OXFORD ECONOMICS

THE ECONOMIC CONTRIBUTION OF HALEON TO THE UK IN 2020

A REPORT FOR HALEON

APRIL 2022

HALEON

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EXECUTIVE SUMMARY

Haleon commissioned Oxford Economics to quantify its economic contribution to the UK economy in 2020. This report describes the size of Haleon's economic contribution in terms of gross value added (GVA), jobs, and wages. It also considers the wider economic benefits of its activity, through investment in research & development (R&D) and exports.

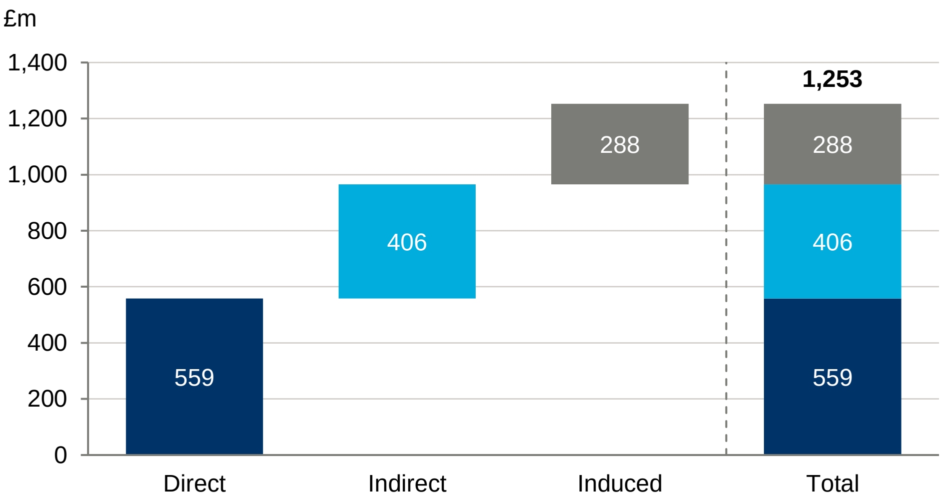
Oxford Economics calculates that Haleon's total contribution to UK GDP was £1.25 billion in 2020. This total GVA comprises direct, indirect, and induced activity. Haleon directly generated £559 million of GVA.[1] It spent £498 million procuring goods and services, of which £455 million was spent across UK suppliers, generating a further £406 million of GVA through indirect effects along its UK-based supply chain. A further £288 million was generated through induced effects as a result of Haleon employees, plus those in the supply chain, spending their incomes within the economy.

£1.25 billion

contribution to GDP in 2020.

Haleon makes a substantial contribution to the UK economy.

Fig. 1. Haleon's gross value added contribution to UK GDP, 2020

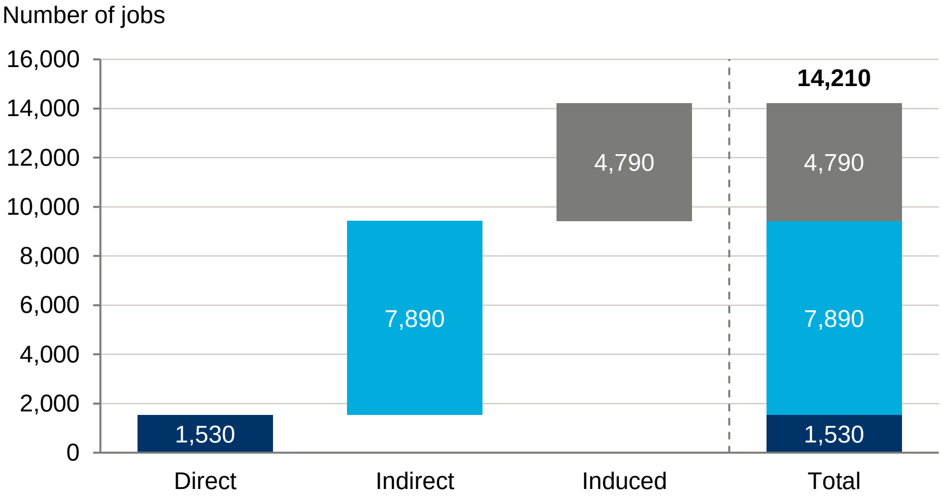


Source: Haleon, Oxford Economics. Note: may not sum due to rounding

Haleon supported an estimated 14,210 jobs across the UK in 2020. It directly employed 1,530 workers across 1,520 full-time equivalent (FTE) jobs. Through stimulating additional supply chain (indirect) activity, Haleon supported 7,890 jobs. A further 4,790 jobs were supported through wage consumption (induced) effects. In total, this equated to more than eight jobs across the wider economy for every job employed directly. Around 10,250 workers (72%) were employed on a full-time basis, slightly higher than the UK workforce as a whole (68%).

[1] Note that this represents an underestimate of Haleon's direct GVA in 2020, as it excludes both direct taxes on production (e.g. business rates and the apprenticeship levy) and employer National Insurance Contributions (NICs) as well as corporation tax and VAT payments made by Haleon in the relevant period.

Fig. 2. Haleon's contribution to UK employment, 2020



Source: Haleon, Oxford Economics. Note: may not sum due to rounding.

14,210 jobs

sustained in 2020.

Eight jobs across the wider economy for every job employed directly by Haleon.

Haleon makes a positive contribution to boosting UK productivity, the average GVA produced by each member of the workforce. Productivity is a key determinant of pay and living standards in the long-run. Haleon's direct operations support an average productivity of £364,200 per worker, almost seven-times higher than the UK average.

Haleon's highly productive workforce is relatively well remunerated. In total, its direct workforce earned £130 million in wages—equivalent to £84,600 per job, or £85,400 per FTE. Average direct earnings are therefore over two-and-a-half times higher than the UK average (£30,600 per job). In total, Haleon supported £531 million in wages across the UK.

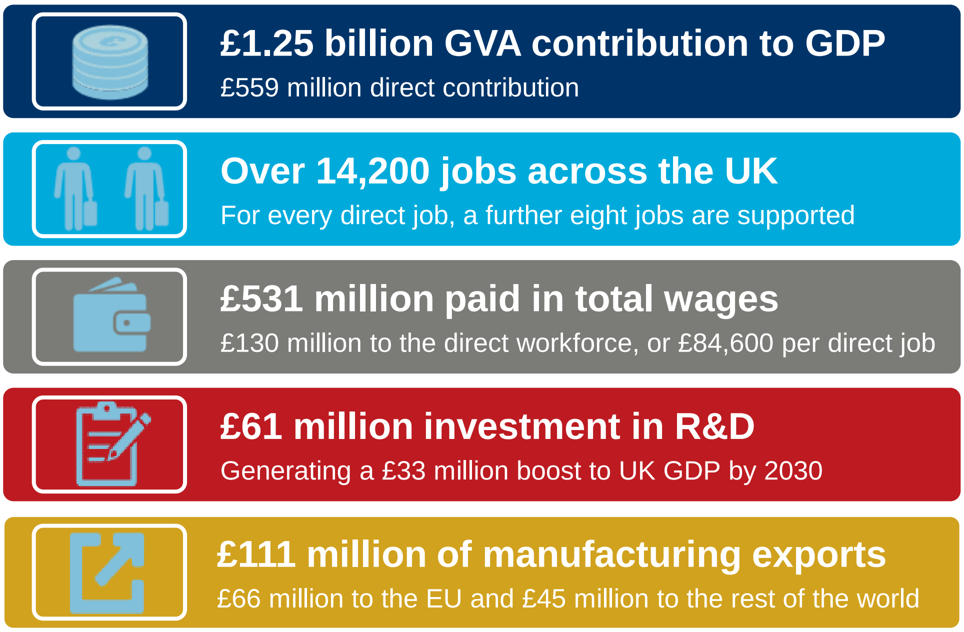
Haleon makes a substantial investment in research and development (R&D). In 2020, it spent £267 million in R&D investment globally, of which £61 million was spent in the UK, a large part of which was researching oral health products at its R&D centre in Weybridge—equivalent to 12.6% of turnover. Haleon therefore makes a positive contribution to raising UK R&D from its current level of 1.7% of GDP, to the government's target of 2.4% by 2027. R&D activity in the UK directly supported approximately 270 jobs, and is focussed on oral health products, an important factor in general health outcomes. Haleon also supported 46 academic collaborations across 18 UK universities, including supporting 38 PhD students.

Haleon's R&D spending can drive economic growth across the economy. In 2020, Haleon invested £61 million in R&D in the UK. Our analysis indicates that this research-led innovation enhances the growth potential of the UK economy overall. We find that Haleon's R&D spending in 2020 alone generates a GDP boost of £33 million by 2030. Of this, 83% of the benefits are realised due to research in the manufacturing of pharmaceutical products sector, the sector within which consumer healthcare products are recognised. The remaining 17% is realised in the rest of the economy as the benefits of innovation are spread widely.

In addition to academic linkages, Haleon supports the training and development of its workforce. In 2020, it employed 54 apprentices and 33 undergraduate placement students.

Haleon also makes a positive contribution to UK exports. In 2020, it sold £111 million of goods manufactured at its Maidenhead site abroad. The EU was the main export market for goods produced at the Maidenhead site, totalling £66 million in sales, or three-fifths of exports, with a further £45 million in sales to the rest of the world.

Fig. 3. A summary of Haleon's economic contribution to the UK, 2020[2]



Source: Haleon, Oxford Economics

[2] Our analysis does not consider the charitable giving of Haleon, including employee charitable activity, as this data is collected at a group level and as such cannot be disaggregated.

1. INTRODUCTION

1.1 BACKGROUND

In July 2022, GSK's Consumer Healthcare business separated from GSK and formed Haleon, a standalone company 100% focused on consumer health and listed on the London Stock Exchange.[3]

Haleon specialises in the research, development and manufacture of consumer healthcare products in a number of areas, including oral health, pain relief, cold flu, allergy, digestive health, vitamin and mineral supplements. In 2020, Haleon delivered sales of £10 billion globally across a portfolio of household-recognised brands, such as **Sensodyne**, **Polident**, **Voltaren**, and **Panadol**.

Haleon is notable for its focus on innovation, having delivered more than 250 innovative products over the past five years.[3]

In 2020, it had three sites in the UK: Brentford, West London (as part of GSK's global headquarters); Weybridge; and Maidenhead.[4]

It is estimated that 32.4 million or 61% of adult shoppers in the UK purchased at least one Haleon product in 2020.[5]

Haleon commissioned Oxford Economics to quantify its economic contribution to the UK. Our analysis reflects the diverse range of activities that Haleon is engaged in, ranging between the research and development of new products, the manufacture and sale of products, as well as business operations, such as human resources, IT, and finance.[6]

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[3] www.haleon.com

[4] As a standalone company from July 2022, Haleon has its global headquarters in Weybridge, UK. It has announced proposals to create a new £120 million headquarters and campus in Weybridge which will include R&D activities currently housed at a different location in Weybridge. Haleon also has a manufacturing site in Maidenhead. As this report is focused on activity in 2020, it covers the 3 Haleon sites in the UK at that time: Brentford; Weybridge; and Maidenhead.

[5] Source: Haleon, Kantar Worldpanel UK.

[6] This corresponds to the following three Standard Industrial Classification (SIC) 2007 sectors: manufacturing of basic pharmaceutical products and pharmaceutical preparations (SIC 21), activities of head offices (SIC 70), and scientific research & development (SIC 72). The manufacturing of pharmaceutical products is classified within the broader manufacturing sector, while both activities of head offices and scientific research & development are classified within professional services.

1.2 REPORTING STRUCTURE

This report is structured as follows:

- **Section 2** presents Haleon's contribution to the economy. In doing so we discuss turnover, GVA contributions to GDP, its regional impacts, sectoral impacts and supply chain spending;
- **Section 3** presents Haleon's employment and wage contribution;
- **Section 4** discusses the wider benefits of Haleon's R&D investment, training and development, and exports;[7] and
- **Appendix 1** details our method.

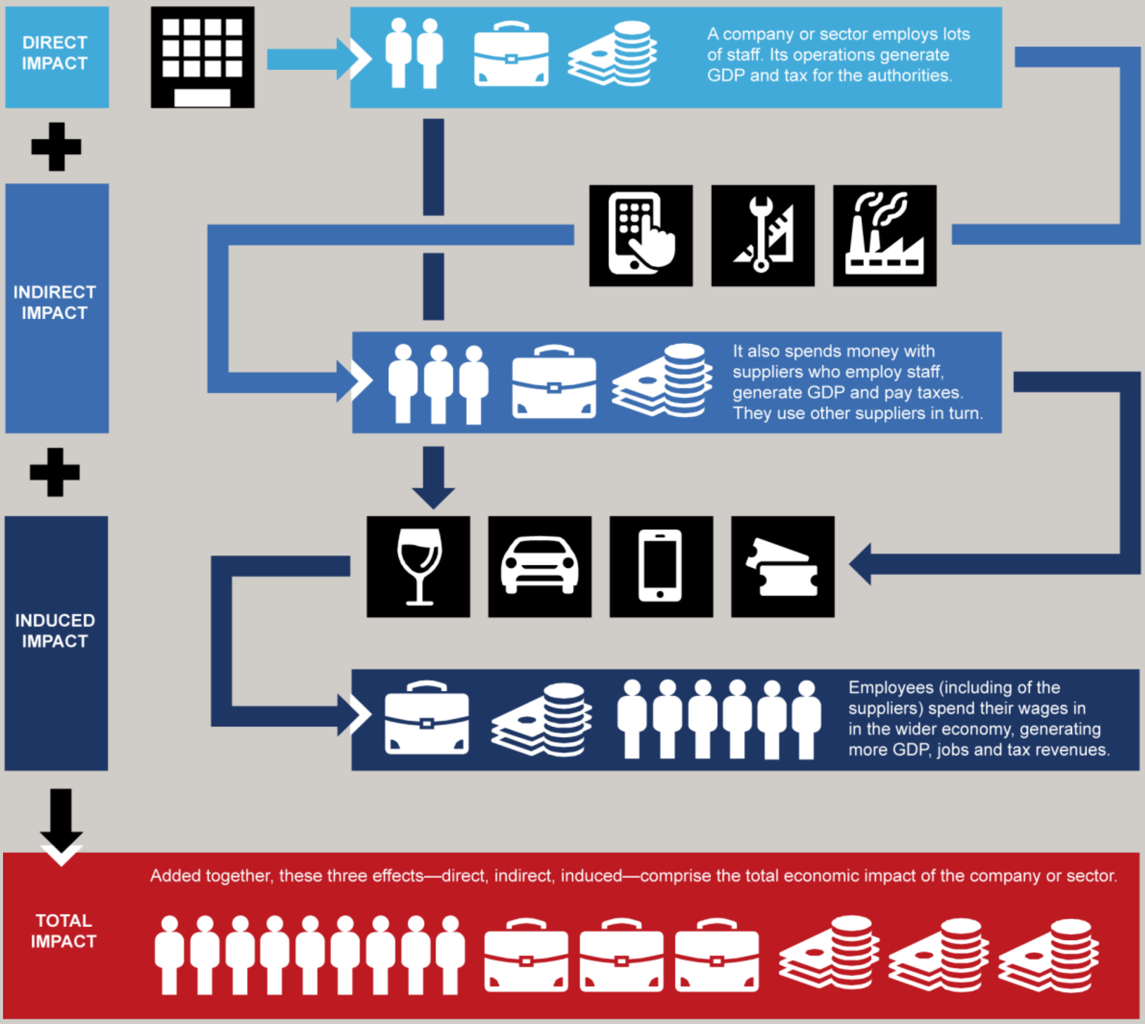
[7] Our analysis does not consider the charitable giving of Haleon, including employee charitable activity, as this data is collected at a group level and as such cannot be disaggregated.

BOX 1: AN INTRODUCTION TO ECONOMIC IMPACT ANALYSIS

The economic impact of a firm or industry is measured using a standard means of analysis called an economic impact assessment. The report quantifies the three ‘core’ channels of impact that comprise the organisation’s ‘economic footprint’:

- **Direct impact**: the economic benefit of Haleon’s operations and activities in the UK, including its direct gross value added (GVA) contribution to GDP, employment, and wages;
- **Indirect impact**: captures the economic benefit and employment stimulated by Haleon’s procurement of goods and services from its UK supply chain, both through purchases made by Haleon from its suppliers, and subsequent spending through further rounds of purchases; and
- **Induced impact**: comprises the wider economic benefits that arise from the payment of wages by Haleon, and the firms in its UK supply chains, to staff who spend a proportion of this income through their household’s consumption.

Fig. 4. Economic impact assessment



Source: Oxford Economics

From these channels, Haleon's total economic footprint in the UK economy is presented, using three key metrics:

- GDP, or more specifically, Haleon's gross value added (GVA) contribution to GDP;[8]
- Employment, as the number of people employed (jobs) or full-time equivalent (FTE); and
- Wages, paid to the workforce.

In addition to the core economic impacts, this report examines the wider effects of its operations in boosting economic activity elsewhere in the economy. These impacts represent the wider benefits that governments, consumers, society and other industries derive from the goods and services Haleon provides. For Haleon, these are captured in the contribution made to UK research and development (R&D), training and development, and exports.

The modelling on which this report is based computes the economic footprint of Haleon in the UK and its regions in 2020. The results are presented on a gross basis, and therefore ignore any displacement of activity from Haleon's competitors or other firms. Nor do they consider what the resources used by Haleon, or stimulated by its expenditure, could alternatively produce their second-most productive usage.

Further detail about the economic impact methodology is included in Appendix 1.

[8] Gross domestic product (GDP) is the main indicator of economic activity in the UK, used to measure the rate of growth or decline in the economy, and when it enters a recession.

2. HALEON'S CONTRIBUTION TO GDP

KEY FINDINGS

- Haleon generated £1.06 billion of economic output in 2020, including a **£559 million direct GVA contribution to UK GDP**.
- Haleon spent £498 million on the purchases of goods and services—£455 million of which was spent domestically, and £43 million through imports. Domestic spending supports additional GVA, through Haleon's direct suppliers, and along the wider supply chain. We estimate that this **indirect effect generated £406 million of GVA**.
- The households of Haleon's employees, and those supported by its supply chain spending, spend a proportion of their wages at retail, leisure, and other outlets. This stimulates economic activity at these firms, and also along their supply chains. We estimate that this **induced effect generated £288 million of GVA**.
- In total, Haleon therefore made a **£1.25 billion GVA contribution to UK GDP in 2020**.
- **Haleon's operations are highly productive**, averaging £364,300 per job. This is almost seven-times higher than average productivity across the UK economy.
- All sectors of the economy benefit from Haleon's activity. Largely due to R&D and head office activity, almost half of the total GVA contribution is in professional service sectors, with manufacturing the next-largest sector.

2.1 INTRODUCTION

This chapter investigates the contribution that Haleon made to UK GDP in 2020. It considers its direct activity, the economic activity it stimulates through procurement, and the household consumption of wages paid to workers.

2.2 A SUBSTANTIAL CONTRIBUTION TO THE UK ECONOMY

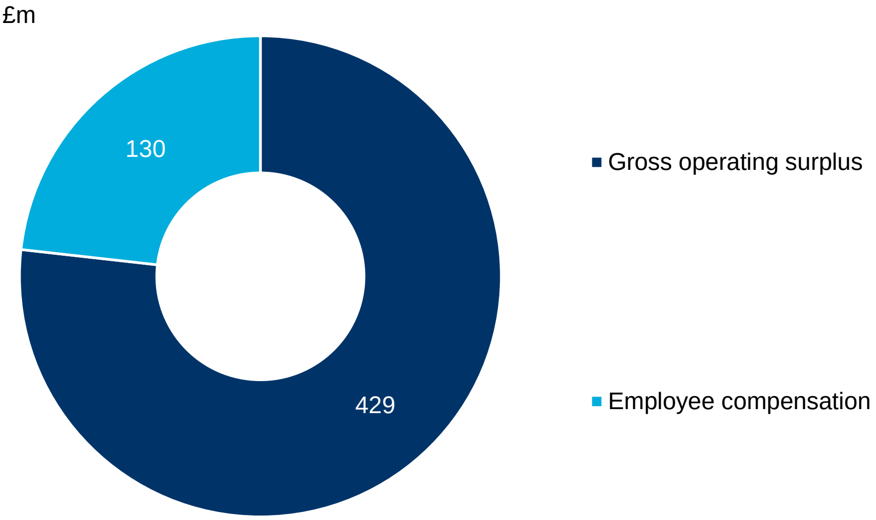
To calculate its contribution to the UK economy, we draw on financial data provided by Haleon. **In 2020, Haleon made a £559 million direct GVA contribution to UK GDP.** Just over three-quarters of this, or £429 million, came from gross operating surplus generated through its operations, with a further £129 million came from the compensation of employees (payroll costs).[9]

[9] Note that this represents an underestimate of Haleon's direct GVA in 2020, as it excludes both direct taxes on production (e.g. business rates and the apprenticeship levy) and employer National Insurance Contributions (NICs) as well as corporation tax and VAT payments made by Haleon in the relevant period.

£559 million

Haleon's direct gross value added contribution to UK GDP in 2020.

Fig. 5. Haleon's direct GVA contribution to UK GDP by source, 2020



Source: Haleon, Oxford Economics. Note: may not sum due to rounding.

Haleon also spent an estimated £498 million in the purchase of goods and services in 2020, of which £455 million was spent with UK suppliers, with a further £43 million on imports. This implies an overall economic output equivalent to £1.06 billion.[10]

Haleon's positive contribution to the UK economy extends past the contribution it makes directly through its own operations. This is because Haleon makes purchases of inputs of goods and services from other firms in order to produce its output.[11] This spending stimulates additional activity along its UK supply chain. This is referred to as the *indirect* impact. In 2020, we estimate that Haleon's procurement stimulated a £406 million GVA contribution to UK GDP along its supply chain.

The households of Haleon's employees, and those supported by its supply chain spending, spend a proportion of their wages at retail, leisure, and other outlets. This stimulates economic activity at these firms, and also along their supply chains. This is referred to as the *induced* impact. In 2020, we estimate the household wage consumption of Haleon's employees and those of its suppliers stimulated a further £288 million GVA contribution to UK GDP.

[10] Note that this reflects the economic output of all of Haleon's activities. The turnover of goods sold as part of its commercial activities equated to around £482 million in 2020. The remaining economic output reflects the activity of the head office and scientific research & development which, while not directly producing goods or services to be sold, nevertheless makes a positive contribution to the UK economy.

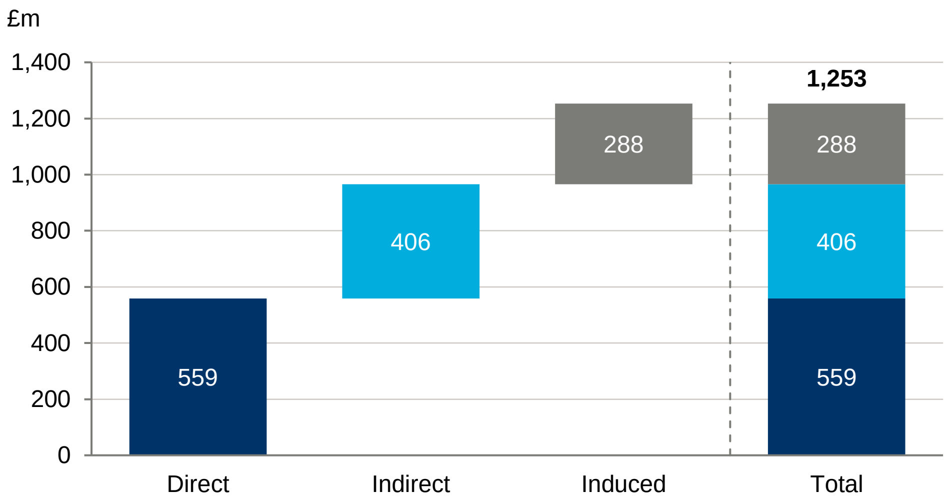
[11] We assume that the sectoral composition of Haleon's procurement spending is a weighted average of the typical spending profile across the three sectors of activity: manufacturing of basic pharmaceutical products and pharmaceutical preparations, activities of head offices, and scientific research & development.

In total, Haleon supported £1.25 billion of gross value added in 2020, equivalent to 0.07% of UK GDP.[12] Haleon supports a GVA multiplier of 2.24, or a further £1.24 of GVA created across the wider UK economy for every £1 of GVA generated directly by Haleon. This GVA multiplier is lower than the equivalent across the manufacture of pharmaceutical products (2.31), activities of head offices (2.91), or scientific research & development (3.07) sector averages, largely because Haleon is less reliant on purchases of intermediate goods and services (procurement) than in each of the wider sectors in which it operates.[13]

Fig. 6. Total GVA contribution to UK GDP, 2020

£1.25 billion

Haleon's total gross value added contribution to UK GDP in 2020.



Source: Haleon, Oxford Economics. Note: may not sum due to rounding

2.3 LABOUR PRODUCTIVITY

Calculating the direct contribution of Haleon to UK GDP allows the measurement of labour productivity—that is, average value added to the UK economy on a per job basis. Having high productivity workers is important as it can enhance the price competitiveness of Haleon's goods and services, and boost their profit margin, both of which potentially add to GDP. In turn, this raises the standard of living of the UK population.

Haleon's operations are highly productive. We estimate that Haleon's operations averaged £364,300 of GVA per job in 2020. This is almost seven-times more productive than the UK average (£53,500 per job), and more productive than the manufacturing of pharmaceutical products (£307,400 per job), scientific research & development (£98,200 per job), or activities of head offices (£27,300 per job) sectors. Haleon is also more productive than each of the 19 broad sectors of the economy, bar real estate (£432,400 per job).

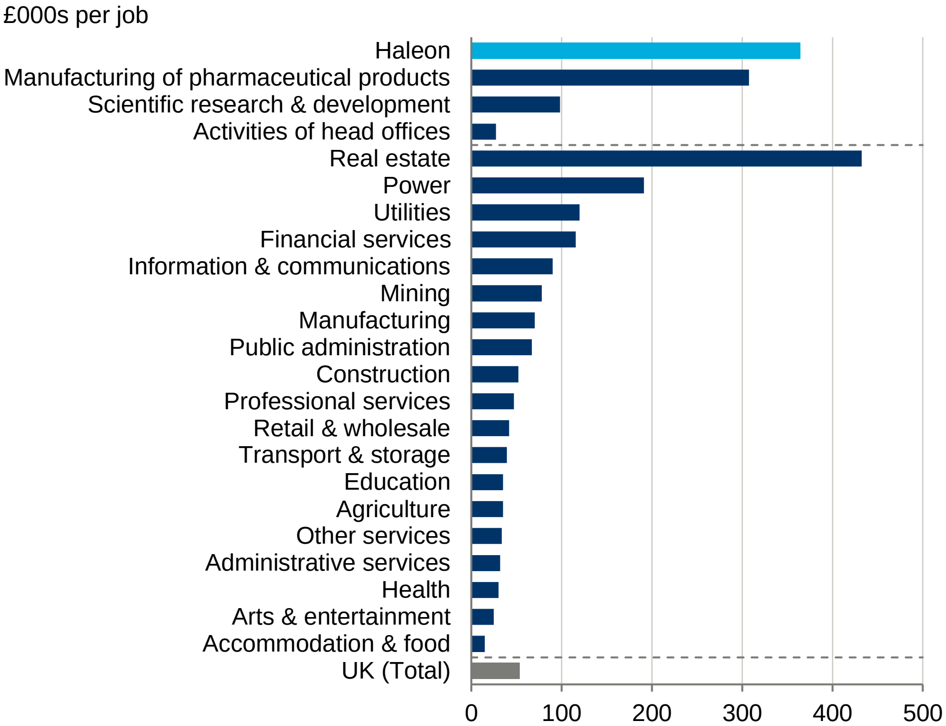
[12] The combined GVA from direct and indirect (supply chain) activity (£965 million) is less than total economic output (£1.06 billion), as both Haleon and firms along its supply chain draw on imports, the GVA associated with which is realised abroad.

[13] Conversely, other firms operating in this sector tend to require more procurement spending for each £1 of GVA, meaning that the associated indirect and induced effects as a proportion of direct activity are greater.

£364,200

Haleon's operations are almost seven-times more productive than the UK average.

Fig. 7. A comparison of Haleon and sectoral productivity, 2020



Source: Haleon, Oxford Economics

2.4 ECONOMIC BENEFITS ARE FELT ACROSS THE ECONOMY

As well as quantifying the impact of Haleon on the UK economy as a whole, we have also estimated its impact at a sectoral level.

We find that just under half of all GVA contributions come in activities categorised within professional services, equating to £570 million. This largely arises from direct operations across Brentford and Weybridge, which support an estimated £412 million of GVA across the activities of head offices and scientific research & development sub-sectors, that form part of the professional services sector.

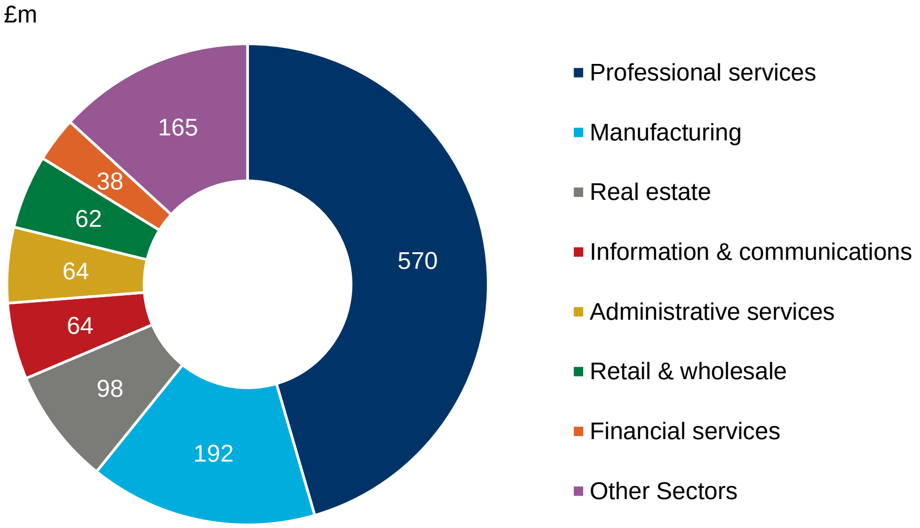
However, professional services also benefit from the propensity of other sectors, including other firms in this sector, to buy services along supply chains. A further £143 million of GVA is generated along Haleon's supply chain, equivalent to 35% of all GVA generated through indirect effects—the most of any sector.

Manufacturing benefits from the second largest GVA impact. Alongside the £147 million directly generated at Haleon's operations in Maidenhead, this sector benefits from a further £25 million of GVA generated along the supply chain, and £20 million through induced effects.

Primarily due to induced effects from household consumption, real estate activities (£98 million) is the third most-affected sector. Retail & wholesale (£62 million) also benefits mostly from household consumption effects. A further 13% of all GVA is generated across other business service sectors, including information & communication (£64 million), administrative services (£64 million), and financial services (£38 million).

> Haleon's activity benefits all sectors of the economy.

Fig. 8. Gross value added contribution to GDP by broad sector, 2020



Source: Haleon, Oxford Economics. Note: may not sm due to rounding.

3. HALEON'S CONTRIBUTION TO EMPLOYMENT

KEY FINDINGS

- Haleon **directly employed 1,530 workers** in 2020, across three locations. Approximately half of the workforce was employed at the Brentford site, with the remaining half split between R&D and head office activity at Weybridge, and manufacturing activity in Maidenhead.
- The supply chain activity stimulated by its procurement spending, and further spending along the supply chain, created an estimated **7,890 indirect jobs** in 2020.
- The households of Haleon's employees, and those supported by its supply chain spending, supported a further **4,790 induced jobs** in 2020.
- In total, Haleon supported **a total of 14,210 jobs across the UK workforce** in 2020, across all sectors of the economy. Each direct job therefore supports more than eight jobs across the wider UK economy on average.
- Approximately 10,250 jobs, or 72% of the total, were on a full-time basis, with the remaining approximately 3,960 jobs part-time.
- Haleon's **workforce is relatively well-remunerated**: average wages equated to £84,600 per direct job, two-and-a-half times the national average. Across its entire economic footprint, it supported £531 million in wages.

3.1 INTRODUCTION

This chapter focuses on the employment impacts of Haleon's activity in the UK. We consider the workforce employed directly, the jobs supported along the UK supply chain, and how wage consumption supports further employment across the economy.

3.2 CONTRIBUTION TO EMPLOYMENT

In 2020, Haleon employed approximately 1,530 workers in the UK.[14]

Employment was split across three locations. Approximately 720 workers, or just under half of the workforce, were employed at the Brentford site in the London Borough of Hounslow. We assume that this workforce is characterised by the activities of head offices sector. A further 410 workers were employed in Weybridge, Surrey, of which Haleon has indicated that 65% (approximately 270 workers) were engaged in R&D activity, in the scientific research & development sector, with the employment of the remaining 35% (140 workers) assumed to also be characterised by the activities of head offices sector. The remaining 400 workers were engaged in the manufacturing of pharmaceutical products in Maidenhead, Berkshire.[6]

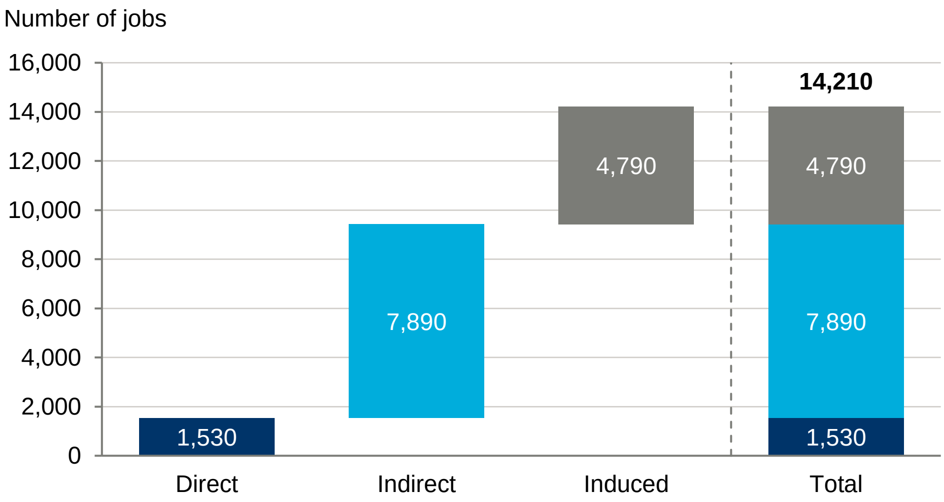
[14] This consists of approximately 1,430 permanent workers and 100 contingency workers.

In 2020, we estimate that Haleon supported 14,210 jobs across the UK economy. Almost 7,900 jobs are supported along Haleon's supply chain, with almost 4,800 jobs as a result of wage consumption. Consequently, Haleon has an employment multiplier of over nine—for every worker employed by Haleon, a further eight jobs are supported across the UK economy.

14,210 jobs

Employment supported across the UK in 2020. Each direct job supports more than eight jobs across the wider UK economy.

Fig. 9. Total employment, 2020



Source: Haleon, Oxford Economics. Note: may not sum due to rounding.

3.3 COMPOSITION OF EMPLOYMENT

Through stimulating supply chain and wage consumption spending, **Haleon supports employment across all sectors of the economy.**

As with GVA, activities categorised within professional services support the most jobs of any sector along Haleon's economic footprint.[15] These activities supported almost 4,200 jobs, or 29% of total employment. However, professional services activities accounted for almost half of GVA. The difference is in part a reflection of the above-average productivity of the Haleon workforce. It also reflects the propensity of firms in this sector and across the economy to support employment in professional services across the supply chain—professional service alone supported over a third of all indirect employment (2,800 jobs).

Manufacturing similarly supports a comparatively small share of employment (1,010 jobs), despite being the second-largest sector in GVA terms. This again reflects the highly-productive nature of both Haleon's direct operations, and manufacturing firms more generally.

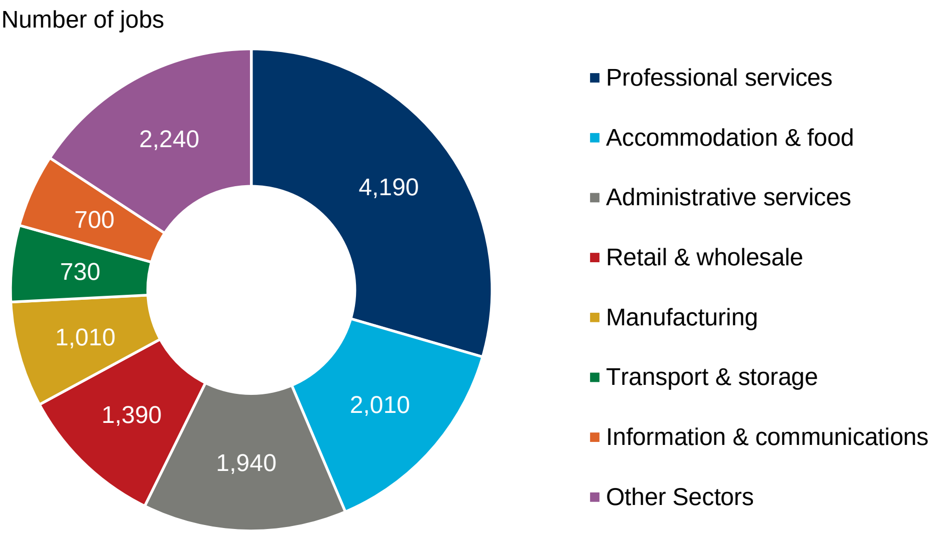
Accommodation & food is the second-largest sector in employment terms, supporting 2,010 jobs. Alongside retail & wholesale (1,390 jobs), employment supported in these sectors is largely due to wage consumption spending of households.

[15] As described in Chapter 2, the professional services sector includes the head office and research & development activity.

A further 1,940 jobs are supported across administrative services, although largely through supply chain (indirect) effects.

> Through stimulating supply chain and wage consumption spending, Haleon supports employment across all sectors of the economy.

Fig. 10. Employment by sector, 2020



Source: Haleon, Oxford Economics. ote: may not sum due to rounding.

Haleon directly supports a mix of types of employment. Across its workforce of 1,530, it directly supports approximately 1,520 full-time equivalent (FTE) jobs. Applying a rule-of-thumb estimate implies that approximately 1,510 workers, or 98%, were employed on a full-time basis, with the remaining 30 workers (2%) employed part-time.[16]

In total, we estimate that 10,250 jobs (72%) supported by Haleon across the UK are employed full-time, with the remaining 3,960 jobs (28%) employed part-time.[17] The proportion of full-time employment across the entire economic footprint is only slightly higher than the UK average (68%). This is largely due to the concentration of indirect and induced employment in sectors such as accommodation & food, administrative services, and retail & wholesale, which tend to support a higher share of part-time work.

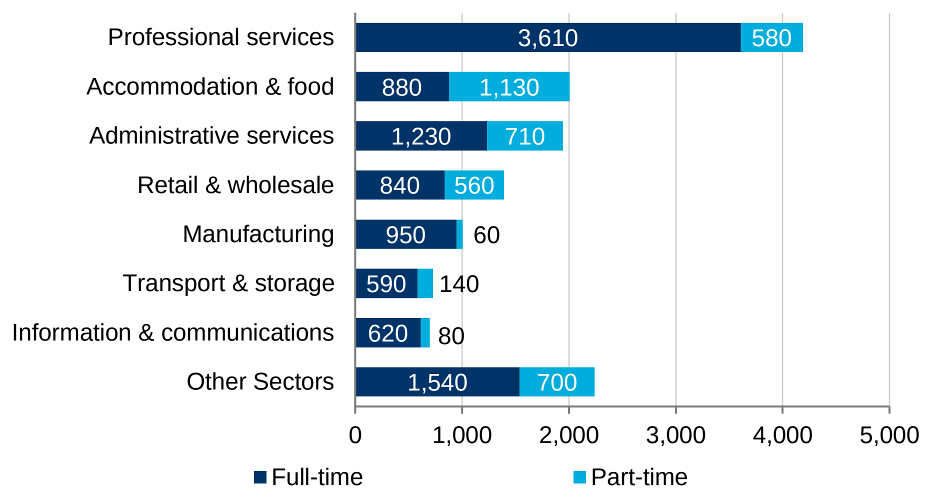
[16] In the absence of detailed information on the composition of employment, we may estimate the full- and part-time mix by assuming that part-time workers are employed on average half of FTE, or 18.75 hours per week.

[17] Note that these figures are rounded to the nearest 10, and therefore do not necessarily sum to total jobs.

10,250 jobs

Full-time employment supported across the UK, with 4,040 jobs part-time.

Fig. 11. Employment by full-time and part-time, 2020



Source: Haleon, Oxford Economics. Note: may not sum due to rounding.

3.4 WAGES

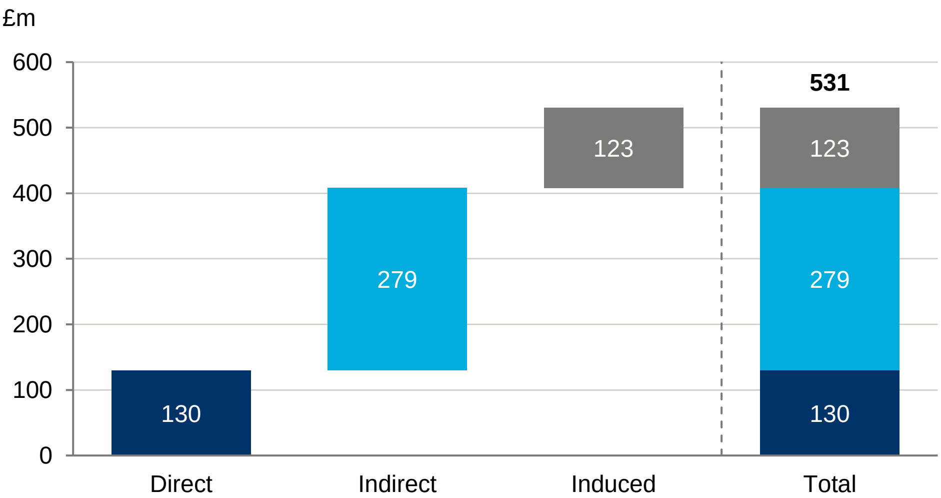
Haleon's highly productive workforce is relatively well-remunerated. In total, its workforce earned £130 million in wages—equivalent to £84,600 per job, or £85,400 per FTE. Average direct earnings are therefore over two-and-a-half times higher than the UK average (£30,600 per job).

Employment supported across the supply chain will earn a further £279 million, while wage consumption will generate a further £123 million in wages. Across its entire economic footprint, Haleon therefore supported £531 million in wages.

£531 million

Total wages earned across Haleon's total economic footprint.

Fig. 12. Total wages, 2020



Source: Haleon, Oxford Economics. Note: may not sum due to rounding.

4. HALEON'S WIDER ECONOMIC CONTRIBUTION

KEY FINDINGS

- **Haleon makes a substantial investment into research & development (R&D)**. In 2020, it invested £267 million in R&D globally, of which £61 million was spent in the UK, a large part of which was researching oral health products at its R&D centre in Weybridge, which supported approximately 270 jobs. This equates to 12.6% of turnover in the UK, contributing to the UK government's wider ambitions to increase R&D spending as a share of UK GDP.
- Haleon also supported 46 academic collaborations across 18 UK universities, including supporting 38 PhD students.
- Building on the quantitative relationship between R&D spending and GDP gains, we estimate that this R&D investment in 2020 alone will generate **a £33 million boost to GDP by 2030**.
- Haleon also invested in the **traning and development** of its workforce. In 2020, it employed 54 apprentices and 33 undergraduate placement students.
- Haleon also makes a **positive contribution to UK exports**. In 2020, it sold £111 million of manufacturing goods produced at its Maidenhead site abroad. The EU was the main export market for Haleon, totalling £66 million in sales, or three-fifths of exports, with a further £45 million in sales to the rest of the world.

4.1 RESEARCH & DEVELOPMENT INVESTMENT AND SPILLOVER EFFECTS

Haleon makes a substantial investment in research and development (R&D). In 2020, it spent £267 million on R&D investment globally, of which £61 million was spent in the UK, a large part of which was researching oral health products at its R&D centre in Weybridge—equivalent to around 12.6% of turnover. Haleon's R&D activity in the UK alone directly supported approximately 270 jobs. Haleon's R&D activity in the UK focusses on developing oral health products, which are important both for oral health and general health outcomes.[18] [19] This is in addition to the £45 million of non-R&D capital expenditure investments made in 2020.

Haleon therefore makes a substantially higher investment in R&D than the UK economy as a whole, where R&D spending equated to just 1.7% of GDP in 2019.[20] Indeed, the investment made by companies such as Haleon will

[18] https://www.who.int/news-room/fact-sheets/detail/oral-health
[19] https://www.newmouth.com/oral-health/
[20] ONS, *Gross domestic expenditure on research and development, UK*, Newport, 2021. https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/datasets/ukgrossdomesticexpenditureonresearchanddevelopment

contribute to the UK government's wider ambitions for R&D spending to equate to 2.4% of GDP by 2027.[21]

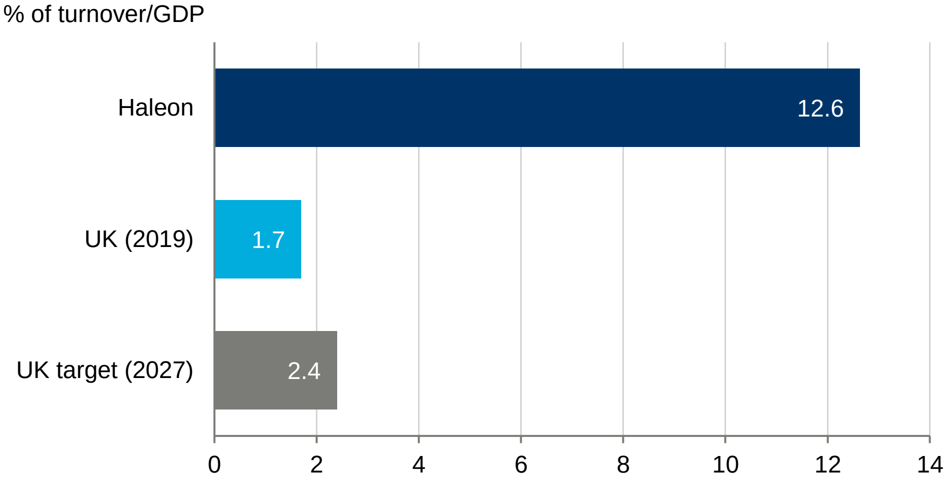
In addition, Haleon also supported 46 academic collaborations across 18 UK universities, including supporting 38 PhD students.

£61 million

R&D spending in the UK in 2020.

Haleon has 46 academic collaborations across 18 UK universities.

Fig. 13. R&D investment, UK, 2020



Source: ONS, Haleon, Oxford Economics. Note: may not sum due to rounding.

R&D makes a difference to economic productivity in a number of ways: by improving the quality of goods, by reducing the costs of producing existing goods, and by increasing the range of goods or intermediate inputs available. Furthermore, R&D carried out in one company can have positive spill-overs to other firms or industries as the benefits accrue to competitors, other firms, suppliers and customers. In this way, R&D advances a nation's technological frontier, helping it to deliver greater economic output. Economic theory identifies various channels through which R&D spending contributes to economic growth in the long run. These include, but are not limited to:

- Stimulating private research;
- Creating a body of accessible knowledge;
- Training skilled graduates;
- Improving human capital and the ability to solve complex problems and develop ideas;
- Creating new scientific methodologies;
- Developing new instrumentation and equipment for the wider sector/industry;
- Forming informal networks through agglomeration;
- Improving economic interaction;
- Attracting greater investment and creating new firms; and

[21] HM Government, *Autumn Budget and Spending Review 2021*, London, 2021. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1029973/Budget_AB2021_Print.pdf

- Increasing domestic competition leading to lower prices and a more diverse set of products.

With R&D spending, the benefits to the economy arise initially from the general increase in spending—general demand increases as research facilities are developed and researchers are deployed. The fruits of R&D-driven innovation are realised over time as new products and processes gradually enter the economy.

To estimate the quantitative relationship between Haleon's R&D spending and GDP gains, Oxford Economics' approach built upon the best practice in the literature and the latest available datasets.[22]

We find that Haleon's 2020 R&D spending generates a GDP boost of £33 million by 2030. The gains from R&D spending are therefore not limited to the sectors or products to which R&D spending is allocated. A large number of sectors benefit, both in the short term and the long term—these effects are called 'spillover' effects. We find that 83% of the GDP benefits are realised due to research in the manufacturing of pharmaceutical products, the sector within which consumer healthcare products are recognised.[23] The remaining 17% spillover to the rest of the economy as the benefits of innovation are spread widely.

4.2 TRAINING AND DEVELOPMENT

In addition to its external academic collaborations, Haleon supports the training and development of its workforce.

In 2020, 54 apprentices were employed by Haleon, 39 of which were existing staff apprenticeships, alongside 15 early talent apprenticeships. Haleon also hosted 33 undergraduate placement students through the 2020 to 2021 academic year.

4.3 EXPORTS

Haleon also makes a positive contribution to UK exports. In 2020, it made sales of £111 million abroad through products manufactured at its Maidenhead site. The EU was the main export market for goods produced at the Maidenhead site, totalling £66 million in sales, or three-fifths of exports, with a further £45 million in sales to the rest of the world.

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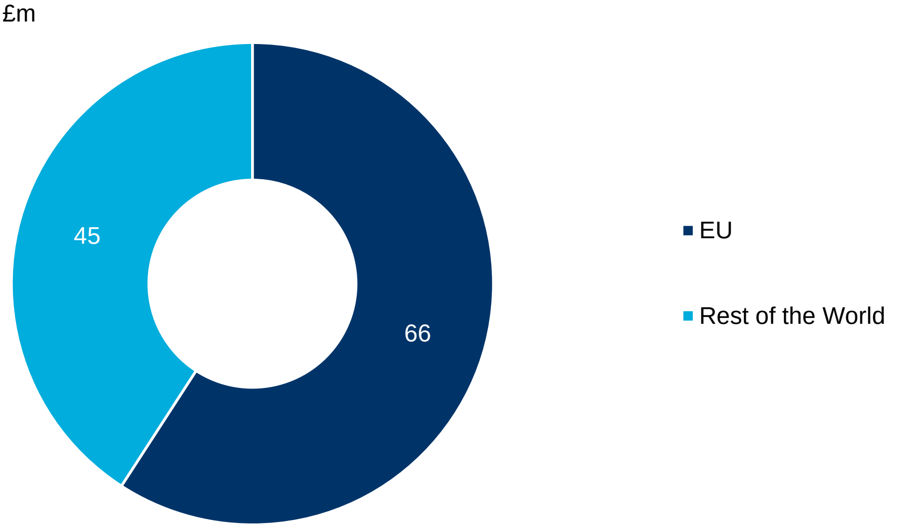
[22] See Appendix 1 for further detail.

[23] Note that this analysis considers the sector of 'output' of R&D spending, rather than the input (scientific research & development). The production of consumer healthcare goods sits within the manufacturing of pharmaceutical products sector.

£111 million

Total exports of manufacturing goods from the Maidenhead site in 2020.

Fig. 14. Exports from the Maidenhead manufacturing site by destination, 2020



Source: Haleon, Oxford Economics

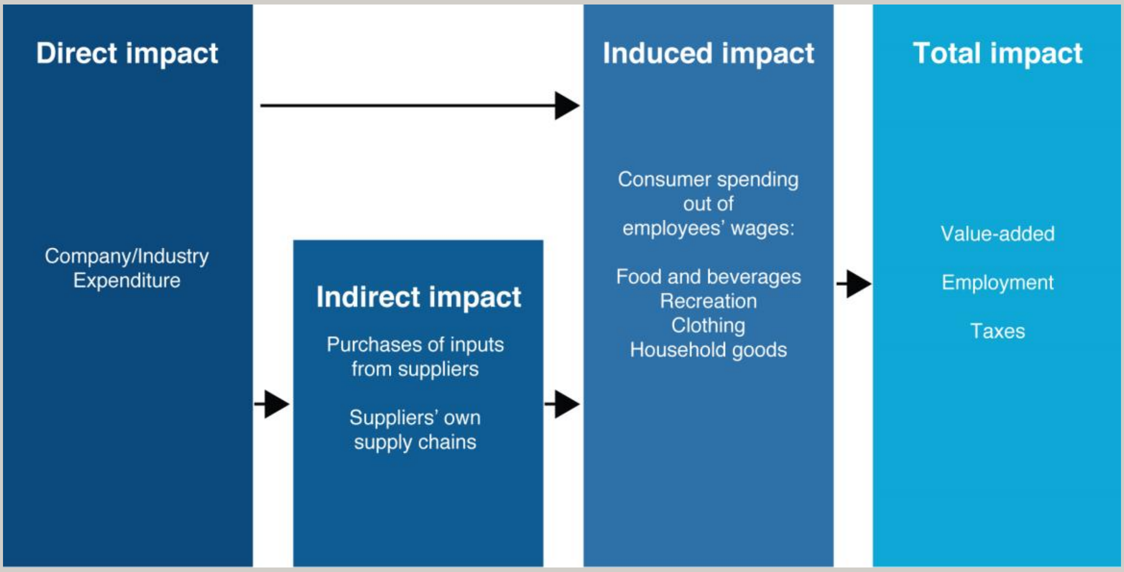
APPENDIX 1 TECHNICAL ANNEX

ECONOMIC IMPACT MODELLING

Economic impact modelling is a standard tool used to quantify the economic contribution of a firm or industry. Impact analysis traces the economic contribution through three separate channels:

- **Direct impact** refers to activity conducted directly by Haleon in the UK.
- **Indirect impact** consists of activity that is supported because of the procurement of goods and services by Haleon throughout the economy. It includes not just its purchases, but subsequent rounds of spending throughout the supply chain.
- **Induced impact** reflects activity supported by the spending of wage income by direct and indirect employees.

Fig. 15. Direct, indirect, induced, and total economic impacts



Direct impacts

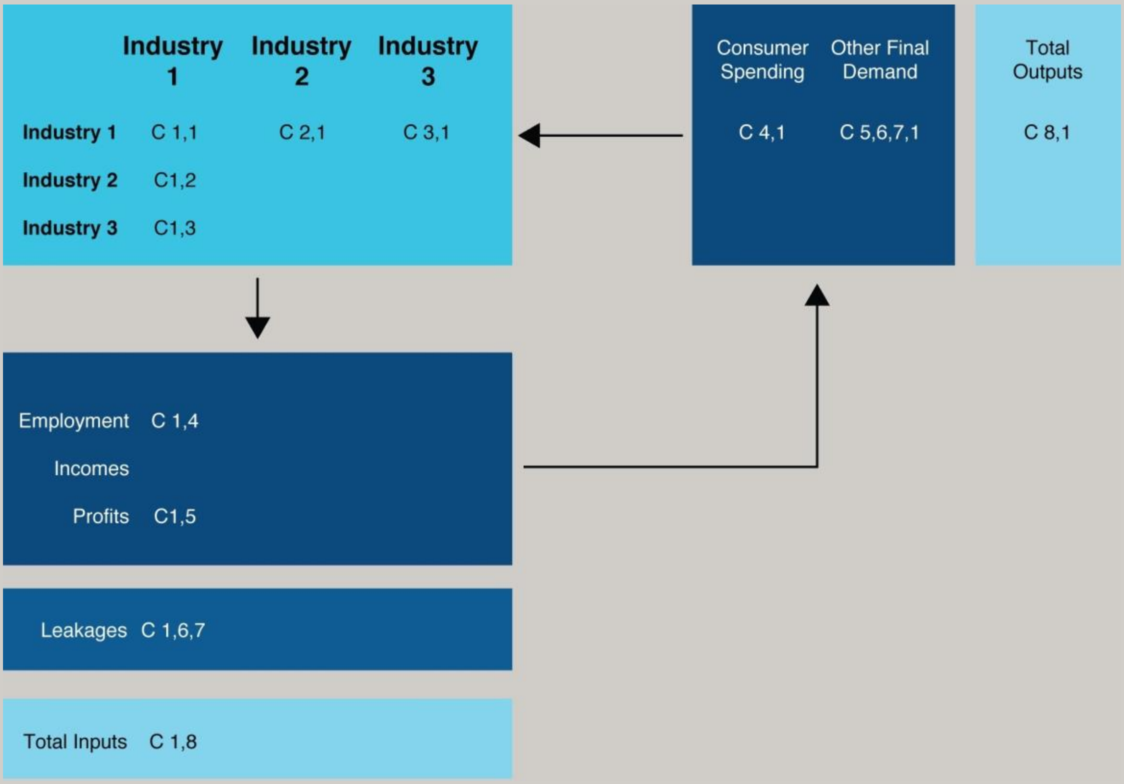
Data on the direct impacts were provided by Haleon.

Indirect and induced impacts

Indirect and induced impacts were estimated using an input-output model. An input-output model gives a snapshot of an economy at any point in time. The model shows the major spending flows from final demand (i.e. consumer spending, government spending, investment, and exports to the rest of the world); intermediate spending patterns (i.e. what each sector buys from every other sector—the supply chain in other words); how much of that spending stays within the economy; and the distribution of income between employment and other forms such as corporate profits. The figure below provides an illustrative guide to a stylised input-output model.

In building our impact model we have adopted the latest UK input-output tables published by the Office for National Statistics (ONS).

Fig. 16. A stylised input-output model



PRODUCTIVITY MODEL

Our analysis investigated how R&D expenditure benefits not only the entities conducting the research, but also the economy more widely. This occurs as the knowledge gained via research spills over into the wider economy, through channels including sharing know-how with suppliers, customers benefiting from innovations, and staff turnover (including those leaving research institutions for other forms of employment). The channels through which innovation and R&D influence the wider economy are well-established in economic literature. The aim of our model was to update this analysis using the most recent and relevant datasets and evidence.

We developed an econometric model to explain how R&D expenditure in different sectors contributes to productivity growth. The boost to productivity identified by the model comes from both new innovations and from enhancing the skills of the labour force. The model includes two channels of benefits supported by this investment:

- those which accrue **directly** to the sector undertaking the research; and
- the **spillover** benefits generated as firms **in other sectors** of the economy apply the knowledge and innovations to help to develop new products and improve operational efficiency.

We begin this section with a description of the existing academic literature on the topic and how it informed our modelling approach, followed by a description of the dataset and the model specification. We conclude with a comparison of our results with other similar studies.

Literature review

A number of studies investigate the relationships between productivity-led economic growth and R&D spending. An extensive literature also exists on the topic of intra-country and inter-country industry spillovers of innovation and R&D influencing overall productivity.

To ensure that the most appropriate approach for our methodology was chosen, Oxford reviewed papers that have modelled the direct effects as well as spillovers. This section discusses studies taking a macroeconomic approach to measuring Total Factor Productivity (TFP), (using R&D data at the country-sector level that is readily available) instead of firm-level data.

Overall modelling approach

The modelling approach was adopted from Badinger and Egger (2008)[24] who adopted a spatial econometric approach to estimate intra-industry and inter-industry productivity spillovers in TFP (total factor productivity) transmitted through input-output relations in a sample of 13 OECD countries and 15 manufacturing industries. Our methodology follows a similar approach with a larger dataset with more countries and more recent data. To account for the spatial element, a spillover matrix is constructed using the latest Social Accounting Matrices for each country from the OECD, broadly following the approach in Coe, et al (2019)[25].

Explanatory variables

The choice of the other selected explanatory variables finds its motivation from the study by Coe, et al (2019), who studied the impact of domestic and foreign R&D on TFP. In particular, they included variables to control for human capital and other institutional variables (legal origin and patent protection) to allow for parameter heterogeneity based on a country's institutional characteristics. Hanel (1994)[26] also used patent information within the spatial matrix to measure the extent of spillovers in the economy.

Several other studies also emphasise controlling for human capital to measure the extent of R&D spillovers on TFP. For example, Engelbrecht (1996)[27] and del Barrio-Castro, *et al.* (2002)[28] use average years of schooling a measure of human capital to account for innovation outside the R&D sector.

Findings from previous studies

Various studies, e.g., Mairesse and Mohnen (1994)[29], Hall (2010), Guellec and van Pottelsberghe de la Potterie (2010)[30], found statistically significant relationships between R&D, including spillovers, and various measures of productivity.

[24] Badinger, Harald, and Peter Egger, Intra-and inter-industry productivity spillovers in OECD manufacturing: A spatial econometric perspective, No. 2181. CESifo working paper, 2008.

[25] Coe, David T., Elhanan Helpman and Alexander W. Hoffmaister, *International R&D Spillovers and Institutions,* IMF Working Paper. WP/08/104.

[26] Hanel, Petr, R&D, Inter-industry and international spillovers of technology and the total factor productivity growth of manufacturing industries in Canada, 1974–1989, CERGE-EI Working Paper Series 73 (1994).

[27] Engelbrecht, Hans-Jürgen,.International R&D spillovers, human capital and productivity in OECD economies: An empirical investigation, European Economic Review 41, no. 8 (1997): 1479-1488.

[28] del Barrio-Castro, Tomás, Enrique López-Bazo, and Guadalupe Serrano-Domingo, *New evidence on international R&D spillovers, human capital and productivity in the OECD*, Economics Letters 77, no. 1 (2002): 41–45.

[29] Mairesse, Jacques, and Pierre Mohnen, *R&D and productivity growth: what have we learned from econometric studies*, In Eunetic Conference on Evolutionary Economics of Technological Change: Assessment of Results and New Frontiers, pp. 817–888. 1994.

[30] Guellec, D. and B. van Pottelsberghe de la Potterie (2001), *R&D and Productivity Growth: Panel Data Analysis of 16 OECD Countries*, OECD Science, Technology and Industry Working Papers, No. 2001/03, OECD Publishing, Paris. https://doi.org/10.1787/652870318341.

Some papers, such as Bournakis, et al (2018),[31] found that cross-industry differences. For example, Bournakis, et al (2018) found that high technology industries have benefitted more from R&D spillovers, mainly due to knowledge spillovers (as opposed to supply-chain effects).

In terms of qualitative conclusions our macroeconomic approach is in line with papers with microeconomic (firm-level) frameworks, such as Hall, B. et al (1996)[32].

Moretti, et al (2021)[33] is the most recent paper using a combination of macroeconomic and firm-level datasets to understand the impact of government R&D spending on privately funded R&D and TFP. They find that government R&D spending crowds in private R&D spending—a 10% increase in government R&D spending increases private R&D spending by 5%–6% in a sample of OECD countries. They find a one percentage point increase in the ratio of R&D spending to value-added TFP growth rates by 0.05–0.08 percentage points (implying GDP elasticity with respect to R&D spending of 0.12–0.20 over a 10-year period).

A comparison of the R&D elasticities[34] from various studies is shown in Fig. 20.

Specific learnings for our methodology

We combined the techniques in the existing literature covering spillovers, but our approach was adapted to capture inter-industry spillovers and direct effects separately. Our approach also accounted for various econometric issues which were explored in the existing academic literature such as: non-stationarity in Tsamadias et al (2019);[35] cointegration techniques in del Barrio-Castro (2002);[36] and R&D and productivity endogeneity in Bravo-Ortega and Marin (2011).[37]

Our approach also used a holistic selection of available explanatory variables discussed extensively in the papers above, thus mitigating the risk of omitted variable bias. We have also accounted for legal, institutional, R&D, and human capital factors in the analysis, and this examination presents the most up-to-date amalgam analysis of the topic.

Data used in our model

A panel dataset was constructed underpinned by a time series of R&D expenditure by sector across a range of countries. The dataset was sourced primarily from the OECD which documents R&D expenditure in member (and some non-member) states broken down by industry and characteristics, such as type of research (basic, experimental, applied), source of funds (public and private) and

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[31] Bournakis, Ioannis, Dimitris Christopoulos and Sushanta Mallick, *Knowledge spillovers and output per worker: an industry-level analysis for OECD countries,* Economic Inquiry, 2017. https://doi.org/10.1111/ecin.12458
[32] Mairesse, Jacques, and Bronwyn H. Hall, Estimating the productivity of research and development: An exploration of GMM methods using data on French & United States manufacturing firms, NBER working paper w5501 (1996).
[33] Moretti, Enrico, Claudia Steinwender, and John Van Reenen, *The intellectual spoils of war? Defense R&D, productivity and international spillovers*, No. w26483. National Bureau of Economic Research, 2019.
[34] R&D elasticity, or the elasticity of GDP with respect to R&D, is defined as the percentage increase in GDP (relative to baseline GDP levels) associated with a 1% increase in R&D spending (relative to a baseline level of R&D spending).
[35] Tsamadias, Constantinos, Panagiotis Pegkas, Emmanuel Mamatzakis, and Christos Staikouras, *Does R&D, human capital and FDI matter for TFP in OECD countries?*, Economics of Innovation and New Technology 28, no. 4 (2019): 386–406.
[36] del Barrio-Castro, Tomás, Enrique López-Bazo, and Guadalupe Serrano-Domingo, *New evidence on international R&D spillovers, human capital and productivity in the OECD*, Economics Letters 77, no. 1 (2002): 41–45.
[37] Bravo-Ortega, Claudio, and Álvaro García Marín, *R&D and productivity: A two way avenue?,* World Development 39, no. 7 (2011): 1090–1107.

subject field. This granularity made it possible test how these characteristics influence the size and sectoral composition of productivity spillovers. Data on productivity (Total Factor Productivity) was sourced from EU KLEMS.[38]

The variables and sources are listed in the table below.

Fig. 17. Variables used in the productivity model

Variable	Data	Source
Total factor productivity	Total factor productivity, index: 2010 = 100[39]	EU KLEMS
	Total factor productivity, index: 2010 = 100	OECD Structural Analysis (STAN) database
Expected research and development, funded by the government sector and performed by private businesses	Government budget allocations for R&D	OECD Research and Development Statistics database
	Gross domestic expenditure on R&D by sector of performance and source of funds	OECD Research and Development Statistics database
	Domestic R&D paid for by the U.S. federal government and performed businesses, by funding agency and industry	National Science Foundation (US) Business Enterprise Research and Development Survey
Domestic spillover variable	Expected government funded research and development carried out by industries—weighted by the strength of industry linkage	OECD Country Input Output tables
Years of schooling in population	Average years of schooling in population	Oxford Economics' Global Economic Model
Strength of intellectual property rights	Protection of intellectual property rights score	Global Competitiveness Index 4.0, standardised by International Property Rights Index
Strength of patent protection	Patent protection score	Patent Rights Index, standardised by International Property Rights Index
Copyright Piracy	Copyright piracy score	BSA Global Software Survey; The Compliance Gap, standardised by International Property Rights Index
Ease of doing business score	Calculated ease of doing business score	World Bank - Ease of Doing Business survey
Public infrastructure	Public infrastructure expenditure as a % of GDP	OECD & International Transport Forum ITF Transport Outlook/OECD. Stat
Origins of legal system	Historical origins of legal system	Web searches

Source: Oxford Economics

Spillover variable

Productivity spillovers, which are the subject of this analysis, are supposed to take place mainly among firms. Since a large share of inter-firm trade is in intermediate goods, the SAM (social accounting matrices) is used to measure the extent and intensity of interactions both within and across industries.

[38] EU KLEMS is a dataset on measures of economic growth, productivity, employment, capital formation, and technological change at the industry level for a number of countries in Europe and elsewhere. For further details, see here: https://euklems.eu/.

[39] TFP is reported in statistical datasets as an index, reflecting the ratio of the output value relative to the value of inputs as of a particular base year. The base year defines the starting point of the dataset; however, a change in the base year would not change the underlying trend in the TFP data series.

The R&D spillover variable was calculated following the approach in Badinger and Egger (2008) [40] using OECD SAM data to capture the strength of inter-industry relationships. For example, if innovation leads to improved productivity in AI, then the technology goods manufacturing sector, which is a major supplier to growing AI businesses, will also benefit. Continuing with the same approach as in in Badinger and Egger (2008), the R&D spillover variable was calculated following the approach by taking the dot product of R&D spending and the weight matrix. Algebraically, this can be expressed as $R\&D\ spending_{\ i-1,t} = W \cdot R\&D\ spending_{\ i,t}$, where W is the inter-industry weight matrix created using the OECD SAM data as described above. We only modify the Badinger and Egger approach by removing within-sector interactions to avoid double counting the direct effect on sectors to which R&D spending is allocated (the direct effect is modelled separately for this study).

Modelling approach

A dynamic panel data econometric model was developed. To develop the model specification, a series of statistical tests were used to identify the correct specification and functional form for the model. The importance of this step was to ensure that the resulting model was statistically robust with unbiased estimates of relationships.

Specifically, starting with a large pool of candidate explanatory variables, the LASSO (least absolute shrinkage and selection operator) method was used which made it possible to identify a more parsimonious model with fewer explanatory variables. Using a statistical method— like LASSO— instead of manually examining the variables reduces the risk of error due to human bias or judgement.

Next, the Wooldridge test for serial correlation was used to ascertain whether there were neglected dynamics in the model worth accounting for. Based on the results from the Wooldridge test, a dynamic model specification was found to be more optimal in capturing key features of the outcome variable (i.e., productivity).

Following the Wooldridge test, another diagnostic test was run to ascertain whether the key explanatory variables used in the parsimonious model can be treated as exogenous. Based, on the results of this test, it can be concluded that the explanatory variables considered can all be treated as exogenous.

Based on the statistical results of all the pre-estimation tests, the model was estimated using the bias corrected LSDVC (least square dummy variable) estimator, where the chosen estimator is the Arellano-Bond estimator.

Finally, the results model passed the Nickell Bias test which is a key statistical test for model robustness.

Further details on the robustness tests and the test results are shown on p.27.

[40] Badinger, Harald, and Peter Egger, Intra-and inter-industry productivity spillovers in OECD manufacturing: A spatial econometric perspective, No. 2181. CESifo working paper, 2008.

STATISTICAL ROBUSTNESS TESTS

Wooldridge test

This test was used to ascertain whether if there was no first-order autocorrelation in the model residuals. The presence of autocorrelation in the residuals signalled the presence of neglected dynamics in the model that ought to be accounted for.

One way to account for such dynamics was to adopt a dynamic model specification. The p-value for this test was 0.000, this meant that the null hypothesis of no first-order autocorrelation was rejected.

Nickell bias

Monte Carlo simulation revealed that estimating a dynamic model using a pooled OLS or Fixed Effect (FE) model results in a bias in the coefficient of the lagged dependent variable.

Specifically, for the pooled OLS estimator, this bias is upward whilst for the FE model, the bias is downward. Hence the correct coefficient ought to be somewhere between the latter two coefficients.

Indeed, the model passed the Nickell bias test given that the coefficient on the lagged productivity is 0.669, this was smaller than the coefficient from the OLS model which was 0.944 and bigger than the one from the FE model; 0.526.

Endogeneity test

A separate diagnostic check also tested for the hypotheses of whether each of the explanatory variable used in the model can be treated as exogenous. The test results indicated that all the variables, except for the lagged productivity variable, can be treated as exogenous.

Fig. 18. Endogeneity test results

Variables	Endogeneity test	Hansen instrument validity test	Result interpretation
1st lag of research and development—direct	P-value=0.15 (no endogeneity)	P-value=0.55 (valid instruments)	Exogenous
2nd lag of research and development—indirect	P value=0.41 (no endogeneity)	P-value=0.48 (valid instruments)	Exogenous
1st lag of change in average schooling	P value=0.24 (no endogeneity)	P-value=0.05 (valid instruments)	Exogenous
1st lag of patent protection	P-value=0.14 (no endogeneity)	P-value=0.07 (valid instruments)	Exogenous

Source: Oxford Economics

The preferred model specification developed using the modelling approach described above was as follows:

$$TFP_{i,t} = \beta_1 TFP_{i,t-1} + \beta_2 R\&D\ spending_{i,t-1} + \beta_3 R\&D\ spending_{i-1,t-2} + other\ control\ variables$$

where, the dependent variable, $TFP_{i,t}$ indicates the productivity in sector i at year t, $TFP_{i,t-1}$ corresponds to the previous year's value, $R\&D\ spending_{i,t-1}$ indicates the R&D spending in in sector i

in the previous year, $R\&D\ spending_{i-1,t-2}$ indicates R&D spending in the rest of the economy (i.e., excluding sector i).

The model specification was extensively tested to identify if quadratic or higher polynomials of the R&D spending variable should be included, but these tests did not provide any basis for their inclusion. Similarly, various lag lengths were also tested, but provided no statistical basis for their inclusion.

Control variables included patent protection, average years of schooling and a time trend. As discussed above, the LASSO approach meant that other control variables (listed in Fig. 17 above) were not found to be statistically significant. A time trend was also included to isolate the impact of trending elements on the explanatory variables. In other words, some variables trend up with time and this may lead the model to falsely conclude that they are correlated. This risk is mitigated through the introduction of a time trend variable.

Discussion of results

The estimated model results and coefficients are shown in the table below.

Fig. 19. Productivity model: econometric results

Productivity	Coefficient	Standard error	Z value	P value	Lower bound	Upper bound
Productivity lag	0.671	0.03	19.51	0.00	0.600	0.740
R&D spending (first lag)	0.002	0.001	1.85	0.06	0.000	0.004
R&D spillovers (second lag)	0.008	0.01	0.72	0.01	0.001	0.016
Average schooling	3.745	1.49	2.51	0.01	0.819	6.670
Patent protection	0.072	0.04	1.76	0.08	-0.008	0.153
Time trend	0.008	0.002	4.39	0.00	0.004	0.011

Source: Oxford Economics

The coefficients estimates are in line with expectation in both their magnitudes and signs. Both the direct and indirect impacts of real R&D spending on productivity are positive and statistically significant.

Specifically, in relation to the direct impact, there is a one-year lag between an initial investment in R&D and its subsequent effect on productivity, whilst for the indirect impact, a two-year lag length is observed.

Note that R&D spending generates some short-term demand-side gains (building new research facilities, consumer spending by newly hired researchers, etc.). Further, there are short-term supply-side gains (new research facilities helps various industries focus and optimise their efforts), and eventual long-term supply-side innovation-led gains (new processes, products, etc.). The model captures all these effects together but does not allow for them to be separated. In other words, it is not possible to identify when the innovation-led gains leading to new products or processes begin to be realised. The model only implies that GDP gains are observed within the sector in a year's time and in the wider economy in two years.

In relation to the relative size of the effects, the results indicate that a ten percent increase in the one-year lagged real R&D spending is associated with a 0.2% increase in returns on inputs measured using GDP. The indirect effects are relatively larger, with a ten percent increase in the two-year lagged real R&D spending associated with a 0.8% increase in average productivity.

It is reiterated that different lag lengths and higher polynomials of R&D spending were tested in the model and were found to be statistically insignificant.

Benchmarking the findings

The implied productivity elasticities with respect to GDP (i.e., the percent increase in TFP per 1% increase in R&D spending) from this analysis is roughly comparable to estimates from other studies, if slightly on the higher side.

Fig. 20. Comparison with R&D elasticities in other studies

Study	Elasticities	Study geography
Blanco, et al (2013)[41]	0.06–0.14	United States
Moretti, et al (2021)[42]	0.12–0.24	OECD countries
Guellec and van Pottelsbergh de la Potterie (2001)[43]	0.13–0.17	OECD countries
Bravo-Ortega and Marin (2011)[44]	0.16–0.17	65 OECD and European countries
Zachariadis (2004)[45]	0.17–0.38	OECD
Gumus and Celikay (2015)[46]	0.44–0.98	52 OECD and European countries
Oxford Economics	0.20–0.80	OECD countries

[41] Blanco, Luisa R., Ji Gu, and James E. Prieger, *The impact of research and development on economic growth and productivity in the US states*, Southern Economic Journal 82, no. 3 (2016): 914–934.
[42] Moretti, Enrico, Claudia Steinwender, and John Van Reenen, *The intellectual spoils of war? Defense R&D, productivity and international spillovers,* No. w26483. National Bureau of Economic Research, 2019.
[43] Guellec, D. and B. van Pottelsberghe de la Potterie (2001), *R&D and Productivity Growth: Panel Data Analysis of 16 OECD Countries*, OECD Science, Technology and Industry Working Papers, No. 2001/03, OECD Publishing, Paris, https://doi.org/10.1787/652870318341.
[44] Bravo-Ortega, Claudio, and Álvaro García Marín, *R&D and productivity: A two way avenue?*, World Development 39, no. 7 (2011): 1090–1107.
[45] Zachariadis, Marios, *R&D-induced Growth in the OECD?*, Review of Development Economics 8, no. 3 (2004): 423–439.
[46] Gumus, Erdal, and Ferdi Celikay, *R&D expenditure and economic growth: new empirical evidence*, Margin: The Journal of Applied Economic Research 9, no. 3 (2015): 205–217.

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