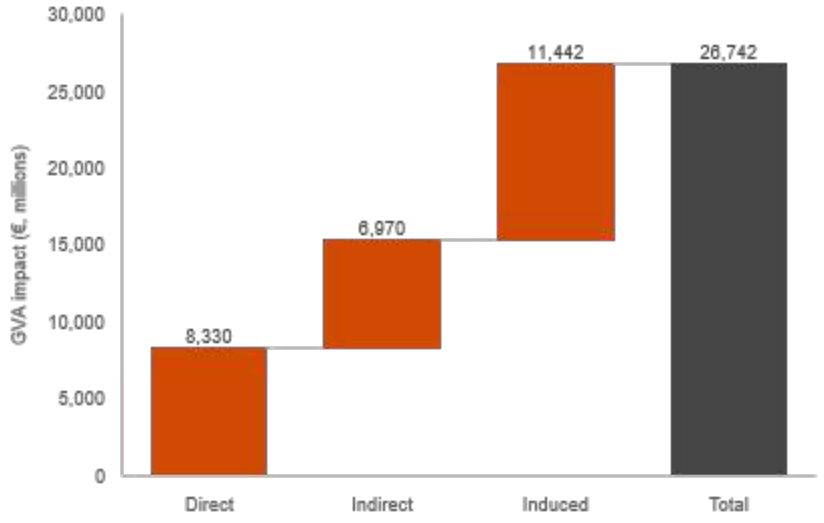
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Italy

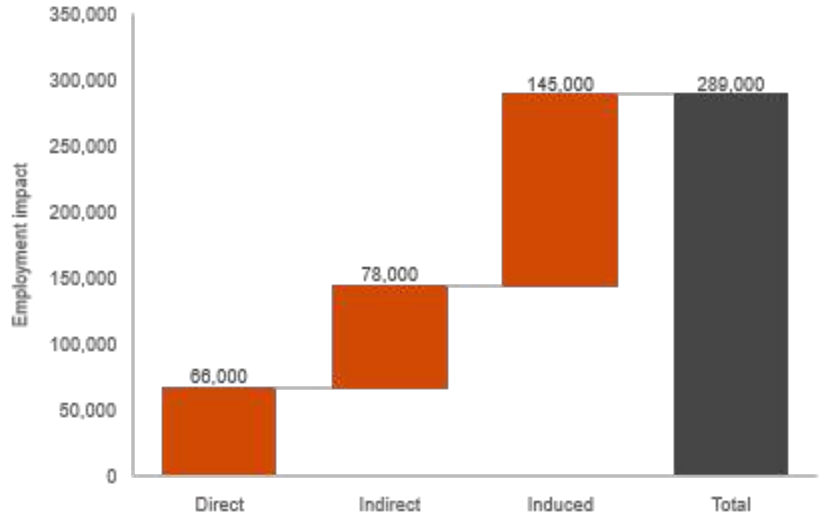
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Italy's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €26.7 billion in GVA and 289,000 jobs. This is approximately 1.6% of total GDP and 1.1% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



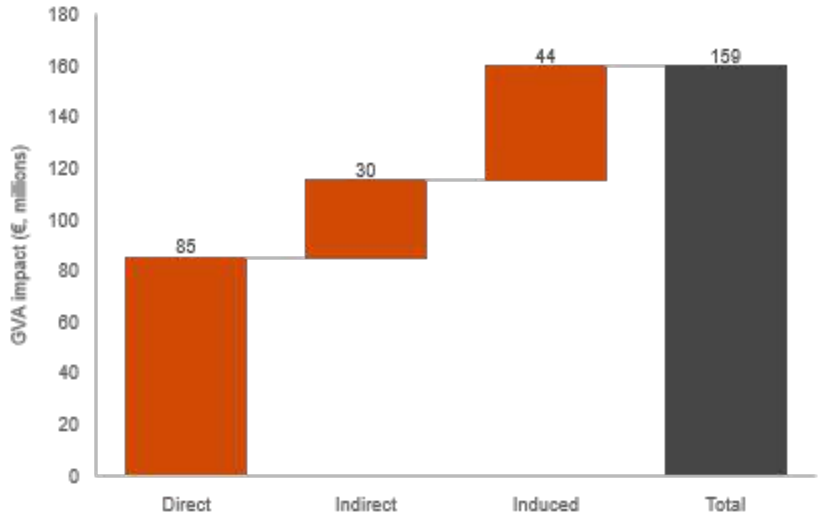
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Latvia

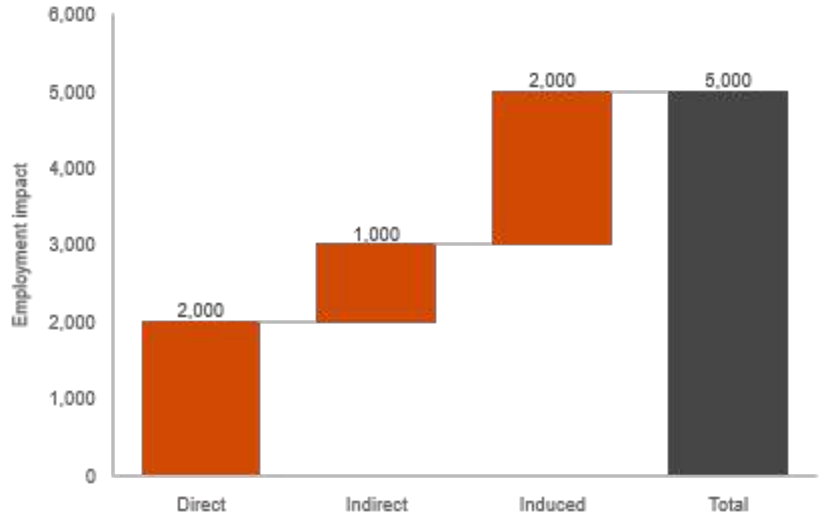
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Latvia's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €159 million in GVA and 5,000 jobs. This is approximately 0.6% of total GDP and employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



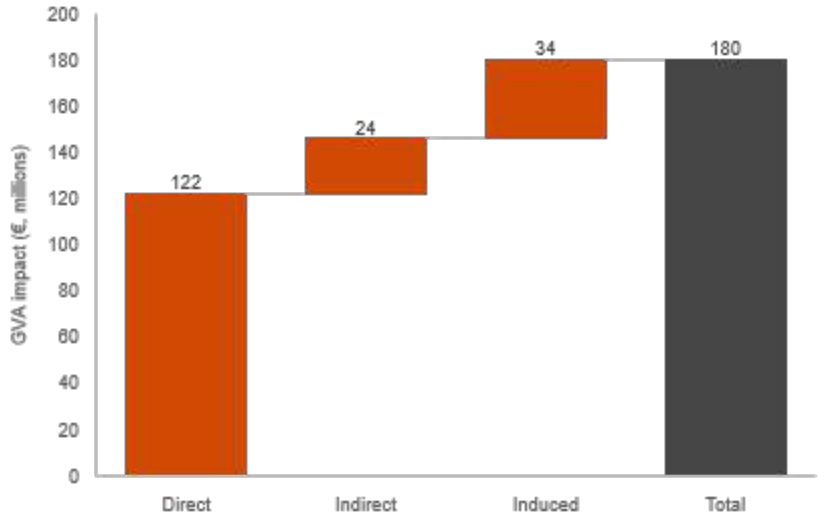
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Lithuania

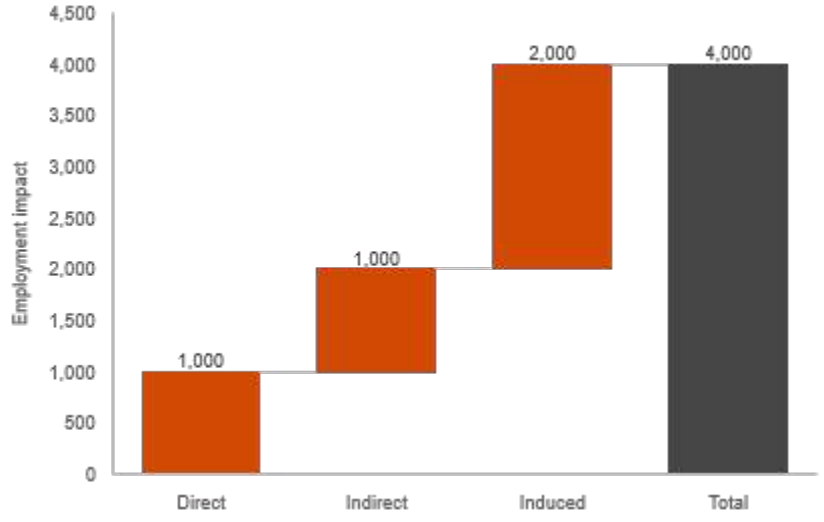
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Lithuania's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €180 million in GVA and 4,000 jobs. This is approximately 0.5% of total GDP and 0.3% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Luxembourg

These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

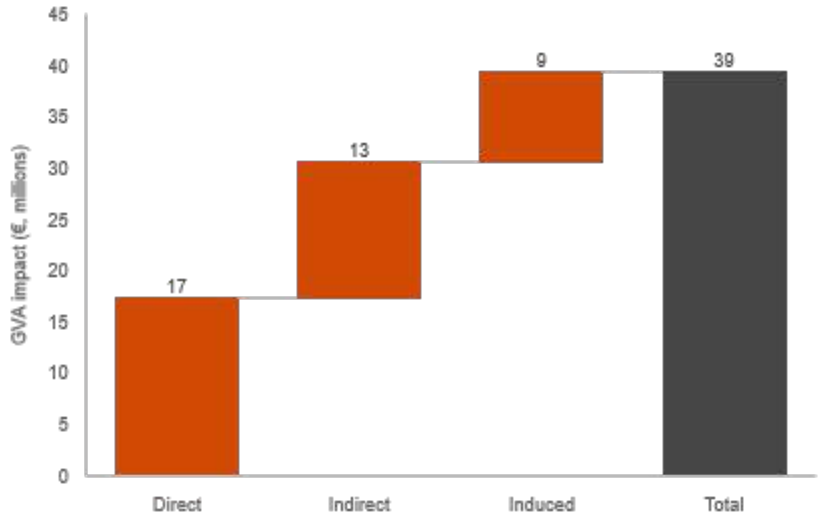
We have not been able to estimate the economic contribution of the pharmaceutical industry in Luxembourg as the sector's presence in the country is relatively small and no reliable data is available.

Economic impact of the pharmaceutical industry in Malta

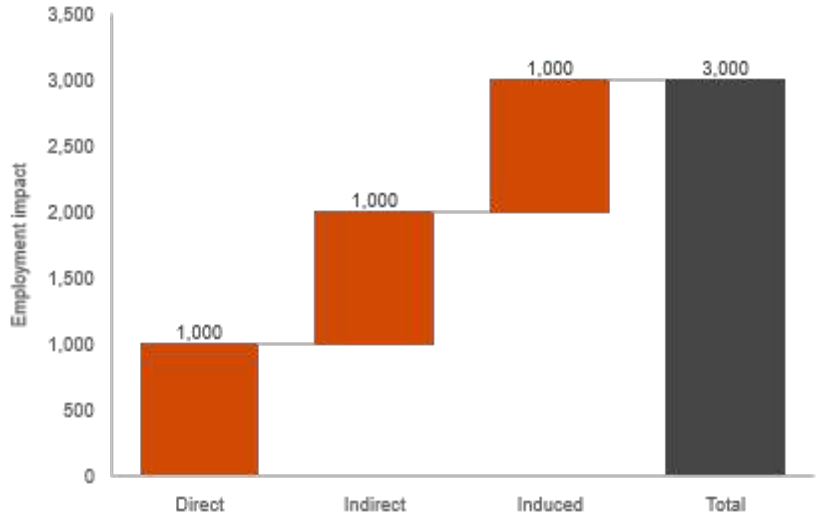
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Malta's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €39 million in GVA and 3,000 jobs. This is approximately 0.4% of total GDP and 1.5% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



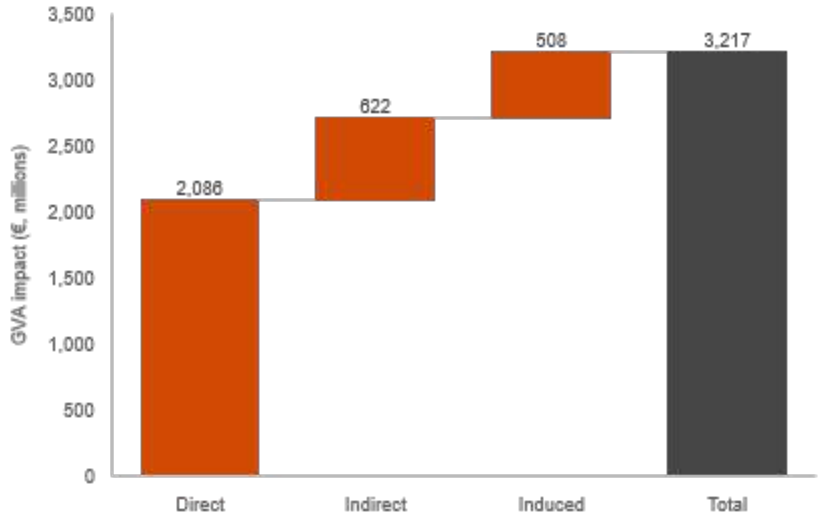
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in the Netherlands

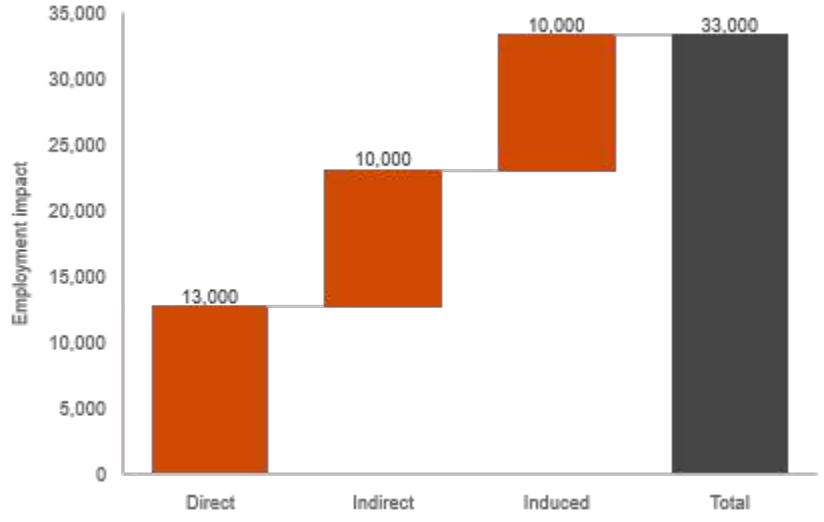
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to the Netherlands' economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €3.2 billion in GVA and 33,000 jobs. This is approximately 0.5% of total GDP and 0.4% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



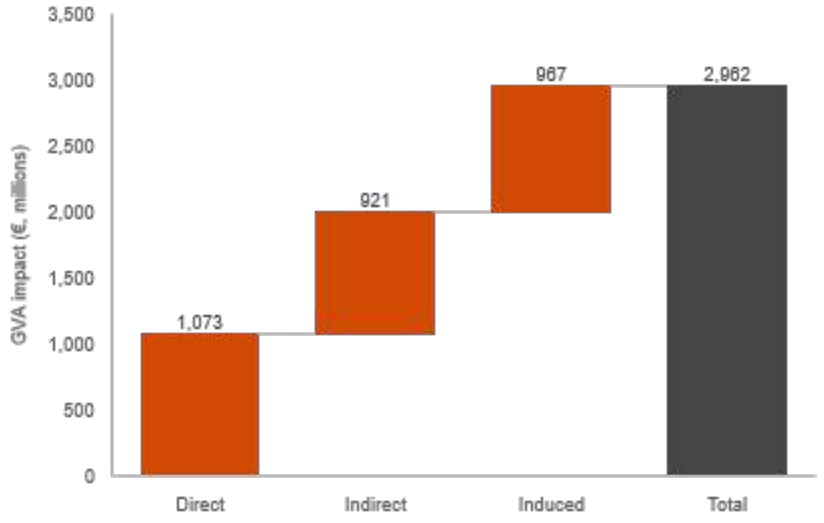
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Poland

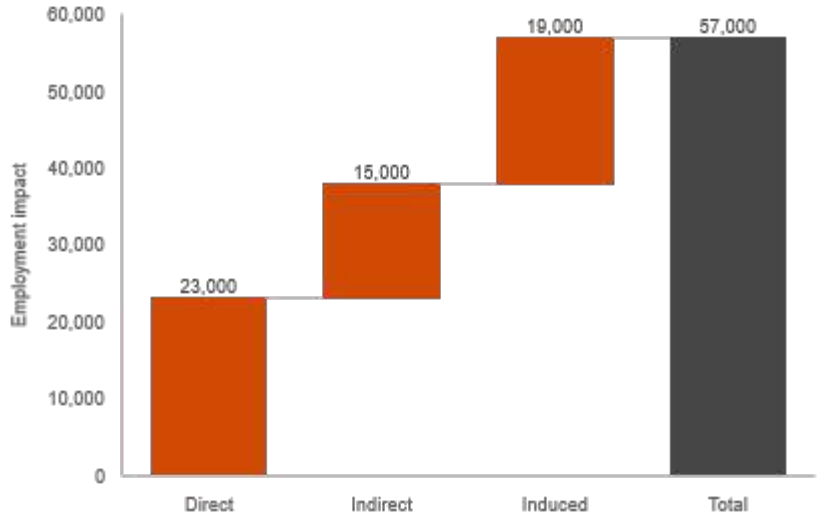
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Poland's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €3.0 billion in GVA and 57,000 jobs. This is approximately 0.7% of total GDP and 0.3% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



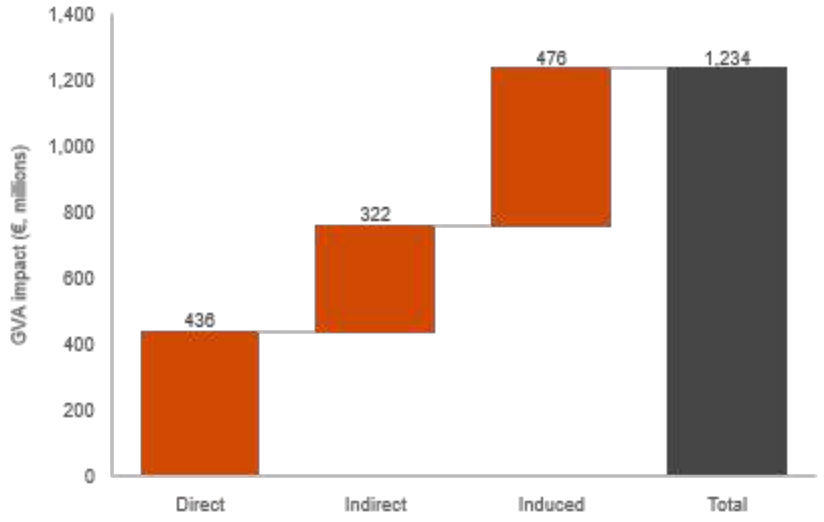
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Portugal

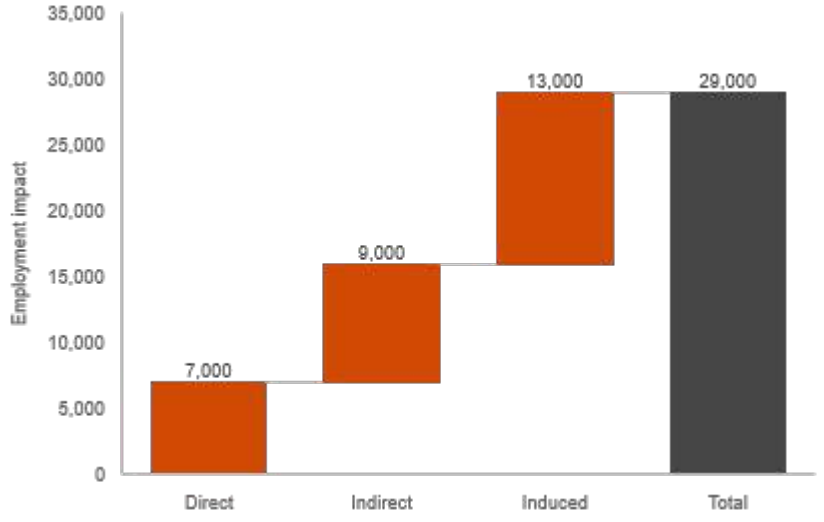
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Portugal's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €1.2 billion in GVA and 29,000 jobs. This is approximately 0.7% of total GDP and 0.6% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



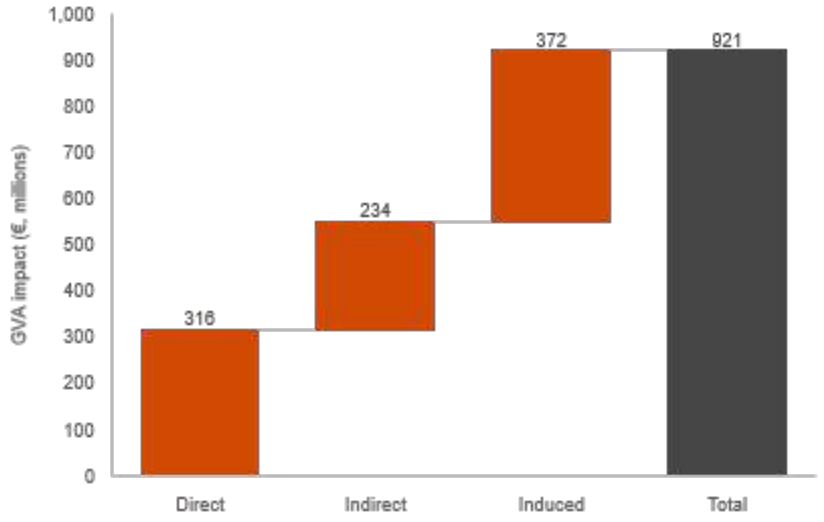
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Romania

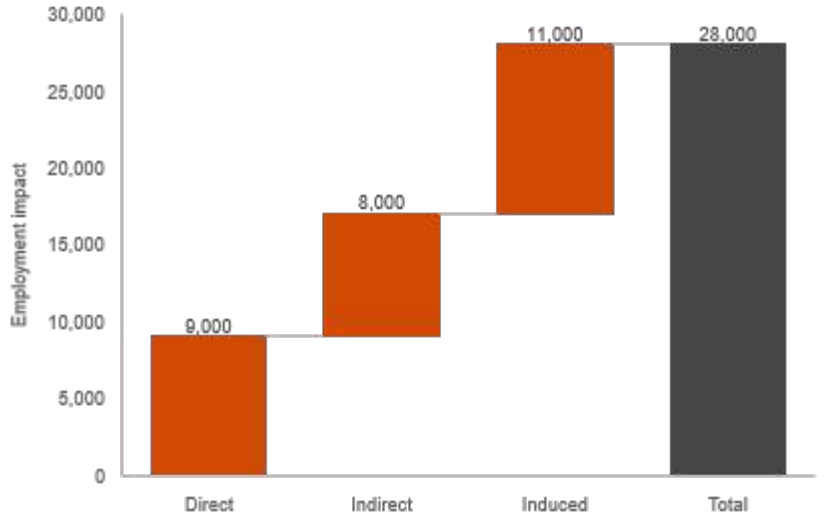
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Romania's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €921 million in GVA and 28,000 jobs. This is approximately 0.5% of total GDP and 0.3% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



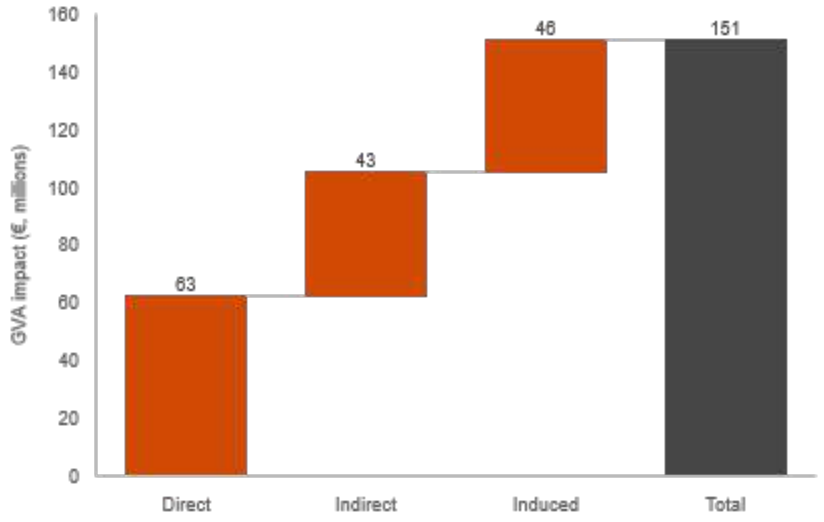
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Slovakia

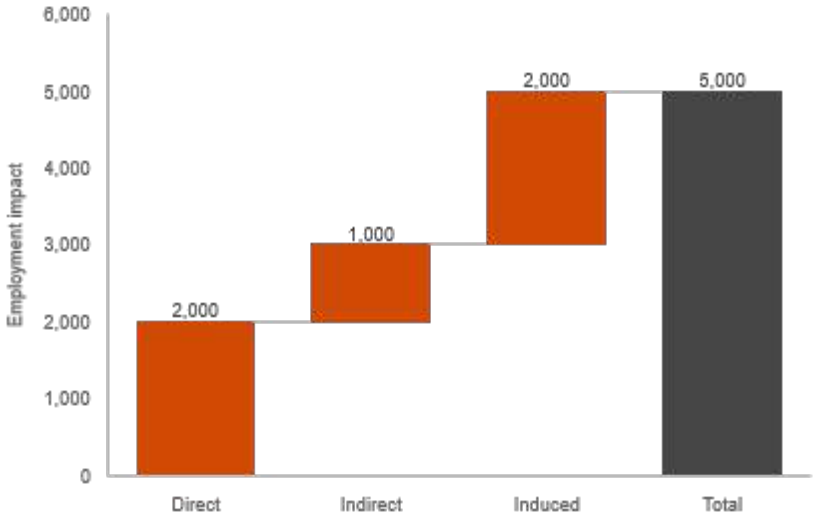
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Slovakia's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €151 million in GVA and 5,000 jobs. This is approximately 0.2% of total GDP and employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



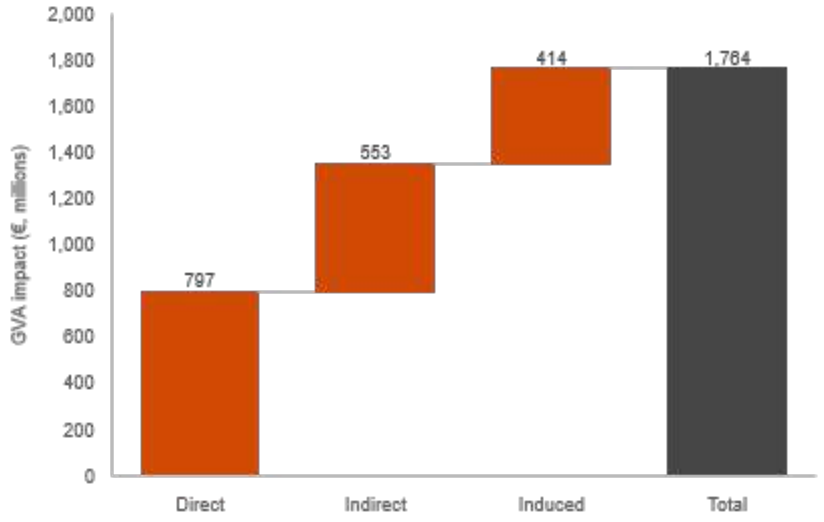
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Slovenia

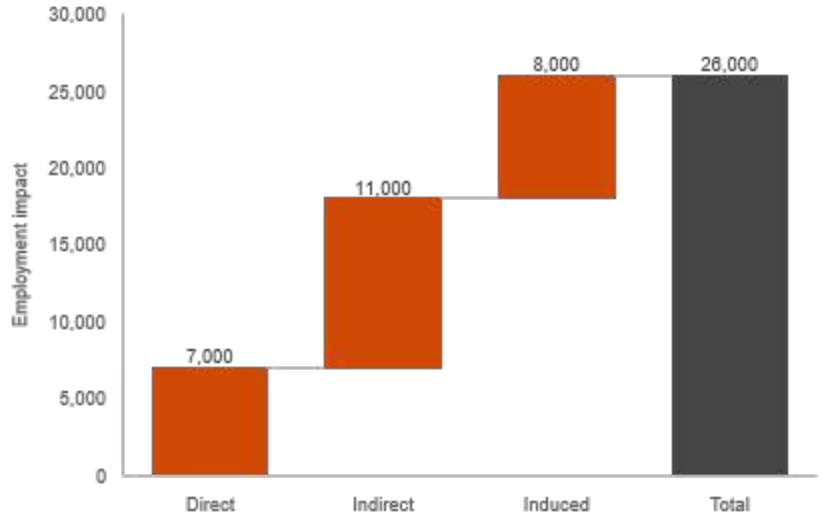
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Slovenia's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €1.8 billion in GVA and 26,000 jobs. This is approximately 4.4% of total GDP and 2.6% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



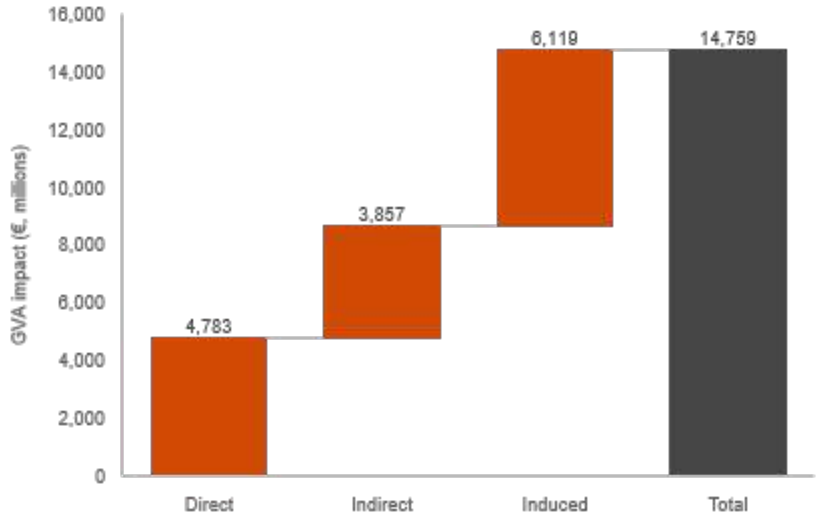
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Spain

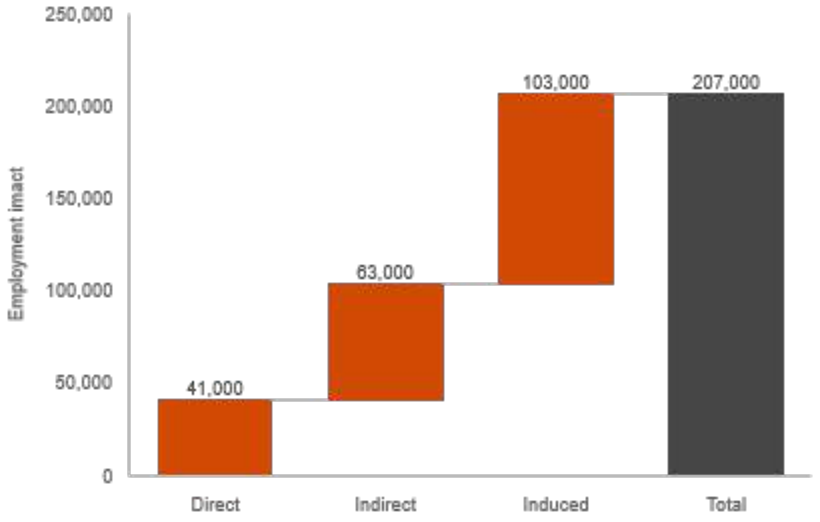
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Spain's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €14.8 billion in GVA and 207,000 jobs. This is approximately 1.3% of total GDP and 0.9% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



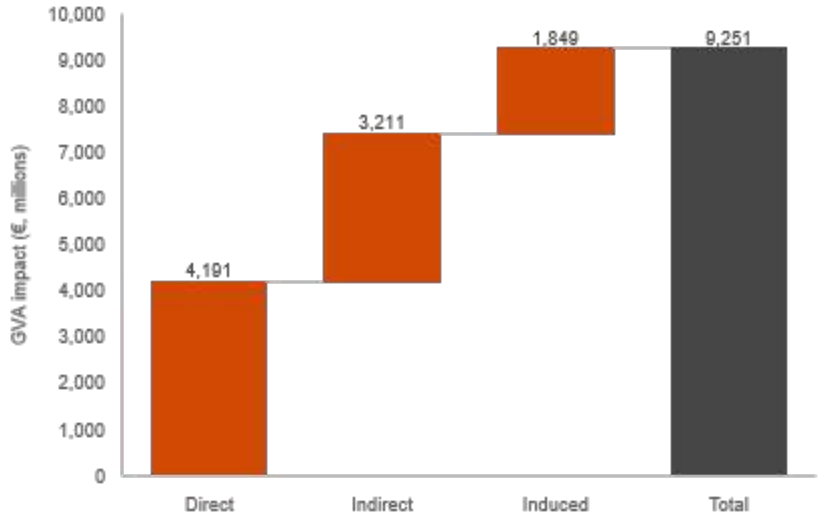
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Sweden

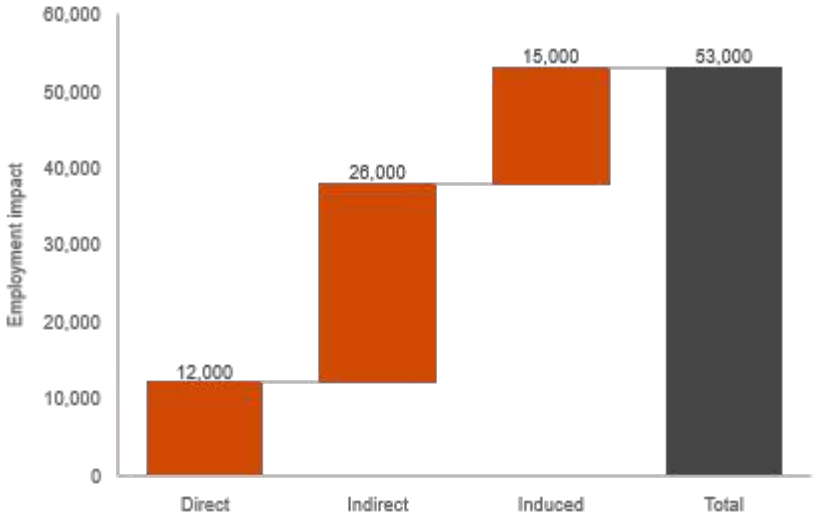
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Sweden's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €9.3 billion in GVA and 53,000 jobs. This is approximately 2.0% of total GDP and 1.0% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



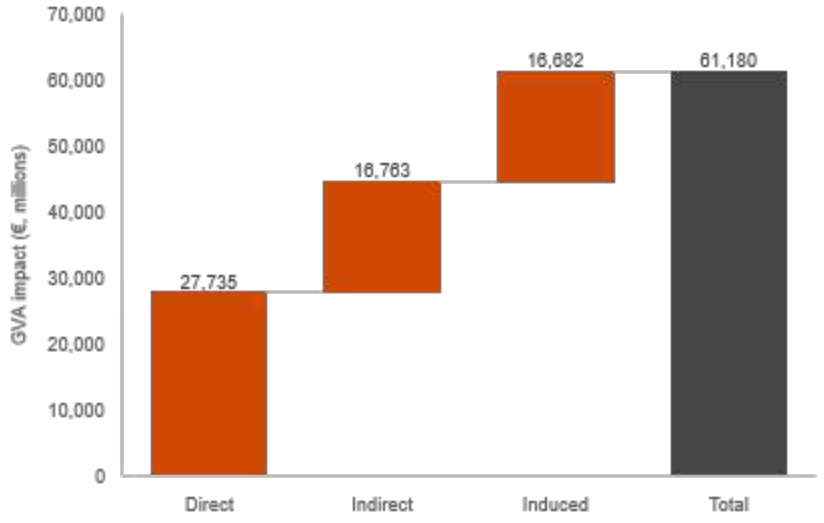
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in Switzerland

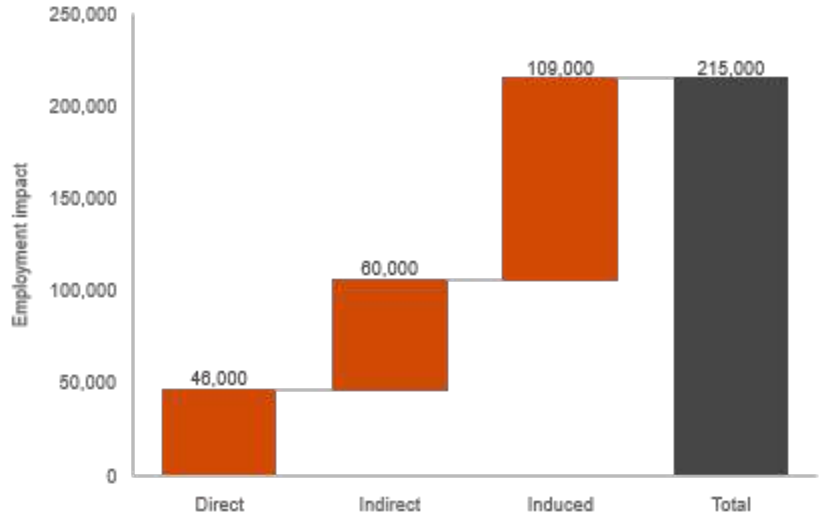
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to Switzerland's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €61.2 billion in GVA and 215,000 jobs. This is approximately 10.1% of total GDP and 4.6% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



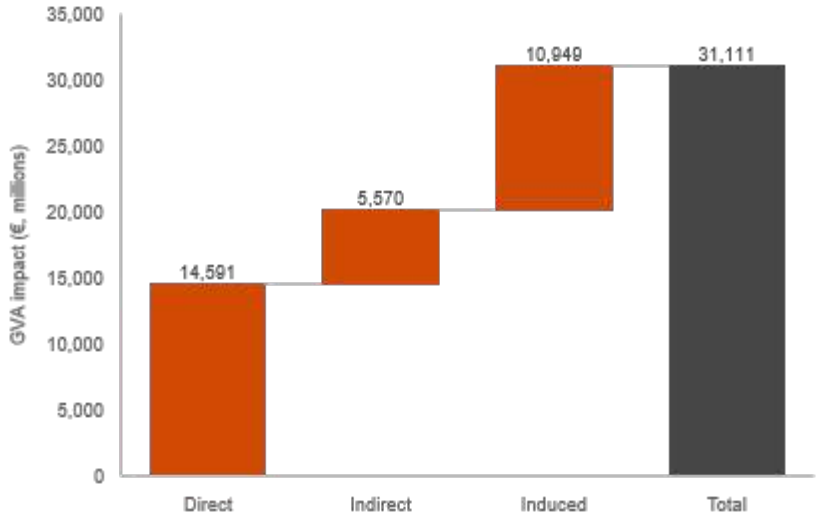
Note: total may not equal sum of components due to rounding

Economic impact of the pharmaceutical industry in the United Kingdom

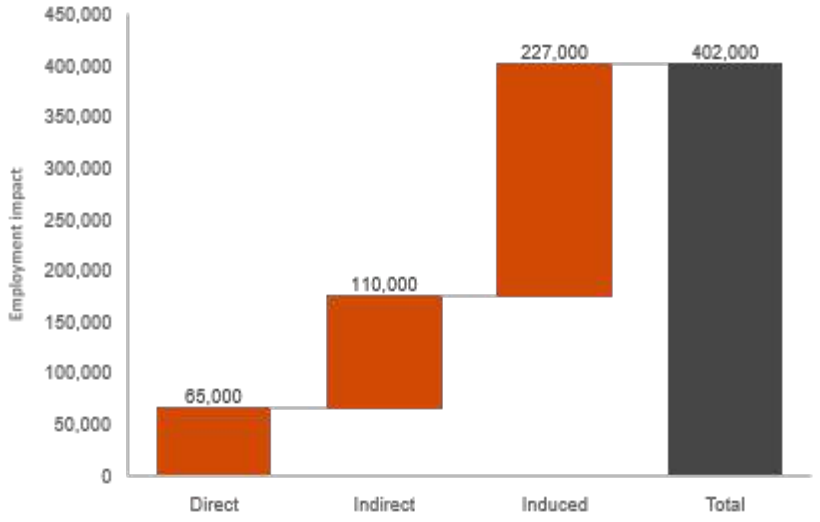
These results form part of an analysis commissioned by EFPIA in which PwC UK estimated the economic impacts of the pharmaceutical industry across Europe. For assumptions, methodology, and limitations please see our report: *Economic & societal footprint of the pharmaceutical industry in Europe.*

We used input-output analysis to estimate the contribution of the pharmaceutical industry to the United Kingdom's economy. Our analysis shows that the sector makes a significant contribution, supporting a total of €31.1 billion in GVA and 402,000 jobs. This is approximately 1.3% of total GDP and 1.2% of employment.

GVA contribution of the pharmaceutical industry



Employment contribution of the pharmaceutical industry



Note: total may not equal sum of components due to rounding

Thank you

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